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Guide for Mechanistic-Empirical Design
OF NEW AND REHABILITATED PAVEMENT STRUCTURES

FINAL DOCUMENT

APPENDIX GG-1:
CALIBRATION OF PERMANENT DEFORMATION MODELS FOR FLEXIBLE PAVEMENTS

NCHRP

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Disclaimer

This is the final draft as submitted by the research agency. The opinions and conclusions expressed or implied in this report are those of the research agency. They are not necessarily those of the Transportation Research Board, the National Research Council, the Federal Highway Administration, AASHTO, or the individual States participating in the National Cooperative Highway Research program.

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Research into the subject area covered in this Appendix was conducted at ASU. The authors of this Appendix are Dr. M. W. Witczack and Mr. M.M. El-Basyouny.

Foreword

The information contained in this appendix serves as a supporting reference to the permanent deformation discussions presented and PART 3, Chapters 3 and 6 of the Design Guide.

This appendix is the first in a series of two volumes on environmental effects on pavements. The other volume is:

Appendix GG-1:	Calibration of Permanent Deformation Models for Flexible Pavements
Appendix GG-2:	Sensitivity Analysis for Permanent Deformation of Flexible Pavements

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Appendix GG-1

Calibration of Permanent Deformation Models for Flexible Pavements

Annex A - CALIBRATION OF PERMANENT DEFORMATION MODELS

Introduction

Permanent deformation is one of the most important types of load-associated distresses occurring in flexible pavement systems. It is associated with rutting in the wheel path, which develops gradually as the number of load repetitions accumulates. In addition, it is the longitudinal variation of rut depth in the wheel path, that is a primary factor in the road roughness, affecting serviceability or IRI. Rutting normally appears as longitudinal depressions in the wheel paths accompanied by small upheavals to the sides. The width and depth of the rutting profile is highly dependent upon the pavement structure (layer thickness and quality), traffic matrix and quantity as well as the environment at the design site.

In general, the design engineer is concerned with the total deformation of the pavement structure and how it affects the lateral and longitudinal profiles at the surface, as this may be a significant safety concern. Major problems can be associated with changes in these profiles due to differential consolidation altering the surface level. In the transverse profile, rutting along the wheel path modifies drainage characteristics and reduces runoff capability. Water can accumulate in traffic lanes, creating conditions for aquaplaning of vehicles, reduced skid resistance of the surface course, and unsafe traffic conditions. Also, in colder environments, snow and ice removal is impeded because the surface is not flat. In the longitudinal profile, differential permanent deformations due to variability of materials and/or construction increase roughness and reduce the overall serviceability of the road.

Permanent Deformation in the 2002 Design Guide

For many years it has been common practice in several mechanistic-empirical pavement design approaches to associate permanent deformation to excessive vertical strains on top of the subgrade. It was assumed that if the pavement was well designed and the quality of pavement materials above the subgrade were well controlled, rutting could be reduced to tolerable levels by limiting the vertical strain on the subgrade. This approach mirrored the historic design approach for flexible pavements by assuming that structural design was merely a procedure to decrease the shear stresses in the controlling subgrade layer. Nevertheless, with time and enhanced technical capabilities and knowledge; it became quite clear to design engineers that the total permanent deformation was a product of cumulative ruts occurring in all layers of the pavement system.

One major and allied objective of the permanent deformation subsystem developed in the Design Guide is to insure that mixture design of the asphaltic mixtures is definitely linked to the structural design process. It is to be recognized and understood that this project task (under NCHRP 1-37A) is highly interactive and integrally tied to the analysis of AC permanent deformation development under NCHRP 9-19.

In the Design Guide, a predictive rutting system was developed to evaluate the permanent deformation within all rut susceptible layers (generally asphaltic and all unbound material layers) in the pavement within the analysis period. Individual layer rut depths are predicted for each layer as a function of time and traffic repetition. This also allow for the prediction of the total pavement rut depth, with time and traffic repetitions.

Regardless of the material type considered, there are generally three distinct stages for the permanent deformation behavior of pavement materials under a given set of material, load and environmental conditions. Figure 1 illustrates the three stages, which can be described as follows:

Primary Stage: high initial level of rutting, with a decreasing rate of plastic deformations, predominantly associated with volumetric change.

Secondary Stage: small rate of rutting exhibiting a constant rate of change of rutting that is also associated with volumetric changes; however, shear deformations increase at increasing rate.

Tertiary Stage: high rate (level) of rutting predominantly associated with plastic (shear) deformations under no volume change conditions.

The Design Guide utilizes an approach that models both the primary and secondary stages, with the primary stage modeled using an extrapolation of the secondary stage trend. The tertiary stage, though also very important, is not taken into account explicitly in the Design Guide methodology. Permanent deformation tests to reach this stage are extremely time consuming, difficult to perform, and lack a prediction methodology for implementation. However, major research studies are currently in progress to analytically treat this type of deformation (e.g. NCHRP 9-19). It should be understood that true plastic shear deformations are not modeled within the system (in fact, few, if any, rutting prediction models incorporate this stage). While, at first, this may seem to be a major limitation; it is generally not. This is because the magnitude of rutting associated with tertiary flow yields a rut depth much greater than what would be typically tolerated in actual practice.

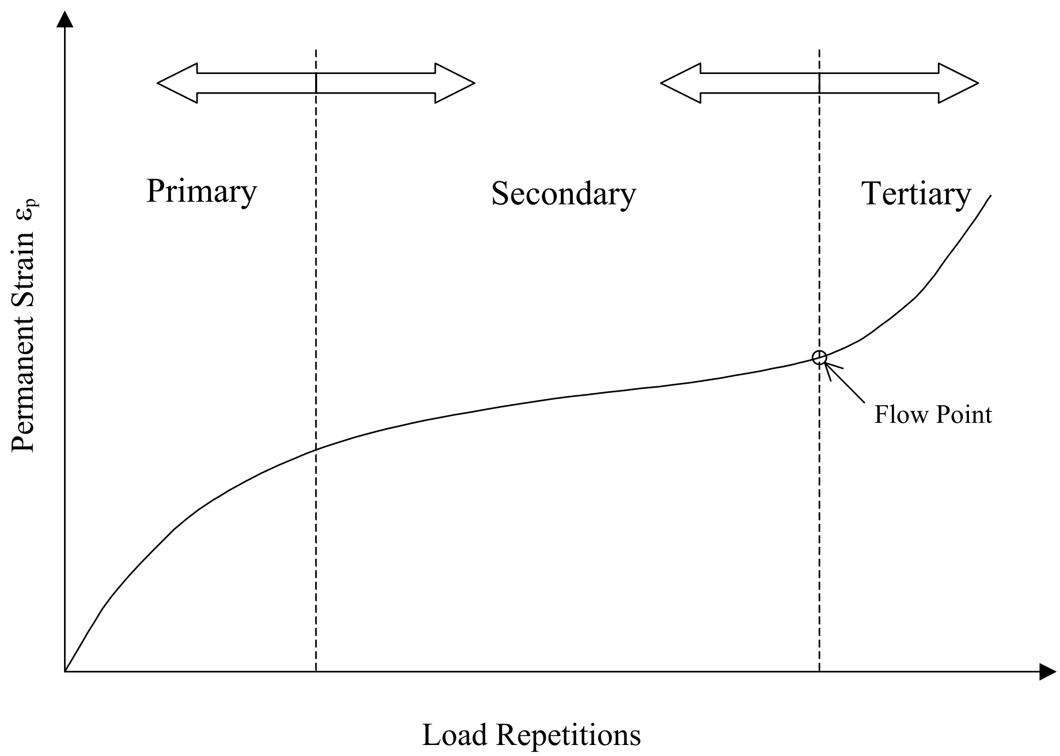


Figure 1 Typical Repeated Load Permanent Deformation Behavior of Pavement Materials.

In addition to the above-mentioned limitation, it should be recognized that no permanent deformation is assumed to occur for chemically stabilized materials, bedrock, and PCC fractured slab materials. These materials are assumed to have no contribution to the total permanent deformation of the pavement system.

As previously mentioned, the approach presented in the Design Guide is based upon incremental damage. The damage or rutting is estimated for each sub-season at the mid-depth of each sub-layer within the pavement system. To estimate the permanent deformation of each individual sub-layer, the system verifies the type of layer, applies the model corresponding to the material type of the sub-layer, and computes the plastic strain accumulated at the end of each sub-season. The overall permanent deformation for a given season is the sum of permanent deformation for each individual layer and is mathematical expressed as:

$$PD = \sum_{i=1}^{nsublayers} \varepsilon_p^i h^i \tag{1}$$

where:

PD	=	Pavement permanent deformation
$nsublayers$	=	Number of sublayers
ε_p^i	=	Total plastic strain in sub-layer i
h^i	=	Thickness of sub-layer I

The process is repeated for each load level, sub-season, and month of the analysis period. The estimation of permanent deformation for asphalt bound and unbound layers is discussed in the following sections.

Permanent Deformation Models

Permanent deformation in the 2002 design guide is calculated for each rut susceptible layer of the pavement structure. The permanent deformation models used to predict the rut in each layer is based on similar concepts. The approach relates vertical elastic compressive strain at the mid-depth of each layer (sublayer) and the number of traffic applications to layer plastic strains. These in turn, can be related to the layer rut depth by equation 4.1, previously shown. For the subgrade layer, the vertical elastic strains at the top of the subgrade and at 6 inches deep from the surface of the subgrade are used to calculate the rut in the subgrade. This will be explained later in more technical detail.

Asphalt Mixture Permanent Deformation Characterization

Permanent deformation (rutting) of asphalt mixtures is one of the most important distress types in flexible pavement systems. Major research efforts are now underway to ensure that this important characteristic of asphalt materials is considered in both the mixture design stage and the structural design aspects of flexible pavement performance.

The Design Guide provides the user with the capability to predict rutting within all asphalt and unbound layer materials. The constitutive relationship used in the 2002 Design

Guide is initially based upon the statistical analysis of laboratory repeated load permanent deformation tests. This model form is:

$$\frac{\varepsilon_p}{\varepsilon_r} = aT^b N^c \qquad (2)$$

where:

ε_p = Accumulated plastic strain at N repetitions of load
ε_r = Resilient strain of the asphalt material as a function of mix properties, temperature and time rate of loading
N = Number of load repetitions
T = Pavement temperature
a, b, c = Non-linear regression coefficients

While the statistical relationship(s), based upon the laboratory analysis of asphalt mixtures, serves as a reasonable starting point; it is logical that field adjustment factors, β_{ri} will be necessary. These coefficients will be determined from the calibration - validation effort using the LTTP data and the typical AC permanent deformation relationship is:

$$\frac{\varepsilon_p}{\varepsilon_r} = \beta_{ri} a T^{\beta_{r2} b} N^{\beta_{r3} c} \qquad (3)$$

One of the original studies utilizing this particular model form was developed by Leahy (1). Her study utilized over 250 AC mix specimens, evaluated for their repeated load permanent deformation behavior. A total of 2860 permanent strain data points were used in these tests to determine a variety of statistical regression equations to predict a variety of mix response parameters. The resilient strain was assumed to be reasonably constant and independent of the number of load repetitions. The experimental factorial included three AC levels, three stress levels, two binder types, three temperatures, and two aggregate types. The model recommended by Leahy relating the ratio of cumulative plastic to elastic strain was:

$$\begin{aligned}\log\left(\frac{\varepsilon_p}{\varepsilon_r}\right) &= -6.631 + 0.435\log N + 2.767\log T + 0.110\log S + 0.118\log\eta \\ &\quad + 0.930\log V_{beff} + 0.5011\log V_a \qquad R^2 = 0.76\end{aligned} \qquad (4)$$

where:

ε_p	=	Accumulated permanent strain
ε_r	=	Resilient strain
N	=	Number of load repetitions
T	=	Mix temperature (deg F)
S	=	Deviatoric stress (psi)
η	=	Viscosity at 70 Deg F (10^6 poise)
V_{beff}	=	Effective asphalt content, percent by volume

V_a = Air void content, percent

A sensitivity analysis performed on the model showed that temperature was by far the most important variable. The model was less sensitive to the loading conditions, material type, and mix parameters.

The Leahy model statistics of $R^2 = 0.76$ are considered quite good in any statistical modeling techniques. However, part of the accuracy of this model was achieved by using a limited number of AC mixtures and incorporating several independent variables that, while increasing the R^2 value, limit the implementation usefulness of the model.

Ayres (2) re-analyzed the original Leahy data plus additional laboratory data that had been developed at the University of Maryland, under Dr. M. W. Witczak. Ayres recommended a model of the form:

$$\log\left(\frac{\varepsilon_p}{\varepsilon_r}\right) = -4.80661 + 2.58155\log T + 0.429561\log N \qquad R^2 = 0.725 \qquad (5)$$

Ayres subsequently utilized this equation in his development of Program AYMA dealing with the "Probabilistic Methodology for AC Pavements." Ayres reported that this new model represented a small decrease in the explained variance of the original Leahy model (R^2=0.725 compared to R^2=0.76). He attributed this difference to the elimination of the four-predictor variables from the original Leahy model. This appeared to be quite justified, as the Ayres model becomes much more direct and easier to implement in systems modeling rutting behavior. This benefit is gained through a very small loss in the R^2 value (3%).

Finally, the recent work conducted in the NCHRP 9-19 "Superpave Models" project at ASU (3) has yielded additional AC mixture data undergoing repeated load permanent deformation testing. These tests were conducted in the Special Geometry and Aggregate Size Study and Simple Performance Test of Task C (NCHRP 9-19). The mixtures, temperatures, and stress levels investigated by Kaloush greatly expanded the data range of the variables introduced in the statistical modeling. While this aspect is a direct benefit to any statistical regression techniques, one logical consequence of a broader database is to lower the correlation coefficient of the developed model.

The database examined by Kaloush used the original Leahy data in combination with the Superpave Models Task C results. This resulted in a total database of 3,476 permanent strain data points being used in the regression analysis. Kaloush developed several models, reflecting a differing number of independent variables used in the equation. They are:

$$\log\left(\frac{\varepsilon_p}{\varepsilon_r}\right) = -3.15552 + 1.734\log T + 0.39937\log N$$

$$R^2 = 0.644 \qquad S_e = 0.321 \qquad \frac{S_e}{S_y} = 0.597 \tag{6}$$

and

$$\log\left(\frac{\varepsilon_p}{\varepsilon_r}\right) = 0.3082 + 0.3534\log N$$

$$R^2 = 0.550 \qquad S_e = .363 \qquad \frac{S_e}{S_y} = 0.675 \tag{7}$$

The equation with the temperature term has approximately 10% greater R^2 than the equation without it. Because this is a significant improvement in the overall model accuracy; this equation (using both the N and T term) was selected as the initial (pre-calibrated) model for use in the 2002 Design Guide. It was envisioned that this model would serve as the original model form that would eventually be field calibrated. It is a relatively simple equation to use in the implementation process. Thus, the final lab model selected for the initial predictive method for AC permanent deformation was:

$$\frac{\varepsilon_p}{\varepsilon_r} = 10^{-3.15552} N^{0.39937} T^{1.734} \tag{8}$$

The field-calibrated form of this model that was subsequently used in the Design Guide is:

$$\frac{\varepsilon_p}{\varepsilon_r} = \beta_{r1} 10^{-3.15552} T^{1.734*\beta_{r2}} N^{0.39937*\beta_{r2}} \tag{9}$$

where;

β_{r1}, β_{r2}, β_{r3} = Calibration factors for the asphalt mixtures rut model.

The computational power and simplicity of this equation form needs to be clearly noted. Given a particular layered pavement cross section, the vertical resilient strain at any given depth (along a vertical axis, defined in the x, y plane) is defined by knowledge of the three-dimensional stress state and the elastic properties (modulus and Poisson's ratio) of the AC layer in question from:

$$\varepsilon_{rz} = \frac{1}{|E^*|}\left(\sigma_z - \mu\sigma_x - \mu\sigma_y\right) \tag{10}$$

The dynamic moduli (| E* |) of asphalt mixtures are employed in the Design Guide via a master curve. Thus, E* is expressed as a function of the mix properties, temperature, and time of load.

Knowledge of the vertical resilient strain at any point, along with the ε_p relationship, allows for the direct calculation of the plastic strain, ε_p, at any given point within the asphalt layer (or sublayer), after N repetitions of load, to be computed.

The incremental rut depth at each depth, along the x, y-axis, through the AC layer can be found from:

$$\Delta R_{d_i} = \varepsilon_{p_i} . \Delta h_i \tag{11}$$

Finally, by simply summing all incremental ΔR_d through the entire layer, one can obtain the total layer rut depth from:

$$R_d = \sum_{i=1}^{n} \Delta R_{d_i} \tag{12}$$

Unbound Materials Permanent Deformation

Models developed by Tseng and Lytton (4) were originally selected to estimate the permanent deformation of unbound granular and subgrade materials. Their basic relationship is:

$$\delta_a(N) = \beta_1 \left(\frac{\varepsilon_0}{\varepsilon_r} \right) e^{-\left(\frac{\rho}{N}\right)^{\beta}} \varepsilon_v \, h \tag{13}$$

where:

δ_a = Permanent deformation for the layer/sub-layer
N = Number of traffic repetitions.
ε_o, β, and ρ = Material properties.
ε_r = Resilient strain imposed in laboratory test to obtain material properties ε_o, β and ρ.
ε_v = Average vertical resilient strain in the layer/sub-layer as obtained from the primary response model.
h = Thickness of the layer/sub-layer.
β_1 = calibration factor for the unbound granular and subgrade materials.

According to Tseng and Lytton (4), the ratio $\varepsilon_o/\varepsilon_r$ is estimated based upon the type of material investigated: granular or subgrade soil. The models developed by Tseng and Lytton were:

Granular

$$\log\left(\frac{\varepsilon_0}{\varepsilon_r}\right) = 0.80978 - 0.06626\,W_c - 0.003077\,\sigma_\theta + 0.000003\,E_r \tag{14a}$$

$R^2 = 0.60$

$$\log\beta = -0.9190 + 0.03105\,W_c + 0.001806\,\sigma_\theta - 0.0000015\,E_r \tag{14b}$$

$R^2 = 0.74$

$$\log\rho = -1.78667 + 1.45062\,W_c + 0.0003784\,\sigma_\theta^2 - 0.002074\,W_c^2\,\sigma_\theta - 0.0000105\,E_r \tag{14c}$$

$R^2 = 0.66$

Subgrade

$$\log\left(\frac{\varepsilon_0}{\varepsilon_r}\right) = -1.69867 + 0.09121\,W_c - 0.11921\,\sigma_d + 0.91219\log E_r \tag{15a}$$

$R^2 = 0.81$

$$\log\beta = -0.9730 - 0.0000278\,W_c^2\,\sigma_d + 0.017165\,\sigma_d - 0.0000338\,W_c^2\,\sigma_\theta \tag{15b}$$

$R^2 = 0.86$

$$\log\rho = 11.009 + 0.000681\,W_c^2\,\sigma_d - 0.40260\,\sigma_d + 0.0000545\,W_c^2\,\sigma_\theta \tag{15c}$$

$R^2 = 0.74$

where:

W_c	=	Water content (%)
σ_d	=	Deviator stress (psi)
σ_θ	=	Bulk stress (psi)
E_r	=	Resilient modulus of the layer/sub-layer (psi)

Modified Model for Unbound Layer Permanent Deformation

Intensive efforts, as well as sensitivity studies, were performed on the original Tseng and Lytton unbound layer rut model. After a considerable effort, it was concluded that the wrong trends for the predicted rutting in the unbound layers were occurring. For example, in many cases the rut depth in the subgrade layer was found to decrease as the subgrade resilient modulus was decreased, while keeping the rest of the design parameters the same. Figure 2 shows the trend of the strain ratio to the unbound resilient modulus at two traffic levels of 1 and 10^7 using the Tseng and Lytton data. It became obvious that unreasonable trends and estimates of deformation where associated with the non-linear (stress) dependent permanent deformation model initially selected.

An attempt was undertaken to revise the Tseng and Lytton models. Ayres provided a modified version of these models, using the same data used to establish the original Lytton models for the revised models. Ayres combined the granular and the subgrade soils data into one database and used this one database to develop new correlations. In addition, and very importantly, the factor of the bulk and deviatoric stresses were eliminated from the new models. This implied that the non-linear characteristics of the unbound permanent deformation model were excluded in the revised model. Figure 3 shows the results using the modified models. The modified model are given below:

$$\log\left(\frac{\varepsilon_0}{\varepsilon_r}\right) = 0.74168 + 0.08109\, W_c - 0.000012157\ M_r \qquad (16)$$

$\left(\frac{\varepsilon_0}{\varepsilon_r}\right)$ is Multiplied by an adjustment factor "ADJ_Strain_Ratio"

$$ADj\_Strain\_ratio = 1.2 - 1.39 * e^{-0.058*(M_r/1000)} \qquad (17)$$

if M_r/1000 < 2.6 then use 2.6

if Adj < 1e-7 use Adj = 1e-7

$$\log\beta = -0.61119 - 0.017638 W_c \qquad (18)$$

β is multiplied by 0.7 as a correction factor.

$$\log\rho = 0.622685 + 0.541524 W_c \qquad (19)$$

$$W_c = 51.712 * CBR^{-0.3586*GWT^{0.1192}} \qquad (20)$$

$$CBR = \left(\frac{M_r}{2555}\right)^{(1/0.64)} \qquad (21)$$

where:

W_c = Water content (%)

CBR = CBR ratio of the unbound layer.

GWT = Ground Water Table (feet)

M_r = Resilient modulus of the layer/sub-layer (psi)

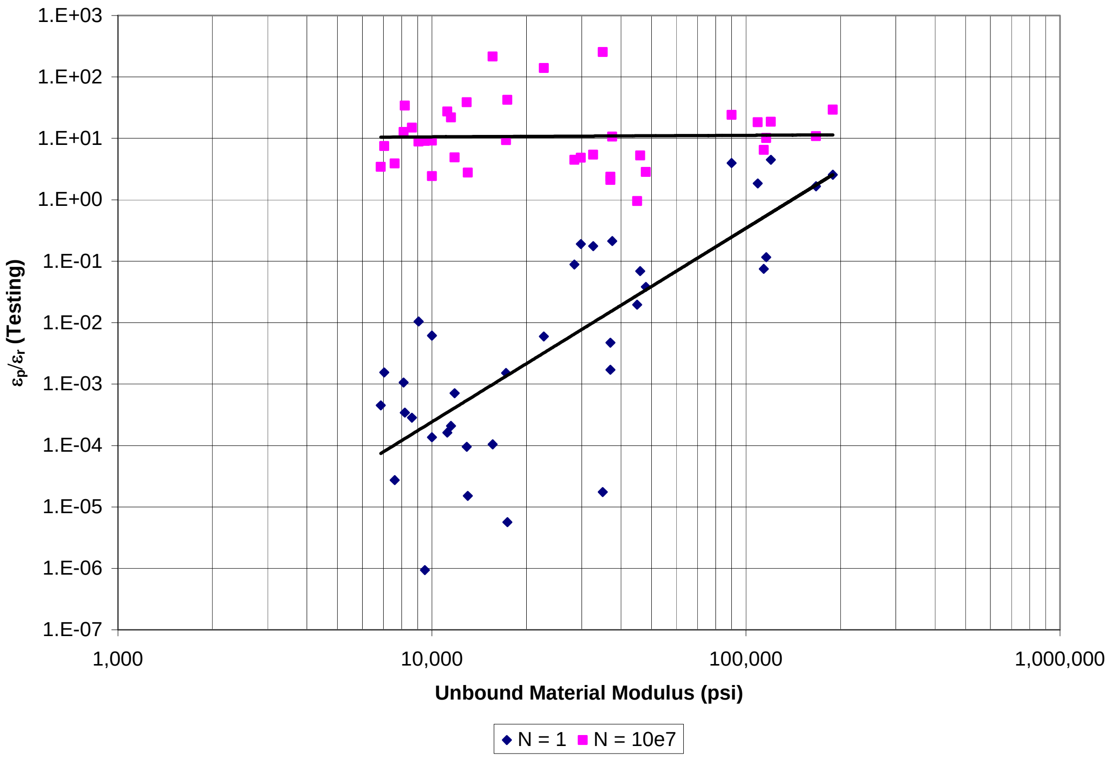


Figure 2 $\varepsilon_p/\varepsilon_r$ vs. Unbound Layer Modulus Using Lytton's Test Data

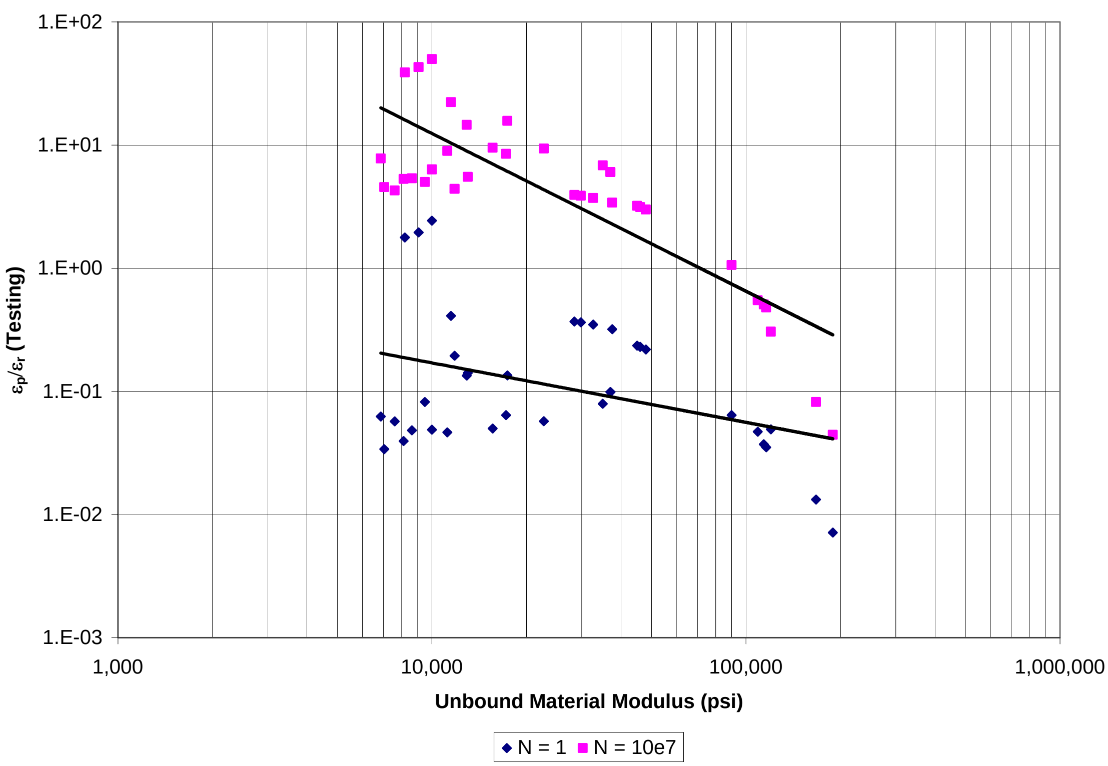


Figure 3 $\varepsilon_p/\varepsilon_r$ vs. Unbound Layer Modulus Using Ayres's Modified Model

This moisture content model (equation 20) development is explained in this appendix.

Use of the Ayres's modified models in the calibration process also resulted in several unfavorable conditions. Predictions of the rut depth were found to possess high degree of scatter and, most importantly, the amount of the rutting in the subgrade found to be very high. With this latest development, El-Basyouny and Witczak set out to develop a final, accurate model modification that could be used in the Design Guide. The form of the modification attempted was to generalize the fundamental model by changing the slope and intercept of the $\varepsilon_p/\varepsilon_r$ to modulus relationship while keeping the "β" the same. The strain ratio in the equation is a function of the layer modulus for different traffic levels. The models were solved for two traffic levels of N = 1 and N = 10^9. The following explains the final modification made to the modified unbound material permanent deformation model.

$$\frac{\varepsilon_p(N)}{\varepsilon_r} = \left(\frac{\varepsilon_0}{\varepsilon_r}\right) e^{-\left(\frac{\rho}{N}\right)^{\beta}} \tag{22}$$

For N =1 $\qquad \dfrac{\varepsilon_p(1)}{\varepsilon_r} = a_1\ E^{b_1}$

For N =10^9 $\qquad \dfrac{\varepsilon_p(10^9)}{\varepsilon_r} = a_9\ E^{b_9}$

Assuming values for $\varepsilon_p/\varepsilon_r$ at different E to calculate the a_1, b_1, a_9, and b_9 values.

$$\left(\frac{\varepsilon_0}{\varepsilon_r}\right) = \frac{\left(e^{(\rho)^{\beta}} * a_1 * E^{b_1}\right) + \left(e^{\left(\frac{\rho}{10^9}\right)^{\beta}} * a_9 * E^{b_9}\right)}{2} \tag{23}$$

where:

$$\log\beta = -0.61119 - 0.017638 W_c \tag{24}$$

The moisture content (W_C) has already been presented in equation 20.

$$\rho = 10^9\left(\frac{C_0}{\left[1-\left(10^9\right)^{\beta}\right]}\right)^{\frac{1}{\beta}} \tag{25}$$

$$C_0 = \ln\left(\frac{a_1 * E^{b_1}}{a_9 * E^{b_9}}\right) \tag{26}$$

Annex B includes 27 different sets of assumptions of $\varepsilon_p/\varepsilon_r$ at different E, which were evaluated in the calibration study. However, only the final set, which was eventually selected for use in the Design Guide, is presented in this chapter as seen in Figure 4. As a major part of the validation study of the modified model for use in the 2002 Design Guide unbound layer rut predictions, a study was conducted using the 1993 AASHTO design guide (5) were used. The study is presented in this chapter with a detailed description of the section data used and the results of the study.

Unbound Materials Moisture Content

The moisture content in the unbound material is one of the most important, and sensitive, factors affecting the unbound material performance under application of loads, especially for the unbound layer permanent deformation in a pavement structure. A study was conducted to develop a regression model that would predict the equilibrium moisture content of the unbound soil for a range of ground water table depths and a range of in-situ material properties (E or Mr).

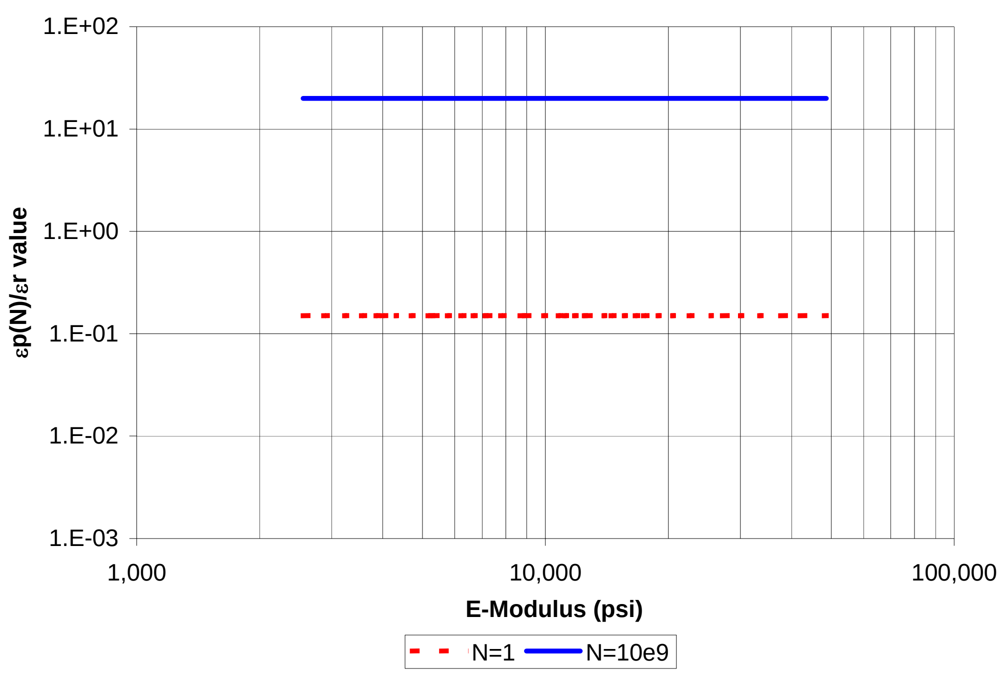


Figure 4 $\varepsilon_p/\varepsilon_r$ vs. Unbound Layer Modulus Using El-Basyouny - Witczak Modified Model

This study utilized regression models that were developed from a matrix of variables used as input in the Enhanced Integrated Climatic Model (EICM) (6). EICM was originally developed for the Federal Highway Agency (FHWA). EICM is a program that is capable of modeling the effect of soil water characteristic curves (SWCC) and permeability functions on pavements to predict real time moisture and temperature values within any specified pavement cross section in any environmental region.

The SWCC is defined as the variation of water storage capacity within the macro and micro pores of a soil, with respect to suction (7). This relationship is generally plotted as the variation of the water content (gravimetric, volumetric, or degree of saturation) with soil suction. Equations proposed by Fredlund and Xing in 1994 (8) are used for the SWCC prediction in an ASU modified to Version 2.2 of the EICM.

Due to the difficulties that arise when the soil suction is directly measured, the fitting parameters of the Fredlund and Xing equation were correlated with soil index properties (9). The properties chosen are the Percentage Passing #200 (P_{200}), the Diameter D_{60}, and the Plasticity Index (PI). When the soil has a PI greater than zero, the SWCC parameters are correlated with the product of P_{200} (decimal) and PI referred to as $P_{200}PI$. For those cases where the PI is zero, the parameters are correlated with the D_{60}. Other soil properties are also, important such as the specific gravity of the solids (G_s) and the saturated hydraulic conductivity (k_{sat}). The G_s and the k_{sat} are both estimated based on $P_{200}PI$ and D_{60} values if no field or laboratory testing values are available.

The equilibrium moisture study started by using basic information about the unbound layer (such as modulus or CBR value) and the ground water table depth (GWT). Models from EICM were then used to calculate the moisture content. The steps for estimating the equilibrium moisture content for a given modulus value are as follows:

1. The correlation that was used to relate CBR to the modulus is

$$Mr = 2555(CBR)^{0.64} \quad (27)$$

2. The $P_{200}PI$ or D_{60} are estimated from the CBR as follows

$$P_{200}PI = ((75/CBR)-1)/0.728 \quad (28)$$

$$D_{60} = (CBR / 28.091)^{2.792516} \quad (29)$$

3. The specific gravity can be estimated from $P_{200}PI$ or D_{60} as follows

$$G_s = 0.041(P_{200}PI)^{0.29} + 2.65 \quad (30)$$

$P_{200}PI = 0$ then $G_s = 2.65$

4. Also, the degree of saturation for a material at optimum moisture is calculated from

$$S_{opt} = 6.752\,(P_{200}PI)^{0.147} + 78 \quad (31)$$

Or it is 78 for $P_{200}PI = 0$

5. Gravimetric Moisture Content at Optimum Condition is estimated from

$$W_{opt} = 1.3\,(P_{200}PI)^{0.73} + 11 \quad (32)$$

Or from D_{60} when $P_{200}PI = 0$

$$w_{opt\,(T99)} = 8.6425\,(D_{60})^{-0.1038} \quad (33a)$$

If layer is not a base course

$$w_{opt} = w_{opt\,(T99)} \quad (33b)$$

If layer is a base course

$$\Delta w_{opt} = 0.0156[w_{opt(T99)}]^2 - 0.1465 w_{opt(T99)} + 0.9 \quad (33c)$$

$$w_{opt} = w_{opt\,(T99)} - \Delta w_{opt} \quad (33d)$$

6. The max compacted dry unit weight is estimated from the following equation

$$\gamma_{d\,max\,comp} = \frac{G_s \gamma_{water}}{1 + \dfrac{w_{opt} G_s}{S_{opt}}} \tag{34}$$

7. The volumetric water content at optimum condition is given as:

$$\theta_{opt} = \frac{w_{opt} \gamma_{d\,\max}}{\gamma_{water}} \tag{35}$$

8. Then the saturated volumetric water content is obtained from:

$$\theta_{sat} = \frac{\theta_{opt}}{S_{opt}} \tag{36}$$

9. The equation proposed by Fredlund and Xing, that calculates the volumetric water content

$$\theta_w = C(h) \times \left[\frac{\theta_{sat}}{\left[\ln\left[EXP(1) + \left(\dfrac{h}{a_f} \right)^{b_f} \right] \right]^{c_f}} \right] \tag{37}$$

Where:

$$C(h) = \left[1 - \frac{ln\left(1 + \dfrac{h}{h_r} \right)}{ln\left(1 + \dfrac{1.45 \times 10^5}{h_r} \right)} \right] \tag{38}$$

10. The SWCC coefficients are calculated from the following regressions

$$a_f = \frac{0.00364(P_{200}PI)^{3.35} + 4(P_{200}PI) + 11}{6.895}, \text{ psi} \tag{39a}$$

$$\frac{b_f}{c_f} = -2.313(P_{200}PI)^{0.14} + 5 \tag{39b}$$

$$c_f = 0.0514(P_{200}PI)^{0.465} + 0.5 \tag{39c}$$

$$\frac{h_r}{a_f} = 32.44e^{0.0186(P_{200}PI)} \tag{39d}$$

11. Finally, the equilibrium gravimetric moisture content is calculated from:

$$w_{equ} = \frac{\theta_w \gamma_{water}}{\gamma_{d\,\max}} \qquad (40)$$

Using these equations for different resilient moduli and GWT depths, regressions showing the relationship between the equilibrium gravimetric moisture content and the CBR values at different GWT depths (from 2 feet to 100 feet) were obtained. These regressions are plotted in Figure 5, and are shown on the figure for each GWT depth.

From Figure 5 it can be seen that all regressions had a power model form, and the intercept is essentially the same for all practical purposes. While, the power term changes from one data set to the other. This led to the fitting of the power term to be a function of the GWT depth. The GWT and the corresponding power factor are shown in

Table 1 and plotted in Figure 6.

An excellent power model representing the relationship between the GWT depth and the power term on the equilibrium gravimetric moisture content and CBR correlation was found.

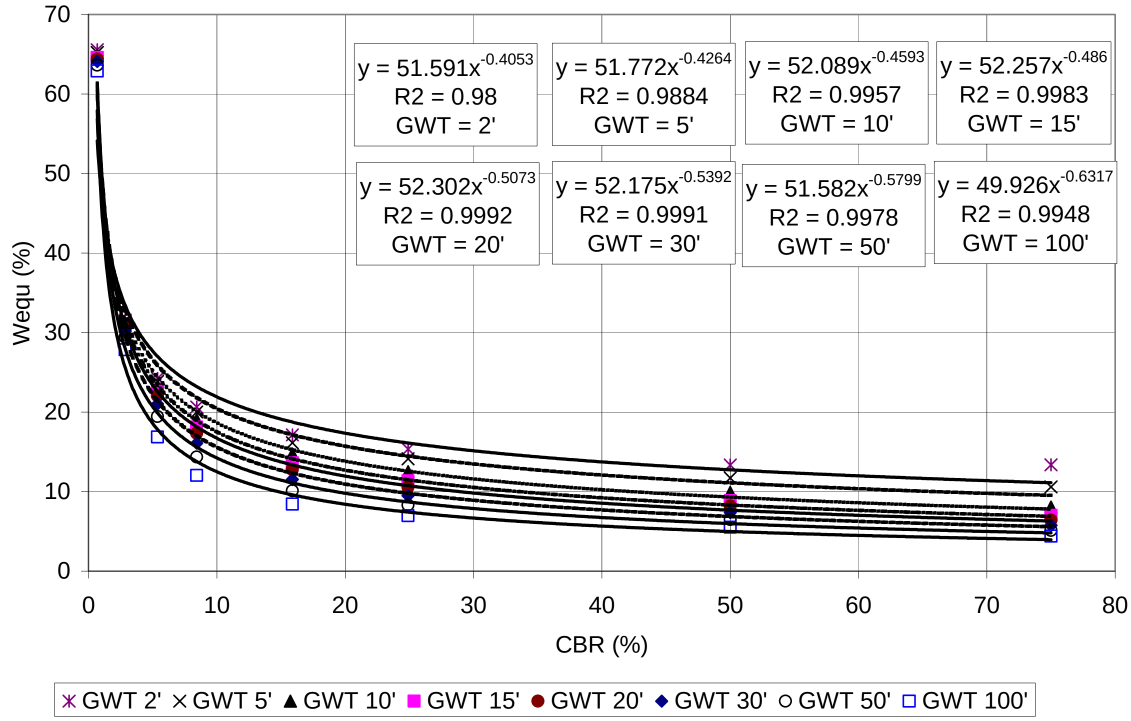


Figure 5 Unbound Material Equilibrium Gravimetric Moisture Content and the CBR Values

Table 1 GWT Depth and the Power Term.

GWT	Power Factor	Intercept
2	0.4053	51.591
5	0.4264	51.772
10	0.4593	52.089
15	0.486	52.257
20	0.5073	52.302
30	0.5392	52.175
50	0.5799	51.582
100	0.6317	49.926

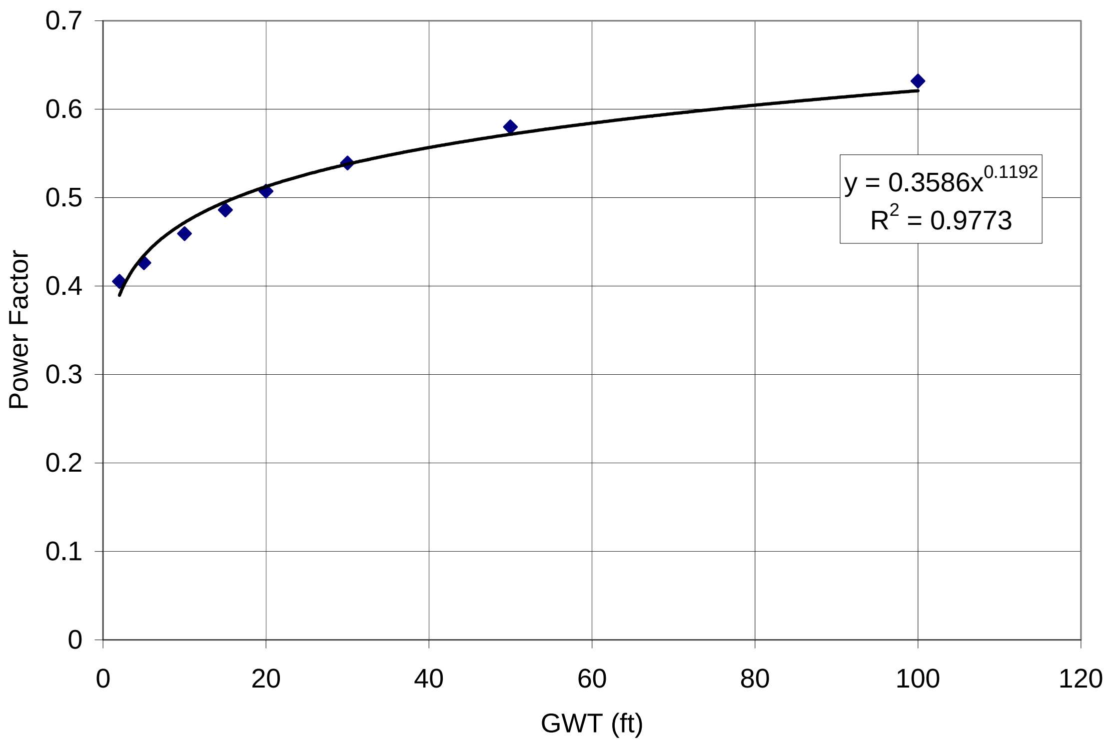


Figure 6 GWT Depth vs. Power Factor for Moisture Content – CBR Relationship

The R^2 for the model was 0.9773. By taking the average of the intercept of the models, the final model obtained is given by the following equation.

$$w_{equ} = 51.712 * CBR^{0.3586*GWT^{0.1192}} \tag{41}$$

where:

Wequ is given in percentage.

Figure 7 shows the comparison between the moisture content calculated from CBR regression model and the moisture content calculated from EICM. It can clearly be seen that the correlation is an excellent one and that the R^2 is 0.9935.

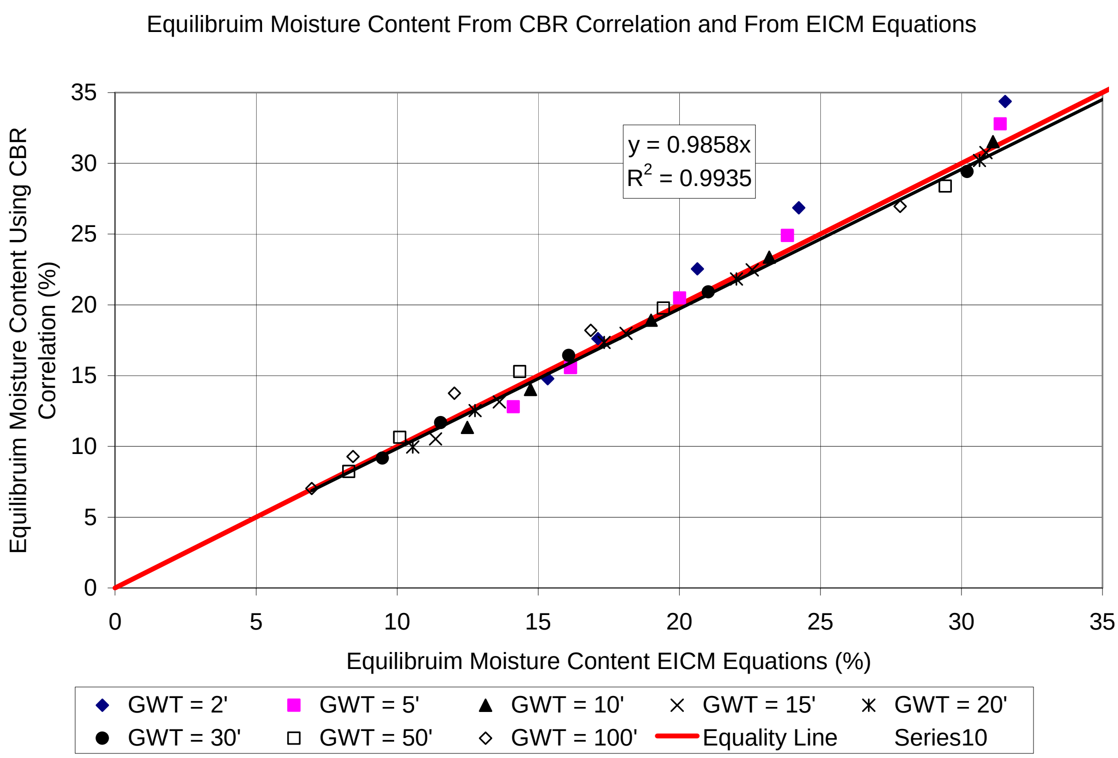


Figure 7 Equilibrium Gravimetric Moisture Content – CBR Relationship

Calibration of Permanent Deformation Models

The permanent deformation model (both asphalt mixture and unbound layer) were calibrated following the process listed below:

- Calibration data was collected from the LTPP database.
- A simulation runs were done using the 2002 Design Guide software and using different calibration coefficients as shown in equations 9 and 13.
- The best coefficient combination was selected based on the reasonableness of the results.
- Adjustment functions were adopted to correct for the confining pressure in the asphalt layer at different depths.
- The predicted damage was correlated to the measured rutting in the field by minimizing the square of the errors between predicted and observed rut depths.

The calibration data collection was done at the same time for all layers. In the following sections, each step of the listed calibration steps will be discussed in detail. The rutting calibration data will be described in a general section and then each rutting model calibration will be discussed separately. The unbound layer will be discussed first because the calibration factor for the unbound was set first (calibrated –validated to existing AASHTO 1993 Design Guide). The calibration factors for the asphalt were then obtained using the least error optimization method while keeping the factors on the unbound layers constant.

Calibration Data

The main data source for the calibration of the permanent deformation was the LTPP database (10). Data were mainly obtained from the General Pavement Sites (GPS) and the Special Pavement Sites (SPS). Appendix EE includes a detailed listing of the sections and the sections data used in the calibration process, as well as the assumption made for some of these sections to replace missing data. For all practical purposes, identical LTPP pavement sections used for AC fatigue calibration were used for the permanent deformation calibration procedure.

Two requirements for calibrating the performance prediction models are to ensure that all major factors that influence the development of pavement distress are included and to ensure that the selected test pavements span the expected range of each factor. The approach used in the plan for model calibration was to select the desired number of field sections as well as desirable attribute values (ranges) of key factors, following generally accepted experimental statistical concepts. The approach emphasizes the recognition of key parameters for the factors of interest, selection of the appropriate number of levels for a factor, and the selection of the number of replicates within each cell of the experiment design. These experiments were designed to:

- Statistically test the hypothesis of distress failure mechanism.
- Determine whether there is any bias in the predictions.
- Establish the cause of any bias.
- Determine the calibration function.

Age (or time) and the independent variables (material properties) of the transfer functions were treated as continuous variables for the load-related distress. Traffic was also treated as a continuous variable for the load-related distress. Only Traffic level 1, involving the actual traffic axle load spectra, was used in the calibration process.

The primary purpose of the rutting model was to predict the amount of permanent deformation in each pavement layer and subgrade. For the HMA mixtures, the rutting model predicts both one-dimensional densification and shear during the primary and secondary repetitions load phases. It is very important for the reader to clearly understand that the single most limitation associated with the permanent deformation calibration study was the fact that only total rut depth observations were available for each LTPP section and that no individual material layer rut depth were achievable for use in the field calibration because trenches were not utilized in the LTPP study. Accurate calibration of the model requires the use of trenches to measure the amount and type of permanent deformation within each layer.

Five critical factors are necessary for the experiment design for calibration of the rutting-permanent deformation model. Each factor is discussed below, along with some additional considerations that will be used in the site selection process.

- The pavement temperature regime (environmental zone) is a major consideration for permanent deformation in HMA mixtures because it influences the viscoplastic properties of the mixtures. Temperature will be included as a key factor in the experiment to determine if different climatic conditions result in any bias of the predictions.
- HMA layer thickness, insofar as it influences the magnitudes of stress and strain in the asphalt layers and underlying layers, also has relevance to the development of rutting. Thus, it is considered a key factor in the experiment. As stated above, trenches are required to measure the permanent deformation in each layer. Without these trenches, only the total magnitude of rutting measured at the surface can be calibrated, unless other calibration – validation methodologies are employed.
- Pavement type and rehabilitation strategy are additional factors of the experiment for checking the failure hypothesis and to determine if there are any biases for the different pavement structures or calculation methodologies. The pavement types and rehabilitation strategies were considered key factors within the calibration experiment. The pavement type and rehabilitation strategies were checked as to how the computations of incremental rut depths for each layer are made to simplify the factorial.
- Subgrade soil type is another significant factor in the calibration experiment, because of the potential for distortions in the subgrade.
- Although permanent deformation of HMA mixtures is a complex phenomenon, mix stiffness or the dynamic modulus is considered a first-order indicator of its susceptibility to this distress. This arises from the fact that the ratio of plastic to resilient strains generally obeys a power law related to the number of repetitions.

In general, different binder or performance grades of asphalt with different gradations (coarse to fine gradations) can be included in the selection of test sections for specific cells to cover the range of stiffness. Since rutting is universally proportional to the mix stiffness (as it influence the vertical elastic – resilient strain), the mix E value becomes a key predictor variable for HMA rutting. In addition, as stated in Chapter 3 for fatigue cracking, the dynamic modulus is dependent on temperature and age. As a result, mixture modulus will be considered as a co-variant parameter in the experiment.

- Similar to fatigue cracking, the rut depths measured at the surface covered the normal range found in pavements. The time-series rutting data, for a given LTPP section, was used to cover the range in rut depths; so separate cells are not needed.

Similar to the fatigue cracking calibration factorial, attempts were made to select two test sections for each cell—one with low rut depth and the second with relatively higher rut depth. The different geometrical shapes of the transverse profile were used in selecting the individual test sections for each cell. Three different shapes of the transverse profile were used or represented within each cell—one representing the typical densification of the HMA surface layer, one representing the mechanical deformation of the underlying layers and subgrade, and one representing lateral flow of HMA mixtures.

The field sections were selected randomly to ensure that a well-balanced experimental plan matrix of key variable was determined. The models were evaluated based on bias, precision, and accuracy, as defined below,

- Bias – An effect that deprives predictions of simulating “real world” observations by systematically distorting it, as distinct from a random error that may distort on any one occasion but balances out on the average.
- Precision – The ability of a model to give repeated estimates that is very close together.
- Accuracy – The closeness of predictions to the “true” or “actual” value. The concept of accuracy encompasses both precision and bias.

Site Selection Criteria and Considerations

The following lists and briefly defines the criteria that were considered in selecting and prioritizing sites for use in the calibration and validation of the Design Guide distress prediction models for flexible pavements.

- **Consistency of Measurements –** It is imperative that a consistent definition and measurement of the surface distresses and other data be used and maintained throughout the calibration and validation process. All data used to establish the inputs for the models (including, material test results, climatic data, and traffic data) and performance monitoring, are collected or measured in accordance with the FHWA LTPP publication Data Collection Guide For Long Term Pavement Performance (11) or with an equivalent method.

- **Time-Series Distress Data –** Projects or test sections that have three or more distress surveys or observations within their analysis life were given a high priority in the site selection process.
- **Materials Characterization and Testing** – Materials tests or properties were required for each input level. However, material testing (level 1 type) is outside the scope of this research work. Thus, test sections for which the material properties have already been measured are required for use to calibrate the distress prediction models. The material properties of the pavement layers must be measured with the same test protocols to ensure that the results are compatible between different projects and test sections.
- **Number of Layers –** The test sections with the fewest number of structural layers and materials (e.g., one or two asphalt concrete layers, one unbound base layer, and one subbase layer) were given a higher priority to reduce the data collection requirements, as well as the complexity of the analysis.
- **Traffic –**The recommended traffic data collection frequency is one week per quarter year, or during periods of peak truck traffic. First priority in the selection of field sections for the calibration experiments was given to those in the LTPP inventory equipped with continuous WIM. Unfortunately, many LTPP test sections do not have continuous WIM data, even for a limited number of years. Thus, a second priority in the selection of field sections was given to those test sections with seasonal WIM monitoring with the greatest frequency of sampling and continuous AVC sampling for multiple years.
- **Rehabilitation and New Construction –** The computation methodology (incremental damage accumulation) to simulate a distress mechanism for both new construction (original pavement surfaces) and rehabilitation (overlays) will be different for some distresses. As a result, test sections with and without overlays were needed for the calibration and validation experiments.
- **Maximum Use of Test Sections Between Model Studies** – Coordination of field activities between projects can substantially reduce the number of test sections that will be required if each project were conducted independently from the others. Those projects or test sections that are planned for use on other research projects were given a higher priority for use in the calibration-validation process of the Design Guide distress prediction models.
- **Non-Conventional Mixtures** – Those test sections that include non-conventional mixtures or layers were given a higher priority for the site selection process. These non-conventional mixtures include: SMA, modified HMA, and open-graded drainage layers. However, open-graded drainage layers were the only non-conventional material that was used in the GPS and SPS-1 and 5 experiments. Thus, it can be stated that the calibration process was primarily based upon conventional dense graded type of asphalt mixtures.
- **Experimental Optimization/Efficiency** – The test sections for the calibration and validation studies came from the SPS and GPS sites included in the LTPP program. Fewer number of sections was used because of the cost and time

required for data collection and review. Those test sections that were used for multiple factorials were given a higher priority for the site selection process.

Identification of Test Sections

The first activity of the site selection process was to categorize all test sections applicable for both the calibration experiments based on the data requirements. The following LTPP studies meet the general criteria listed above:

- GPS,
- SPS-1, Structural Factors for Flexible Pavements.
- SPS-5, Rehabilitation of Asphalt Concrete Pavements.

In summary, these projects include varying climates, traffic levels, subgrade soils, and pavement structural cross sections. The specific sites used in the calibration process are shown in Figure 8 and Figure 9. There were 136 LTPP test sections (94 new sections and 42 overlay sections) used for the calibration. As previously noted, these are

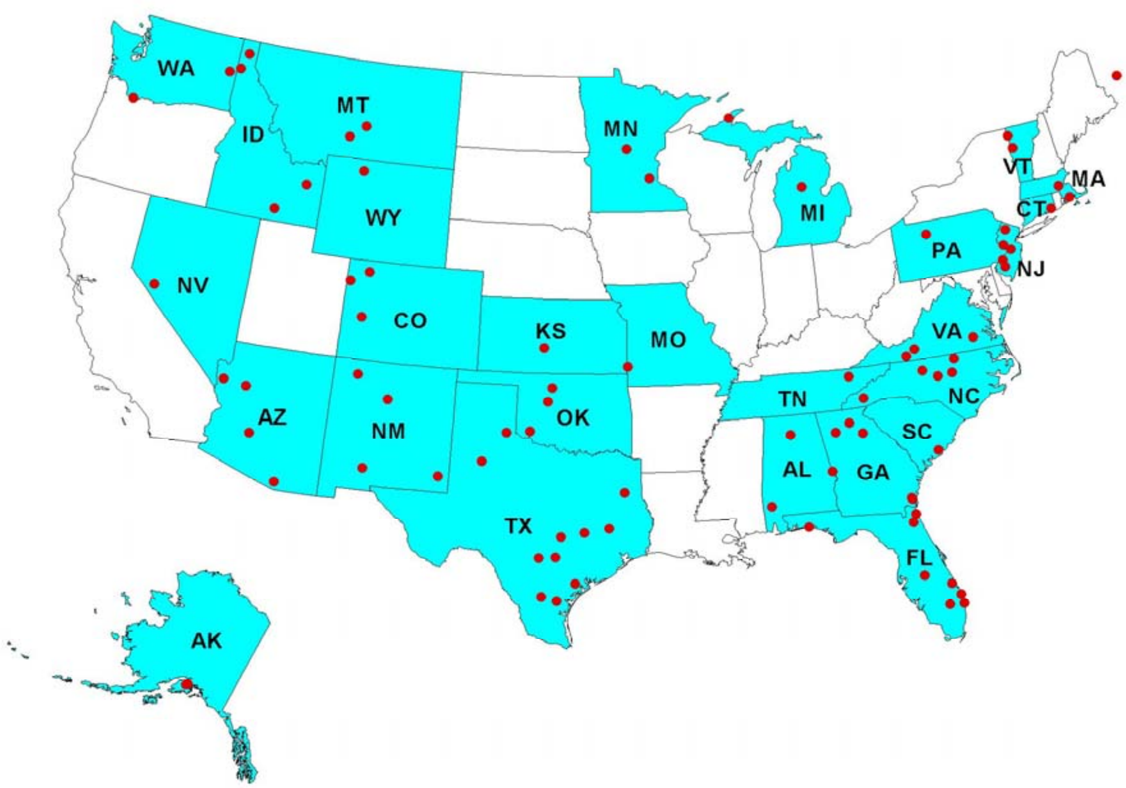


Figure 8 Location of the Sections used in the New Pavement Calibration

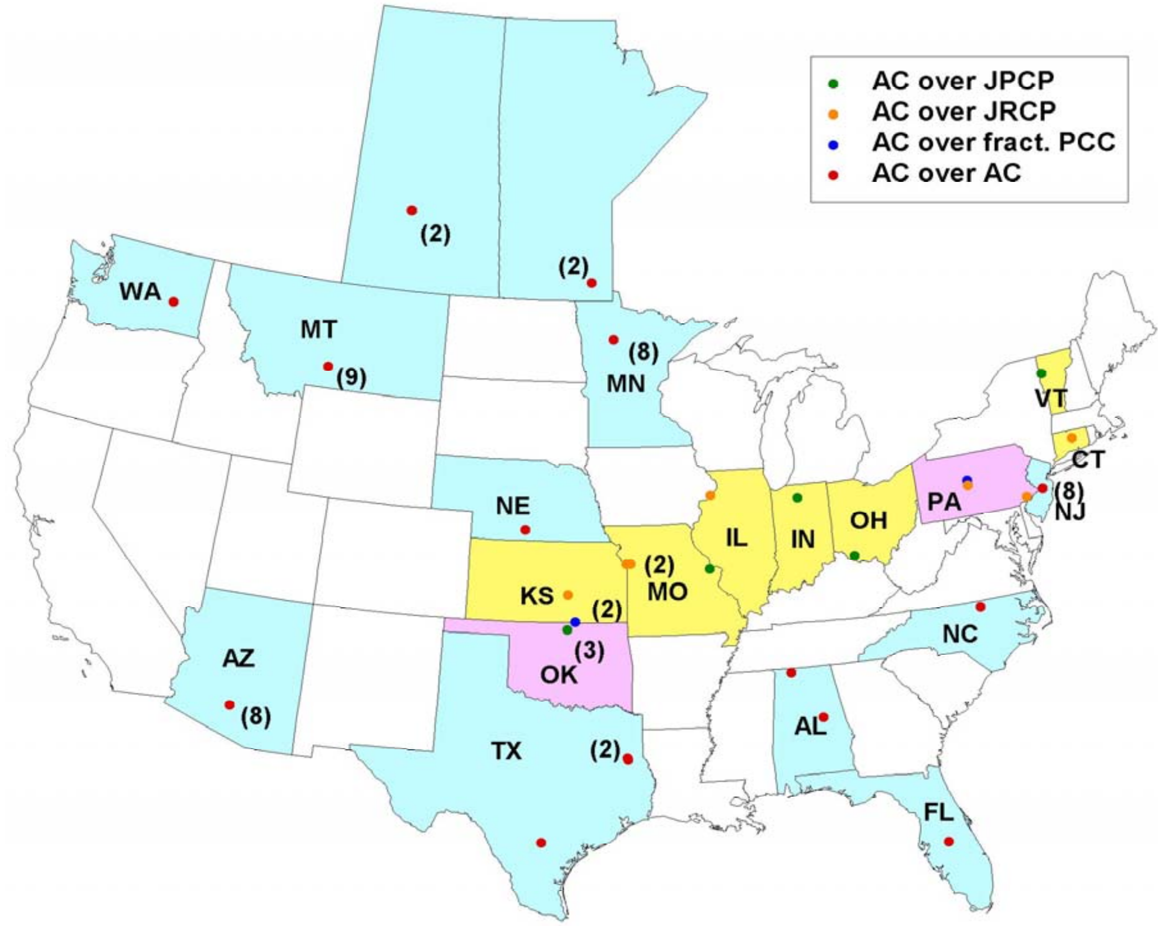


Figure 9 Location of the Sections used in the Rehabilitations Calibration

the same sites used in the fatigue calibration study and the specific details for each test section are summarized in Appendix EE. It has to be noted that the rehabilitation data is included in the dissertation.

The LTPP database provided the rut depth at the surface of the pavement structure for each LTPP section. The rut depth reported was measured in the left and the right lanes. In this research work, it was agreed that the average rut depth of both lanes was used in the comparison to the predicted total rut depth. However, to obtain an estimate of the true field rutting in individual layers, the percentage from the predicted sub-layer rutting was multiplied by the average total rutting to approximate the true field rutting in each layer. This approach was applied to rutting in the base / subbase and subgrade layers. This assumption was necessary in the rutting model development because trench (layer rut depth) data were not available. The true ramifications of this assumption cannot, obviously, be ascertained. However, it was the opinion of the research team that this assumption (for each individual LTPP section) was not greatly in error from the true reality of the field situation.

Simulation Process

After selecting the LTPP sections suitable for use in for the calibration and collecting all the data needed to analyze each pavement section; the next step in the calibration process was to run the 2002 Design Guide software for all available sections. The output from the software was the monthly rut for each layer and the total rut depth for each section, for each month of the pavement section design life.

Permanent Deformation Prediction Procedure

The analysis part of the software is a complicated process. The design starts with inputting the data using the windows based input screens, then the analysis is run and finally the output is presented in excel worksheets. The procedure needed to predict permanent deformation for flexible pavements follows certain steps these steps are summarized below:

- **Tabulate input data**: summarize all inputs needed.
- **Process traffic data**: the processed traffic data needs to be further processed to determine equivalent number of single, tandem, and tridem axles produced by each passing of tandem, tridem, and quad axles.
- **Sub layering of Pavement Structure**: the pavement structure is subdivided into smaller sublayers to account for the change in temperature and frequency in the asphalt layers, as well as moisture content changes in unbound layers.
- **Process pavement temperature profile data**: the hourly pavement temperature profiles generated using EICM (nonlinear distribution) need to be converted to a distribution of temperature by calendar month at each vertical depth used in the computational analysis.
- **Process monthly moisture conditions data**: the effects of seasonal changes in moisture conditions on base and subgrade modulus.

- **Calculate stress and strain states**: calculate vertical strains at the mid depth of each sublayer, as well as, the top of the subgrade and 6 inches below the surface of the subgrade. The strains are calculated for each load, load level, load position, and temperature interval for each month within the design period. The elastic strains at each computational point using the material modulus and Poisson's ratio and triaxial states of stress from JULEA.
- **Calculate permanent deformation** – calculate rutting for each sub-season and sum to determine accumulated rutting in each layer.

A detailed step-by-step procedure is given below:

Step 1: Tabulate input data

All input data required for the prediction of permanent deformation is explained in detail in Appendix EE.

Step 2: Process traffic data

The traffic inputs are first processed to determine the expected number of single, tandem, tridem, and quad axles in each month within the design period. As mentioned earlier Level-1 traffic is used in the calibration process. Level-1 traffic includes the actual traffic axle–load spectra data for each section from the LTPP database.

Step 3: Process temperature profile data

A normal computational unit of one month is typically used for pavement response computations. In situations where the pavement is exposed to freezing and thawing cycles, the base unit is changed to 15-days (half month) duration to account for rapid changes in the pavement material properties during frost/thaw period. While pavement response computations are based on a two-week or monthly average temperature; the influence of extreme temperatures, above and below the average, are directly accounted for in the design analysis. In order to include the extreme temperatures during a given month (or during 15 days for freeze/thaw period), the following approach is used in the analysis scheme.

The solution sequence from the EICM provides temperature data at intervals of 0.1 hours (6 minutes) over the analysis period. This temperature distribution for a given month (or 15-days) can be represented by a normal distribution with a certain mean value (μ) and the standard deviation (σ), $N(\mu,\sigma)$ as shown in Figure 10.

The frequency distribution of temperature data obtained using EICM is assumed to be normally distributed as depicted in Figure 10. The frequency diagram obtained from the EICM represents the distribution at a specific depth and time. Temperatures in a given month (or bi-monthly for frost/thaw) may have extreme temperatures (even at a low frequency of occurrence) that could be significant for the rutting prediction.

Using the average temperature value will not capture the effect caused by these extreme temperatures. In order to account for the extreme temperature, the temperatures over a given interval are divided into five different sub-seasons. For each sub-season, the sub-layer temperature is defined by a temperature that represents 20 % of the frequency distribution of the pavement temperature. This sub-season will also represent those conditions when 20% of the monthly traffic will occur. This is accomplished by computing pavement temperatures corresponding to standard normal deviates of -1.2816, -0.5244, 0, 0.5244 and 1.2816. These values correspond to accumulated frequencies of 10, 30, 50, 70 and 90 % within a given month.

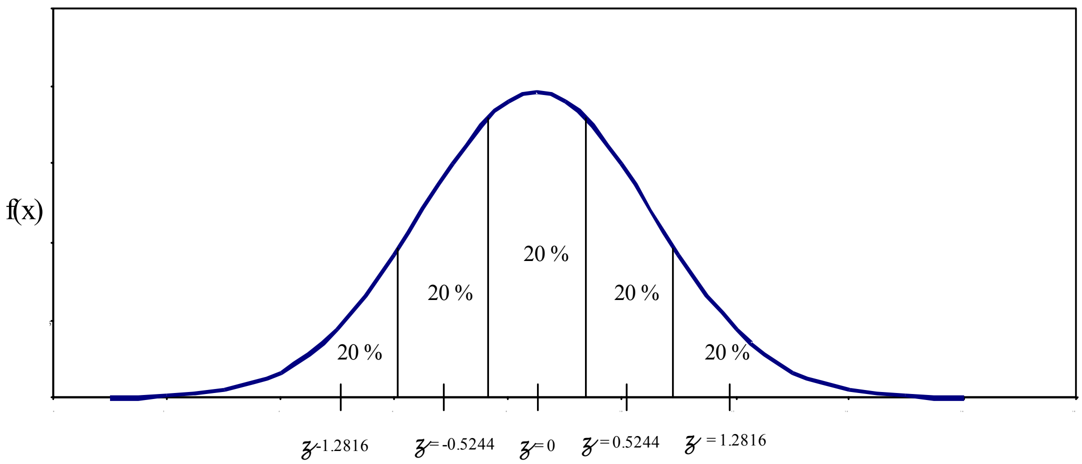


Figure 10 Temperature Distribution for a Given Analysis Period

Step 4: Process monthly moisture conditions data

EICM calculates the moisture content and corrects for the moisture change in the unbound layer. The reader is referred to the NCHRP 1-37A documentations (12) for a more detailed explanation of the method used to adjust the unbound layer modulus as a function of in-situ moisture changes.

Step 5: Pavement Sub layering

Each layer (material type difference) in the pavement structure may be sub divided into smaller sublayers to account for the changes in the temperature and frequency in the asphalt layers, as well as, the changes in the moisture content in the unbound base, subbase and subgrade layers.

The first 1-inch of the asphalt layer is subdivided into two 0.5 and 0.5 inch sublayers. Then the asphalt layer is further subdivided into 1-inch sublayers to a depth of 4 inches. If the thickness of the asphalt layer is greater than 4 inches then a sublayer is added with a maximum thickness of 4 inches, which makes the total asphalt thickness to be 8 inches. The remaining thickness of the asphalt layer is taken as one final AC sublayer. For example if the AC layer thickness was 10 inches; then the asphalt sublayers would be 0.5, 0.5, 1,1,1,4 and 2 inches. All base, subbase and subgrade layers are subdivided as shown in Figure 11. If there is a chemically stabilized layer, these layers are not subdivided. Finally, it is important to recognize that no sublayering is conducted for any layer material greater than 8 feet from the surface. The maximum number of AC layers that can be used in the new design process is three; the maximum number of layers that can be input is 10 and the maximum number of sublayers, used in stress- strain computations, is 19.

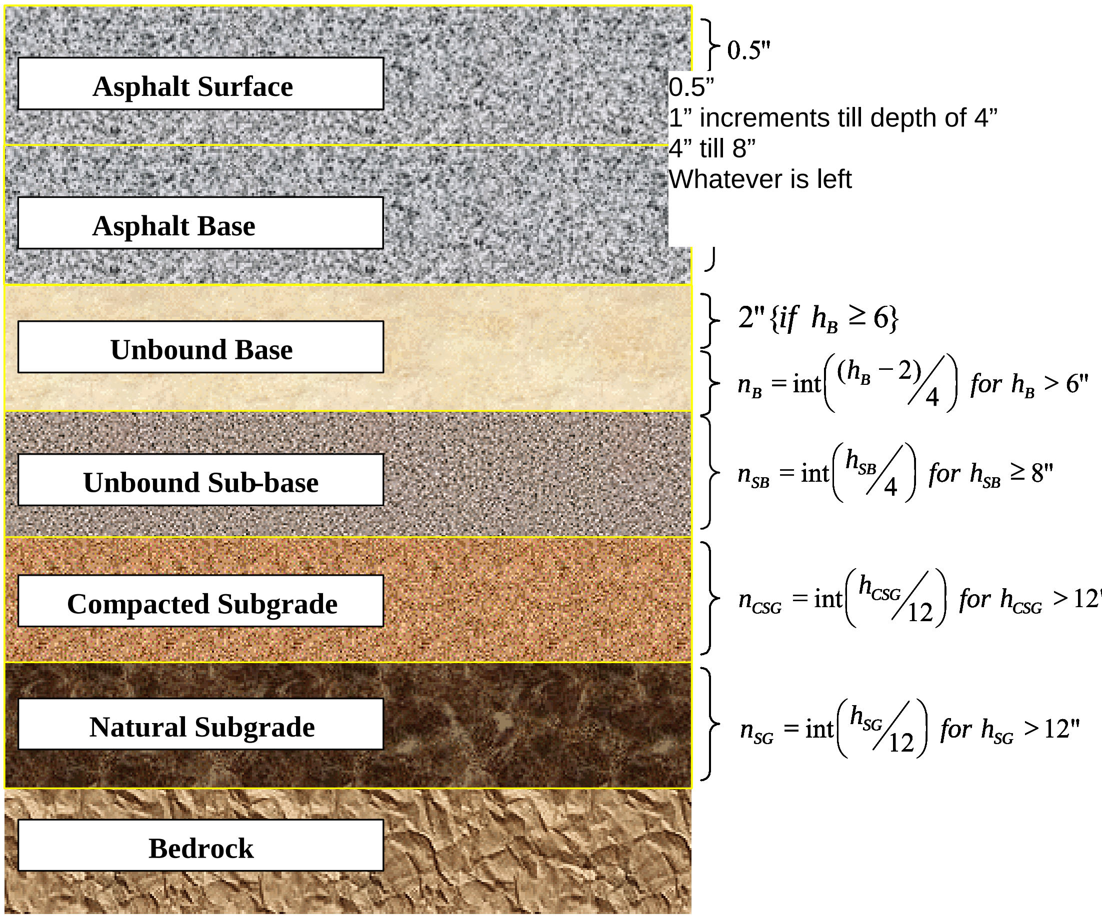


Figure 11 Layered Pavement Cross-Section for Flexible Pavement Systems (No Sub layering Beyond 8 Feet).

Step 6: Calculate strain

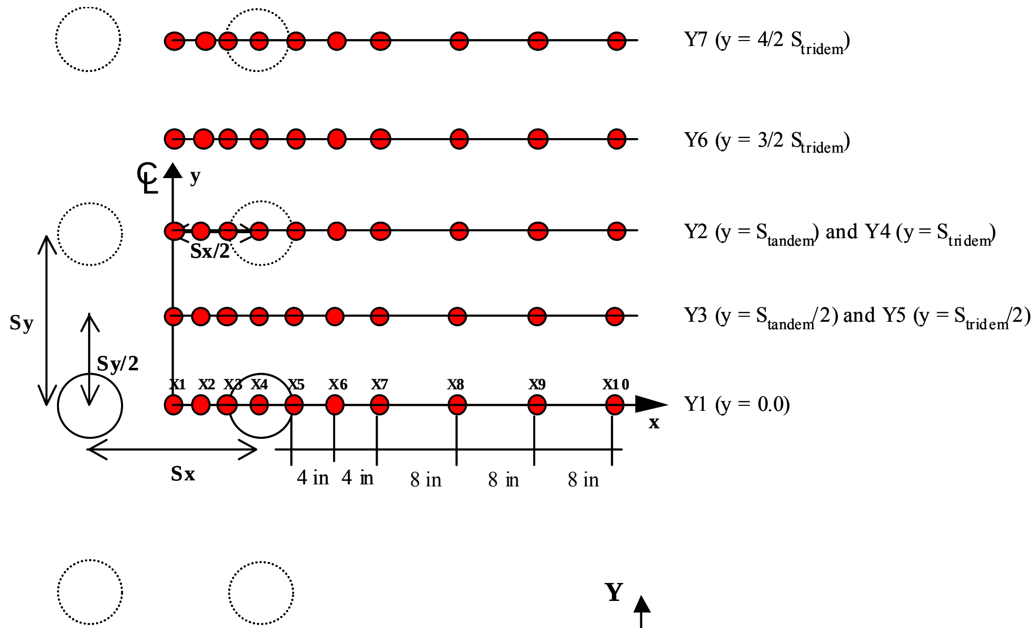
It is necessary to use the pavement response model for the layered pavement structure to calculate potentially critical strains for all cases that need to be analyzed. The number of computational locations depends on the rutting increment. The following increments are considered:

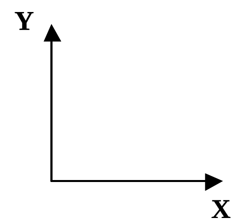
- Pavement age – by year.
- Season – by month or semi-month.
- Load configuration – axle type.
- Load level – discrete load levels in 1,000 to 3,000 lb increments, depending on axle type.
- Temperature – pavement temperature for the HMA dynamic modulus.

For the rutting computation, it is important to identify the locations in the pavement system that will result in a critical response value. However, within any given pavement cross section, it may not be possible to specify the one location that will result in a maximum damage; especially as conditions change within seasonal intervals and several different combinations of axle configurations must be analyzed. To overcome this problem, the program internally specifies a matrix of computational points that will insure that the location of the maximum damage (rutting) will always occur. It should be recalled that the program uses a maximum of four-axle types for design and analysis. It is also possible to have only one or two axle types from the four in the traffic mix. Based upon the type of axles in the traffic mix, the program defines the analysis locations where the maximum rutting could occur because of mixed traffic. Once these locations are defined, rutting is calculated at these locations for performance prediction and to estimate the maximum rutting occurring in the pavement.

The analysis location defined below is applicable both for the layer elastic analysis (JULEA) and for the FEM approach. For the layered elastic analysis (JULEA), the principle of superposition is used to account for axles within the specific axle type (single, tandem, tridem, or quad). For any axle type, the response in only obtained for dual wheels on the single axle and the effect of other wheels within the axle configuration is obtained by superposition. This was done to optimize and minimize the number of JULEA runs for the layer elastic analysis. The only restriction with this approach is that all wheels in the gear assembly have the same load and tire pressure. Figure 12 shows the analysis locations for the four axle types used for the general traffic analysis. In addition, the figure also shows the approach used for the estimation of critical response.

Before explaining the approach used for the determination of the critical response, it is important to understand the location of the analysis points. A description of the “X” and “Y” locations are shown in Figure 12.





Computed Responses

- Single
  - Response 1 = Y1
- Tandem
  - Response 1 = Y1 + Y2
  - Response 2 = 2 * Y3
- Tridem
  - Response 1 = Y1 + 2 * Y4
  - Response 2 = 2 * Y5 + Y6
- Quad
  - Response 1 = Y1 + 2 * Y4 + Y7
  - Response 2 = 2 * Y5 + 2 * Y6

Figure 12 Schematics for Horizontal Analysis Locations Regular Traffic

X-Axis Locations

$X1 = 0.0$ {center of dual tires/tire spacing}

$X2 = ((T_{spacing}/2) - T_{radius})/2$ {$T_{spacing}$ = tire spacing; T_{radius} = tire contact radius}

$X3 = (T_{spacing}/2) - T_{radius}$

$X4 = T_{spacing}/2$

$X5 = (T_{spacing}/2) + T_{radius}$

$X6 = (T_{spacing}/2) + T_{radius} + 4$ in

$X7 = (T_{spacing}/2) + T_{radius} + 8$ in

$X8 = (T_{spacing}/2) + T_{radius} + 16$ in

$X9 = (T_{spacing}/2) + T_{radius} + 24$ in

$X10 = (T_{spacing}/2) + T_{radius} + 32$ in

Y-Axis Locations

Y1: $y = 0.0$ {center of dual tires/tire spacing}

Y2: $y = S_{tandem}$ {tandem axle spacing}

Y3: $y = S_{tandem}/2$

Y4: $y = S_{tridem}$ {tridem/quad axle spacing)

Y5: $y = S_{tridem}/2$

Y6: $y = S_{tridem}3/2$

Y7: $y = S_{tridem}4/2$

The above combination of locations results in a total of 70 analysis points (10 X-locations with 7 Y-locations) for 4 axle types. These analysis locations are used for the determination of critical stresses/strains for the rutting calculations. It should be remembered that for a given axle type the response at these analysis locations is determined by the dual wheels only, and not by the entire wheel configuration on a specific axle type.

The simplest case is that of a single axle with dual wheels, where no superposition due to other axles is required. Along the x-y plane, the designated analysis locations are X1 to X10 along the Y1 ($y = 0.0$), as shown in Figure 12. The response is measured along these points to determine the critical value. The critical location is the one at which the response (stress/strain) is maximum. This is shown as Response 1, under the single axle category. For tandem axles, a total of 30 analysis points are needed. These points are along Y1, Y2, and Y3. Y1 is set at $y = 0$ (over the x-axis), Y2 is set at $y = S_{tandem}$ (tandem axle spacing), and Y3 is set at $y = S_{tandem}/2$. It should be recalled that the stresses/strains are only estimated for the twin wheels at these analysis locations. For tandem axles, it is very obvious because of the geometry that the maximum response will be either along the axis under the twin wheels (along Y1 or Y2) or along Y3. Since the responses along Y1 and Y2 should be same, the response is only estimated at one of these locations. The two responses for the tandem axle configuration are shown in Figure 12 as Response 1 and Response 2. Response 1 will be the summation of stresses/strains along Y1 (wheel location at y=0) and Y2 (wheel location at $y = S_{tandem}$), whereas Response 2 will be two times Y3 (accounting for two axles at $y = S_{tandem}/2$). The critical stress/strain along x-axis is determined by comparing the two responses at the same x-axis distance. That is, the two X1 values along y = 0 and at y = $S_{tandem}/2$ are compared for maximum value. Comparing all the paired values will then define the critical response.

Similarly, two sets of responses are estimated for tridem and quad axle configurations. For tridem axles total of 40 analysis locations are used, while for quad axles, 50 locations are required.

The above only relates to the horizontal analysis locations in the x-y plane. On these horizontal locations, critical responses are determined at several depth locations depending upon the distress type (generally at mid depths of each sublayer). Given a particular layered pavement cross section, the vertical resilient strain at any given depth (along a vertical axis, defined in the *x*, *y* plane) is computed from knowledge of the three-dimensional stress state and the elastic properties (modulus and Poisson's ratio) of each sublayer in question from:

$$\varepsilon_{rz} = \frac{1}{E}(\sigma_z - \mu\sigma_x - \mu\sigma_y) \tag{42}$$

For the linear elastic analysis using the JULEA program, it is necessary to estimate the vertical strains for sublayers that are too close to the surface. This is a minor limitation of the JULEA code and occurs when the layer mid-depth location is between the surface (Z = 0) and a depth not exceeding 20 percent of the tire contact area radius. A simple and highly accurate process was developed for obtaining these strains at shallow depths. This is accomplished by linear interpolation between the JULEA response at the surface (Z = 0) and at the depth corresponding to this minimum value ($Z > 0.2\ a_c$). This approach has been found to give very accurate and identical comparisons to other pavement response models (e.g. BISAR) that do not have this computational limitation of JULEA.

Step 7: Calculate permanent deformation

The Model for permanent deformation in the 2002 Design Guide provides the plastic strain under a specific set of pavement conditions for a total number of load repetitions. Because conditions vary from one season to another (e.g., temperature, resilient strain, moisture); it is necessary to account for the total plastic deformation up to the specific season *i*, by a special approach called the strain hardening approach, to incorporate these variable parameters in a cumulative deformation subsystem.

For the general solution, permanent deformation is estimated for each layer and at each computational location using pavement responses calculated through JULEA at the mid-depth of each sub-layer. Computations of permanent deformations were done at locations defined by the analysis module for regular traffic. In the ensuing models described, equivalent number of load cycles for each sub-season are found by solving the permanent deformation model for N with the accumulated deformation up to the sub-season and material properties and load conditions prevailing in the given sub-season.

The approach is illustrated in Figure 13 for a model of the form:

$$\varepsilon_p = f(\varepsilon_r, T, N) \tag{43}$$

where:

ε_p = Total plastic strain (in/in).

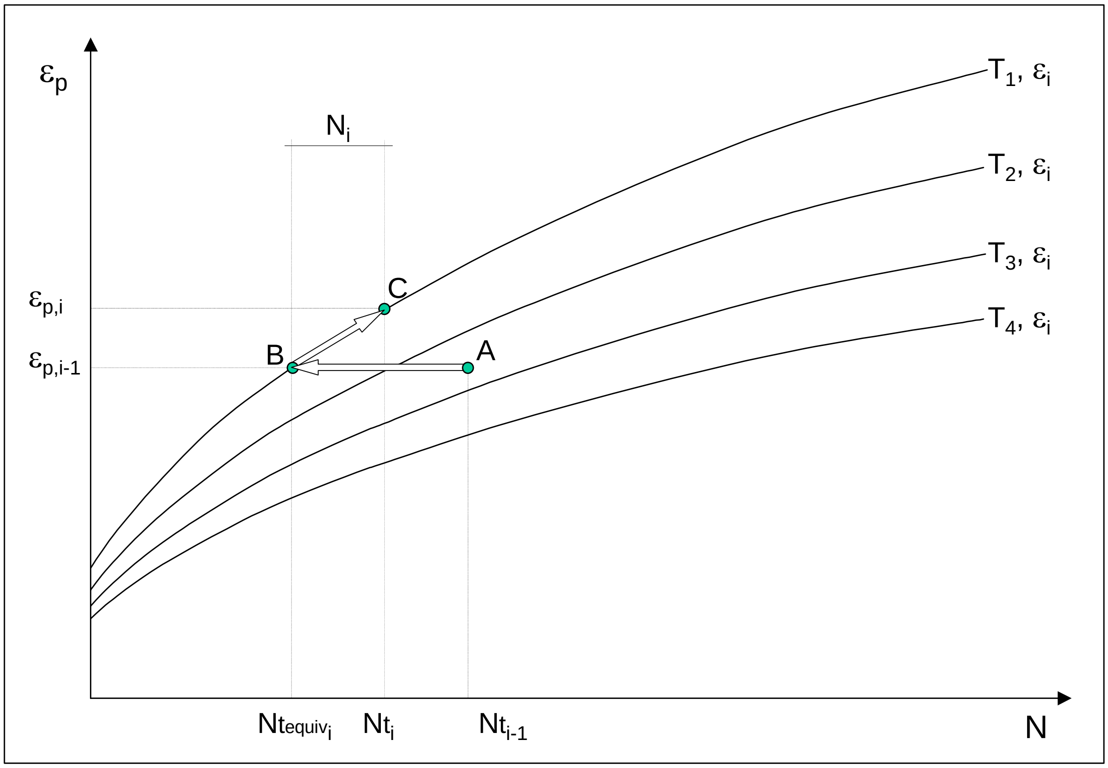


Figure 13 Permanent Deformation Approach.

ε_r = Resilient strain (in/in).
T = Temperature (deg. F).
N = Total number of load cycles (given axle type and load).

The total plastic strain $\varepsilon_{p,i-1}$ at the end of subseason i-1 corresponds to a total number of traffic repetitions Nt_{i-1} (point A). In the next subseason *i*, the layer temperature is T_1 and resilient strain for load and material conditions prevailing in *i* is $\varepsilon_{r,i}$.

At the beginning of the next subseason *i* (point B), there is an equivalent number of traffic repetitions $Nteq_i$ that is associated with the total deformation at the end of subseason *i-1* but under conditions prevailing in the new sub-season (T_1, $\varepsilon_{r,i}$). The approach is necessary because models for permanent deformation provide an estimate of the total deformation rather than the increment in plastic strain due to seasonal traffic.

By adding the number of traffic repetitions at season *i* (N_i) to the total equivalent number of repetitions $Nteq_i$, using the specific material model, it is possible to estimate point C, which corresponds to the total plastic strain at the end of sub-season *i*.

Pavement subgrades are pavement foundation layers that may have very large depths and, in some cases, may be considered to be a layer with infinite depth. Therefore, in many cases, it is not be technically computational feasible to divide the subgrade into sublayers and compute plastic strains at the mid depth of each sub-layer in order to estimate the total subgrade permanent deformation, due to the huge computational effort involved.

An alternative approach was developed by Ayres (13) to evaluate the plastic strain for an infinite layer. Using pavement response model JULEA, pavement responses at three different horizontal locations for various depths from the top of the subgrade, ranging from 0 to 150 inches, were obtained for several pavement structures. Overburden stresses resulting from the materials above the computational points were added to the stresses computed by JULEA.

Using the model for subgrade materials provided by Tseng and Lytton, plastic strains were calculated for the computational locations within the subgrade.

Evaluation of the plastic strain trend along each of the three vertical axes previously selected was performed using numerical optimization techniques. This analysis indicated that the following model structure provides an R^2 exceeding 97 percent:

$$\varepsilon_p(z) = (\varepsilon_{p,z=0})\, e^{-k\,z} \qquad (44)$$

where:
$\varepsilon_p(z)$ = Plastic vertical strain at depth z (measured from the top of the subgrade)
$\varepsilon_{p,z=0}$ = Plastic vertical strain at the top of the subgrade (z = 0)
z = Depth measured from the top of the subgrade

k = Constant obtained from regression

Using this assumption, the procedure used to estimate the total permanent deformation of thick subgrades follows the procedure as noted.

Compute pavement response at the top of the subgrade and at a depth of 6 inches from the top of the subgrade (resilient strain and deviator stress). Using the models already described for subgrade materials, compute the parameters: $\left(\frac{\varepsilon_o}{\varepsilon_r}\right)$, β and ρ at the two depths, z = 0 and z = 6 in.

Using the parameters previously computed, estimate the plastic strain for both depths as:

$$\varepsilon_p = \left(\frac{\varepsilon_o}{\varepsilon_r}\right) e^{-\left(\frac{\rho}{N}\right)^{\beta}} \varepsilon_v \tag{45}$$

Using the model structure described and the two data points, solve for the regression constant, k:

$$k = \frac{1}{6} \ln\left(\frac{\varepsilon_{p,z=0}}{\varepsilon_{p,z=6}}\right) \tag{46}$$

In the above equation, the assumption is that the strains at the top of the subgrade are larger than the strains at 6 inches below the subgrade. However, this is not true in all situations, and the reverse happens in some situations, invalidating the assumption resulting in a negative k value. This will result in increased permanent strain with depth resulting in inaccurate permanent deformation predictions for the subgrade. This can happen because of the overlapping stresses because of multiple wheel configurations.

To overcome this problem, a limiting value of K equal to 0.000001 is used in the program. This assumption will not cause any significant error in the results since the subgrade is divided into several sub-layers and the contribution for the last sub-layer should be negligible.

The plastic deformation of the subgrade is given by the following relationship:

$$d\delta = \varepsilon_{\mathrm{p}}(\mathrm{z})\, dz \tag{47}$$

The total permanent deformation is found by solving the following integral:

$$\delta = \int_{0}^{h_{bedrock}} \varepsilon_p(z)\, dz \tag{48}$$

or:

$$\delta = \varepsilon_{p,z=0} \int_{0}^{h_{bedrock}} e^{-k\,z}\,dz = \left(\frac{1-e^{-kh_{bedrock}}}{k}\right)\varepsilon_{p,z=0} \tag{49}$$

where:

δ = Total plastic deformation of the subgrade

$h_{bedrock}$ = Depth to bedrock

The stresses and strains computed by the pavement response model, combined with the overburden stresses calculated by the program, are used in the permanent deformation models available. Depending upon the pavement response model used (linear elastic versus FEM), type of layer, one or more of the following pavement responses at the mid-depth of the layer may be required. These responses are needed when non-linear Mr models are used in the Finite Element code.

- Vertical resilient strain
- Bulk stress
- Deviator stress

The stresses and strains are always computed at the mid depth location of each layer/sub-layer of the pavement structure, except for the subgrade. Subgrade response is estimated at the interface between the subgrade and lowermost pavement layer and also at a depth of 6 inches from this interface, as previously described.

To obtain the deviator and bulk stresses needed for modeling unbound material permanent deformation, models were used to calculate the vertical and horizontal overburden pressures using the specific gravity values and lateral pressure coefficients for the materials composing the pavement. The following relationships are used for these calculations:

$$\sigma o_j^z = \frac{62.4}{12^3}\left(\sum_{i=1}^{n} h_i\,G_i + \frac{h_j}{2}G_j\right) \tag{50}$$

$$\sigma o_j^x = \sigma o_j^y = \frac{62.4}{12^3}Ko_j\left(\sum_{i=1}^{n} h_i\,G_i + \frac{h_j}{2}G_j\right) \tag{51}$$

where:

σo_j^z = Overburden pressure in z (vertical direction) at mid depth of layer j

$\sigma o_j^x = \sigma o_j^y$ = Overburden pressure in x and y direction respectively, for layer j

h_i = Thickness of layer i

G_i = Specific gravity of layer i

Ko_j = Lateral pressure coefficient for layer j where overburden is to be computed (typically, Ko varies from 0.5 for uncompacted materials to 1.0 to compacted materials)

n = Number of layers/sublayers above the layer/sub-layer where overburden pressure is computed

For the two locations at the subgrade, interface and 6-in depth, h_j is considered zero and 12 inches, respectively.

Wander Effect

One of the inputs required in the design process is the lateral vehicle wander, in inches. Wander is the lateral traffic distribution over a pavement cross-section, and is very important due to the fact that not all vehicles stress the pavement surface at the exact same point. The amount of lateral wander plays a direct and significant role in affecting the permanent deformation within the pavement system. An increase in wander will result in less permanent deformation within the pavement system. It is not practical to assess the exact distribution of wander; however, a good approximation is to assume that the wander is normally distributed. The standard deviation for the normal distribution plot represents the wander in inches. For most typical highway applications, the standard deviation (wander) is taken at 10.0 inches.

For the fatigue cracking and because Miner's Law is linear with traffic, damage distribution because of the wander is computed from the fatigue damage profile obtained that has no wander (wander = 0 inch), as explained in Chapter 3. However, for rutting, instead of incorporating the wander approach for the damage like the fatigue analysis, wander must be accounted for in the pavement response after every JULEA run because rutting is not a linear function as fatigue damage.

Layer Rut

The incremental rut depth for each sublayer in the AC layer can be found from:

$$\Delta R_{d_i} = \varepsilon_{p_i} . \Delta h_i \tag{52}$$

Finally, by simply summing all incremental ΔR_d through the entire layer, one can obtain the total layer rut depth from:

$$R_d = \sum_{i=1}^{n} \Delta R_{d_i} \tag{53}$$

Simulation Runs

The total number of calibration factors in the permanent deformation calibration is 5 (three for the asphalt layers, one for the unbound granular base and one for the unbound subgrade), as shown in equations 9 and 13. These calibration factors were introduced to eliminate the bias and scatter in the predictions for each layer rut depth. These calibration factors are correction values applied to the initial theoretical models selected to achieve the final set of field calibrated permanent deformation models.

The final general approach used in the calibration process is described in the following paragraphs. It is again very important, at this point, to recognize that since no trench studies were available, actual layer rut depths could not calibrated purse. Rather, several other engineering approaches were used in this task. The simulation runs were done by running the software for a combination of values of the calibration factors β_{r2}, β_{r3} on the asphalt model only. Then the most reasonable solution was optimized using β_{r1} of the asphalt as a function of the total asphalt concrete layer thickness and the depth of the asphalt layer. This last correction was intended to compensate for the variable confining pressure, with depth, in the asphalt layers. This correction was felt to be extremely critical because it eventually models the AC rutting occurring with depth for any given thickness of AC layer.

The β_{GB} of the granular base and β_{SG} of the subgrade were found from a study using designed pavement sections from the 1993 AASHTO Design Guide (5). This study is explained later. The selection of the final model(s) was to optimize (minimize) the error square of the total rut varying the three factors (β_{r1}, β_{GB} and β_{SG}) at the same time.

These simulation runs were conducted for combinations of the calibration factor on the temperature (β_{r2}) and the number of load repetition (β_{r3}). Each one of the two calibration factors (β_{r2} and β_{r3}) initially utilized three values of 0.8, 1.0 and 1.2. This resulted in a matrix of simulation runs of 9 (3*3). Two additional runs were eventually found necessary to complete. One had a β_{r2} of 0.9 and a β_{r3} of 1.2 and the other run had β_{r2} equal to 1.0 and β_{r3} equal to 1.1. These two additional runs were added based on experience gained from running the optimization to focus on certain values, which were felt to be closer to the optimum solution.

Annex C shows the results of the simulation runs for both the asphalt and the unbound layers models for all combinations of the temperature and number of load repetition calibration factors grouped by total asphalt layer thickness, and subgrade modulus. In the following section, the results will be discussed and analyzed for the final step of the calibration process.

Only 88 sections out of the 94 new sections were selected for the simulation as they had permanent deformation data. The 88 sections were located in 28 different states with a different climatic location. The average running time of the program was 1.5 min per year within the design life, which average about half an hour running per section. The 11 simulation runs were done using one unbound layer-rutting model. However, 26 additional runs were done for each unbound layer rut model. This accumulated a total computer running time of 1628 hours

((11+26) simulations *88 sections *0.5 hour) in addition to the time take to input the data in the program.

It must be noted that the calibration process was not conducted only once. Unfortunately, the "calibration process" was repeated and rerun numerous times. Many factors contributed to numerous calibration runs. One of the biggest reasons for having to repeat the calibration process was due to bugs/errors in the program or the input data (like traffic). These problems only came to light after running a full set of calibration runs. This frequently necessitated that the results be completely disregarded and the calibration process be redone. Nonetheless, the results shown in this dissertation are the results of the last final set of runs after all analysis and software code bugs and errors were fixed and finalized.

Coefficient Selection

As noted, a matrix of different simulation runs were conducted on the 88 sections. Detailed plots, showing the results of each run grouped by asphalt thickness, are given in Annex C. As mentioned earlier, the calibration study was done using different β_{r2} and β_{r3} values ranging from 0.8 to 1.2. The total number of runs eventually completed were 11 combinations. To select the most accurate combination of β_{r2} and β_{r3} values, the total rut sum of error square and the total sum of error for the asphalt layer were compared for each combination after optimizing β_{r2} and β_{r3} for each solution. The optimization was done using two approaches for each combination of β_{r2} and β_{r3}:

- The first method was to keep the calibration factor for the granular and subgrade layers fixed at a certain value, minimize the sum of square of the error of the total rut, and then set the sum of error of the asphalt layer to zero varying β_{r1} only.
- The second method was to minimize the sum of error square of the total rut using all three-calibration factors (β_{r1}, β_{GB} and β_{SG}) at the same time, and then set the sum of error of the total rut to zero.

The results of the optimization for the two methods are shown in Table 2 and Table 3 respectively. Contour plots were used to compare the results and find the minimum solution for the sum of errors square and closest sum of error to the zero value. Figure 14 to Figure 17 show the plots of these contour lines, as a function of the β_{r2} and β_{r3} values.

Examining the contour lines, it is evident that best combination for the β_{r2} and β_{r3} values is the 0.9 and the 1.2 values (respectively) using both optimization methods. The following are some conclusions obtained from the contour plots:

- It was discovered that using a β_{r2} greater than 1.0 and β_{r3} equal to 1.2 resulted in very high rut depth predictions in thin sections. These solutions reached a maximum allowable rut value equal to the total thickness of the asphalt layer. It was concluded that these combinations couldn't be used due to the excessive rutting in thin sections.

- For the first optimization method the minimum sum of squared error for the total rut is found at β_{r2} of 0.9 and β_{r3} of 1.2 or any value of β_{r2} and β_{r3} should be less than 1.0 as shown in Figure 14. The optimum sum of error-square in the asphalt occurred at β_{r2} of 0.95 and β_{r3} of 0.95, Figure 15. However, for β_{r2} of 0.9 and β_{r3} of 1.2 the AC sum of squared error was not high. β_{r2} of 0.9 and β_{r3} of 1.2 was selected for method one optimization.
- For the second optimization method, the minimum sum of error-square for the total rut is at any value of β_{r2} and β_{r3} equal to 0.8 as shown in Figure 16. However, at β_{r2} of 0.9 and β_{r3} of 1.2 a value very close to the minimum value can be observed. However, the minimum sum of error-square for the asphalt layer rut is at β_{r2} of 0.9 and β_{r3} of 1.2 as shown in Figure 17. That is why β_{r2} of 0.9 and β_{r3} of 1.2 was selected.

After selecting the best values for the two calibration factors (β_{r2} and β_{r3}) on the asphalt layer rut model, the remaining three calibration factors were then further evaluated and adjusted as needed to provide accurate solutions for other calibration criterion deemed important. This will be explained in the following sections.

Table 2 Optimization Results for Optimization Method One

	β_{r2} and β_{r3} Combination	AC Layer	GB Layer	SG Layer	Total Rut
Sum of Error Squares	0.8,0.8	2.190	0.109	0.804	6.832
	0.8,1.0	2.189	0.113	0.842	6.907
	0.8,1.2	2.390	0.121	0.922	7.380
	0.9,1.2	2.290	0.116	0.888	6.885
	1.0,0.8	2.168	0.110	0.810	6.820
	1.0,1.0	2.179	0.115	0.849	6.914
	1.0,1.1	2.264	0.119	0.887	7.123
	1.0,1.2	2.379	0.122	0.921	7.366
	1.2,0.8	2.151	0.112	0.816	6.820
	1.2,1.0	2.430	0.115	0.842	7.309
	1.2,1.2	2.485	0.134	0.823	7.507
Sum of errors	0.8,0.8	0.000	0.057	0.972	0.753
	0.8,1.0	0.000	-0.252	-0.002	-0.529
	0.8,1.2	0.000	-0.683	-1.417	-2.375
	0.9,1.2	0.000	-0.672	-1.456	-2.128
	1.0,0.8	0.000	-0.014	0.868	0.579
	1.0,1.0	0.000	-0.332	-0.131	-0.739
	1.0,1.1	0.000	-0.541	-0.816	-1.633
	1.0,1.2	0.000	-0.694	-1.326	-2.296
	1.2,0.8	0.000	-0.088	0.746	0.382
	1.2,1.0	0.000	-0.284	0.485	-0.074
	1.2,1.2	0.000	-0.305	1.718	1.137

Shaded columns are the optimized values

Table 3 Optimization Results for Optimization Method Two

	β_{r2} and β_{r3} Combination	AC Layer	GB Layer	SG Layer	Total Rut
Sum of Error Squares	0.8,0.8	2.817	0.110	0.416	6.622
	0.8,1.0	2.219	0.166	0.714	6.908
	0.8,1.2	1.974	0.220	0.984	7.355
	0.9,1.2	1.971	0.213	0.885	6.852
	1.0,0.8	2.920	0.120	0.368	6.640
	1.0,1.0	2.476	0.169	0.588	6.947
	1.0,1.1	2.270	0.199	0.746	7.176
	1.0,1.2	2.263	0.213	0.833	7.416
	1.2,0.8	3.010	0.130	0.334	6.688
	1.2,1.0	3.207	0.188	0.328	7.184
	1.2,1.2	4.245	0.303	0.013	6.723
Sum of errors	0.8,0.8	0.324	-0.008	-0.041	0.000
	0.8,1.0	0.335	-0.005	-0.054	0.000
	0.8,1.2	0.738	-0.088	-0.374	0.000
	0.9,1.2	0.757	-0.150	-0.606	0.000
	1.0,0.8	0.533	-0.053	-0.204	0.000
	1.0,1.0	0.736	-0.096	-0.364	0.000
	1.0,1.1	0.864	-0.123	-0.465	0.000
	1.0,1.2	1.052	-0.175	-0.601	0.000
	1.2,0.8	0.726	-0.107	-0.343	0.000
	1.2,1.0	0.811	-0.097	-0.438	0.000
	1.2,1.2	0.618	-0.197	-0.145	0.000

Shaded columns are the optimized values

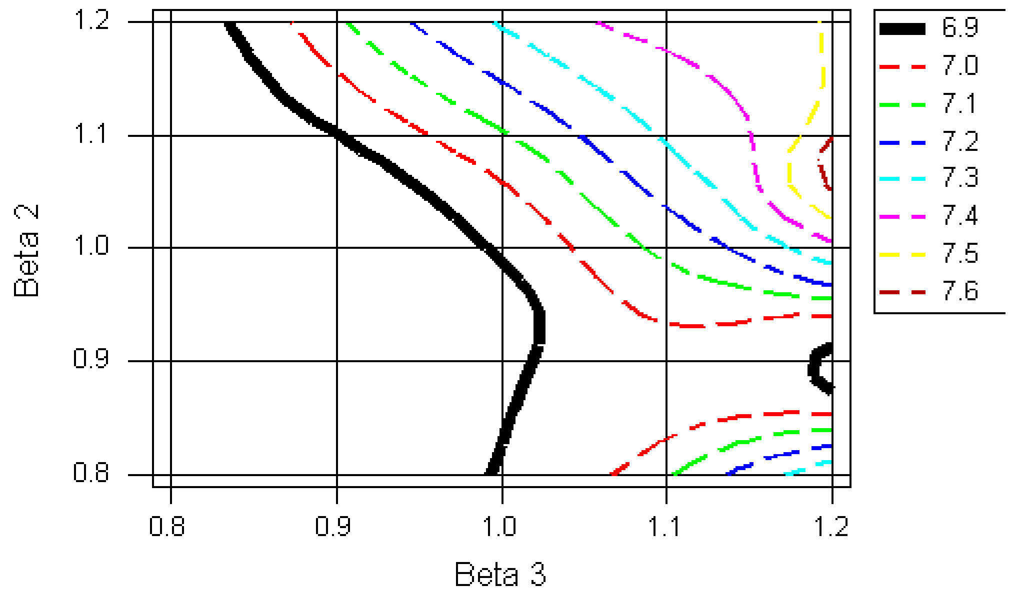


Figure 14 Total Rut Sum of Squared Error Contour for Optimization Method One

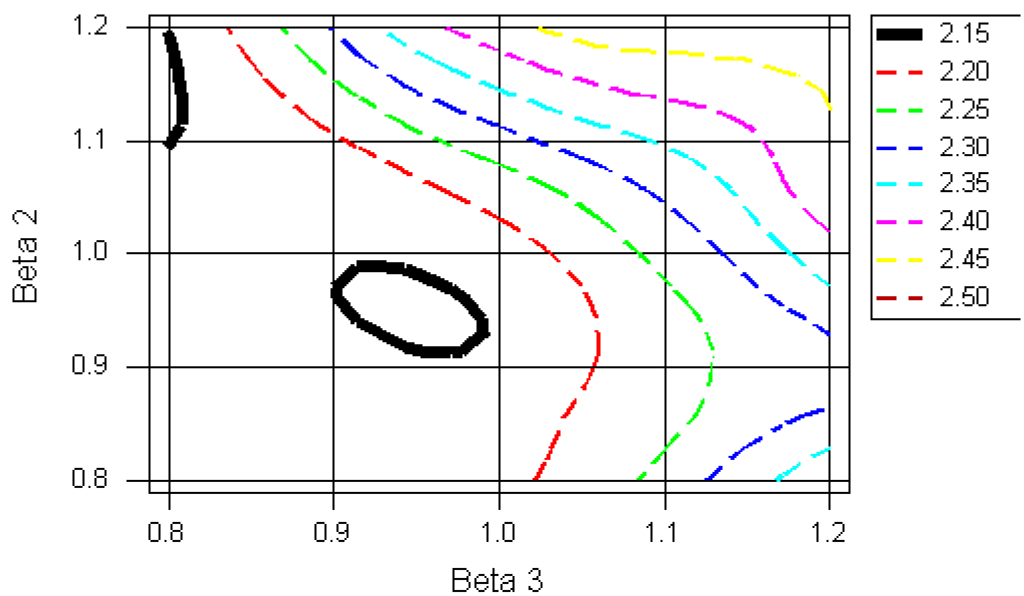


Figure 15 Asphalt Rut Sum of Squared Error Contour for Optimization Method One

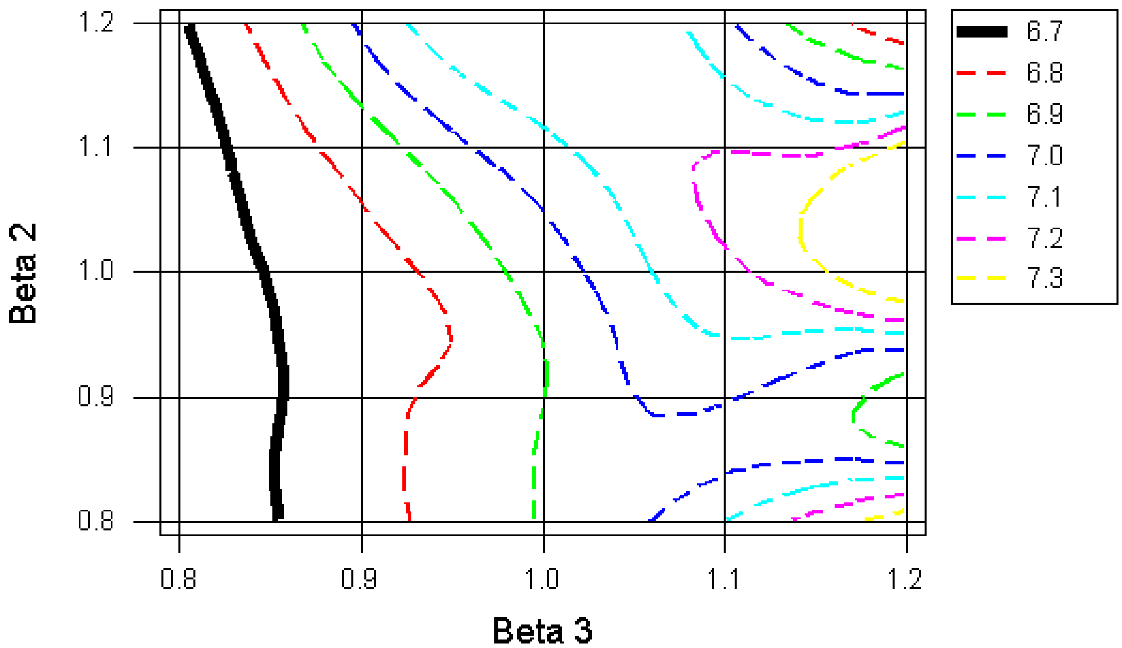


Figure 16 Total Rut Sum of Squared Error Contour for Optimization Method Two

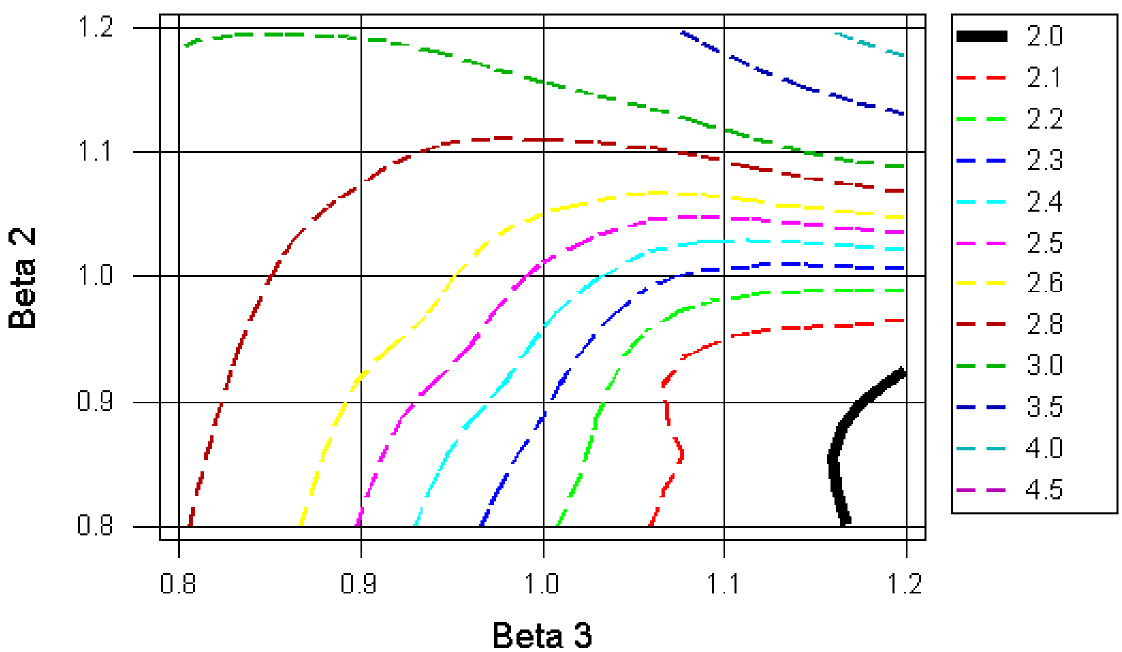


Figure 17 Asphalt Rut Sum of Squared Error Contour for Optimization Method Two

Unbound Layers Permanent Deformation Calibration

After selecting the "best" estimate of the AC rut model (β_{r2} and β_{r3} factors), the final step of the permanent deformation calibration was to determine the calibration factors on the asphalt, granular base and subgrade (β_{r1}, β_{GB} and β_{SG} respectively). While these calibration factors were eventually obtained from the numerical optimization process; it was readily apparent that any final combination of the calibration factors had to be checked for correct trends and calibration factors adjusted for any illogical and unreasonable trends. The first method for the optimization was done on the asphalt calibration factor while keeping the granular base and subgrade factors constant at a predefined value. The following section explains how these predefined values for the unbound materials were obtained and calculated.

Calibration of the Unbound Layer Rut Models Using 1993 AASHTO Guide

The unbound layer permanent deformation model was explained earlier in this chapter as well as the modifications done on it to correct for illogical trends for the $\varepsilon_p/\ \varepsilon_r$, versus modulus relationship. After numerous unsuccessful attempts with trying to find the final combination of calibration factors for unbound material rutting with LTTP data; an alternative solution methodology was developed. The final selection of the unbound rutting model calibration factors was eventually based on a study of the unbound layer rut depth using a matrix of pavement designs generated from the 1993 AASHTO design guide. The major variables used in this sensitivity study were subgrade support and design traffic level.

The main objective of this study was to rely, quite heavily, upon a comparison of expected, unbound base/subbase/subgrade rut depths, for pavements designed with the 1993 AASHTO Design Guide to calibration factors (β_{GB} and β_{SG}). A major assumption on this approach is that the empirically developed procedure, modified by field performance over the last forty years, yields pavement structures that have a relatively uniform level of rutting, independent of pavement subgrade support, design traffic repetitions or design life period.

Design Parameters and Pavement Structure

The matrix of AASHTO sections designed incorporated four different traffic levels and four-subgrade CBRs. The reliability used for this study was a 50% reliability level. The design life selected for each program run was 20 years. The granular base construction completion date was set two months earlier than the asphalt construction completion date for all problems, while the traffic opening date was set to be the same as the asphalt construction completion date. The environment site selected for the matrix of runs was that of a location near Ottawa, Illinois (site of the AASHO Road Test).

A simple conventional flexible pavement structure was used in the study. The structure was a three-layer or a four-layer (depending if a granular base (6 inches thick) was needed or not) pavement system with a single asphalt concrete layer, an unbound granular subbase layer and a subgrade. Figure 18 shows the pavement structure used in the study. As previously noted, the thickness of the unbound granular base was fixed at 6 inches, for all problems analyzed.

Traffic

The classical 18 kip ESAL approach was used for the traffic with the 1993 design procedure. The traffic volume was expressed by the average annual daily truck traffic (AADTT). This variable was selected to represent a very high traffic volume (7000 daily truck), high truck traffic (700 daily truck), medium traffic (70 daily truck) and a low traffic (7 daily truck). The general 20-year E18KSAL repetitions for these traffic levels are approximately: 100 million, 10 million, 1 million and 100,000. The rest of the traffic parameters were set to the default values given by the software.

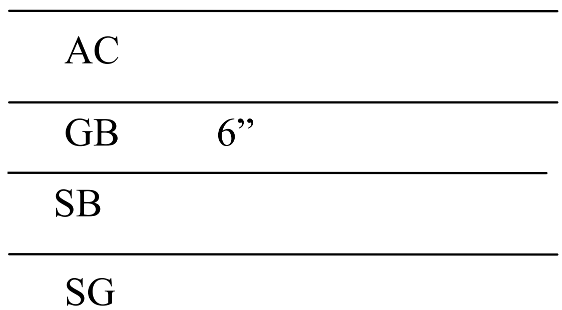


Figure 18 Pavement Structure for AASHTO Study

Only vehicle class number 5 was used to represent the traffic in this study. Class 5 vehicles have two dual tires single axles. Table 4 shows the axle configuration and properties used in the study. The monthly adjustment factors for traffic were set at 1; while the standard deviation of traffic wander was taken to be 10 inches. Finally, no traffic growth was considered in the study.

Climate, Ground Water Table and Bedrock Depth

Only one climatic location was used (Chicago, Illinois) due to its proximity to Ottawa, Illinois. The mean annual air temperature for this location was 50.8 ºF. This location was selected as it represents a nearby location for which the AASHO road test (which is the basis of the 1993 AASHTO design guide) was conducted. The ground water table used was set at a depth of 10 feet. This was selected because several AASHO Road Test reports documented (14) that the typical GWT depth was close to this value. No bedrock was assumed in this design.

Material Characterizations

<u>Asphalt Concrete Mixtures</u>

Three different asphalt concrete mixtures were used in this study. The range of E* master curves (mix stiffness) selected was based upon using as broad a range in stiffness of historic AC mixtures as possible. In Table 5 typical mixture properties as well as typical binder grade and properties, are shown for the three mixtures evaluated. The mixture E* master curves chosen are representative of mixtures utilizing PG 46-34; PG 58-28 and PG 76-16 binders.

Table 4 Axle Configuration and Properties

Average axle width (edge-to-edge) outside dimensions, ft)	8.5
Dual tire spacing (in)	12
Single Tire Pressure (psi)	120
Dual Tire Pressure (psi)	120

Table 5 Asphalt Mixture properties

Variable	***Low Mix***	***Med Mix***	***High Mix***
Air Voids (%)	7	7	8
Effective Binder content (%)	12	11	10
Voids Filed with Asphalt (%)	63	61	55
% Retained ¾”	0	11.62	30
% Retained 3/8”	1.16	35.3	47
% Retained # 4	27.65	52.64	52.8
% Passing # 200	11.12	7.28	8.38
PG Grade	46-34	58-28	76-16
Binder A	11.504	11.01	10.015
Binder VTS	-3.901	-3.701	-3.315

Figure 19 shows the master curve for the three AC mixtures. These plots are typically defined, in mathematical models, by use of Witczak et al predictive equation (15). The equation form used is:

$$\log(E^*) = \delta + \frac{\alpha}{1 + e^{\beta + \gamma(\log t_r)}} \qquad (54a)$$

and

$$\log(t_r) = \log(t) - c\left(\log(\eta) - \log(\eta_{T_r})\right) \qquad (54b)$$

where

E^*	=	Dynamic modulus
t	=	Time of loading, seconds
t_r	=	Time of loading at the reference temperature
δ	=	Minimum value of E*
$\delta+\alpha$	=	Maximum value of E*
β, γ	=	Parameters describing the shape of the sigmoidal function
η	=	Bitumen viscosity, 10^6 Poise
η_{Tr}	=	Bitumen viscosity at reference temperature, 10^6 Poise
c	=	regression coefficient

Table 6 shows the dynamic modulus equation parameters (sigmoidal function) for the three AC mixtures utilized in the study. In the subsequent study, it was found that the prediction of the rutting within the unbound base/ subbase and subgrade were very similar, regardless of the AC mix stiffness. As a consequence, the rutting results for the unbound materials are shown only for the low AC mix stiffness.

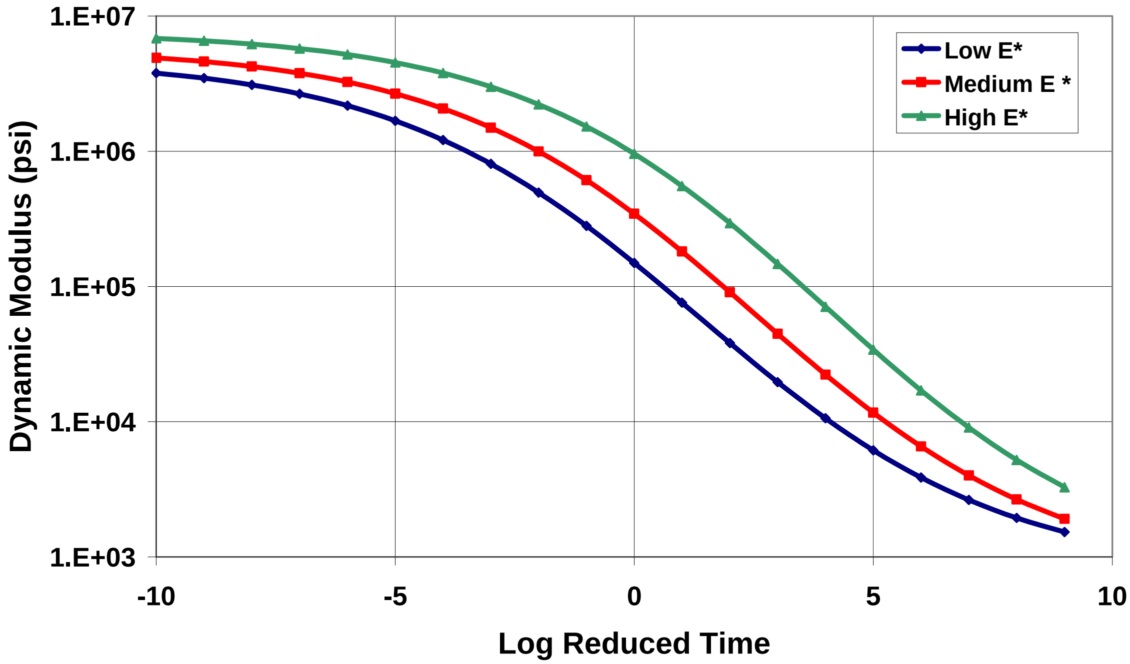


Figure 19 Typical Asphalt Concrete Mix Master Curves

Table 6 Asphalt Concrete Dynamic Modulus Parameters (Sigmoidal Model Form)

Dynamic Modulus Parameters	***Low Stiffness***	***Med Stiffness***	***High Stiffness***
Delta	2.8657	2.8234	-0.6719
Alpha	3.8185	3.9435	4.1776
Beta	-0.4236	-0.7920	-1.2554
Gamma	0.313351	0.313351	0.313351
c	1.255882	1.255882	1.255882

Unbound Layers Material

The unbound granular base properties were the same for all computer runs used in this study. The CBR value for the base was set at 100. This yields a resilient modulus of 48,000 psi from the TRL equation (16):

$$M_r = 2555 * CBR^{0.64} \tag{55}$$

where

M_r	=	Unbound Material Resilient modulus, psi
CBR	=	California Bearing Ratio, %

Similarly the subbase layer CBR was fixed at 40, which yields a modulus of 27,000 psi. However, the material properties for the subgrade soil were changed to reflect a broad range of subgrade support values. The subgrade CBR values assumed for the study were 2, 5, 10 and 20. This resulted in subgrade modulus values of 4000, 7157, 11150 and 17380 psi, respectively. These input values represent the "Design Conditions" for input into the program.

For both base and subgrade material, a constant value of modulus was used through out the design life of the pavement. No moisture correction was done to modify the modulus and the integrated climatic model was not used in this study.

Structural Design of the Pavement

The design of pavement structures using the 1993 AASHTO design guide is based on the structural number theory of the pavement layer. In this study, layer coefficients used were 0.44, 0.16 and 0.14 for the asphalt, base and subbase layer, respectively. The structural number for each layer was calculated. Then the thickness of the subbase layer was calculated. and 1.35 for the Subgrade.

Table 7 shows the required structural number for each design. Finally Table 8 shows the designs of 38 typical sections, designed by the AASHTO structural number approach, used in this study. In addition, the structural number of each layer in the pavement structure is also shown.

Results of the AASHTO Study

The 38 AASHTO pavement cross-sections were run for a large number of sets of the unbound layer permanent deformation model. These models are shown in Annex B. The results of these runs are shown in Annex D. For the purpose of this study, the asphalt rut depth was not considered to be a major factor in selecting the final unbound material calibration factors. Because of this, all runs were constructed using the same calibration factors for the AC layer (β_{r1}= 0.508, β_{r2}= 0.9, β_{r3}= 1.2).

The results for the base/ subbase and subgrade rut depths from each set of the 27 sets evaluated as the unbound material rut model was shifted in order to obtain an average rut depth of approximately 0.075“ in the base/ subbase and about 0.2” in the subgrade.

Table 9 shows the shift factors (β_{GB} and β_{SG}) for the granular base and subgrade for each set. Comparing the average predicted subgrade rut depth, for each set, by the subgrade CBR and traffic level, it was found that the "best" solution that fulfilled the initial assumption for this study (rut depth should be the same irrespective of the subgrade support and traffic level) was set 8-CB. The shift factor for the granular base was 1.05 and 1.35 for the Subgrade.

Table 7 Required Structural Number for Each Combination of Traffic and Subgrade Design

CBR	Mr	N(des)	SN
2	3981.5	10^5	2.43
		10^6	3.55
		10^7	5.06
		10^8	6.88
5	7157	10^5	1.93
		10^6	2.84
		10^7	4.13
		10^8	5.76
10	11153	10^5	1.61
		10^6	2.39
		10^7	3.50
		10^8	5.00
20	17380	10^5	1.34
		10^6	2.01
		10^7	2.96
		10^8	4.29

Table 8 AASHTO Study Structural Design

CBR(sg)	N(des)	H(ac)(in)	a(ac)	SN(ac)	H(gb)	a(gb)	SN(gb)	H(sb)	a(sb)	SN(sb)	SN(total)
2	10^5	2	0.44	0.88	6	0.16	0.99	4.15	0.14	0.56	2.43
	10^6	2	0.44	0.88	6	0.16	0.99	12.47	0.14	1.69	3.55
	10^7	2	0.44	0.88	6	0.16	0.99	23.59	0.14	3.19	5.06
	10^8	2	0.44	0.88	6	0.16	0.99	37.05	0.14	5.01	6.88
	10^5	4	0.44	1.76	0	0.16	0.00	4.94	0.14	0.67	2.43
	10^6	4	0.44	1.76	6	0.16	0.99	5.97	0.14	0.81	3.55
	10^7	5	0.44	2.2	6	0.16	0.99	13.84	0.14	1.87	5.06
	10^8	5	0.44	2.2	6	0.16	0.99	27.29	0.14	3.69	6.88
	10^5	4	0.44	1.76	0	0.16	0.00	4.94	0.14	0.67	2.43
	10^6	6	0.44	2.64	0	0.16	0.00	6.76	0.14	0.91	3.55
	10^7	7	0.44	3.08	6	0.16	0.99	7.33	0.14	0.99	5.06
	10^8	8	0.44	3.52	6	0.16	0.99	17.53	0.14	2.37	6.88
	10^5	4	0.44	1.76	0	0.16	0.00	4.94	0.14	0.67	2.43
	10^6	6	0.44	2.64	0	0.16	0.00	6.76	0.14	0.91	3.55
	10^7	10	0.44	4.4	0	0.16	0.00	4.87	0.14	0.66	5.06
	10^8	12	0.44	5.28	6	0.16	0.99	4.53	0.14	0.61	6.88
	10^5	4	0.44	1.76	0	0.16	0.00	4.94	0.14	0.67	2.43
	10^6	6	0.44	2.64	0	0.16	0.00	6.76	0.14	0.91	3.55
	10^7	10	0.44	4.4	0	0.16	0.00	4.87	0.14	0.66	5.06
	10^8	14	0.44	6.16	0	0.16	0.00	5.32	0.14	0.72	6.88
5	10^5	3	0.44	1.32	0	0.16	0.00	4.52	0.14	0.61	1.93
	10^6	2	0.44	0.88	6	0.16	0.99	7.18	0.14	0.97	2.84
	10^7	2	0.44	0.88	6	0.16	0.99	16.73	0.14	2.26	4.13
	10^8	2	0.44	0.88	6	0.16	0.99	28.77	0.14	3.89	5.76
	10^5	3	0.44	1.32	0	0.16	0.00	4.52	0.14	0.61	1.93
	10^6	5	0.44	2.2	0	0.16	0.00	4.72	0.14	0.64	2.84
	10^7	5	0.44	2.2	6	0.16	0.99	6.97	0.14	0.94	4.13
	10^8	5	0.44	2.2	6	0.16	0.99	19.02	0.14	2.57	5.76
	10^5	3	0.44	1.32	0	0.16	0.00	4.52	0.14	0.61	1.93
	10^6	5	0.44	2.2	0	0.16	0.00	4.72	0.14	0.64	2.84
	10^7	8	0.44	3.52	0	0.16	0.00	4.51	0.14	0.61	4.13
	10^8	8	0.44	3.52	6	0.16	0.99	9.26	0.14	1.25	5.76
	10^5	3	0.44	1.32	0	0.16	0.00	4.52	0.14	0.61	1.93
	10^6	5	0.44	2.2	0	0.16	0.00	4.72	0.14	0.64	2.84
	10^7	8	0.44	3.52	0	0.16	0.00	4.51	0.14	0.61	4.13
	10^8	11	0.44	4.84	0	0.16	0.00	6.80	0.14	0.92	5.76
	10^5	3	0.44	1.32	0	0.16	0.00	4.52	0.14	0.61	1.93
	10^6	5	0.44	2.2	0	0.16	0.00	4.72	0.14	0.64	2.84
	10^7	8	0.44	3.52	0	0.16	0.00	4.51	0.14	0.61	4.13
	10^8	11	0.44	4.84	0	0.16	0.00	6.80	0.14	0.92	5.76
CBR(sg)	N(des)	H(ac) (in)	a(ac)	SN(ac)	H(gb)	a(gb)	SN(gb)	H(sb)	a(sb)	SN(sb)	SN(total)

10	10^5	2	0.44	0.88	0	0.16	0.00	5.43	0.14	0.73	1.61
	10^6	2	0.44	0.88	4	0.16	0.66	6.32	0.14	0.85	2.39
	10^7	2	0.44	0.88	6	0.16	0.99	12.10	0.14	1.64	3.50
	10^8	2	0.44	0.88	6	0.16	0.99	23.13	0.14	3.13	5.00
	10^5	2	0.44	0.88	0	0.16	0.00	5.43	0.14	0.73	1.61
	10^6	4	0.44	1.76	0	0.16	0.00	4.68	0.14	0.63	2.39
	10^7	5	0.44	2.2	4	0.16	0.66	4.78	0.14	0.65	3.50
	10^8	5	0.44	2.2	6	0.16	0.99	13.37	0.14	1.81	5.00
	10^5	2	0.44	0.88	0	0.16	0.00	5.43	0.14	0.73	1.61
	10^6	4	0.44	1.76	0	0.16	0.00	4.68	0.14	0.63	2.39
	10^7	6	0.44	2.64	0	0.16	0.00	6.39	0.14	0.86	3.50
	10^8	8	0.44	3.52	5	0.16	0.82	4.83	0.14	0.65	5.00
	10^5	2	0.44	0.88	0	0.16	0.00	5.43	0.14	0.73	1.61
	10^6	4	0.44	1.76	0	0.16	0.00	4.68	0.14	0.63	2.39
	10^7	6	0.44	2.64	0	0.16	0.00	6.39	0.14	0.86	3.50
	10^8	10	0.44	4.4	0	0.16	0.00	4.41	0.14	0.60	5.00
	10^5	2	0.44	0.88	0	0.16	0.00	5.43	0.14	0.73	1.61
	10^6	4	0.44	1.76	0	0.16	0.00	4.68	0.14	0.63	2.39
	10^7	6	0.44	2.64	0	0.16	0.00	6.39	0.14	0.86	3.50
	10^8	10	0.44	4.4	0	0.16	0.00	4.41	0.14	0.60	5.00
20	10^5	1	0.44	0.44	0	0.16	0.00	6.62	0.14	0.90	1.34
	10^6	3	0.44	1.32	0	0.16	0.00	5.12	0.14	0.69	2.01
	10^7	5	0.44	2.2	0	0.16	0.00	5.59	0.14	0.76	2.96
	10^8	8	0.44	3.52	0	0.16	0.00	5.69	0.14	0.77	4.29
	10^5	1	0.44	0.44	0	0.16	0.00	6.62	0.14	0.90	1.34
	10^6	3	0.44	1.32	0	0.16	0.00	5.12	0.14	0.69	2.01
	10^7	5	0.44	2.2	0	0.16	0.00	5.59	0.14	0.76	2.96
	10^8	8	0.44	3.52	0	0.16	0.00	5.69	0.14	0.77	4.29
	10^5	1	0.44	0.44	0	0.16	0.00	6.62	0.14	0.90	1.34
	10^6	3	0.44	1.32	0	0.16	0.00	5.12	0.14	0.69	2.01
	10^7	5	0.44	2.2	0	0.16	0.00	5.59	0.14	0.76	2.96
	10^8	8	0.44	3.52	0	0.16	0.00	5.69	0.14	0.77	4.29
	10^5	1	0.44	0.44	0	0.16	0.00	6.62	0.14	0.90	1.34
	10^6	3	0.44	1.32	0	0.16	0.00	5.12	0.14	0.69	2.01
	10^7	5	0.44	2.2	0	0.16	0.00	5.59	0.14	0.76	2.96
	10^8	8	0.44	3.52	0	0.16	0.00	5.69	0.14	0.77	4.29
	10^5	1	0.44	0.44	0	0.16	0.00	6.62	0.14	0.90	1.34
	10^6	3	0.44	1.32	0	0.16	0.00	5.12	0.14	0.69	2.01
	10^7	5	0.44	2.2	0	0.16	0.00	5.59	0.14	0.76	2.96
	10^8	8	0.44	3.52	0	0.16	0.00	5.69	0.14	0.77	4.29

Table 9 AASHTO Study Base/ Subbase and Subgrade Shift Factors

Set	β_{GB}	β_{SG}
1-A	3.20	6.25
2-A	3.40	6.00
3-A	3.00	6.10
1-2-A	3.30	6.25
1-CB	2.15	1.75
2-CB	2.00	1.85
3-CB	1.75	1.75
4-CB	0.19	0.19
5-CB	1.65	1.65
6-CB	1.70	1.70
7-CB	1.75	1.71
8-CB*	1.05	1.35
8-CB-1*	0.40	0.74
9-CB**	0.60	0.93
10-CB*	1.14	1.51
11-CB*	0.24	0.33
11-CB-1*	0.23	0.31
4-E	0.81	1.43
1-F	1.85	1.81
2-F	1.82	1.79
3-F	1.80	1.76
4-F	1.78	1.74
1-G	5.70	19.40
2-G	5.75	19.60
3-G	5.05	17.10
4-G	2.80	5.25
5-G	2.10	2.50

* 10^9 Traffic was used
** 10^11 Traffic was used

The rut depth predicted, using set 8-CB, is shown as a function of the traffic level in Table 10; while the results are arranged by subgrade CBR in Table 11. The data in both tables have calibration factors of β_{r1}= 0.508, β_{r2}= 0.9, β_{r3}= 1.2, β_{GB}= 1.05, and β_{SG}= 1.35. Table 10 shows that there is ***no*** significant difference between the average values of the rut depth predicted using a low traffic level (10^5) or a high traffic (10^8). Similarly, Table 11 shows that the rut depth predicted using a CBR of 5 is ***not much different*** than the rut depth predicted using a subgrade CBR of 20.

These findings are graphically shown in Figure 20. This figure shows the average values of the subgrade rut depth compared to the $\varepsilon_p/\varepsilon_r$ value at different traffic and subgrade CBR. It is clear from the figure that the average rut depth in the subgrade is 0.2 inches. Furthermore, irrespective of the traffic level, individual section rutting is clustered around 0.2 inches (with small scatter). Similarly, Figure 21 leads to the same conclusion for subgrade rutting, when results are grouped by subgrade support. Figure 22 shows the base rut depth by subgrade CBR values. While the scatter, from the base/subbase results, visually appears to be significant; the reader must recognize that rutting differences are very, very small (approximately ± 0.025”).

Set 8-CB yields a constant relation between the $\varepsilon_p/\varepsilon_r$ parameter and traffic repetition of 1 and 10^9. For set 8-CB; $b_1 = b_9 = 0$, while $a_1 = 0.15$ and $a_9 = 20$. The final form of the unbound permanent deformation model is given as follows:

$$\frac{\varepsilon_p(N)}{\varepsilon_r} = \left(\frac{\varepsilon_0}{\varepsilon_r}\right) e^{-\left(\frac{\rho}{N}\right)^{\beta}} \tag{56a}$$

For N =1 $$\frac{\varepsilon_p(1)}{\varepsilon_r} = 0.15 \tag{56b}$$

For N =10^9 $$\frac{\varepsilon_p(10^9)}{\varepsilon_r} = 20 \tag{56c}$$

$$\left(\frac{\varepsilon_0}{\varepsilon_r}\right) = \frac{\left(0.15 * e^{(\rho)^{\beta}}\right) + \left(20 * e^{\left(\frac{\rho}{10^9}\right)^{\beta}}\right)}{2} \tag{56d}$$

where:

$$\log \beta = -0.61119 - 0.017638 W_c \tag{56e}$$

The moisture content (W_C) has been previously presented in equation 20.

$$\rho = 10^9 \left(\frac{-4.89285}{\left[1 - \left(10^9\right)^{\beta}\right]}\right)^{\frac{1}{\beta}} \tag{56f}$$

Table 10 AASHTO Study Results Using Set 8-CB By Traffic Level (β_{r1}= 0.508, β_{r2}= 0.9, β_{r3}= 1.2, β_{GB}= 1.05, and β_{SG}= 1.35)

				Rut Depth Value			
Hac	***CBRsg***	***N Design***	***SN***	***AC***	***GB***	***SG***	***Total***
2	2	1.00E+05	3.22	0.047	0.067	0.163	0.278
4	2	1.00E+05	3.22	0.070	0.033	0.185	0.288
3	5	1.00E+05	2.57	0.078	0.036	0.209	0.324
2	10	1.00E+05	2.17	0.065	0.053	0.210	0.327
1	20	1.00E+05	1.82	0.012	0.093	0.192	0.297
			Average	***0.054***	***0.056***	***0.192***	***0.303***
2	2	1.00E+06	4.64	0.152	0.119	0.171	0.442
4	2	1.00E+06	4.64	0.199	0.065	0.192	0.456
6	2	1.00E+06	4.64	0.172	0.039	0.213	0.424
2	5	1.00E+06	3.76	0.157	0.099	0.200	0.456
5	5	1.00E+06	3.76	0.187	0.033	0.237	0.458
2	10	1.00E+06	3.18	0.162	0.090	0.203	0.455
4	10	1.00E+06	3.18	0.206	0.039	0.235	0.480
3	20	1.00E+06	2.68	0.219	0.052	0.214	0.485
			Average	***0.182***	***0.067***	***0.208***	***0.457***
2	2	1.00E+07	6.37	0.481	0.172	0.163	0.816
5	2	1.00E+07	6.37	0.577	0.088	0.196	0.862
7	2	1.00E+07	6.37	0.507	0.054	0.214	0.775
10	2	1.00E+07	6.37	0.390	0.022	0.244	0.656
2	5	1.00E+07	5.31	0.486	0.157	0.185	0.828
5	5	1.00E+07	5.31	0.558	0.068	0.212	0.839
8	5	1.00E+07	5.31	0.458	0.025	0.248	0.731
2	10	1.00E+07	4.58	0.472	0.143	0.185	0.800
5	10	1.00E+07	4.58	0.580	0.055	0.216	0.851
6	10	1.00E+07	4.58	0.541	0.044	0.230	0.814
5	20	1.00E+07	3.91	0.575	0.046	0.209	0.829
			Average	***0.511***	***0.080***	***0.209***	***0.800***
2	2	1.00E+08	8.49	0.906	0.221	0.160	1.287
5	2	1.00E+08	8.49	1.820	0.127	0.179	2.126
8	2	1.00E+08	8.49	1.522	0.077	0.200	1.800
12	2	1.00E+08	8.49	0.960	0.032	0.244	1.236
14	2	1.00E+08	8.49	0.611	0.018	0.266	0.895
2	5	1.00E+08	7.18	0.901	0.210	0.156	1.267
5	5	1.00E+08	7.18	1.760	0.113	0.175	2.048
8	5	1.00E+08	7.18	1.462	0.060	0.207	1.729
11	5	1.00E+08	7.18	1.108	0.029	0.239	1.376
2	10	1.00E+08	6.3	0.900	0.200	0.146	1.246
5	10	1.00E+08	6.3	1.726	0.100	0.174	2.000
8	10	1.00E+08	6.3	1.432	0.044	0.200	1.676
10	10	1.00E+08	6.3	1.234	0.022	0.223	1.479
8	20	1.00E+08	5.49	1.461	0.035	0.190	1.686
			Average	***1.272***	***0.092***	***0.197***	***1.561***

Table 11 AASHTO Study Results Using Set 8-CB By Subgrade CBR (β_{r1}= 0.508, β_{r2}= 0.9, β_{r3}= 1.2, β_{GB}= 1.05, and β_{SG}= 1.35)

				Rut Depth Value			
Hac	***CBRsg***	***N Design***	***SN***	***AC***	***GB***	***SG***	***Total***
2	2	100000	3.22	0.047	0.067	0.163	0.278
4	2	100000	3.22	0.070	0.033	0.185	0.288
2	2	1.00E+06	4.64	0.152	0.119	0.171	0.442
4	2	1.00E+06	4.64	0.199	0.065	0.192	0.456
6	2	1.00E+06	4.64	0.172	0.039	0.213	0.424
2	2	1.00E+07	6.37	0.481	0.172	0.163	0.816
5	2	1.00E+07	6.37	0.577	0.088	0.196	0.862
7	2	1.00E+07	6.37	0.507	0.054	0.214	0.775
10	2	1.00E+07	6.37	0.390	0.022	0.244	0.656
2	2	1.00E+08	8.49	0.906	0.221	0.160	1.287
5	2	1.00E+08	8.49	1.820	0.127	0.179	2.126
8	2	1.00E+08	8.49	1.522	0.077	0.200	1.800
12	2	1.00E+08	8.49	0.960	0.032	0.244	1.236
14	2	1.00E+08	8.49	0.611	0.018	0.266	0.895
	2				***0.081***	***0.199***	
3	5	1.00E+05	2.57	0.078	0.036	0.209	0.324
2	5	1.00E+06	3.76	0.157	0.099	0.200	0.456
5	5	1.00E+06	3.76	0.187	0.033	0.237	0.458
2	5	1.00E+07	5.31	0.486	0.157	0.185	0.828
5	5	1.00E+07	5.31	0.558	0.068	0.212	0.839
8	5	1.00E+07	5.31	0.458	0.025	0.248	0.731
2	5	1.00E+08	7.18	0.901	0.210	0.156	1.267
5	5	1.00E+08	7.18	1.760	0.113	0.175	2.048
8	5	1.00E+08	7.18	1.462	0.060	0.207	1.729
11	5	1.00E+08	7.18	1.108	0.029	0.239	1.376
	5				***0.083***	***0.207***	
2	10	1.00E+05	2.17	0.065	0.053	0.210	0.327
2	10	1.00E+06	3.18	0.162	0.090	0.203	0.455
4	10	1.00E+06	3.18	0.206	0.039	0.235	0.480
2	10	1.00E+07	4.58	0.472	0.143	0.185	0.800
5	10	1.00E+07	4.58	0.580	0.055	0.216	0.851
6	10	1.00E+07	4.58	0.541	0.044	0.230	0.814
2	10	1.00E+08	6.3	0.900	0.200	0.146	1.246
5	10	1.00E+08	6.3	1.726	0.100	0.174	2.000
8	10	1.00E+08	6.3	1.432	0.044	0.200	1.676
10	10	1.00E+08	6.3	1.234	0.022	0.223	1.479
	10				***0.079***	***0.202***	
1	20	1.00E+05	1.82	0.012	0.093	0.192	0.297
3	20	1.00E+06	2.68	0.219	0.052	0.214	0.485
5	20	1.00E+07	3.91	0.575	0.046	0.209	0.829
8	20	1.00E+08	5.49	1.461	0.035	0.190	1.686
	20				***0.056***	***0.201***	

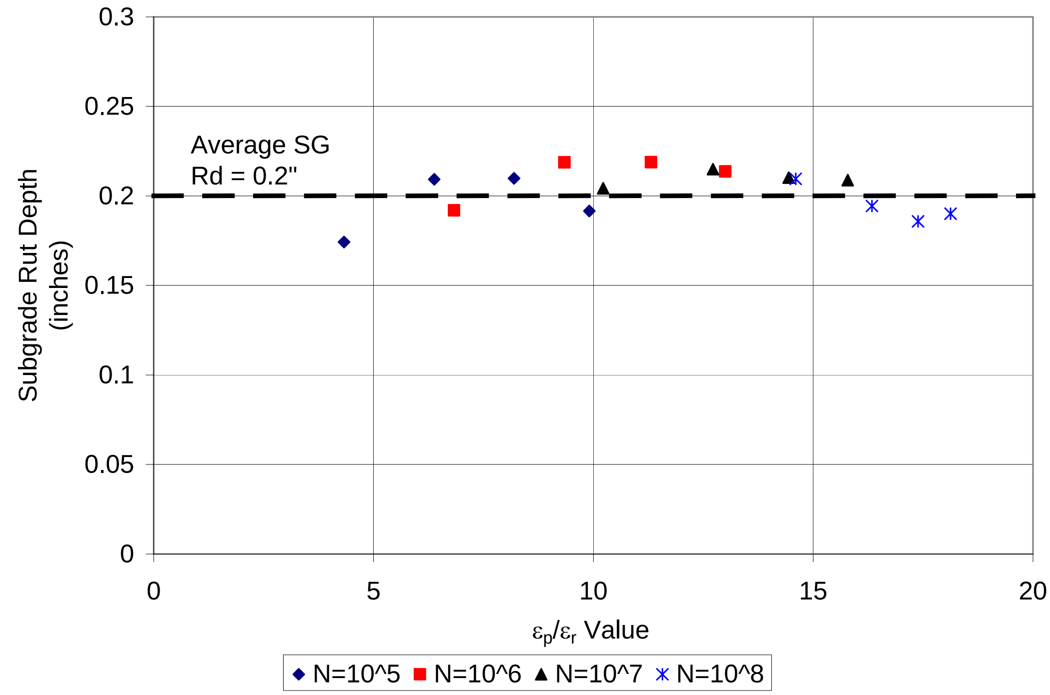


Figure 20 Subgrade Rut Depth Vs. $\varepsilon_p/\varepsilon_r$ for the AASHTO Study

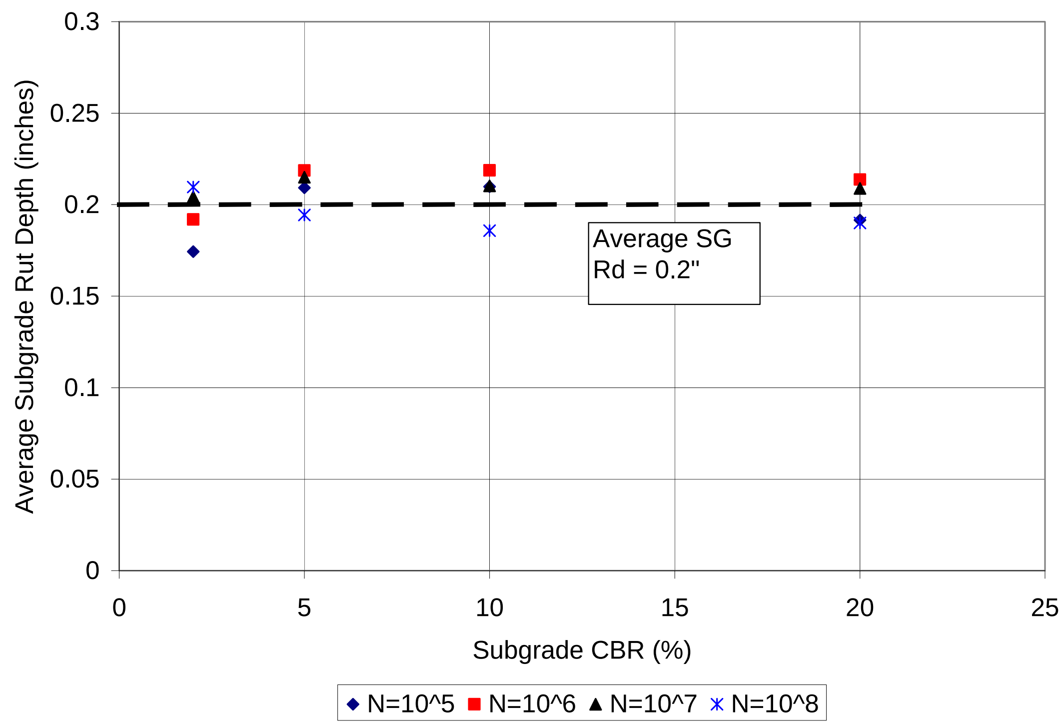


Figure 21 Subgrade Rut Depth Vs. Subgrade CBR for the AASHTO Study

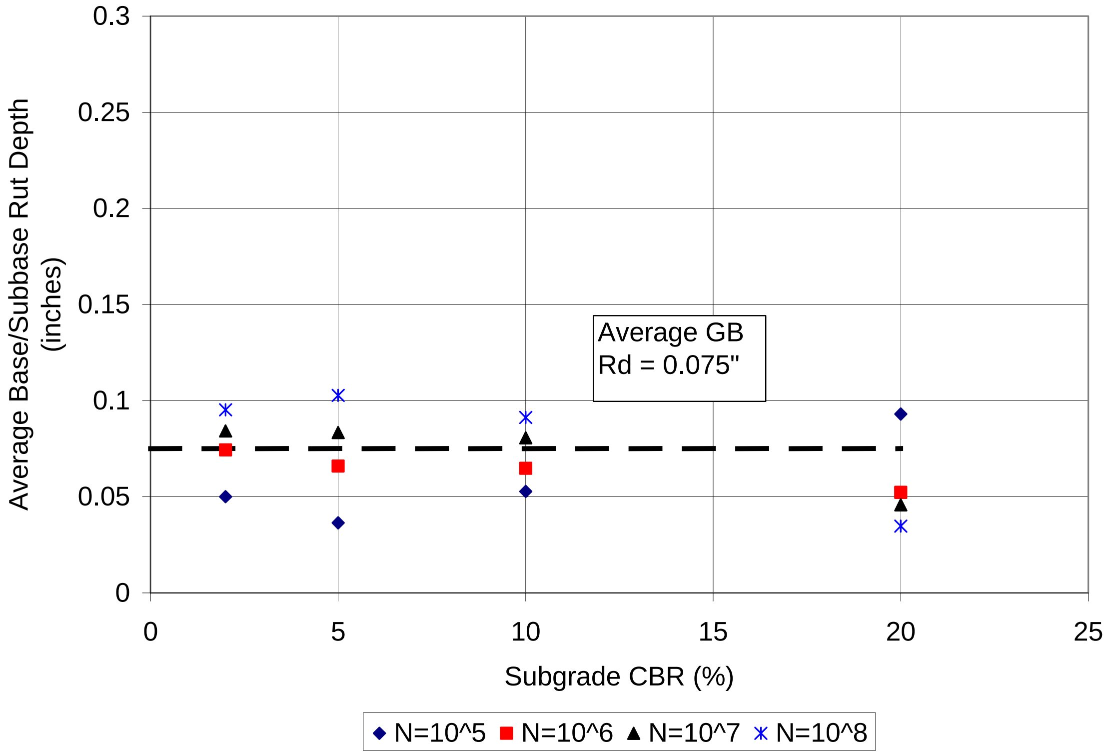


Figure 22 Base/Subbase Rut Depth Vs. Subgrade CBR for the AASHTO Study

Calibration of the Unbound Layer Rut Models Using LTPP Sections

The final step in this calibration effort was to determine the final value for the calibration factors for both the granular base and subgrade, using the results from set 8-CB with the LTPP pavement sections. The assumptions made in the subsequent study is that the average value of the rut in the granular base layer should be about 0.075 inches. This value yielded a calibration factor (β_{GB}) for the unbound granular base of 1.05. For the subgrade layer it was desirable to have the average subgrade rut depth to be approximately 0.2 inches. It should be noted that these rut depths are associated with a design life of 20 years. For performance periods, above or below this value, rut depths would change accordingly. This required a calibration factor for the subgrade (β_{SG}) to be 1.35. These assumptions were based, in part, on a questionnaire send to nearly 40 Department of Transportation material engineers to indicate their opinion as to the expected layer rut depth in different pavement structures (17).

The calibration factors selected (β_{GB} = 1.05 and β_{SG} = 1.35) are the predefined values mentioned earlier in the optimization process method one. Going back to the simulation runs, these factors were also fixed and only the calibration factor on the asphalt model is changed to minimize the sum of the error square in the total predicted rut depth.

When the second optimization method was evaluated (optimizing three factors β_{r1}, β_{GB} and β_{SG} at the same time), the calibration factors obtained were:

- β_{GB} = 1.673 and β_{SG} = 1.35

Table 12 shows the calibration factors obtained from the optimization and Table 13 shows the standard error and sum of squared error using both methods of optimizations. More discussion of the optimization process is explained with the asphalt rut depth model calibration, in the following section.

Comparing both optimization methods, the following conclusions can be observed:

- The calibration factor on the subgrade (β_{SG}) was found to be exactly the same (β_{SG} = 1.35) obtained from the AASHTO study and from the LTPP section optimization.

Table 12 Calibration Factors Obtained by Optimization

Optimization	β_{r1}	β_{r2}	β_{r3}	β_{GB}	β_{SG}
Method One	0.551	0.900	1.200	1.050	1.350
Method Two	0.509	0.900	1.200	1.673	1.350

Table 13 Statistical Values for Each Layer

Optimization		**AC**	**GB**	**SG**	**Total**
Method One	Average =	0.175	0.035	0.113	0.323
	Sum of error =	0.000	-0.882	-1.872	-2.754
	Sum of error^2 =	2.372	0.107	0.931	7.043
	Percentage =	51.26%	11.14%	37.60%	100.00%
	Se =	0.071	0.015	0.045	0.122
	R^2 =	0.6227	0.6786	0.1624	0.4067
Method Two	Average =	0.162	0.055	0.113	0.330
	Sum of error =	0.884	-0.144	-0.741	0.000
	Sum of error^2 =	1.883	0.243	0.931	6.915
	Percentage =	46.60%	16.73%	36.67%	100.00%
	Se =	0.063	0.023	0.045	0.121
	R^2 =	0.648	0.677	0.1363	0.399

Number of Observations was 387 points.

- The calibration factor on the granular base differed between the AASHTO study (β_{GB} = 1.05) and the LTPP section optimization (β_{GB} = 1.673). However, because the expected average granular base rutting is small; the difference between the 1.05 and the 1.673 values is not excessive (average of 0.075" rutting versus 0.12" rutting).

At this stage of the calibration procedure, a final conclusion for the calibration factors for the granular base and subgrade cannot be set because the base / subgrade rut depth is linked to the asphalt run depth. The Asphalt rut depth calibration is discussed in the following section, and then a final conclusion can be stated.

As a final check on the calibrated model a sensitivity study were done to validate the calibration of the unbound layers permanent deformation. The results for this study are given in details in Appendix GG2.

Asphalt Layers Permanent Deformation Calibration

After calibrating the unbound layers and finding the calibration factors, the next step was to determine the final calibration factor for the asphalt layer rut model. The two factors on the power terms for the temperature and number of traffic repetitions were found from previous computerized optimization studies explained earlier. These studies led to the final values of β_{r2}= 0.9 and β_{r3}= 1.2, respectively for the AC layers.

The final calibration step was to evaluate a direct multiplier calibration factor (β_{r1}) on the asphalt rut model using the other calibration factors. However, this resulted in having the AC rut depth increase as the thickness of the AC increased, which does not conform to known field practice. To overcome this limitation, AC sections that had trenches, in order to obtain the rut depth in each sublayer, were used to correct the predicted rut depth to accurately model the influence of depth and layer thickness upon AC rut depth.

MnRoad Test Study

Fortunately, there was one available road test, which had complete data and trench studies within the pavement cells used in the main experiment. This site was the MnRoad experimental site (18). Seven sections from MnRoad were trenched in 1998, and the rut depth in each pavement layer was measured and recorded. Quite fortunately, even the nominal 8-inch AC layers had rut depths delineated by 4 to 5 sublayers. The measured rut depth is shown in Table 14.

Design Parameters and Pavement Structure

The design life selected for each program run was 4 years. The granular base construction completion date was set two months earlier than the asphalt construction completion date for all problems, while the traffic opening date was set to be the same as the asphalt construction completion date. The original pavement structure was used in the study.

Each structure was constructed in four separate lifts, using the same asphalt mixture for a given cell. In addition, an unbound granular subbase layer and a subgrade were present. The original structure and the thickness of the MnRoad cells used in the depth study are shown in Table 15.

Table 14 1998 MnRoad Mainline Forensic Study

Cell	HMA Layer Thickness	Asphalt Binder	Surface Rut	Lift and Layer Deformation					
				1	2	3	4	Base	Subgrade
4	8.0	120-150	0.41	0.13	0.24	0	0	0	0
16	7.3	AC-20	0.21	0.07	0.14	0	0	0	0
17	6.9	AC-20	0.30	0.15	0.15	0	0	0	0
18	7.6	AC-20	0.24	0.09	0.15	0	0	0	0
19	7.3	AC-20	0.24	0.06	0.04	0.07	0.07	0	0
20	7.1	120-150	0.48	0.24	0.10	0.12	0.02	0	0
22	7.3	120-150	0.30	0.12	0.06	0.06	0	0	0

* Note: HMA Layer Thickness and Permanent Deformation within Sublayers are in inches.

Table 15 Pavement Structure for MnRoad Cells

Section	Layer Number	Layer Type	Thickness (in)	Construction Start	Construction End
4	1	Hot Mix Asphalt	1.5	09/28/92	09/28/92
	2	Hot Mix Asphalt	1.8	09/25/92	09/25/92
	3	Hot Mix Asphalt	2.3	09/24/92	09/24/92
	4	Hot Mix Asphalt	2.4	09/23/92	09/23/92
	5	Clay Subgrade		08/10/92	08/10/92
16	1	Hot Mix Asphalt	1.6	07/29/93	07/29/93
	2	Hot Mix Asphalt	1.5	07/28/93	07/28/93
	3	Hot Mix Asphalt	2.1	07/21/93	07/21/93
	4	Hot Mix Asphalt	2.1	07/20/93	07/20/93
	5	Class-3 Special Base	28.0	06/29/92	06/02/93
	6	Clay Subgrade		06/26/92	06/26/92
17	1	Hot Mix Asphalt	1.6	07/29/93	07/29/93
	2	Hot Mix Asphalt	1.4	07/28/93	07/28/93
	3	Hot Mix Asphalt	2.0	07/21/93	07/21/93
	4	Hot Mix Asphalt	1.9	07/20/93	07/20/93
	5	Class-3 Special Base	28.0	07/06/92	06/02/93
	6	Clay Subgrade		06/26/92	06/26/93
18	1	Hot Mix Asphalt	1.5	07/29/93	07/29/93
	2	Hot Mix Asphalt	1.6	07/28/93	07/28/93
	3	Hot Mix Asphalt	2.1	07/21/93	07/21/93
	4	Hot Mix Asphalt	2.4	07/20/93	07/20/93
	5	Class-6 Special Base	12.0	07/15/92	07/20/93
	6	Class-3 Special Base	9.0	06/26/92	07/07/92
	7	Clay Subgrade		06/26/92	06/26/92
19	1	Hot Mix Asphalt	1.6	07/29/93	07/29/93
	2	Hot Mix Asphalt	2.3	07/28/93	07/28/93
	3	Hot Mix Asphalt	2.0	07/21/93	07/21/93
	4	Hot Mix Asphalt	1.4	07/20/93	07/20/93
	5	Class-3 Special Base	28.0	06/26/92	06/28/93
	6	Clay Subgrade		06/02/92	06/02/92
20	1	Hot Mix Asphalt	1.5	07/29/93	07/29/93
	2	Hot Mix Asphalt	1.3	07/28/93	07/28/93
	3	Hot Mix Asphalt	2.1	07/21/93	07/21/93
	4	Hot Mix Asphalt	2.2	07/20/93	07/20/93
	5	Class-3 Special Base	28.0	06/29/92	06/28/93
	6	Clay Subgrade		06/02/92	06/02/92
22	1	Hot Mix Asphalt	1.5	07/29/93	07/29/93
	2	Hot Mix Asphalt	1.4	07/28/93	07/28/93
	3	Hot Mix Asphalt	2.2	07/21/93	07/21/93

	4	Hot Mix Asphalt	2.2	07/20/93	07/20/93
	5	Class-6 Special Base	18.0	06/25/92	06/28/93
	6	Clay Subgrade		06/04/92	06/04/92

Traffic

Information used by the MnDot relied upon the 18 kip ESAL approach for the traffic analysis. The traffic volume was expressed by the average annual daily truck traffic (AADTT) selected to represent actual truck traffic (720 daily trucks). The 4-year E18KSAL repetitions for this traffic level were approximately 2.1 million. The rest of the traffic parameters were set to the default values given by the software.

Only vehicle Class number 5 (2 single axles with dual tires) was used to represent the traffic in this study. Table 16 shows the axle configuration used in the study. The monthly adjustment factors for traffic were set at 1; while the standard deviation of traffic wander was taken to be 10 inches. Finally, no traffic growth was considered in the study.

Climate, Ground Water Table and Bedrock Depth

The climatic location used in the study was Minneapolis St. Paul, Minnesota (about 20-25 miles from test track). The mean annual air temperature for this location was 46.8 ºF. The ground water table used was set at a depth of 20 feet. No bedrock was assumed in this design, as the site is a glacial till plain.

Material Characterizations

Asphalt Concrete Mixtures

Each cell was constructed with a slightly different asphalt mixture. While the job mix aggregate gradation is the same; two different binders were used as shown in Table 14 (AC-20 and Pen 120-150). In addition each cell was constructed with different asphalt content and in-situ (in-place) initial air voids. The dynamic modulus values for each cell are tabulated in Annex E, along with the dynamic modulus equation parameters (sigmoidal function) for the AC mixtures utilized in the study.

Table 16 Axle Configuration

Average axle width (edge-to-edge) outside dimensions, ft)	8.5
Dual tire spacing (in)	12
Single Tire (psi)	120
Dual Tire (psi)	120

Unbound Layers Material

Four different aggregate gradations were used as base and subbase materials in the construction of the MnRoad project. These materials are referred to as Class 3 SP, Class 4 SP, Class 5 SP and Class 6 SP and are labeled “special” due to the fact that they were developed for use at MnRoad exclusively. The specifications in grading and plasticity characteristics for the “special” aggregate blends are much more stringent than the Minnesota DOT Class 3, Class 4, Class 5, and Class 6.

Gradation tests, conducted by the Minnesota Department of Transportation, were run on all four classes of base material and the tests show that the materials are classified as:

- Class 3 SP: gravelly sand with the highest percentage of fines at approximately 12.3% to 13.2%.
- Class 4 SP: gravelly sand with about 7.3% fines.
- Class 5 SP: sandy gravel with approximately 5.7% fines.
- Class 6 SP: sandy gravel with the lowest percentage of fines at about 4.7%.

In-situ gradation test results are presented in Table 17.

The resilient modulus used for the base was set equal to 25,000 psi; while the subgrade resilient modulus was selected as 8,000 psi. Because the major purpose of this study was to investigate the distribution of AC rutting by depth within the AC layer, the final values of moduli used for the unbound base, subbase and subgrade are not overly sensitive to the final analysis.

Table 17 In-Situ Gradation Results for the Granular Materials

Material	Gradation (% Passing)									
	1"	3/4"	3/8"	No.4	No.10	No.20	No.40	No.60	No.100	No.200
Class-3 SP	100	99.5	97.7	90.5	79.6	61.9	39.6	26.2	18.3	13.2
Class-4 SP	100	98	91	80	67	46	28	-	11	7.3
Class-5 SP	100	96	81	69	54	34	20	-	8	5.7
Class-6 SP	100	97.7	69.7	46	27.8	15.1	10.4	8.1	6.3	4.7

Results of the MnRoad Study

After running the MnRoad cells (sections); the predicted rut depth (as a function of depth within the AC layer) was compared to the measured rut depths from the trench study. Using these results, an empirical model was developed to correct the rutting model to reflect the same trends of the measured rut in the asphalt layers as a function of depth within the AC layer. The resulting model was found to have the following form:

$$k_1 = (C_1 + C_2 * depth) * 0.328196^{depth} \tag{57a}$$

$$C_1 = -0.1039 * H_{ac}^2 + 2.4868 * H_{ac} - 17.342 \tag{57b}$$

$$C_2 = 0.0172 * H_{ac}^2 - 1.7331 * H_{ac} + 27.428 \tag{57c}$$

where:

H_{ac} = the total thickness of the asphalt layer

k_1 = function of total asphalt layer(s) thickness and depth to computational point, to correct for the variable confining pressures that occur at different depths.

This new model was reintroduced in the computer code of the 2002 Design Guide and the sections were rerun. The results of the comparison of the asphalt rut depth predicted using the new model to the measured rut depth was found to be very comparable as shown in Figure 23 and Figure 24.

Final Calibration of Asphalt Layer Rut Model Using LTPP Sections

As can be summarized, the final calibration of the total rut model was a very complicated process as it involved five calibration factors, two of which are on a power terms. The calibration was done in a step-by-step basis. First the two-power calibration factors (β_{r2} and β_{r3}) on the asphalt model were found from the simulation runs. These values were found to be β_{r2}= 0.9, and β_{r3}= 1.2. Then, the two calibration factors on the granular base and subgrade (β_{GB} and β_{SG}) were found from the AASHTO study and the LTPP section optimization. These values found were from the AASHTO study (β_{GB}= 1.05, and β_{SG}= 1.35) while from the LTPP optimization study (β_{GB}= 1.673, and β_{SG}= 1.35). Finally, the last calibration factor on the asphalt (which is a direct multiplier) (β_{r1}) was obtained through optimization after being corrected for the confining pressure-depth effect using MnRoad sections subjected to a forensic study involving trenches.

As mentioned earlier the optimization to find the last calibration factor (β_{r1}) on the asphalt rut model, was done twice using two different methods. The first used the unbound factor found from the AASHTO study (β_{GB}= 1.05, and β_{SG}= 1.35). In this

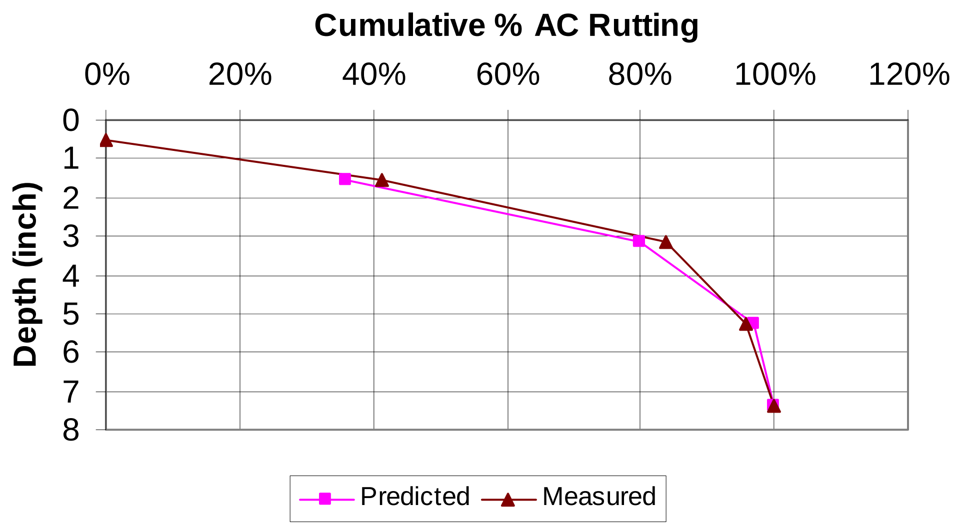


Figure 23 Cumulative % Asphalt Rut Depth – MnRoad Study

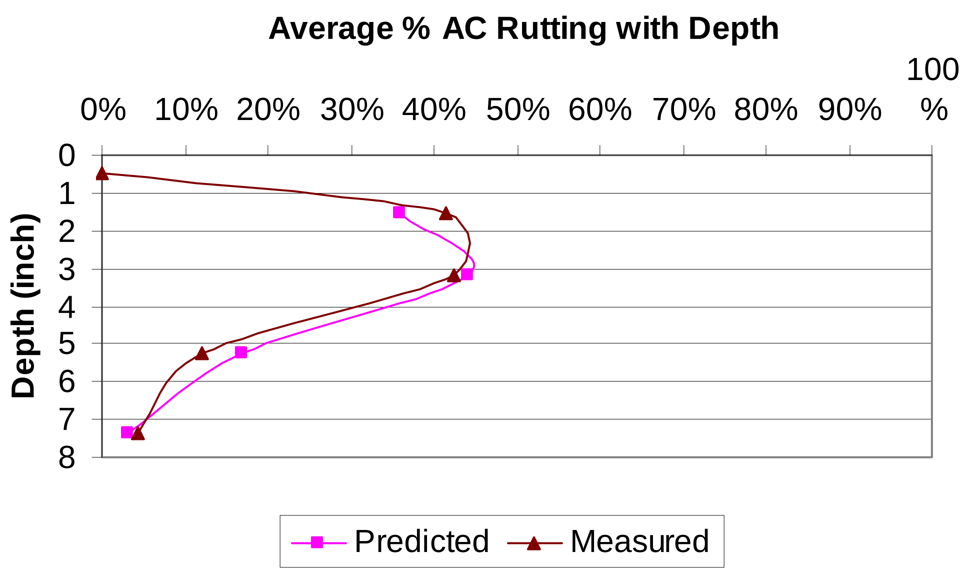


Figure 24 Average Percentage Asphalt Rut Depth-MnRoad Study

approach only the asphalt was optimized. The second method was based upon optimizing all three factors (β_{r1}, β_{GB} and β_{SG}) on the asphalt, granular base and subgrade respectively.

The calibration factors obtained from both optimization methods are shown in Table 18. It is clear that the calibration factors are very close to each other and that the difference in the granular base factor does not significantly impact the asphalt calibration factor to any significant degree. Table 19 shows the statistics of the calibration for all the asphalt, granular base, subgrade and total rut depth on the LTPP section optimization. The number of observations used in the final calibration analysis was based upon 387 points. The second optimization method was eventually selected because it was derived from the LTPP sections. The results will be presented in this portion of the report.

The final field-calibrated model used in the Design Guide was determined by numerical optimization and other modes of comparison to result in calibration factors of:

$\beta_{r1} = 0.509$
$\beta_{r2} = 0.9$
$\beta_{r3} = 1.2$

This resulted in the final model to be:

$$\frac{\varepsilon_p}{\varepsilon_r} = k_1 * 10^{-3.4488} T^{1.5606} N^{0.479244} \qquad (58)$$

In this equation it can be observed that a depth parameter "k_1"has also been introduced to provide as accurate a rut depth prediction model as possible. This analysis was developed by utilizing trench studies from the MnRoad test site.

k_1 = function of total asphalt layers thickness and depth to computational point, to correct for the confining pressure at different depths as given in equation 57 and restated below.

$$k_1 = (C_1 + C_2 * depth) * 0.328196^{depth} \qquad (59a)$$
$$C_1 = -0.1039 * H_{ac}^2 + 2.4868 * H_{ac} - 17.342 \qquad (59b)$$
$$C_2 = 0.0172 * H_{ac}^2 - 1.7331 * H_{ac} + 27.428 \qquad (59c)$$

Also Figure 25, to Figure 28 show the plot of the predicted rut depth versus the measured rut depth for the asphalt, granular base, subgrade and total rut respectively using the second optimization method.

Table 18 Calibration Factors Obtained by Optimization

Optimization	β_{r1}	β_{r2}	β_{r3}	β_{GB}	β_{SG}
Method One	0.551	0.900	1.200	1.050	1.350
Method Two	0.509	0.900	1.200	1.673	1.350

Table 19 Statistical Values for Each Layer

Optimization		**AC**	**GB**	**SG**	**Total**
Method One	Average =	0.175	0.035	0.113	0.323
	Sum of error =	0.000	-0.882	-1.872	-2.754
	Sum of error^2 =	2.372	0.107	0.931	7.043
	Percentage =	51.26%	11.14%	37.60%	100.00%
	Se =	0.071	0.015	0.045	0.122
	R^2 =	0.6227	0.6786	0.1624	0.4067
Method Two	Average =	0.162	0.055	0.113	0.330
	Sum of error =	0.884	-0.144	-0.741	0.000
	Sum of error^2 =	1.883	0.243	0.931	6.915
	Percentage =	46.60%	16.73%	36.67%	100.00%
	Se =	0.063	0.023	0.045	0.121
	R^2 =	0.648	0.677	0.1363	0.399

Number of Observations was 387 points.

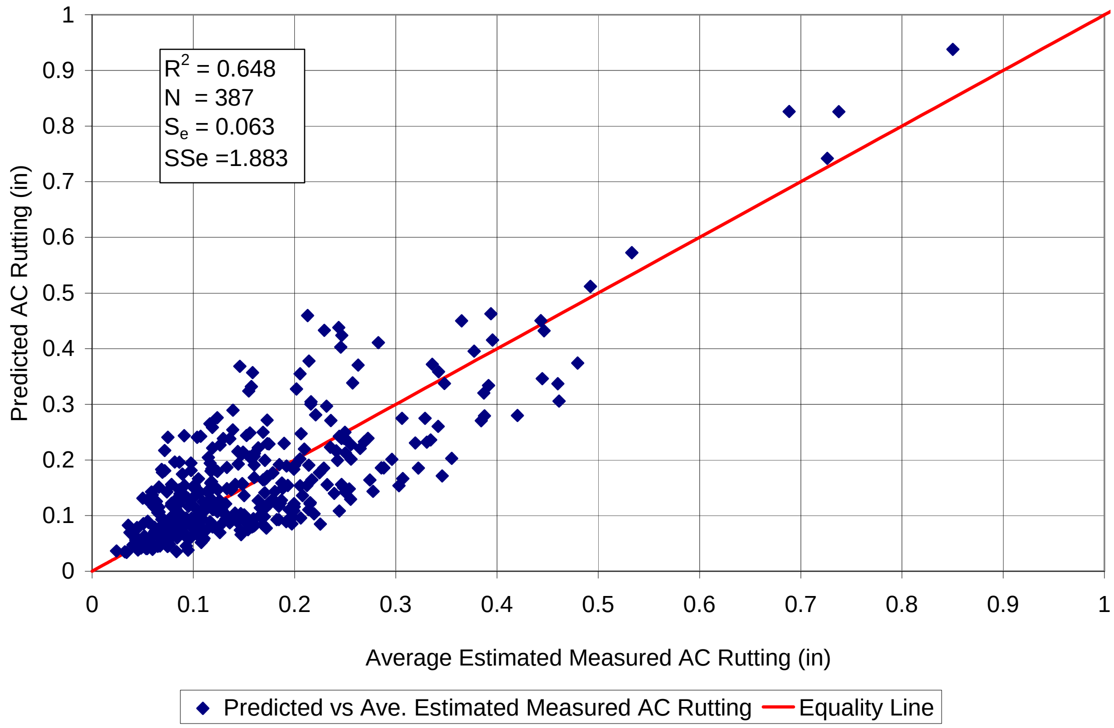


Figure 25 Asphalt Layers Measured vs. Predicted Rut Depth

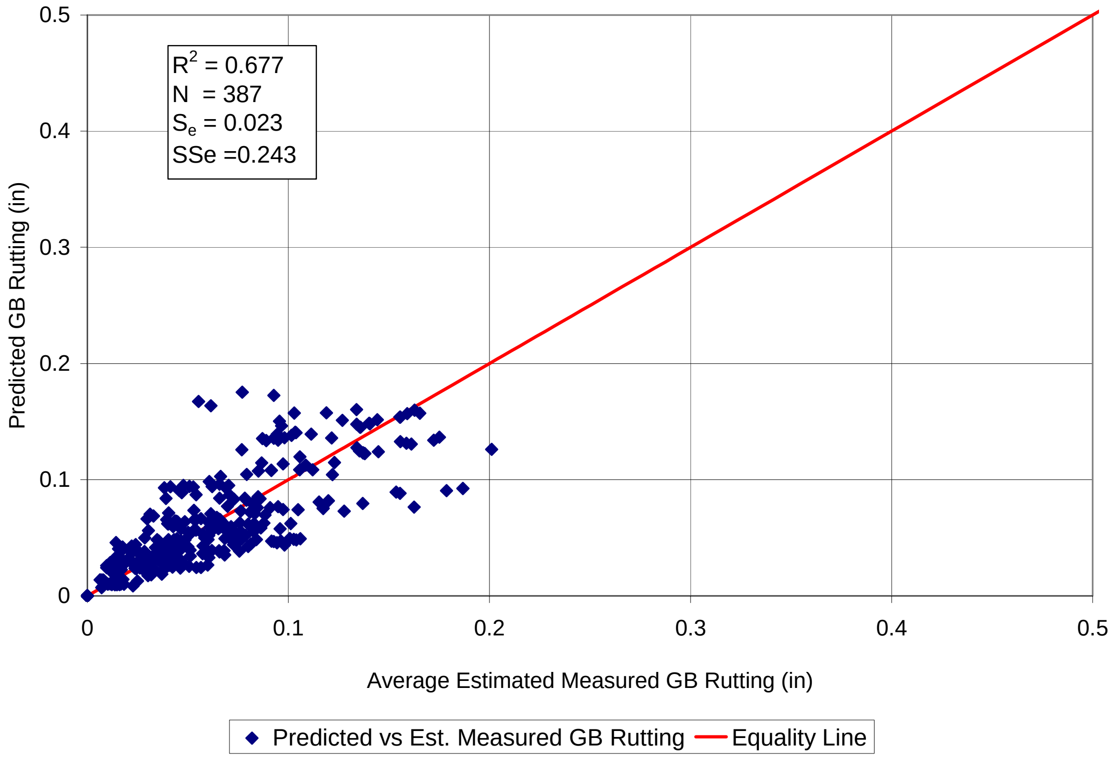


Figure 26 Granular Base Measured vs. Predicted Rut Depth

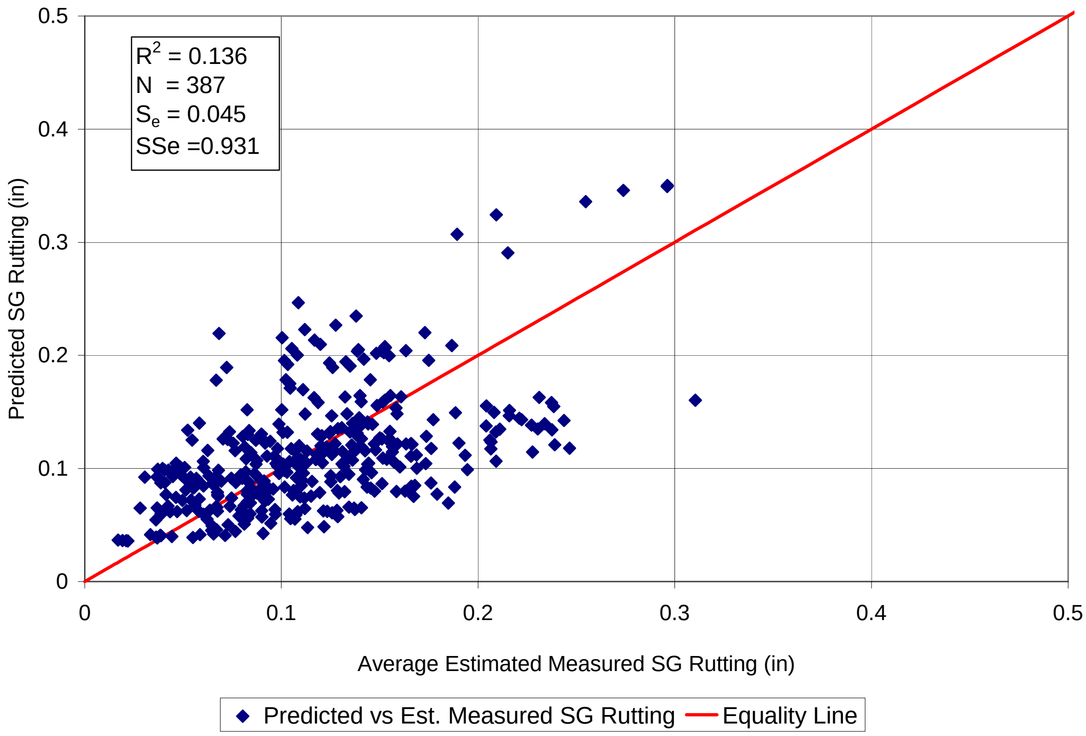


Figure 27 Subgrade Measured vs. Predicted Rut Depth

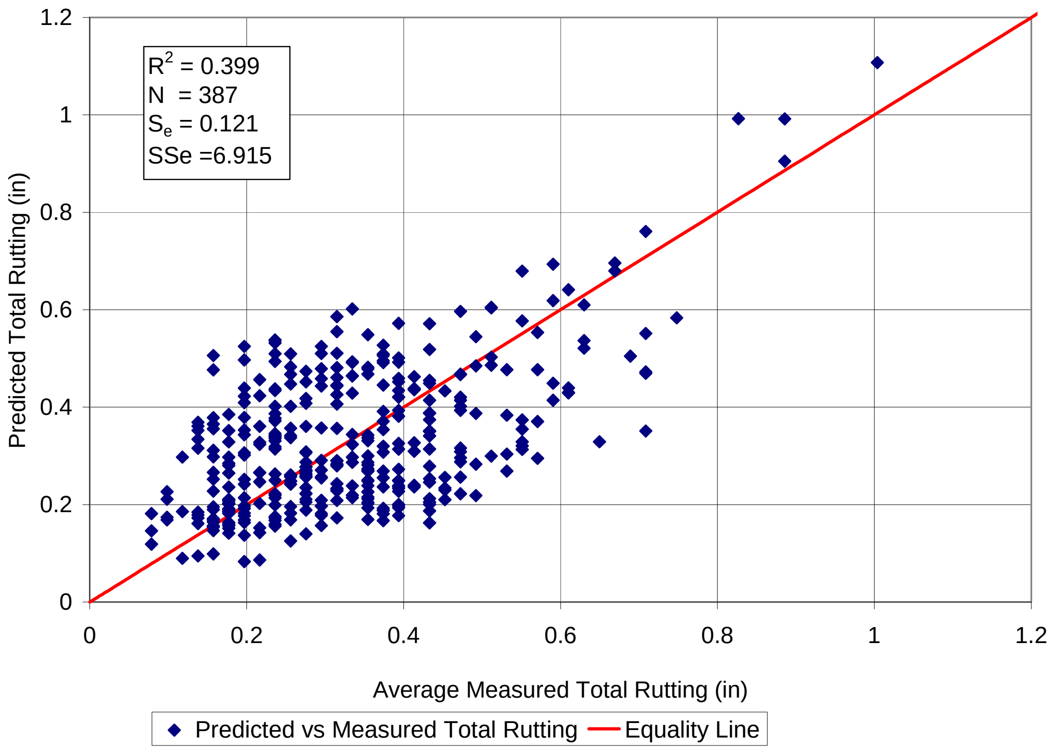


Figure 28 Total Measured vs. Predicted Rut Depth

Permanent Deformation Reliability

The reliability design, for the prediction of the total rut depth, is obtained at the desired level of reliability by the following equation:

$$RUT\_P = \sum_i \left(\overline{RUT}_i\right) + \left(\sqrt{Se_{AC}^{\ 2} + Se_{GB}^{\ 2} + Se_{SG}^{\ 2}}\right) * Z_p \qquad (60)$$

where:

RUT_P	= predicted rutting at the reliability level P, inch.
$\overline{RUT}_i$	= predicted rutting based on mean inputs (corresponding to 50% reliability), inch.
Se_{RDi}	= standard error of rutting for the predicted mean rutting
Z_P	= standard normal deviate (one-tailed distribution).
i	= layer type, HMA, base, or subgrade.

When considering the total rut depth, the summation of the square of the standard error for each layer is derived from the expansion of a Taylor series. The total rut is equal to the summation of the individual layer rut depth. By expanding this in Taylor series to solve for the variance, and because the individual layer rut depths are independent from each other, the total rut will be the summation of the square of the standard error of each layer.

If one is analyzing a conventional structure, the total rut depth variance will simply be the sum of the variances of each layer as shown in equation 60. If the pavement structure is a full depth asphalt section, equation 60 is still applicable. However, the total rut depth variance will be the sum of the variances associated with only the AC layer and subgrade. The reliability equation will be

$$RUT\_P = \sum_i \left(\overline{RUT}_i\right) + \left(\sqrt{Se_{AC}^{\ 2} + Se_{SG}^{\ 2}}\right) * Z_p \qquad (61)$$

The standard errors associated for each separate layer are as follows:

$$Se_{RDAC} = 0.1587\ PD_{ac}^{0.4579} \qquad (62a)$$

$$Se_{RDGB} = 0.1169\ PD_{GB}^{0.5303} \qquad (62b)$$

$$Se_{RDSG} = 0.1724\ PD_{SG}^{0.5516} \qquad (62c)$$

The standard error equations were obtained by first checking the error. The error is defined as the difference between the predicted and the measured rut depth for each layer. The rut depth was grouped depending on the scatter of the error. The standard error was then calculated from the rut depth for each group. Finally, a power model was fitted to the data (as shown in equations 62a to 62c).

Figure 29 and Figure 30 show the plots of the error and standard deviation for the asphalt concrete layer. Figure 31 and Figure 32 show the same plots for the granular base layer; while

Figure 33 and Figure 34 are applicable to the subgrade layer standard deviation and error plots. Finally Figure 35 shows the error in the total rut depth of the pavement.

The standard deviation relations shown earlier are computed from the relation between the average rut depth and the standard error for each layer within separate groups. The different layers groups, average rut depth and the corresponding standard error are shown in Table 20, Table 21 and Table 22 for asphalt concrete layer, granular base layer and subgrade layer respectively.

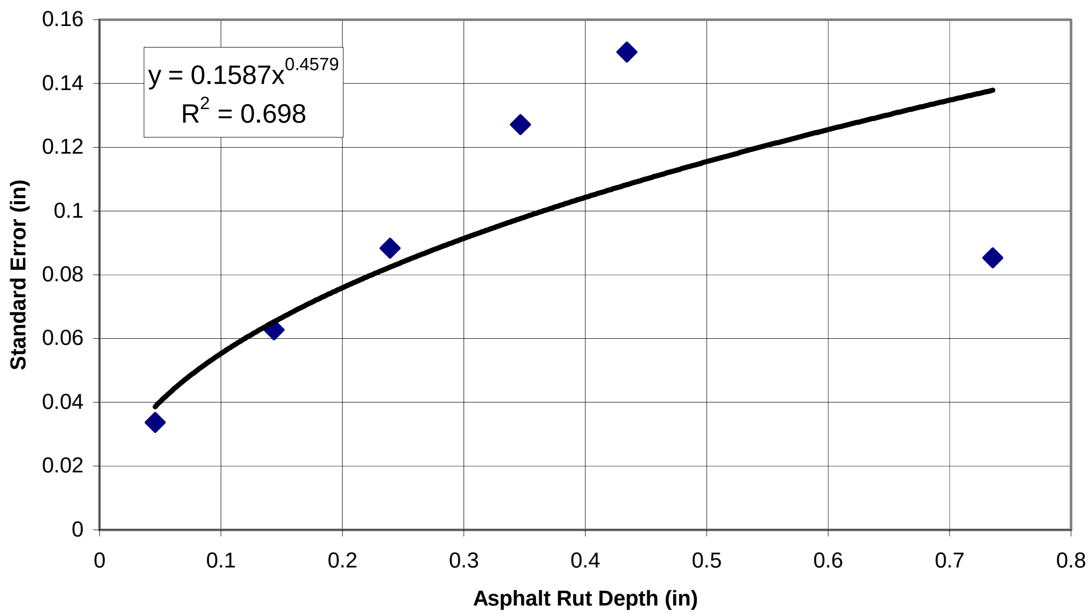


Figure 29 Standard Deviation for Asphalt Rut Depth

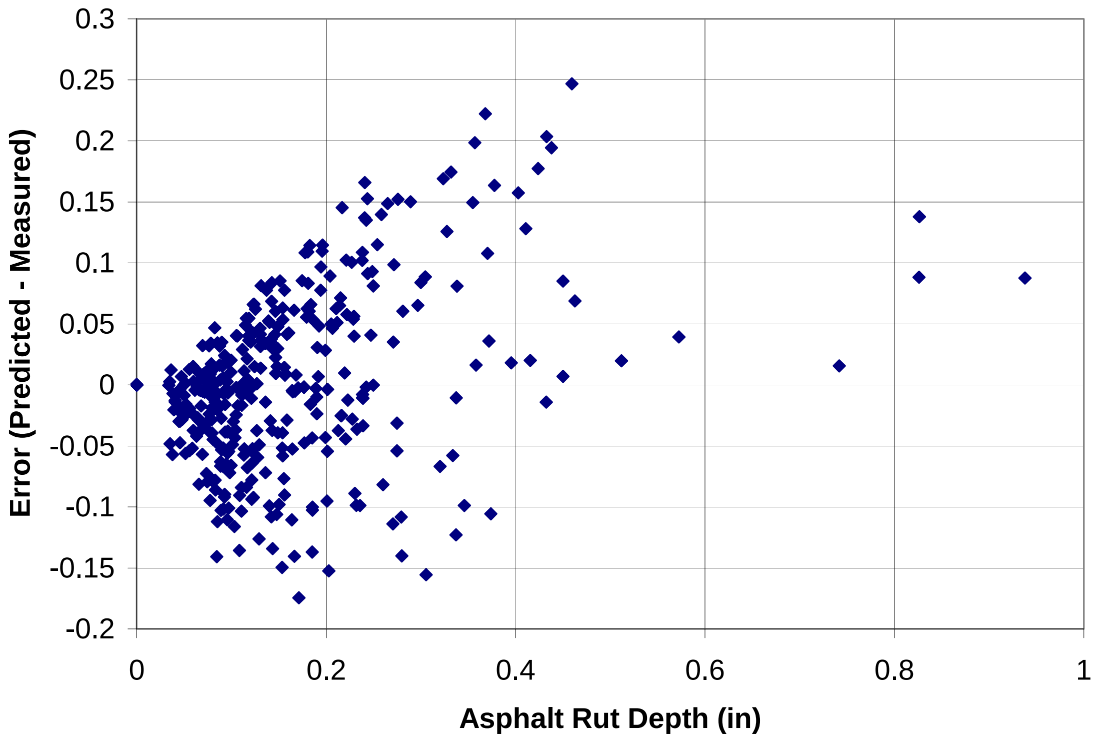


Figure 30 Error for Asphalt Rut Depth

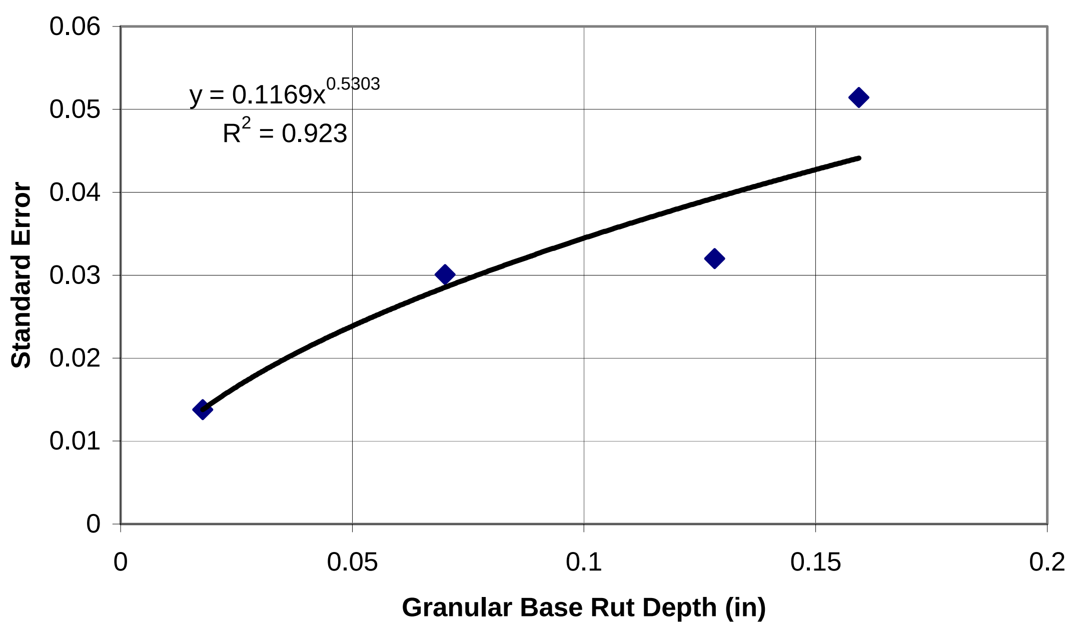


Figure 31 Standard Deviation for Granular Base Rut Depth

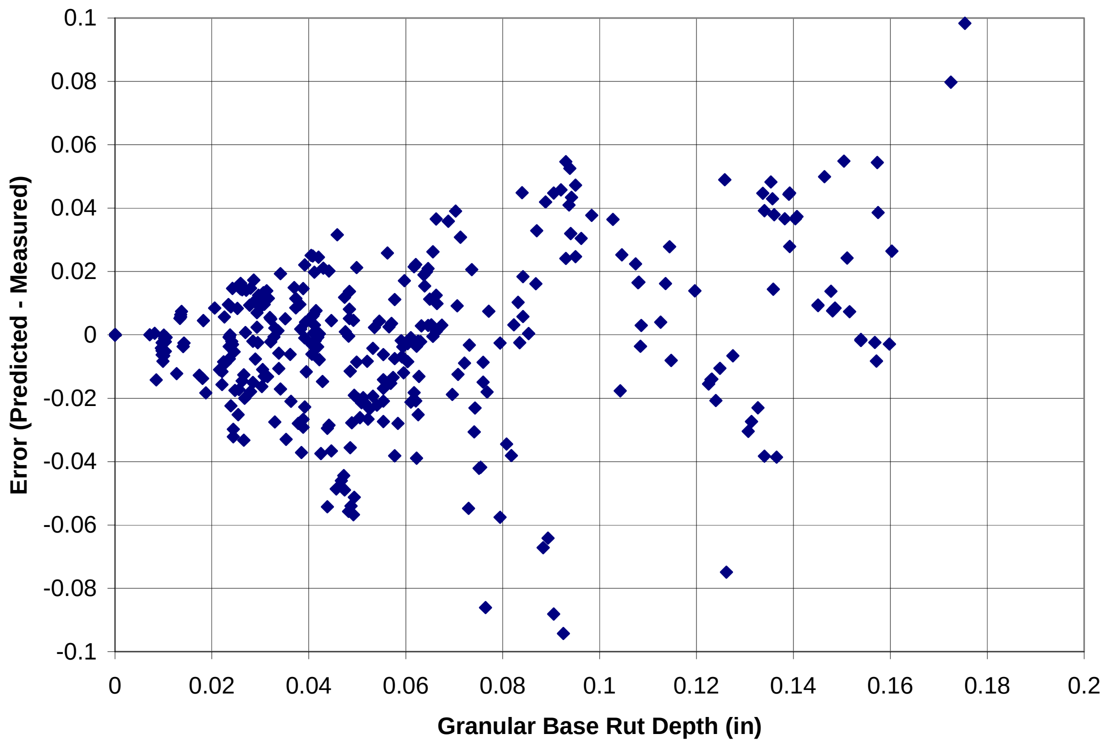


Figure 32 Error for Granular Base Rut Depth

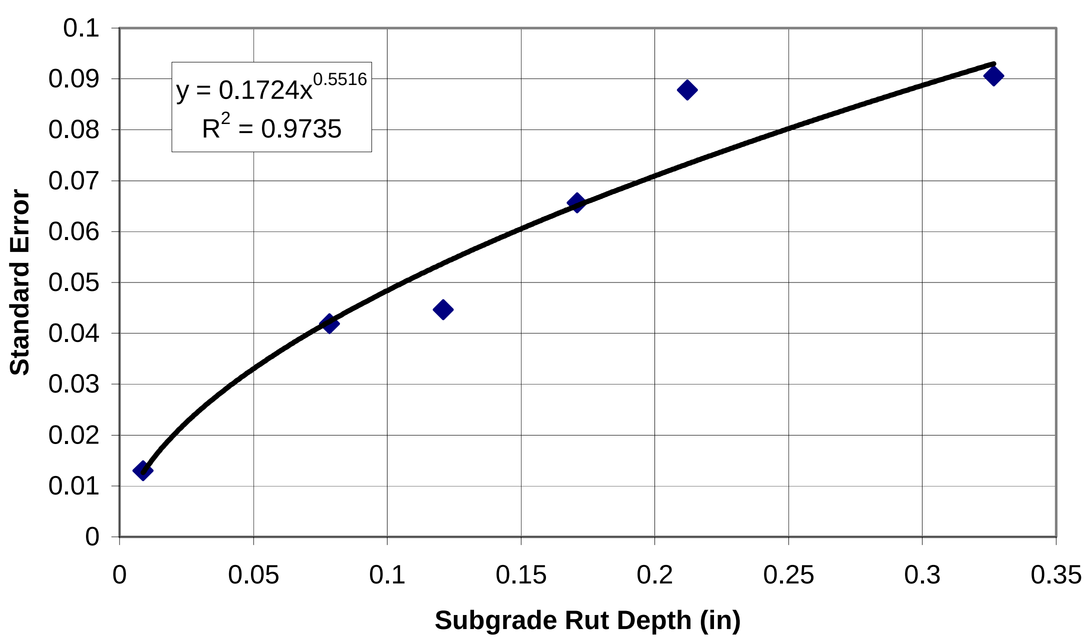


Figure 33 Standard Deviation for Subgrade Rut Depth

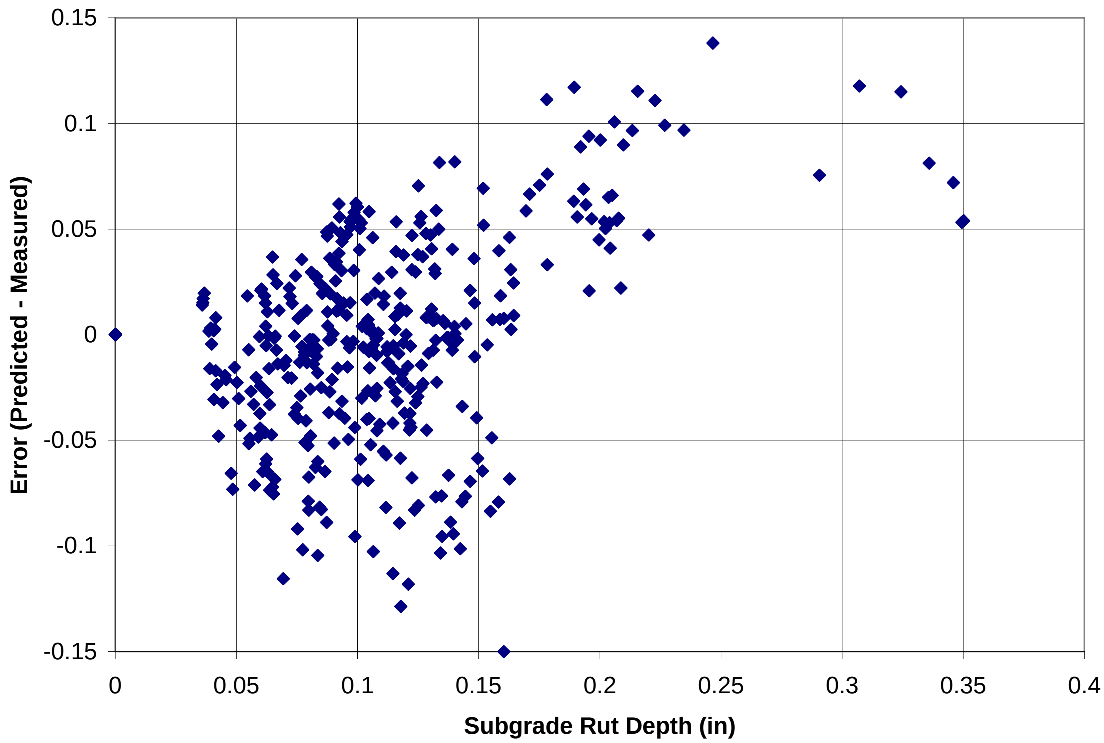


Figure 34 Error for Subgrade Rut Depth

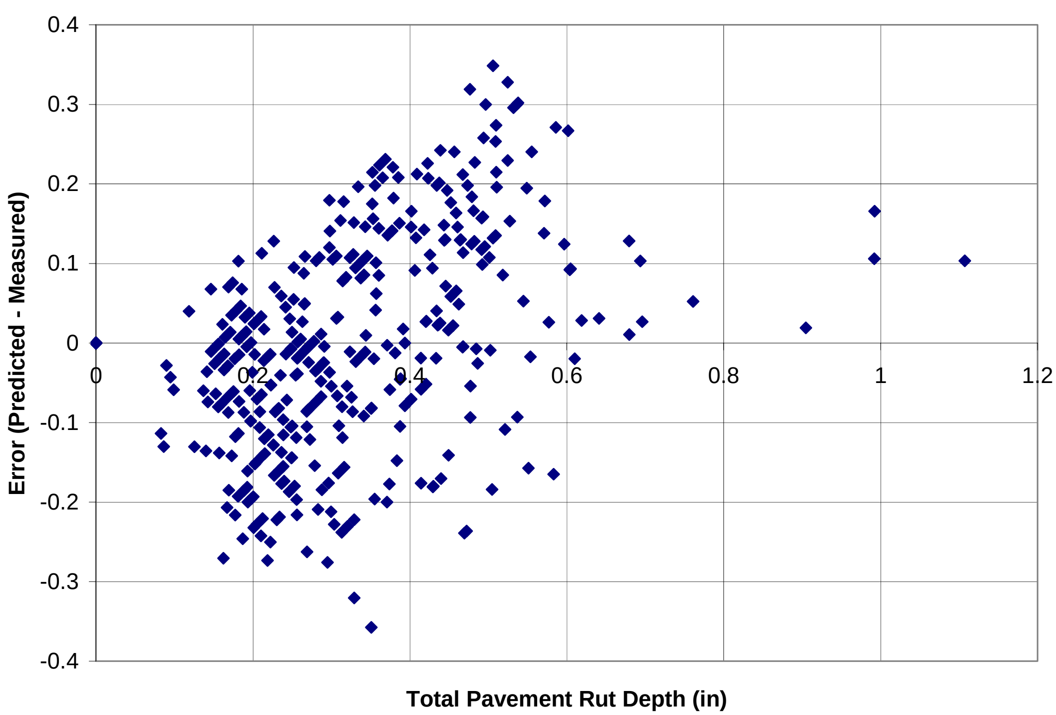


Figure 35 Error for Total Pavement Rut Depth

Table 20 Computed Statistical Parameters for Each Data Group (AC Rut).

Group	Range of predicted AC rut, inches	Number of data points	Average Predicted AC Rut, inches	Average Measured AC Rut, inches	Standard Error for Predicted AC Rut inches
1	0 - 0.1	219	0.05	0.06	0.034
2	0.1 - 0.2	153	0.15	0.15	0.063
3	0.2 - 0.3	61	0.24	0.12	0.088
4	0.3 - 0.4	20	0.35	0.30	0.127
5	0.4 - 0.5	11	0.44	0.32	0.150
6	0.5 and above	6	0.74	0.67	0.085

Table 21 Computed Statistical Parameters for Each Data Group (GB Rut).

Group	Range of predicted Base rut, inches	Number of data points	Average Predicted Granular Base Rut, inches	Average Measured Granular Base Rut inches	Standard Error for Predicted Granular Base Rut, inches
1	0 - 0.05	294	0.018	0.02	0.014
2	0.05 - 0.1	115	0.07	0.07	0.030
3	0.1 - 0.15	41	0.13	0.12	0.032
4	0.15 - 0.2	20	0.16	0.13	0.051

Table 22 Computed Statistical Parameters for Each Data Group (SG Rut).

Group	Range of predicted Subgrade Rut, inches	Number of data points	Average Predicted Subgrade Rut, inches	Average Measured Subgrade Rut, inches	Standard Error for Predicted Subgrade Rut, inches
1	0-0.05	105	0.01	0.01	0.013
2	0.05-0.1	155	0.08	0.09	0.042
3	0.1-0.15	148	0.12	0.13	0.045
4	0.15-0.2	36	0.17	0.14	0.066
5	0.2-0.25	19	0.21	0.13	0.088
6	0.25-0.4	7	0.33	0.25	0.091

Conclusions

The calibration of the permanent deformation characteristics within each major pavement layer was a very fundamental task. The main problem associated with the task was due to the fact that LTPP data only provides the total (surface) rutting present in the test section. The only certain way to accurately know rutting that is occurring within each layer would be to have periodic trench studies to visually note and quantity layer rutting.

Because of this limitation the initial approach used the assumption that the predicted rut depth in each layer (from the Design Guide models) would be exactly proportional to the actual rut depth available from the LTPP data. A total of 88 of 94 sections were used (due to missing rut depth information) and were located in 28 states.

An untold number of major calibration-validation runs were initially used through the majority of the study. In the general opinion of the research team, it was reluctantly concluded to abandon this procedure of proportioning rutting within layers. The decision was made to calibrate the unbound base, subbase and subgrade rut depth prediction to a special study involving the use of numerous test sections designed by the 1993 AASHTO Design Guide. This led to much more satisfactory conclusions for the unbound material process. The major conclusions from his effort were:

- From the AASHTO study, it was found that a calibration factor; for the granular base, of β_{GB} = 1.05 was developed while, for the subgrade soils, the β_{SG} =1.35. The final permanent strain model was set 8-CB (as noted in the text). The basis for this selection was the fact that the 8-CB set yielded subgrade rut depth predictions that were approximately equal for all combinations for subgrade soil type and traffic repetitions. This finding implies that any properly designed pavement will have the same level of distress at "failure" regardless of all design input conditions. The final permanent deformation relationship used are as follows:

$$\frac{\varepsilon_p(N)}{\varepsilon_r} = \left(\frac{\varepsilon_0}{\varepsilon_r}\right) e^{-\left(\frac{\rho}{N}\right)^{\beta}}$$

For N =1 $\quad \dfrac{\varepsilon_p(1)}{\varepsilon_r} = 0.15$

For N =10^9 $\quad \dfrac{\varepsilon_p(10^9)}{\varepsilon_r} = 20$

$$\left(\frac{\varepsilon_0}{\varepsilon_r}\right) = \frac{\left(0.15 * e^{(\rho)^\beta}\right) + \left(20 * e^{\left(\frac{\rho}{10^9}\right)^\beta}\right)}{2}$$

where:

$$\log \beta = -0.61119 - 0.017638 W_c$$

$$\rho = 10^9 \left(\frac{-4.89285}{\left[1 - \left(10^9\right)^\beta\right]}\right)^{\frac{1}{\beta}}$$

- Assuming that the unbound portion of the rutting analysis was "final calibrated"; optimization efforts to determine the most accurate rutting models for the asphalt layers began. A study using results at the MnRoad test Road was used in the calibration process to adopt the effect of confining pressure on the asphalt layer rutting. This correlation adjusted the asphalt rut by the total asphalt thickness and the depth at which the rut is calculated.

$$k_1 = (C_1 + C_2 * depth) * 0.328196^{depth}$$

$$C_1 = -0.1039 * H_{ac}^2 + 2.4868 * H_{ac} - 17.342$$

$$C_2 = 0.0172 * H_{ac}^2 - 1.7331 * H_{ac} + 27.428$$

where:

H_{ac} = the total thickness of the asphalt layer

k_1 = function of total asphalt layers thickness and depth

- The general AC rut depth equation (uncalibrated) was

$$\frac{\varepsilon_p}{\varepsilon_r} = \beta_{r1} * 10^{-3.5111} T^{1.734 * \beta_{r2}} N^{0.3999 * \beta_{r3}}$$

In this equation the β_{r1}, β_{r2}, β_{r3} coefficients are the calibration factors to be determined. A very comprehensive optimization study was completed and it was found that the calibration factor on the temperature (β_{r2}) and on the number of load repetitions (β_{r3}) in the asphalt layer rut model was found to be 0.9 and 1.2, respectively.

- The calibration of the asphalt layer rut depth prediction was accomplished by two methods of optimization: the first approach used the unbound layer factors from the AASHTO study and, as a consequence, only the asphalt layer had to be optimized. The second method used the approach of optimizing the error for the total rut on all layers simultaneously. The results of these studies yielded:

    - First Method β_{GB} = 1.05 and β_{SG} = 1.35
    - Second Method β_{GB} = 1.673 and β_{SG} = 1.35

  It was concluded that both optimization methods were very close to each other. In fact, the subgrade had the same calibration factor from both methods.

- The full optimization method (second approach) was selected and the statistical properties of the calibrated models on the total rut depth was: sum of error square = 6.885, standard error was 0.133 and the correlation coefficient was 0.4182 for the total rut, 0.647 for the asphalt layers, 0.6427 for the granular base and 0.2247 for the subgrade.

- The final model for the AC rut is shown below.

$$\frac{\varepsilon_p}{\varepsilon_r} = k_1 * 10^{-3.4488} T^{1.5606} N^{0.479244}$$

- The Reliability analysis for the total rut depth, utilized the following equation:

$$RUT\_P = \sum_i \left(\overline{RUT}_i\right) + \left(\sqrt{Se_{AC}^{\ 2} + Se_{GB}^{\ 2} + Se_{SG}^{\ 2}}\right) * Z_p$$

  The standard error of each layer was found to be:

  Se_{RDAC} =0 .1587 $PD_{ac}^{0.4579}$

  Se_{RDGB} = = 0.1169 $PD_{GB}^{0.5303}$

  Se_{RDSG} = 0.1724 $PD_{SG}^{0.5516}$

Individual layer rut depth reliability equations would utilize the same form of the reliability equation previously noted. However, only the appropriate layer variances (standard deviation) would be used in the equation for the specific layer type being investigated.

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Annex B

Unbound Materials Modified Rut Model Results

Table B-23 Coefficients for Different Unbound Materials Rut Models

Set	a1	b1	a7	b7
1-A	1.8E-15	2.91129	0.03162	0.5
2-A	3.4E-22	4.18147	0.03162	0.5
3-A	8.9E-11	2.02805	0.03162	0.5
1-2-A	1.1E-18	3.52005	0.03162	0.5
1-CB	0.00001	0	10	0
2-CB	0.001	0	10	0
3-CB	0.1	0	10	0
4-CB	0.1	0	100	0
5-CB	0.5	0	10	0
6-CB	0.2	0	10	0
7-CB	0.15	0	10	0
8-CB*	0.15	0	20	0
8-CB-1*	0.15	0	2.5	0.30103
9-CB**	0.15	0	40	0
10-CB*	0.05	0	20	0
11-CB*	0.1	0	100	0
11-CB-1*	-0.301	3.2	100	0
4-E	1.2E-07	1.30376	0.24843	0.43459
1-F	1.1E-09	1.65173	10	0
2-F	1.1E-05	0.82586	10	0
3-F	0.00636	0.24861	10	0
4-F	0.1	0	10	0
1-G	0.15516	-0.3504	0.0001	1
2-G	0.0035	0	0.0001	1
3-G	0.1	0	0.0001	1
4-G	0.5	0	0.03162	0.5
5-G	0.1	0	1.76777	0.15051

* 10^9 Traffic was used
** 10^11 Traffic was used

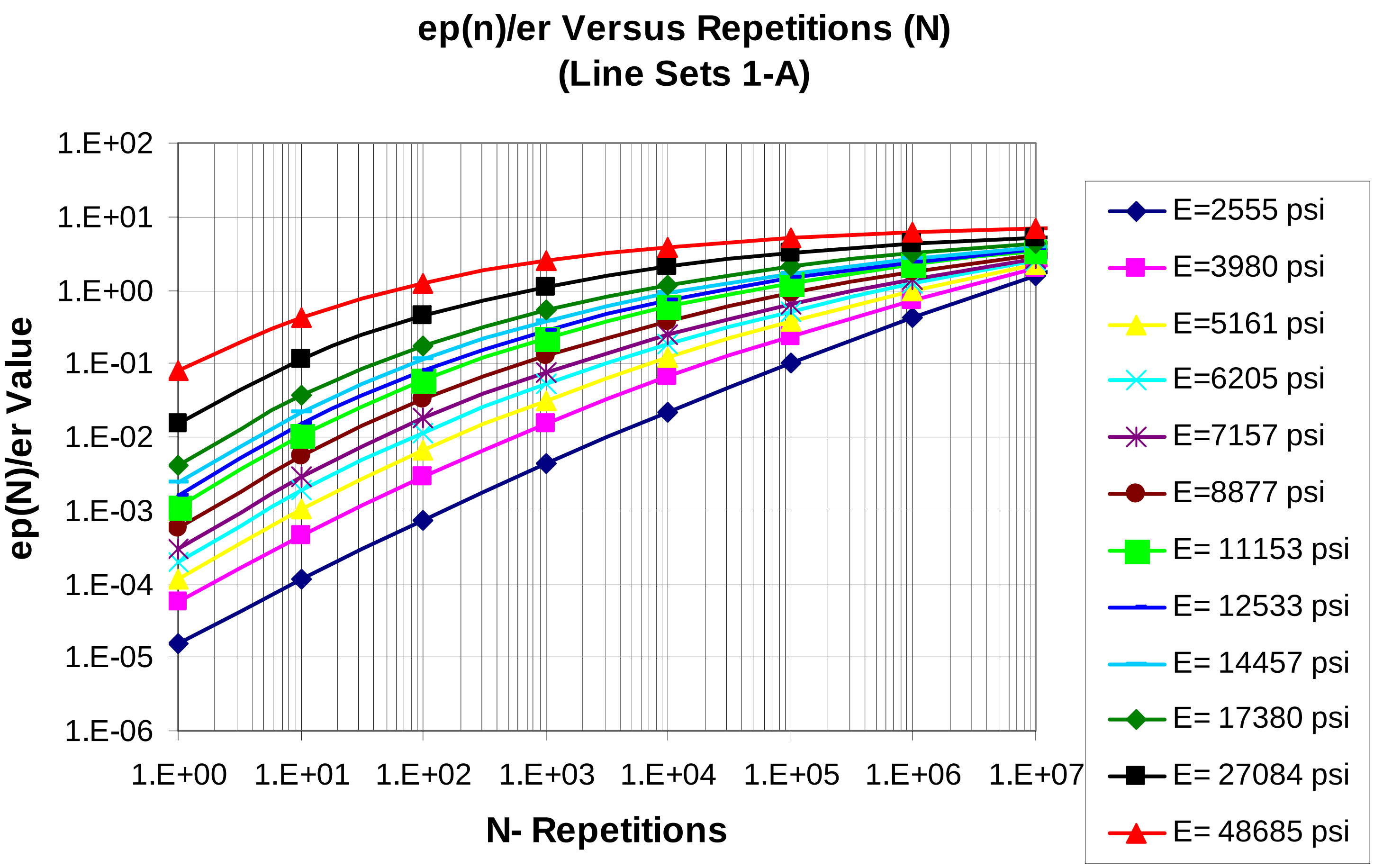


Figure B-36 Subgrade Material $\varepsilon_p / \varepsilon_r$ vs. Number of Load Repetitions Set 1-A

Table B-24 Unbound Material Rut Model Set 1-A Computations

N=1 Repetition

	ep(1)/er	**E (psi)**
Data Set 1	0.000001	1000
Data Set 2	5	200000

b(1)=	2.9112919
a(1)1=	1.846E-15
a(1)2=	1.846E-15
a(1)(avg)=	1.846E-15

N=10^7 Repetition

	ep(10^7)/er	**E (psi)**
Data Set 1	1	1000
Data Set 2	10	100000

b(10^7)=	0.5
a(10^7)1=	0.0316228
a(10^7)2=	0.0316228
a(10^7)(avg)=	0.0316228

CBR=	1	2	3	4	5	7	10	12	15	20	40	100
GWT (ft)=	10	10	10	10	10	10	10	10	10	10	10	10
E (psi)=	2555	3981.5	5161.2	6204.5	7157	8876.7	11153	12533.3	14457.4	17380	27083.8	48684.5
ep(1)/er=	1.535E-05	5.584E-05	0.0001189	0.0002031	0.0003079	0.0005763	0.0011201	0.001573218	0.0023843	0.0040752	0.0148264	0.0817498
ep(10^7)=	1.5984367	1.9953696	2.2718275	2.4908834	2.675257	2.9793791	3.3396108	3.540240105	3.8022888	4.1689327	5.2042098	6.9774279
Beta=	0.0299719	0.0538458	0.0700934	0.0821515	0.0916235	0.1058432	0.1205232	0.127772481	0.1363509	0.146865	0.1693629	0.1927432
C0=	-11.553593	-10.483928	-9.8581728	-9.4142401	-9.0698689	-8.5506238	-8.0001773	-7.71882638	-7.3744522	-6.9305003	-5.8608135	-4.4467717
Rho=	2.285E+49	2.208E+23	3.945E+16	3.08E+13	4.79E+11	4.243E+09	112362119	25705720.92	5481521.6	1037104.4	50976.572	2919.9702
X1=	191731405	3934.4117	251.20434	75.562095	39.185784	19.865231	12.735224	10.93978401	9.5534146	8.5382865	7.8338866	8.5934294
X2=	191731405	3934.4117	251.20434	75.562095	39.185784	19.865231	12.735224	10.93978401	9.5534146	8.5382865	7.8338866	8.5934294
X(avg)=	191731405	3934.4117	251.20434	75.562095	39.185784	19.865231	12.735224	10.93978401	9.5534146	8.5382865	7.8338866	8.5934294

N	ep(0)/er=											
1	1.535E-05	5.584E-05	0.0001189	0.0002031	0.0003079	0.0005763	0.0011201	0.001573218	0.0023843	0.0040752	0.0148264	0.0817498
10	0.0001147	0.0004592	0.0010417	0.0018529	0.0028794	0.0055212	0.0107675	0.014999798	0.0222916	0.0365671	0.1122898	0.4335901
100	0.000749	0.0029543	0.006606	0.0115466	0.0176024	0.0324461	0.0598117	0.08049723	0.1141147	0.1748276	0.4422786	1.2646484
1000	0.0043178	0.0152968	0.031811	0.0524931	0.0762579	0.1299993	0.2192789	0.28150965	0.3762249	0.5335293	1.1189137	2.5132654
10000	0.0221455	0.0653843	0.1211918	0.1838264	0.2499736	0.3857854	0.5867854	0.715526043	0.899392	1.182163	2.0976168	3.9048481
100000	0.1018508	0.2359301	0.3782586	0.5186856	0.6537822	0.9048473	1.2369938	1.433832506	1.7000541	2.0847706	3.2101111	5.1806268
1000000	0.4231087	0.7330059	0.9963897	1.2239366	1.424148	1.7649354	2.1765373	2.406748373	2.7068826	3.1242534	4.2819294	6.2109125
10000000	1.5984367	1.9953696	2.2718275	2.4908834	2.675257	2.9793791	3.3396108	3.540240105	3.8022888	4.1689327	5.2042098	6.9774279
100000000	5.5264382	4.8330934	4.5811169	4.4850019	4.4575528	4.4909647	4.6192151	4.719725233	4.8736719	5.1210369	5.9390017	7.5183273

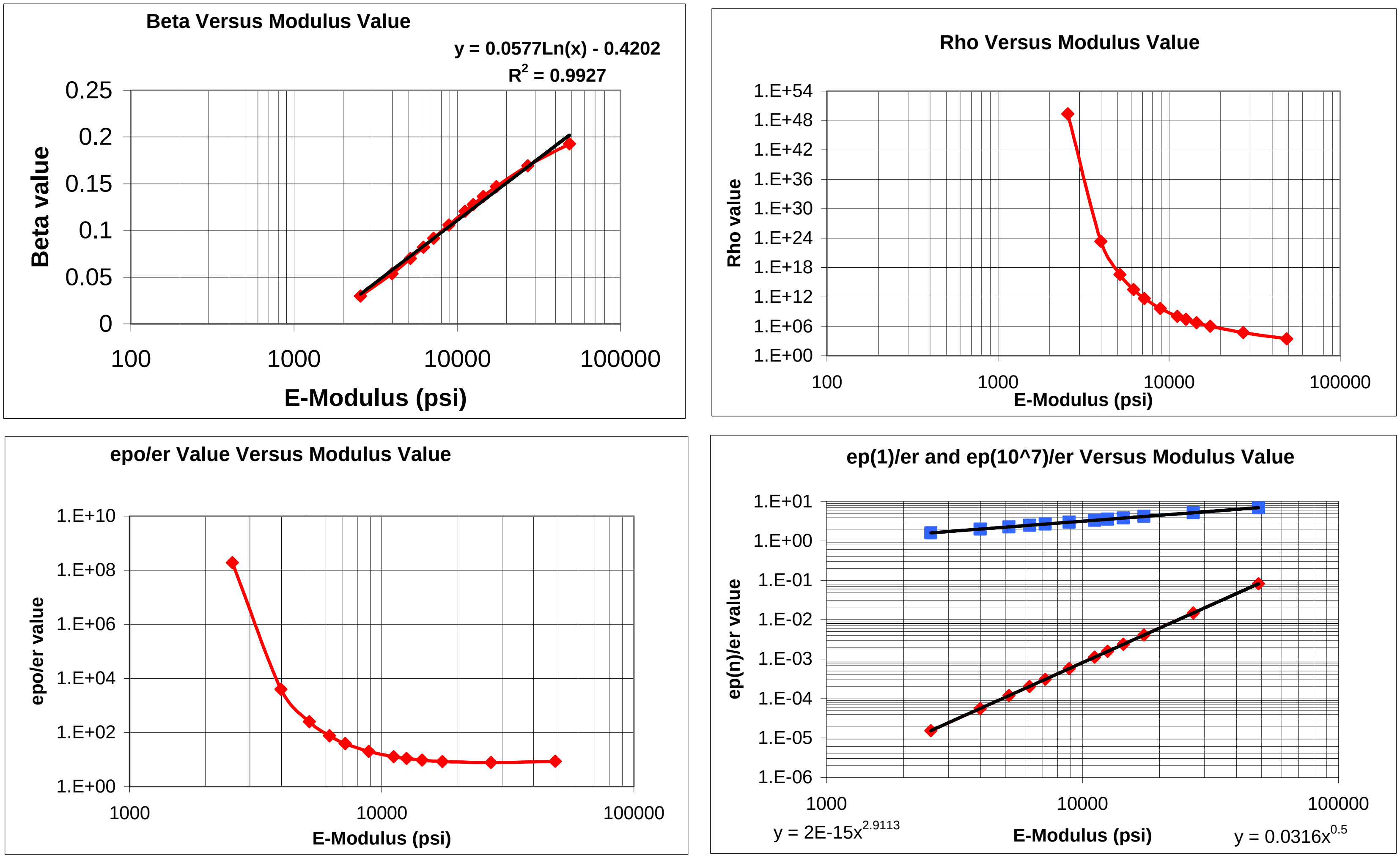


Figure B-37 Subgrade Material Set 1-A graphs

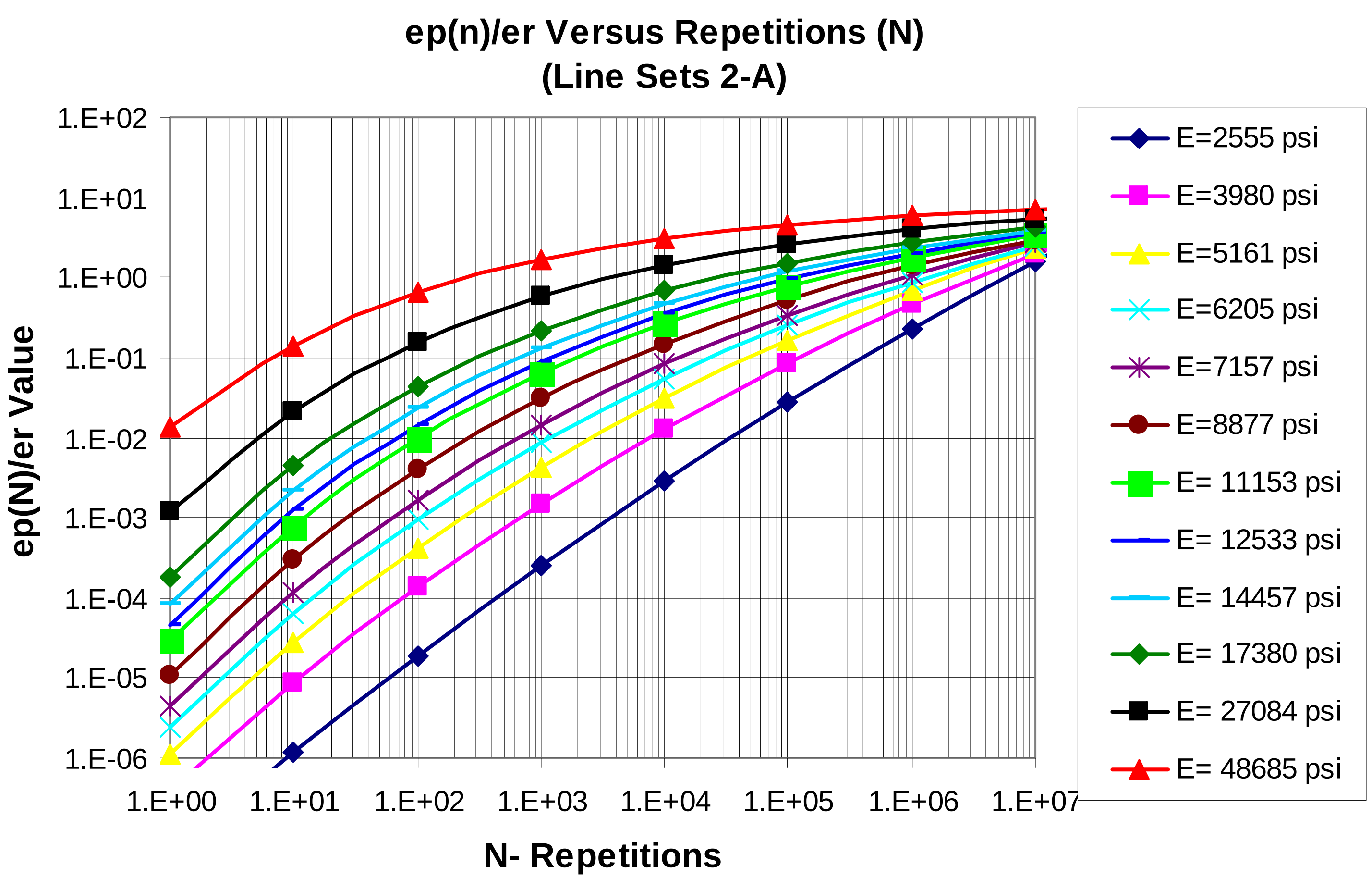


Figure B-38 Subgrade Material $\varepsilon_p / \varepsilon_r$ vs. Number of Load Repetitions Set 2-A

Table B-25 Unbound Material Rut Model Set 2-A Computations

N=1 Repetition

	ep(1)/er	E (psi)
Data Set 1	0.000001	5000
Data Set 2	5	200000

b(1)=	4.1814726
a(1)1=	3.411E-22
a(1)2=	3.411E-22
a(1)(avg)=	3.411E-22

N=10^7 Repetition

	ep(10^7)/er	E (psi)
Data Set 1	1	1000
Data Set 2	10	100000

b(10^7)=	0.5
a(10^7)1=	0.0316228
a(10^7)2=	0.0316228
a(10^7)(avg)=	0.0316228

CBR=	1	2	3	4	5	7	10	12	15	20	40	100
GWT (ft)=	10	10	10	10	10	10	10	10	10	10	10	10
E (psi)=	2555	3981.5	5161.2	6204.5	7157	8876.7	11153	12533.3	14457.4	17380	27083.8	48684.5
ep(1)/er=	6.036E-08	3.858E-07	1.142E-06	2.466E-06	4.48E-06	1.102E-05	2.864E-05	4.66452E-05	8.475E-05	0.000183	0.0011698	0.0135848
ep(10^7)=	1.5984367	1.9953696	2.2718275	2.4908834	2.675257	2.9793791	3.3396108	3.540240105	3.8022888	4.1689327	5.2042098	6.9774279
Beta=	0.0299719	0.0538458	0.0700934	0.0821515	0.0916235	0.1058432	0.1205232	0.127772481	0.1363509	0.146865	0.1693629	0.1927432
C0=	-17.091918	-15.458793	-14.503412	-13.825632	-13.299858	-12.507094	-11.666692	-11.2371359	-10.711358	-10.033548	-8.4003894	-6.241482
Rho=	1.08E+55	2.993E+26	9.733E+18	3.313E+15	3.124E+13	1.542E+11	2.571E+09	485905268.7	84694149	12881196	427057.24	16955.537
X1=	1.43E+12	144000.75	2306.8003	373.87546	137.0298	47.791738	23.519265	18.29549504	14.494664	11.769881	9.352844	9.3471785
X2=	1.43E+12	144000.75	2306.8003	373.87546	137.0298	47.791738	23.519265	18.29549504	14.494664	11.769881	9.352844	9.3471785
X(avg)=	1.43E+12	144000.75	2306.8003	373.87546	137.0298	47.791738	23.519265	18.29549504	14.494664	11.769881	9.352844	9.3471785

N	ep(0)/er=											
1	6.036E-08	3.858E-07	1.142E-06	2.466E-06	4.48E-06	1.102E-05	2.864E-05	4.66452E-05	8.475E-05	0.000183	0.0011698	0.0135848
10	1.182E-06	8.624E-06	2.783E-05	6.337E-05	0.0001189	0.0003005	0.0007766	0.001243011	0.0021788	0.0043865	0.0213026	0.1412833
100	1.899E-05	0.0001342	0.0004215	0.0009307	0.0016906	0.0040075	0.0094661	0.014347367	0.0233521	0.0422561	0.1519721	0.6347614
1000	0.0002535	0.0015163	0.0042565	0.0086027	0.0145109	0.0305189	0.0629449	0.088779658	0.1320906	0.2125142	0.5748226	1.664408
10000	0.0028473	0.0129128	0.030456	0.0541992	0.0827506	0.1498166	0.2644602	0.345229942	0.4684287	0.6723712	1.4149067	3.0893031
100000	0.0272132	0.0856617	0.1625225	0.2486485	0.3388762	0.5213133	0.7846716	0.949681133	1.1810774	1.5286361	2.603728	4.5940081
1000000	0.2237406	0.4557534	0.6757134	0.877315	1.0613434	1.385191	1.7887668	2.018534589	2.3210907	2.7457074	3.9348767	5.9259443
10000000	1.5984367	1.9953696	2.2718275	2.4908834	2.675257	2.9793791	3.3396108	3.540240105	3.8022888	4.1689327	5.2042098	6.9774279
100000000	10.016136	7.3542395	6.3752781	5.9080493	5.6559688	5.4300172	5.3595776	5.380714508	5.453061	5.6150766	6.2888001	7.7483326

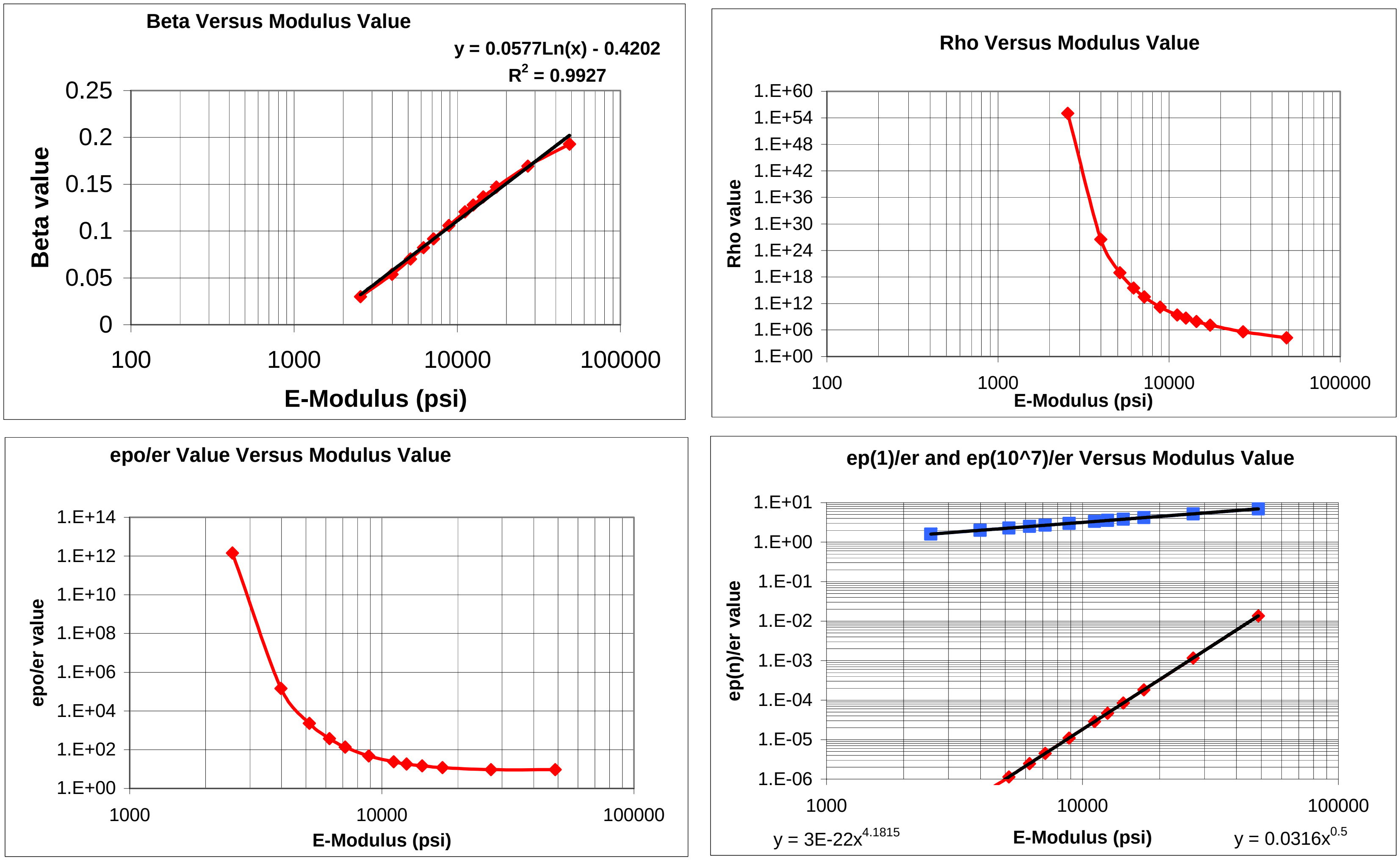


Figure B-39 Subgrade Material Set 2-A graphs

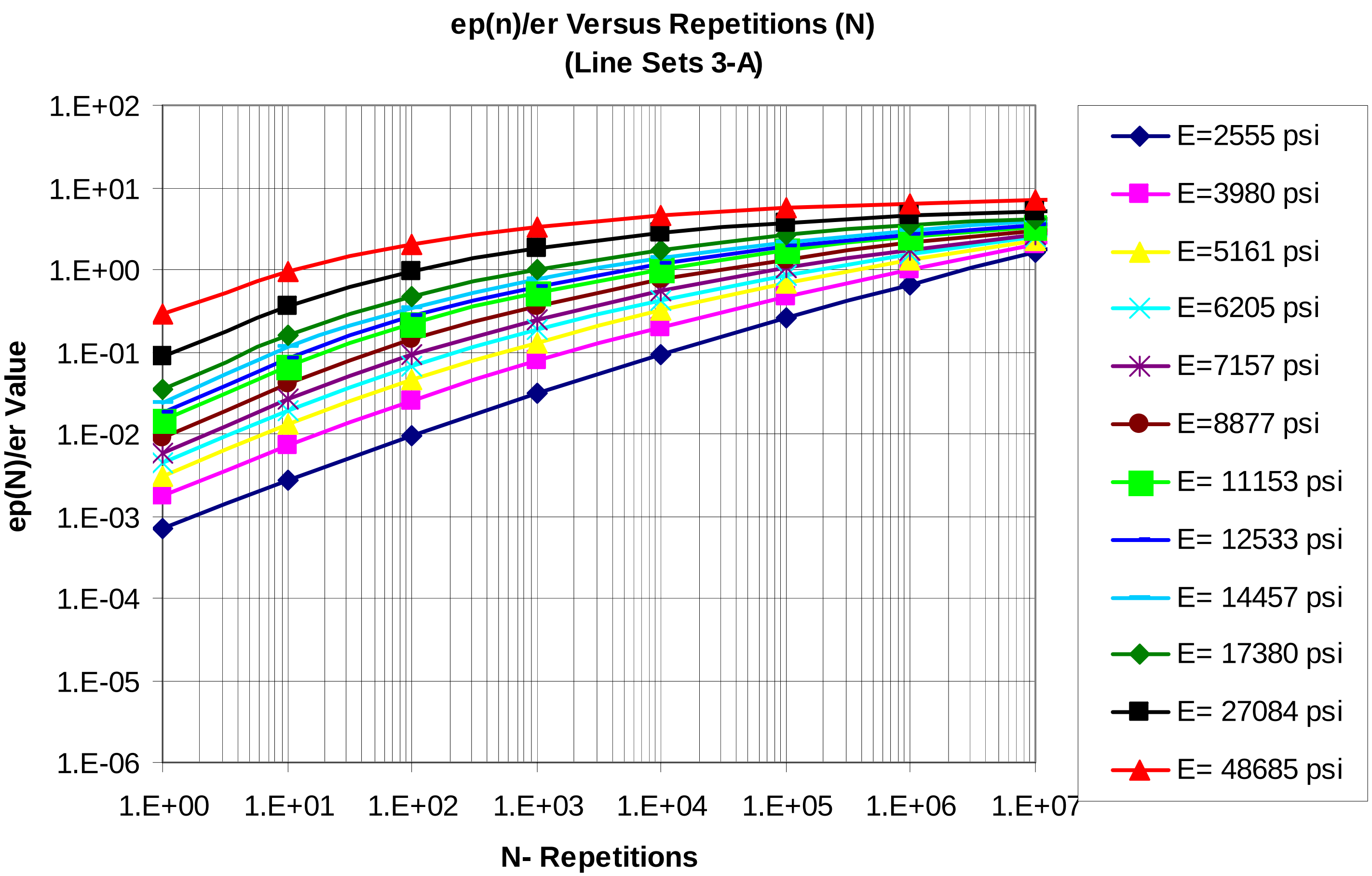


Figure B-40 Subgrade Material $\varepsilon_p / \varepsilon_r$ vs. Number of Load Repetitions Set 3-A

Table B-26 Unbound Material Rut Model Set 3-A Computations

N=1 Repetition

	ep(1)/er	E (psi)
Data Set 1	0.001	3000
Data Set 2	5	200000

b(1)=	2.0280455
a(1)1=	8.876E-11
a(1)2=	8.876E-11
a(1)(avg)=	8.876E-11

N=10^7 Repetition

	ep(10^7)/er	E (psi)
Data Set 1	1	1000
Data Set 2	10	100000

b(10^7)=	0.5
a(10^7)1=	0.0316228
a(10^7)2=	0.0316228
a(10^7)(avg)=	0.0316228

CBR=	1	2	3	4	5	7	10	12	15	20	40	100
GWT (ft)=	10	10	10	10	10	10	10	10	10	10	10	10
E (psi)=	2555	3981.5	5161.2	6204.5	7157	8876.7	11153	12533.3	14457.4	17380	27083.8	48684.5
ep(1)/er=	0.0007221	0.0017754	0.0030052	0.0043654	0.0058319	0.0090256	0.0143395	0.018167831	0.0242712	0.0352577	0.0866915	0.2847617
ep(10^7)=	1.5984367	1.9953696	2.2718275	2.4908834	2.675257	2.9793791	3.3396108	3.540240105	3.8022888	4.1689327	5.2042098	6.9774279
Beta=	0.0299719	0.0538458	0.0700934	0.0821515	0.0916235	0.1058432	0.1205232	0.127772481	0.1363509	0.146865	0.1693629	0.1927432
C0=	-7.7024045	-7.0245537	-6.6280099	-6.346688	-6.1284585	-5.7994108	-5.4505906	-5.27229733	-5.054066	-4.7727318	-4.0948669	-3.1987829
Rho=	3.045E+43	1.301E+20	1.369E+14	2.536E+11	6.64E+09	108308626	4654231.1	1301237.561	343139.6	81806.048	6136.7172	528.62393
X1=	388776.93	321.86837	53.752312	24.855509	16.40835	10.7889	8.3128114	7.650817796	7.1492766	6.8302268	6.9255951	8.105424
X2=	388776.93	321.86837	53.752312	24.855509	16.40835	10.7889	8.3128114	7.650817796	7.1492766	6.8302268	6.9255951	8.105424
X(avg)=	388776.93	321.86837	53.752312	24.855509	16.40835	10.7889	8.3128114	7.650817796	7.1492766	6.8302268	6.9255951	8.105424

N	ep(0)/er=											
1	0.0007221	0.0017754	0.0030052	0.0043654	0.0058319	0.0090256	0.0143395	0.018167831	0.0242712	0.0352577	0.0866915	0.2847617
10	0.0027594	0.0072855	0.0129326	0.0193755	0.026416	0.0417926	0.0670131	0.084762845	0.1123088	0.1597733	0.3567256	0.9456203
100	0.0096434	0.0253585	0.0447751	0.0665174	0.0897718	0.1389178	0.2155315	0.267066614	0.3439247	0.4693098	0.9296098	2.042375
1000	0.0310029	0.0763175	0.1288248	0.1846269	0.2417483	0.3561135	0.5222911	0.628056925	0.7790156	1.0119214	1.7780394	3.3473013
10000	0.092205	0.2019897	0.3166333	0.4297768	0.5392095	0.744722	1.0213162	1.187741856	1.4156354	1.7502119	2.7582484	4.5957212
100000	0.2550002	0.477248	0.6806176	0.8648659	1.032491	1.3277007	1.6975716	1.909477558	2.1900778	2.5867971	3.7131822	5.6321483
1000000	0.6589705	1.0200381	1.3053143	1.542808	1.7472433	2.0887916	2.4947113	2.71990147	3.0123429	3.4178341	4.5411456	6.4171098
10000000	1.5984367	1.9953696	2.2718275	2.4908834	2.675257	2.9793791	3.3396108	3.540240105	3.8022888	4.1689327	5.2042098	6.9774279
100000000	3.6547903	3.6095277	3.6405449	3.7028801	3.7773556	3.9354852	4.1655601	4.308578122	4.5074745	4.8033543	5.707297	7.3624251

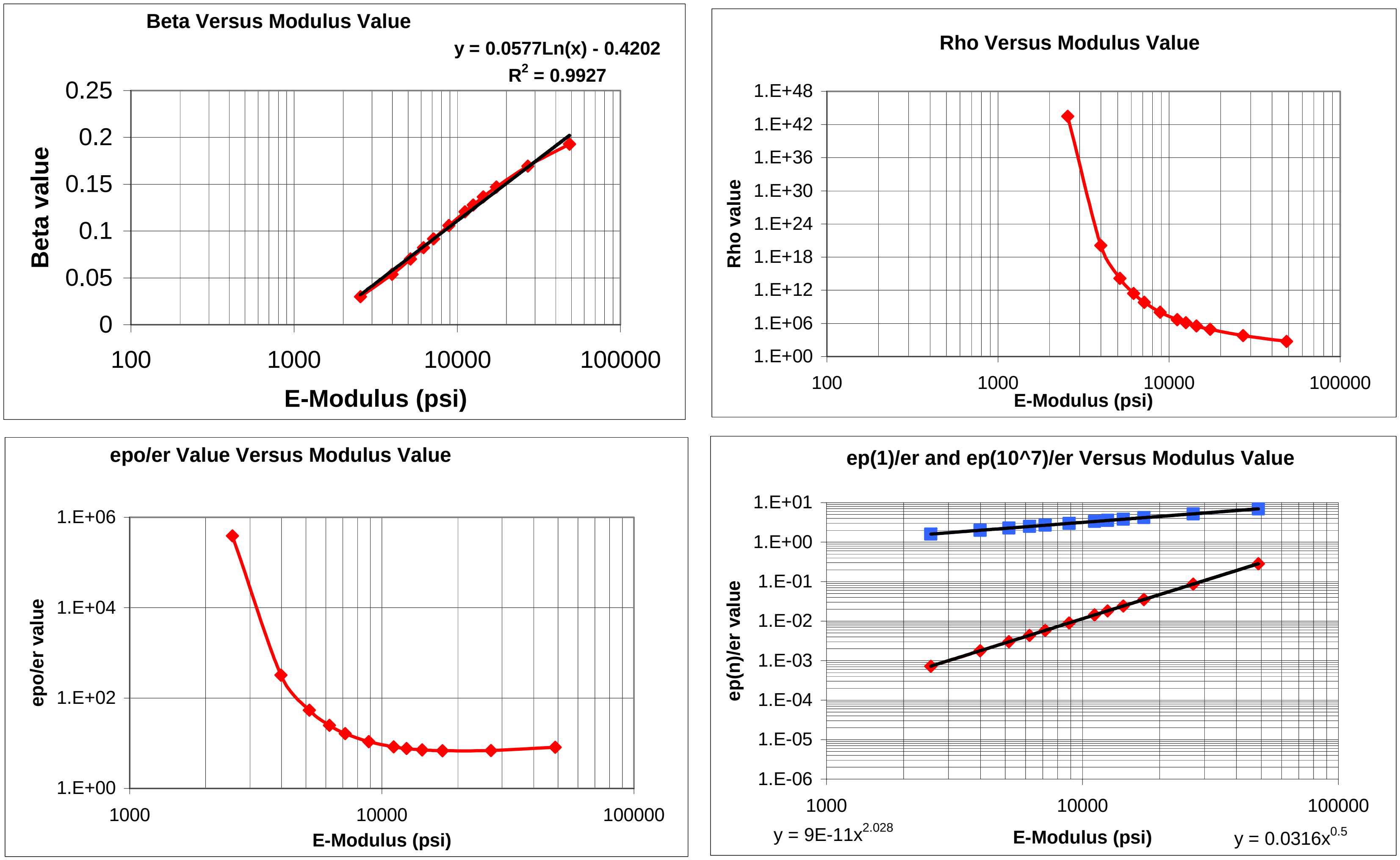


Figure B-41 Subgrade Material Set 3-A graphs

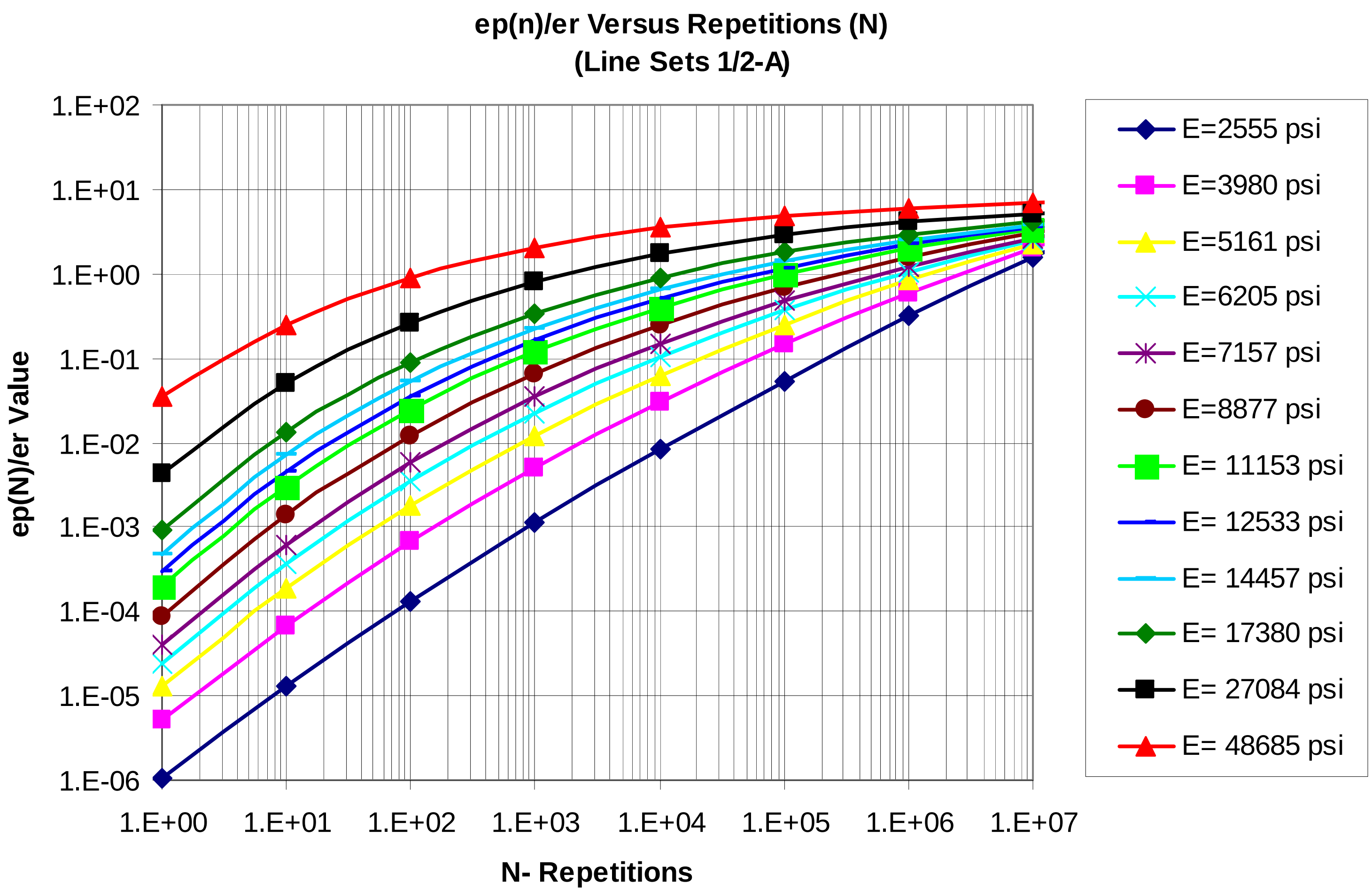


Figure B-42 Subgrade Material $\varepsilon_p/\ \varepsilon_r$ vs. Number of Load Repetitions Set 1-2-A

Table B-27 Unbound Material Rut Model Set 1-2-A Computations

N=1 Repetition

	ep(1)/er	E (psi)
Data Set 1	0.000001	2500
Data Set 2	5	200000

b(1)=	3.520049
a(1)1=	1.094E-18
a(1)2=	1.094E-18
a(1)(avg)=	1.094E-18

N=10^7 Repetition

	ep(10^7)/er	E (psi)
Data Set 1	1	1000
Data Set 2	10	100000

b(10^7)=	0.5
a(10^7)1=	0.0316228
a(10^7)2=	0.0316228
a(10^7)(avg)=	0.0316228

CBR=	1	2	3	4	5	7	10	12	15	20	40	100
GWT (ft)=	10	10	10	10	10	10	10	10	10	10	10	10
E (psi)=	2555	3981.5	5161.2	6204.5	7157	8876.7	11153	12533.3	14457.4	17380	27083.8	48684.5
ep(1)/er=	1.08E-06	5.145E-06	1.283E-05	2.452E-05	4.054E-05	8.652E-05	0.0001932	0.000291391	0.0004817	0.000921	0.0043897	0.0345883
ep(10^7)=	1.5984367	1.9953696	2.2718275	2.4908834	2.675257	2.9793791	3.3396108	3.540240105	3.8022888	4.1689327	5.2042098	6.9774279
Beta=	0.0299719	0.0538458	0.0700934	0.0821515	0.0916235	0.1058432	0.1205232	0.127772481	0.1363509	0.146865	0.1693629	0.1927432
C0=	-14.207935	-12.868222	-12.084488	-11.528479	-11.097168	-10.446834	-9.7574209	-9.40503985	-8.9737246	-8.4176922	-7.0779512	-5.3069191
Rho=	2.267E+52	9.924E+24	7.206E+17	3.628E+14	4.33E+12	2.816E+10	583618539	120672748.5	23124612	3896669.8	155324.81	7308.4258
X1=	1.376E+10	22090.638	727.03296	162.59933	71.400315	30.256521	17.088024	13.99736499	11.666213	9.9582115	8.5283463	8.9467751
X2=	1.376E+10	22090.638	727.03296	162.59933	71.400315	30.256521	17.088024	13.99736499	11.666213	9.9582115	8.5283463	8.9467751
X(avg)=	1.376E+10	22090.638	727.03296	162.59933	71.400315	30.256521	17.088024	13.99736499	11.666213	9.9582115	8.5283463	8.9467751

N	ep(0)/er=											
1	1.08E-06	5.145E-06	1.283E-05	2.452E-05	4.054E-05	8.652E-05	0.0001932	0.000291391	0.0004817	0.000921	0.0043897	0.0345883
10	1.28E-05	6.834E-05	0.0001836	0.0003675	0.000625	0.0013682	0.0030538	0.004546781	0.0073133	0.0132343	0.0506236	0.2533269
100	0.0001287	0.0006713	0.0017665	0.0034539	0.0057266	0.0119083	0.0247216	0.035221265	0.053348	0.0885188	0.2650624	0.9088589
1000	0.0011096	0.0050524	0.0121318	0.0220624	0.0344293	0.0649087	0.1205636	0.1619175	0.2278158	0.343211	0.8131341	2.062812
10000	0.0082858	0.0300505	0.0625184	0.1023757	0.1471589	0.2451711	0.4004935	0.504578743	0.6579149	0.9020362	1.7368891	3.4901305
100000	0.0541072	0.1451801	0.2523232	0.3646407	0.4771488	0.6947073	0.9945486	1.176921459	1.4277429	1.7966972	2.9036407	4.8906777
1000000	0.3117705	0.5837102	0.827166	1.0434104	1.2369523	1.5714502	1.9811918	2.212163615	2.5145784	2.9367241	4.111936	6.0726657
10000000	1.5984367	1.9953696	2.2718275	2.4908834	2.675257	2.9793791	3.3396108	3.540240105	3.8022888	4.1689327	5.2042098	6.9774279
100000000	7.3488374	5.9101947	5.3673467	5.1182577	4.9964075	4.9188189	4.9603335	5.025719038	5.1432417	5.3521412	6.1041521	7.6276968

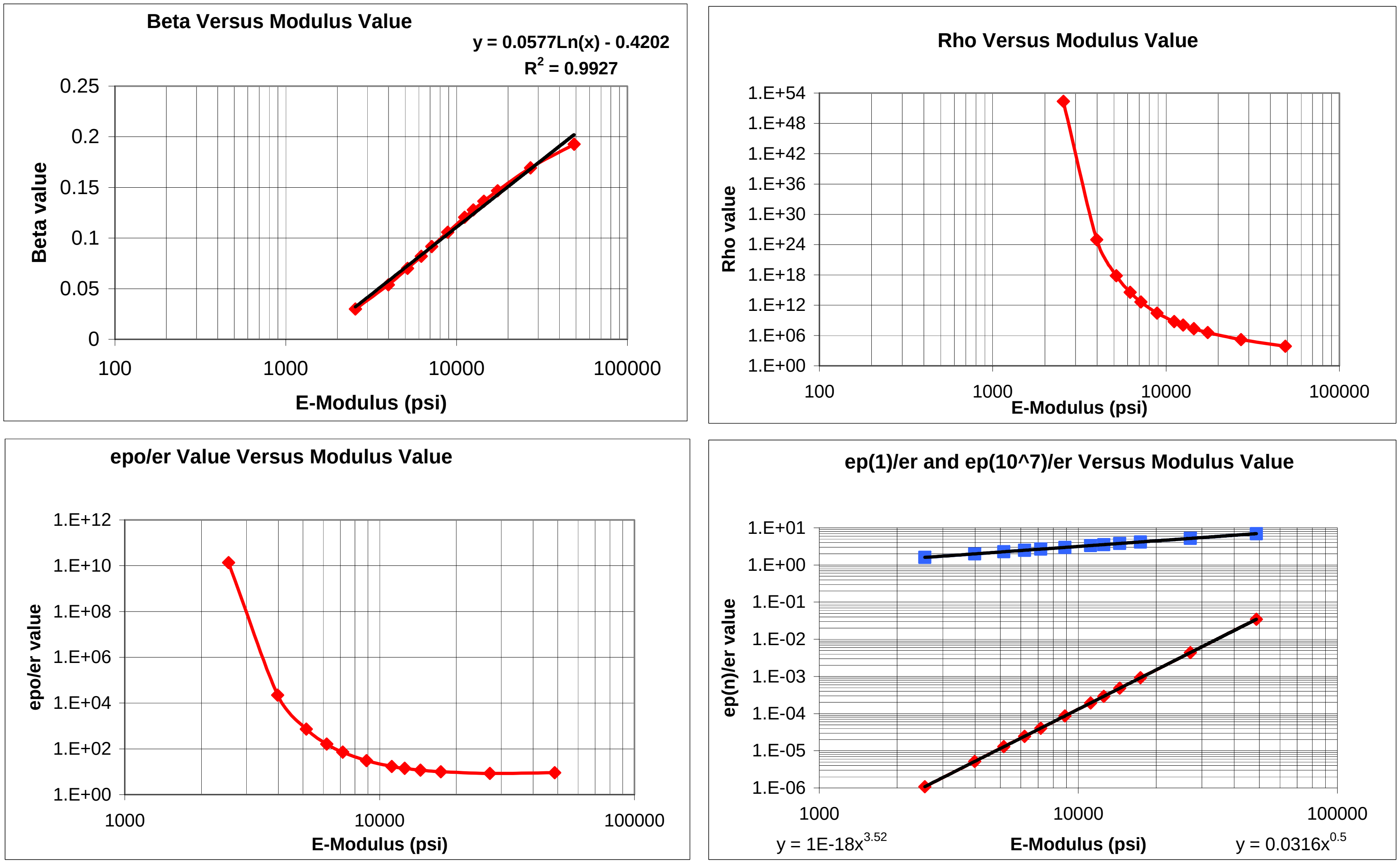


Figure B-43 Subgrade Material Set 1-2-A graphs

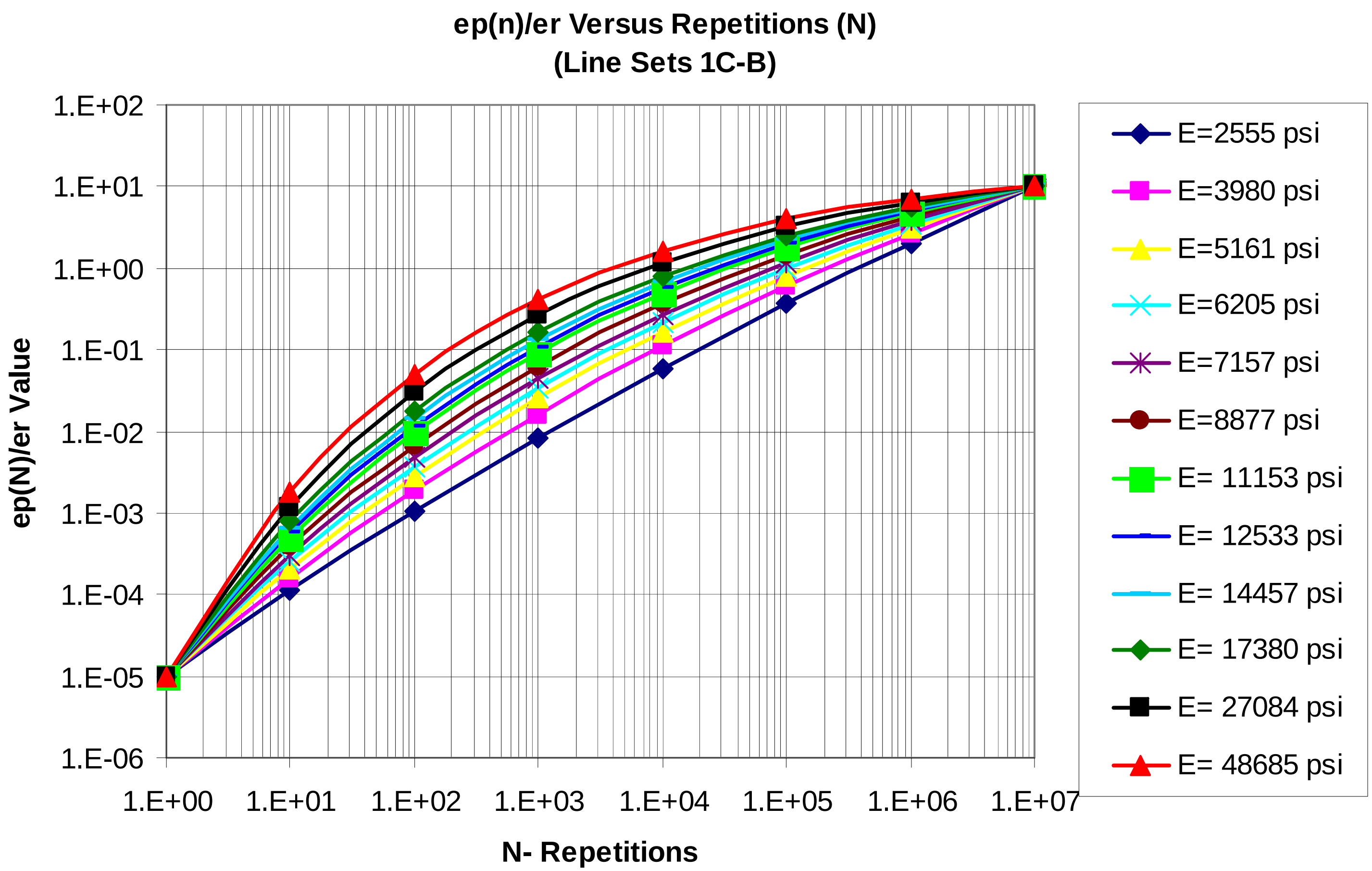


Figure B-44 Subgrade Material $\varepsilon_p / \varepsilon_r$ vs. Number of Load Repetitions Set 1-C-B

Table B-28 Unbound Material Rut Model Set 1-C-B Computations

N=1 Repetition

	ep(1)/er	E (psi)
Data Set 1	0.00001	1000
Data Set 2	0.00001	200000

b(1)=	0
a(1)1=	0.00001
a(1)2=	0.00001
a(1)(avg)=	0.00001

N=10^7 Repetition

	ep(10^7)/er	E (psi)
Data Set 1	10	1000
Data Set 2	10	100000

b(10^7)=	0
a(10^7)1=	10
a(10^7)2=	10
a(10^7)(avg)=	10

CBR=	1	2	3	4	5	7	10	12	15	20	40	100
GWT (ft)=	10	10	10	10	10	10	10	10	10	10	10	10
E (psi)=	2555	3981.5	5161.2	6204.5	7157	8876.7	11153	12533.3	14457.4	17380	27083.8	48684.5
ep(1)/er=	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001
ep(10^7)=	10	10	10	10	10	10	10	10	10	10	10	10
Beta=	0.0299719	0.0538458	0.0700934	0.0821515	0.0916235	0.1058432	0.1205232	0.127772481	0.1363509	0.146865	0.1693629	0.1927432
C0=	-13.815511	-13.815511	-13.815511	-13.815511	-13.815511	-13.815511	-13.815511	-13.8155106	-13.815511	-13.815511	-13.815511	-13.815511
Rho=	8.904E+51	3.712E+25	4.866E+18	3.284E+15	4.732E+13	3.948E+11	1.045E+10	2447198560	547553440	113712190	8058469.2	1046331.3
X1=	4.578E+10	219733.25	7311.8795	1495.479	596.66015	214.44239	100.89411	75.33237156	56.180315	41.749193	26.224298	19.102117
X2=	4.578E+10	219733.25	7311.8795	1495.479	596.66015	214.44239	100.89411	75.33237156	56.180315	41.749193	26.224298	19.102117
X(avg)=	4.578E+10	219733.25	7311.8795	1495.479	596.66015	214.44239	100.89411	75.33237156	56.180315	41.749193	26.224298	19.102117

N	ep(0)/er=											
1	0.00001	0.00001	0.00001	1E-05	0.00001	0.00001	0.00001	0.00001	1E-05	1E-05	0.00001	0.00001
10	0.0001107	0.0001607	0.0002095	0.0002564	0.0003013	0.0003852	0.0004981	0.000565965	0.0006587	0.0007937	0.0011824	0.0017832
100	0.0010448	0.0018674	0.0027885	0.0037581	0.0047492	0.0067357	0.0096219	0.011450709	0.0140386	0.0179561	0.0299343	0.049609
1000	0.0084864	0.0163056	0.025237	0.0346802	0.0443083	0.0634318	0.0906977	0.10764497	0.1312073	0.1660073	0.2669231	0.4190249
10000	0.0599458	0.1105833	0.1644827	0.2182009	0.2703191	0.3677783	0.4963821	0.571633823	0.6715118	0.8107699	1.1742332	1.6473548
100000	0.3716837	0.5999317	0.8107141	0.9999197	1.1691903	1.458067	1.7994463	1.983462796	2.2135146	2.5121308	3.2015715	3.9649897
1000000	2.0405443	2.6722469	3.1503922	3.5247954	3.827572	4.2912874	4.7743893	5.012082085	5.2908749	5.6268459	6.3139814	6.9659332
10000000	10	10	10	10	10	10	10	10	10	10	10	10
100000000	44.078238	32.084367	26.722011	23.703699	21.764447	19.406433	17.50945	16.73104726	15.921229	15.068835	13.652423	12.610803

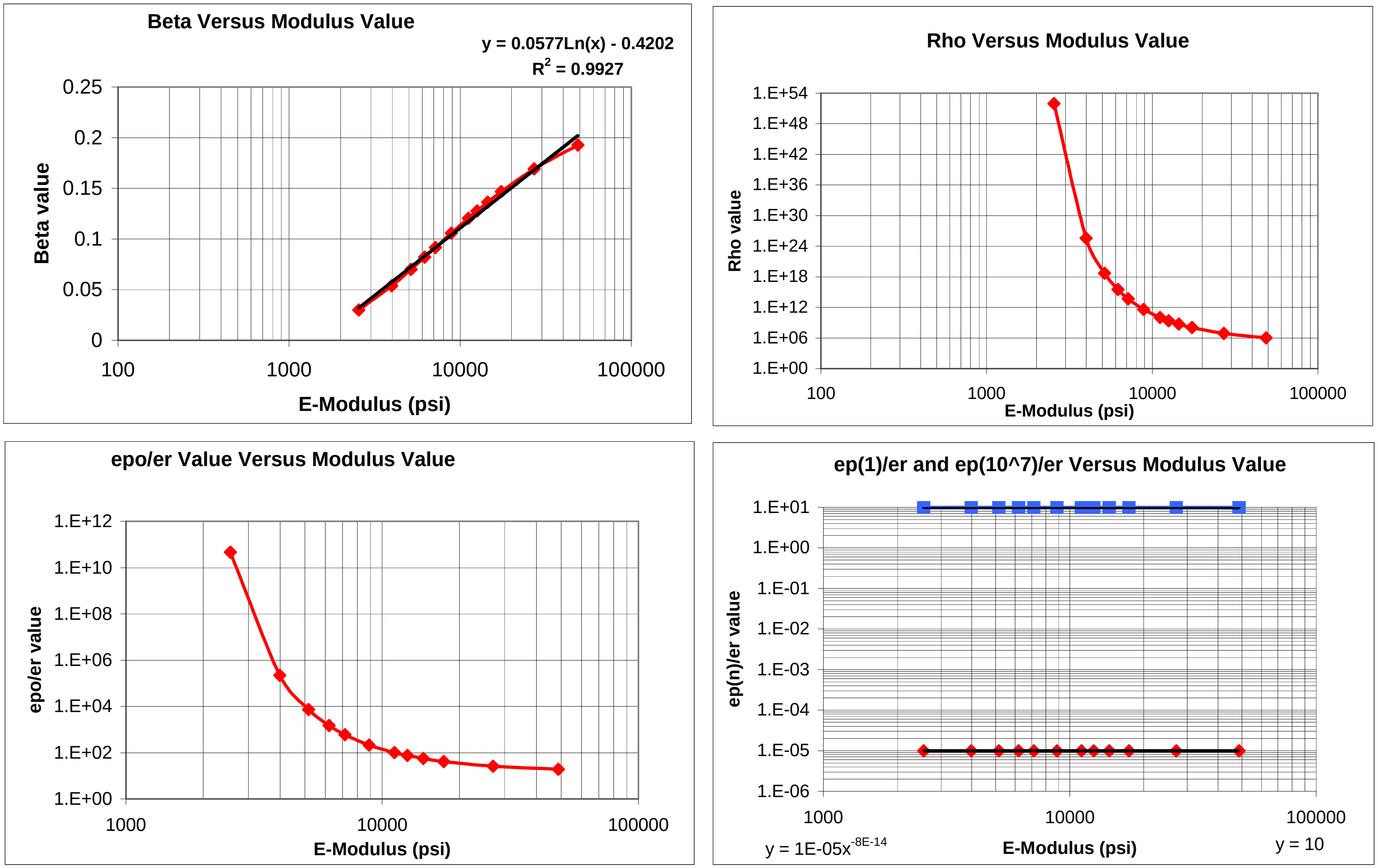


Figure B-45 Subgrade Material Set 1-C-B graphs

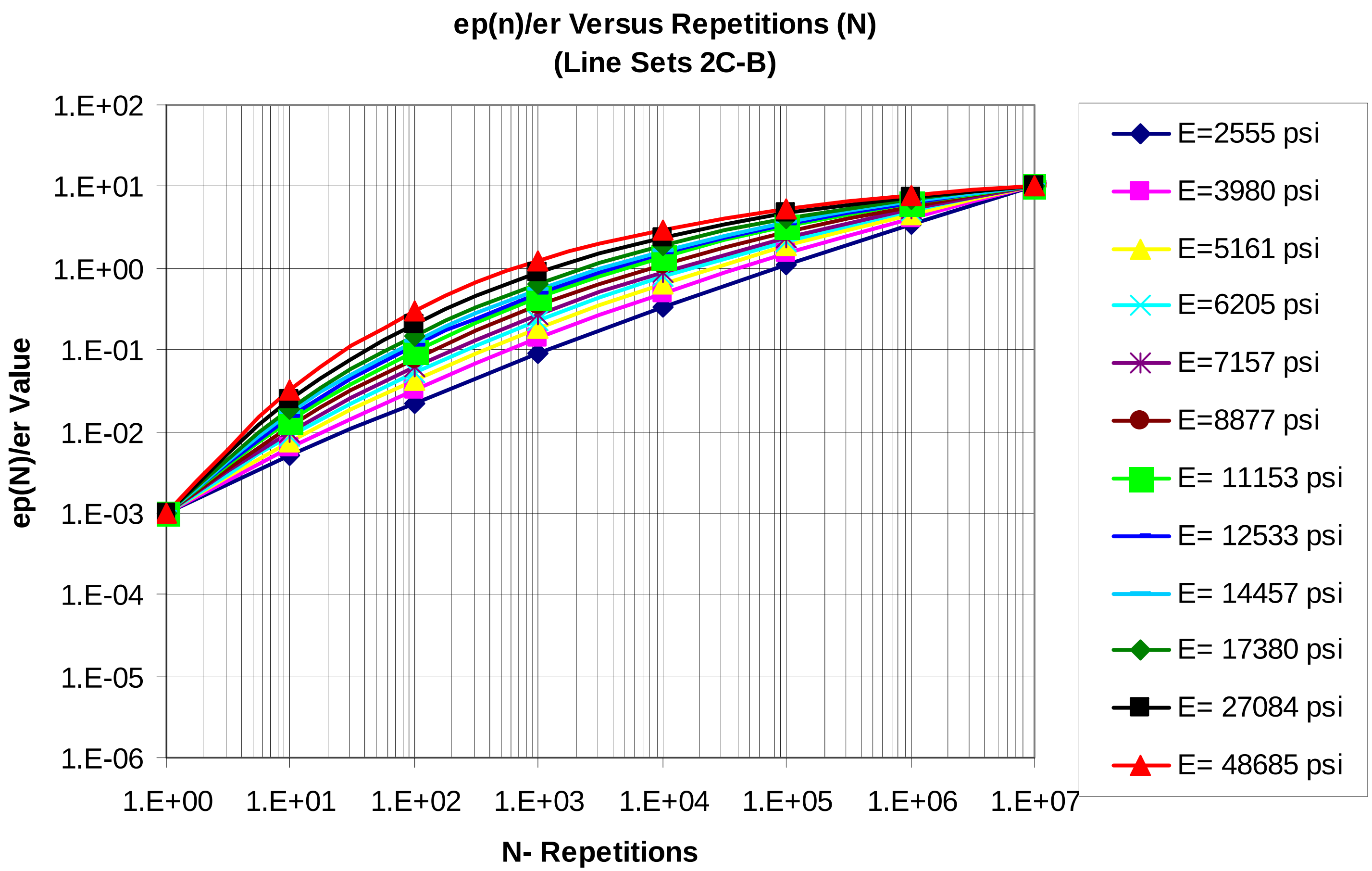


Figure B-46 Subgrade Material $\varepsilon_p/\ \varepsilon_r$ vs. Number of Load Repetitions Set 2-C-B

Table B-29 Unbound Material Rut Model Set 2-C-B Computations

N=1 Repetition

	ep(1)/er	E (psi)
Data Set 1	0.001	1000
Data Set 2	0.001	200000

b(1)=	0
a(1)1=	0.001
a(1)2=	0.001
a(1)(avg)=	0.001

N=10^7 Repetition

	ep(10^7)/er	E (psi)
Data Set 1	10	1000
Data Set 2	10	100000

b(10^7)=	0
a(10^7)1=	10
a(10^7)2=	10
a(10^7)(avg)=	10

CBR=	1	2	3	4	5	7	10	12	15	20	40	100
GWT (ft)=	10	10	10	10	10	10	10	10	10	10	10	10
E (psi)=	2555	3981.5	5161.2	6204.5	7157	8876.7	11153	12533.3	14457.4	17380	27083.8	48684.5
ep(1)/er=	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
ep(10^7)=	10	10	10	10	10	10	10	10	10	10	10	10
Beta=	0.0299719	0.0538458	0.0700934	0.0821515	0.0916235	0.1058432	0.1205232	0.127772481	0.1363509	0.146865	0.1693629	0.1927432
C0=	-9.2103404	-9.2103404	-9.2103404	-9.2103404	-9.2103404	-9.2103404	-9.2103404	-9.21034037	-9.2103404	-9.2103404	-9.2103404	-9.2103404
Rho=	1.187E+46	1.992E+22	1.496E+16	2.36E+13	5.664E+11	8.564E+09	361582621	102448727.5	27987906	7191281.2	735402.57	127662.55
X1=	27570745	7845.0766	811.61989	281.74327	152.69261	77.186336	46.692152	38.42858793	31.602598	25.927784	19.016733	15.395283
X2=	27570745	7845.0766	811.61989	281.74327	152.69261	77.186336	46.692152	38.42858793	31.602598	25.927784	19.016733	15.395283
X(avg)=	27570745	7845.0766	811.61989	281.74327	152.69261	77.186336	46.692152	38.42858793	31.602598	25.927784	19.016733	15.395283

N	ep(0)/er=											
1	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
10	0.0049685	0.0063673	0.0075991	0.0086949	0.0096822	0.0114055	0.0135371	0.014740985	0.0163101	0.0184681	0.0240901	0.0316815
100	0.022183	0.0326711	0.0426821	0.0520774	0.0608716	0.0768399	0.0974631	0.109451464	0.1253764	0.1477318	0.2077048	0.2908753
1000	0.0896363	0.1385344	0.185364	0.2291155	0.2697676	0.3426663	0.4349081	0.487523807	0.5562953	0.650756	0.8931493	1.2064053
10000	0.3299937	0.4963559	0.6467655	0.780856	0.9007089	1.1059209	1.3506539	1.483924977	1.6520979	1.8732615	2.3979285	3.0050942
100000	1.1137362	1.5325025	1.8731755	2.1543193	2.3910582	2.7702459	3.1873219	3.40107367	3.6592178	3.9813299	4.67996	5.3971114
1000000	3.466017	4.1487544	4.6299513	4.9898706	5.2716784	5.6892943	6.1086496	6.309749482	6.5416152	6.8156929	7.3598483	7.858136
10000000	10	10	10	10	10	10	10	10	10	10	10	10
100000000	26.883315	21.753492	19.256592	17.777775	16.794423	15.55836	14.527192	14.09338829	13.634872	13.143765	12.306649	11.672445

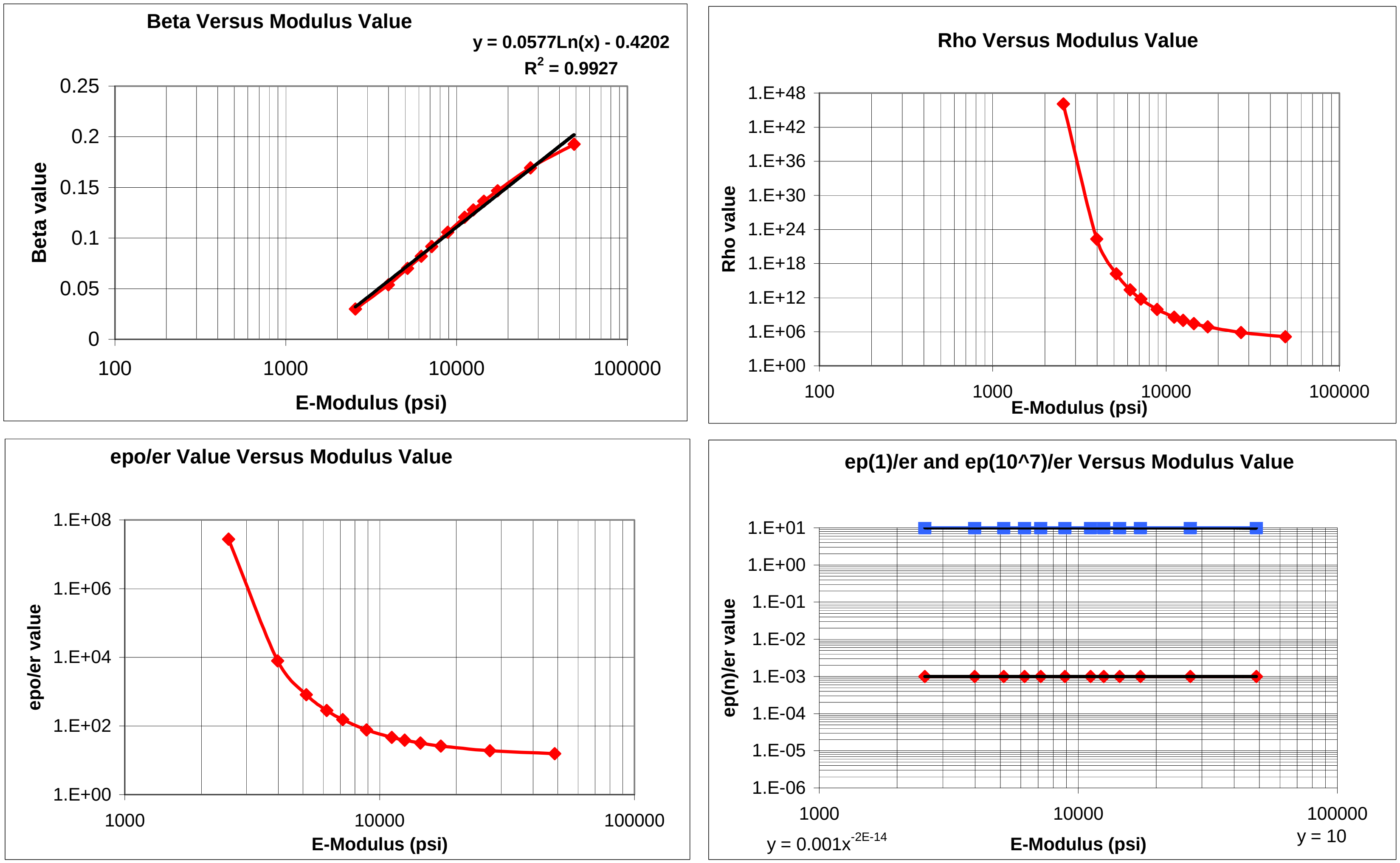


Figure B-47 Subgrade Material Set 2-C-B graphs

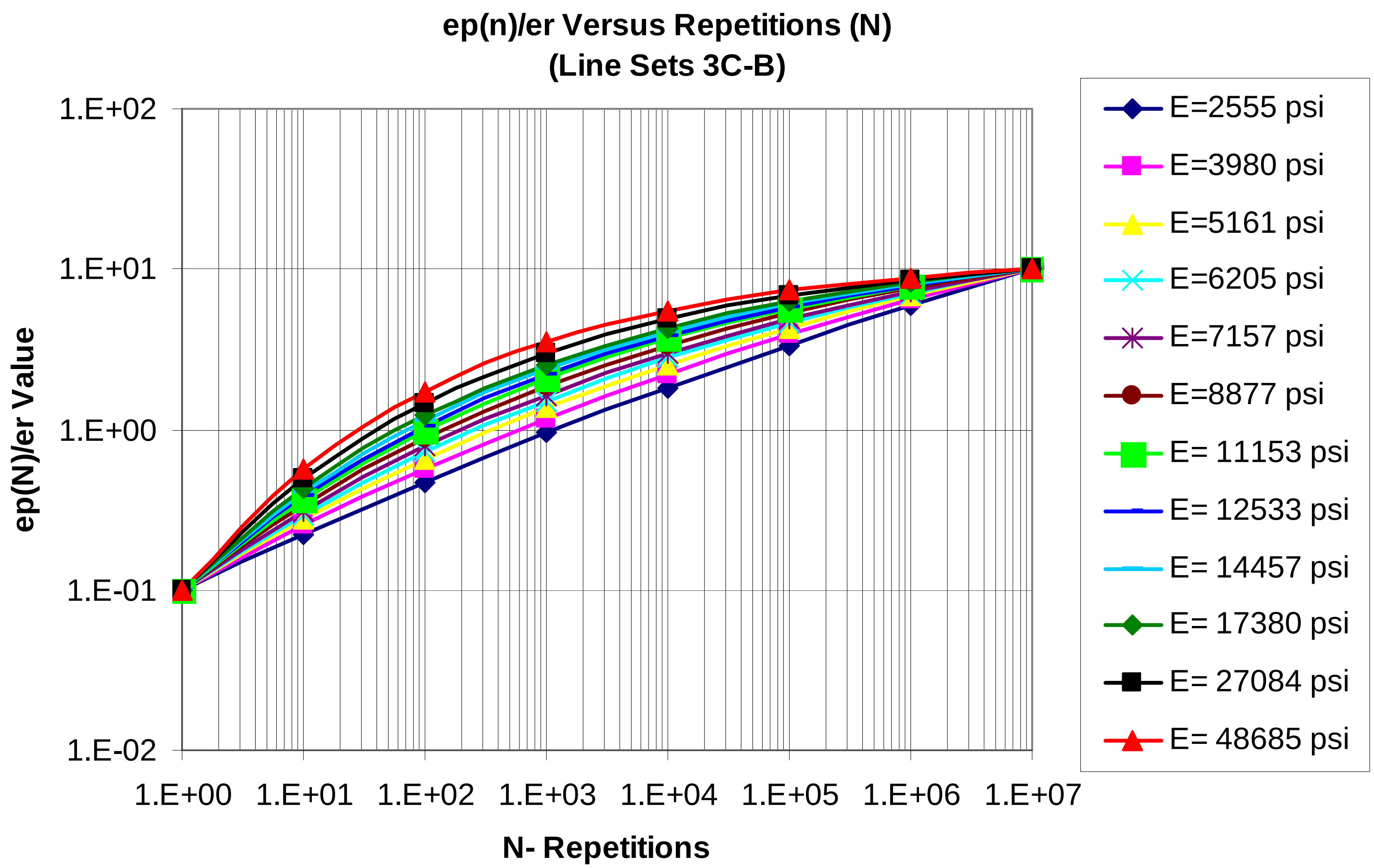


Figure B-48 Subgrade Material $\varepsilon_p/\ \varepsilon_r$ vs. Number of Load Repetitions Set 3-C-B

Table B-30 Unbound Material Rut Model Set 3-C-B Computations

N=1 Repetition

	ep(1)/er	E (psi)
Data Set 1	0.1	1000
Data Set 2	0.1	200000

b(1)=	0
a(1)1=	0.1
a(1)2=	0.1
a(1)(avg)=	0.1

N=10^7 Repetition

	ep(10^7)/er	E (psi)
Data Set 1	10	1000
Data Set 2	10	100000

b(10^7)=	0
a(10^7)1=	10
a(10^7)2=	10
a(10^7)(avg)=	10

CBR=	1	2	3	4	5	7	10	12	15	20	40	100
GWT (ft)=	10	10	10	10	10	10	10	10	10	10	10	10
E (psi)=	2555	3981.5	5161.2	6204.5	7157	8876.7	11153	12533.3	14457.4	17380	27083.8	48684.5
ep(1)/er=	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
ep(10^7)=	10	10	10	10	10	10	10	10	10	10	10	10
Beta=	0.0299719	0.0538458	0.0700934	0.0821515	0.0916235	0.1058432	0.1205232	0.127772481	0.1363509	0.146865	0.1693629	0.1927432
C0=	-4.6051702	-4.6051702	-4.6051702	-4.6051702	-4.6051702	-4.6051702	-4.6051702	-4.60517019	-4.6051702	-4.6051702	-4.6051702	-4.6051702
Rho=	1.073E+36	5.113E+16	7.59E+11	5.111E+09	293523503	12262060	1149511.8	451358.8626	173464.9	64135.865	12277.202	3501.4202
X1=	16604.441	280.09064	90.089949	53.079494	39.075902	27.782429	21.608367	19.60321094	17.777119	16.102107	13.790117	12.407773
X2=	16604.441	280.09064	90.089949	53.079494	39.075902	27.782429	21.608367	19.60321094	17.777119	16.102107	13.790117	12.407773
X(avg)=	16604.441	280.09064	90.089949	53.079494	39.075902	27.782429	21.608367	19.60321094	17.777119	16.102107	13.790117	12.407773

N	ep(0)/er=											
1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
10	0.2229009	0.2523351	0.2756638	0.294871	0.3111626	0.33772	0.3679275	0.383939904	0.4038578	0.4297448	0.4908163	0.5628636
100	0.470988	0.5715865	0.6533155	0.7216466	0.7802028	0.8765835	0.9872338	1.046190538	1.1197159	1.2154499	1.4411966	1.7055068
1000	0.9467643	1.1770064	1.3614843	1.5136561	1.6424603	1.8511247	2.0854451	2.207994128	2.3585913	2.550992	2.9885603	3.4733346
10000	1.816573	2.2279045	2.5431584	2.7943801	3.0011812	3.3255389	3.6751243	3.852174681	4.0646007	4.3281191	4.8968648	5.481874
100000	3.3372686	3.914719	4.3280198	4.6414646	4.8898447	5.2633125	5.6456372	5.831872486	6.0491469	6.309778	6.8410233	7.3465035
1000000	5.8872888	6.4410825	6.8043745	7.0639016	7.2606325	7.5427411	7.8157851	7.943393155	8.0880252	8.255721	8.5789558	8.8646128
10000000	10	10	10	10	10	10	10	10	10	10	10	10
100000000	16.396132	14.749065	13.876812	13.333332	12.95933	12.473316	12.05288	11.87155773	11.676845	11.464626	11.093534	10.803909

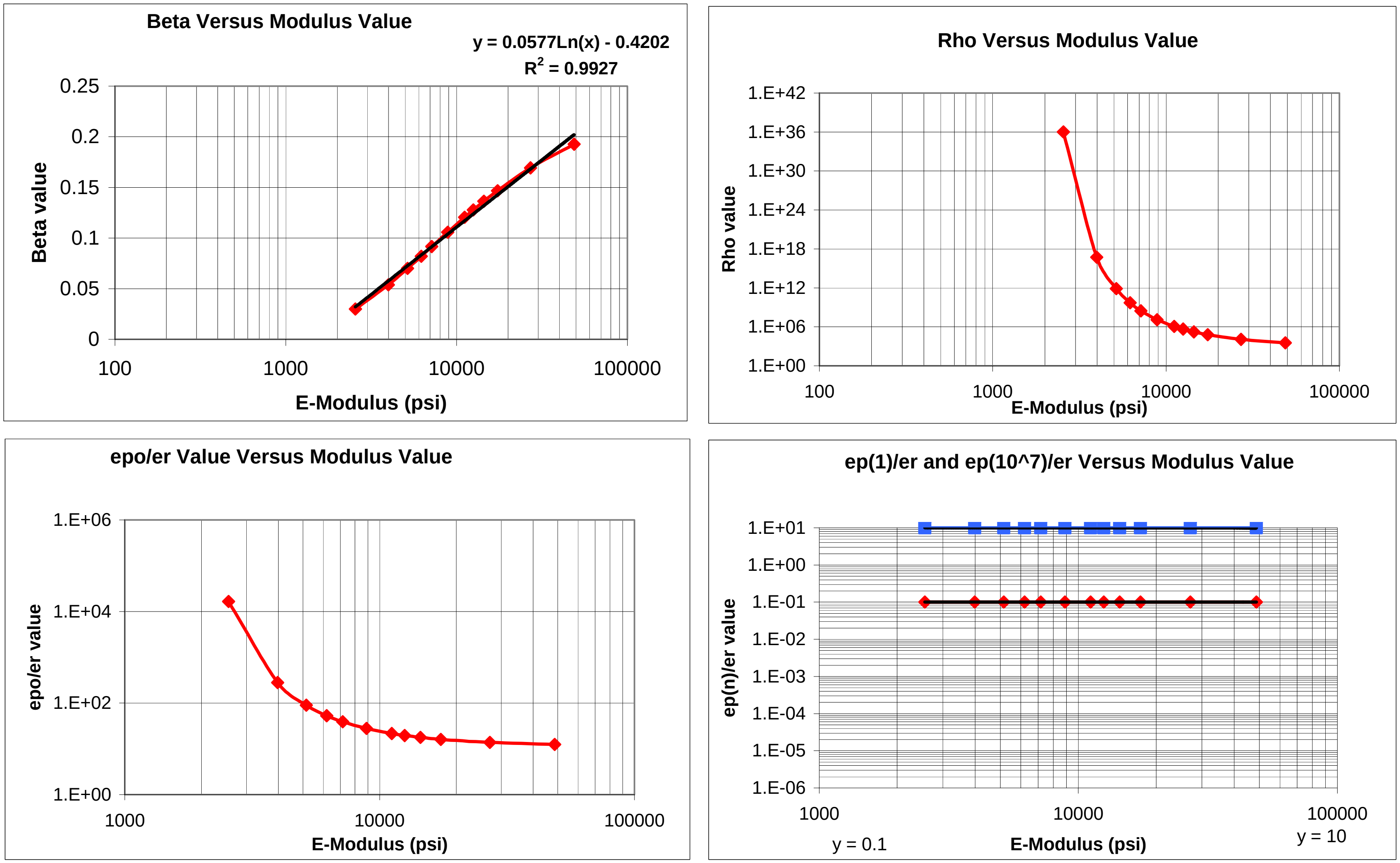


Figure B-49 Subgrade Material Set 3-C-B graphs

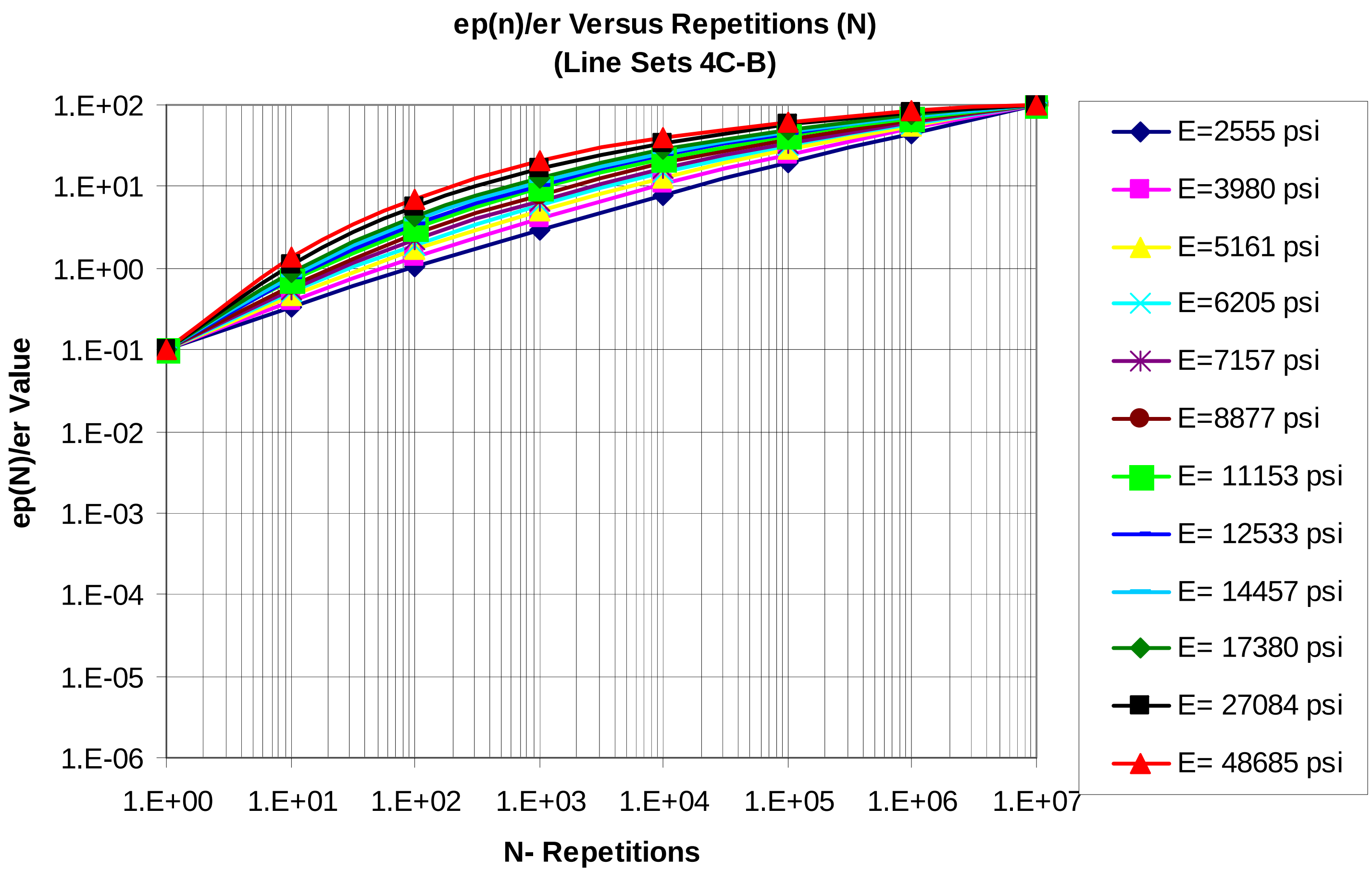


Figure B-50 Subgrade Material ε_p/ ε_r vs. Number of Load Repetitions Set 4-C-B

Table B-31 Unbound Material Rut Model Set 4-C-B Computations

N=1 Repetition

	ep(1)/er	E (psi)
Data Set 1	0.1	1000
Data Set 2	0.1	200000

b(1)=	0
a(1)1=	0.1
a(1)2=	0.1
a(1)(avg)=	0.1

N=10^7 Repetition

	ep(10^7)/er	E (psi)
Data Set 1	100	1000
Data Set 2	100	100000

b(10^7)=	0
a(10^7)1=	100
a(10^7)2=	100
a(10^7)(avg)=	100

CBR=	1	2	3	4	5	7	10	12	15	20	40	100
GWT (ft)=	10	10	10	10	10	10	10	10	10	10	10	10
E (psi)=	2555	3981.5	5161.2	6204.5	7157	8876.7	11153	12533.3	14457.4	17380	27083.8	48684.5
ep(1)/er=	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
ep(10^7)=	100	100	100	100	100	100	100	100	100	100	100	100
Beta=	0.0299719	0.0538458	0.0700934	0.0821515	0.0916235	0.1058432	0.1205232	0.127772481	0.1363509	0.146865	0.1693629	0.1927432
C0=	-6.9077553	-6.9077553	-6.9077553	-6.9077553	-6.9077553	-6.9077553	-6.9077553	-6.90775528	-6.9077553	-6.9077553	-6.9077553	-6.9077553
Rho=	8.051E+41	9.528E+19	2.469E+14	7.113E+11	2.452E+10	565279402	33233098	10781634.73	3393655.3	1014148.9	134532.37	28697.889
X1=	6766068.3	14823.402	2704.0487	1222.8978	772.4378	463.07925	317.63834	274.4674326	237.02387	204.32619	161.93918	138.21041
X2=	6766068.3	14823.402	2704.0487	1222.8978	772.4378	463.07925	317.63834	274.4674326	237.02387	204.32619	161.93918	138.21041
X(avg)=	6766068.3	14823.402	2704.0487	1222.8978	772.4378	463.07925	317.63834	274.4674326	237.02387	204.32619	161.93918	138.21041

N	ep(0)/er=											
1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
10	0.3327881	0.4008357	0.457688	0.5063468	0.5488848	0.6206333	0.7057377	0.75230661	0.8116014	0.8908733	1.0873727	1.3353795
100	1.0221503	1.3665418	1.6698768	1.9385938	2.1792709	2.595314	3.101916	3.383889568	3.746811	4.2374597	5.4712282	7.0433647
1000	2.91315	4.0380178	5.0236452	5.8889899	6.6564445	7.9644085	9.5235343	10.37520941	11.454576	12.884384	16.33778	20.470099
10000	7.7424655	10.515862	12.825081	14.771623	16.441383	19.177546	22.279634	23.90886494	25.913545	28.474021	34.267086	40.587619
100000	19.279099	24.493503	28.473041	31.621507	34.193425	38.184643	42.419881	44.5360842	47.048003	50.121161	56.582431	62.968164
1000000	45.172384	51.693781	56.128355	59.369988	61.867374	65.507919	69.096956	70.79605981	72.7384	75.012305	79.460565	83.462166
10000000	100	100	100	100	100	100	100	100	100	100	100	100
100000000	209.94818	179.12109	163.46869	153.96006	147.52778	139.30698	132.32328	129.3485495	126.17935	122.75518	116.84358	112.29783

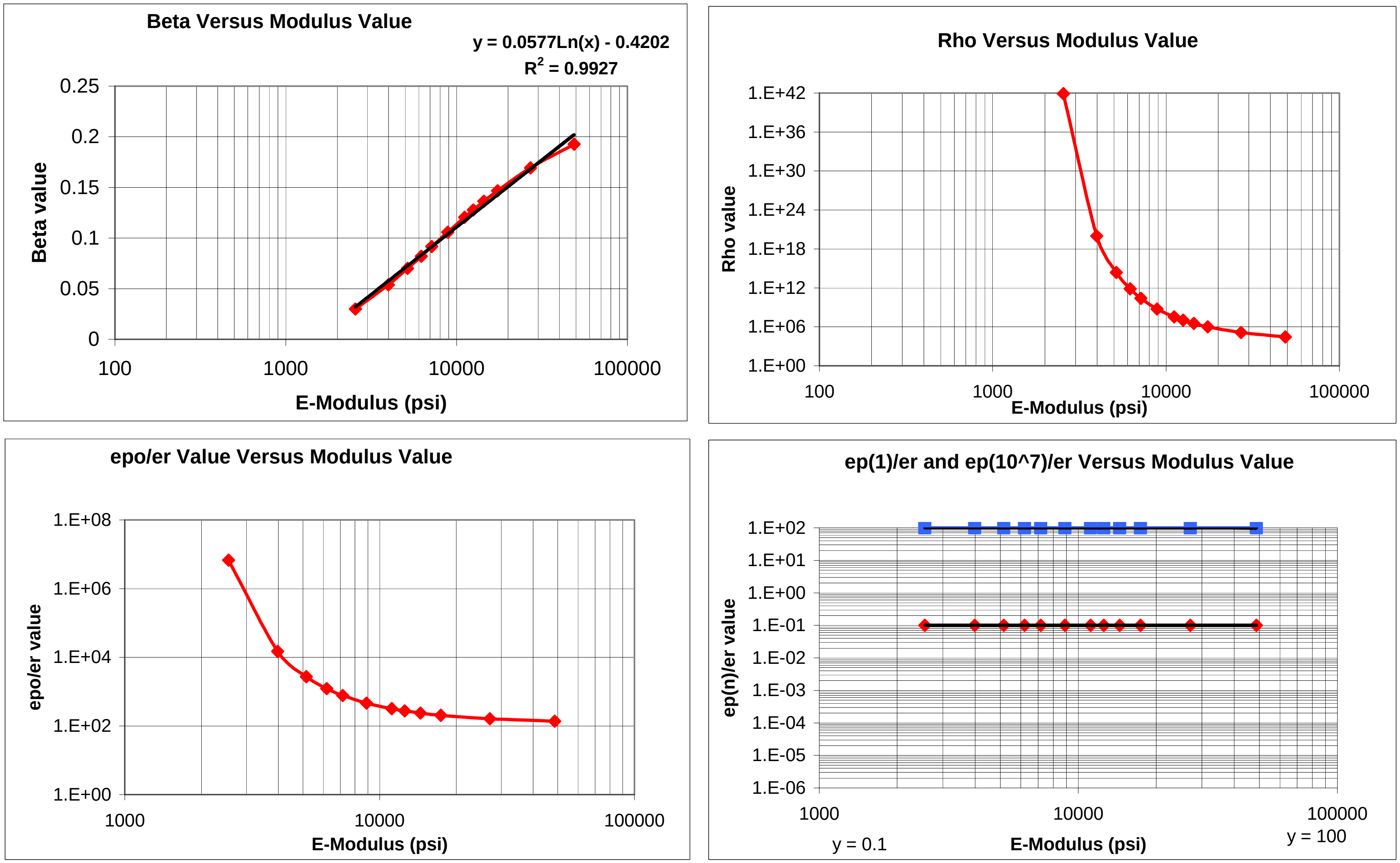


Figure B-51 Subgrade Material Set 4-C-B graphs

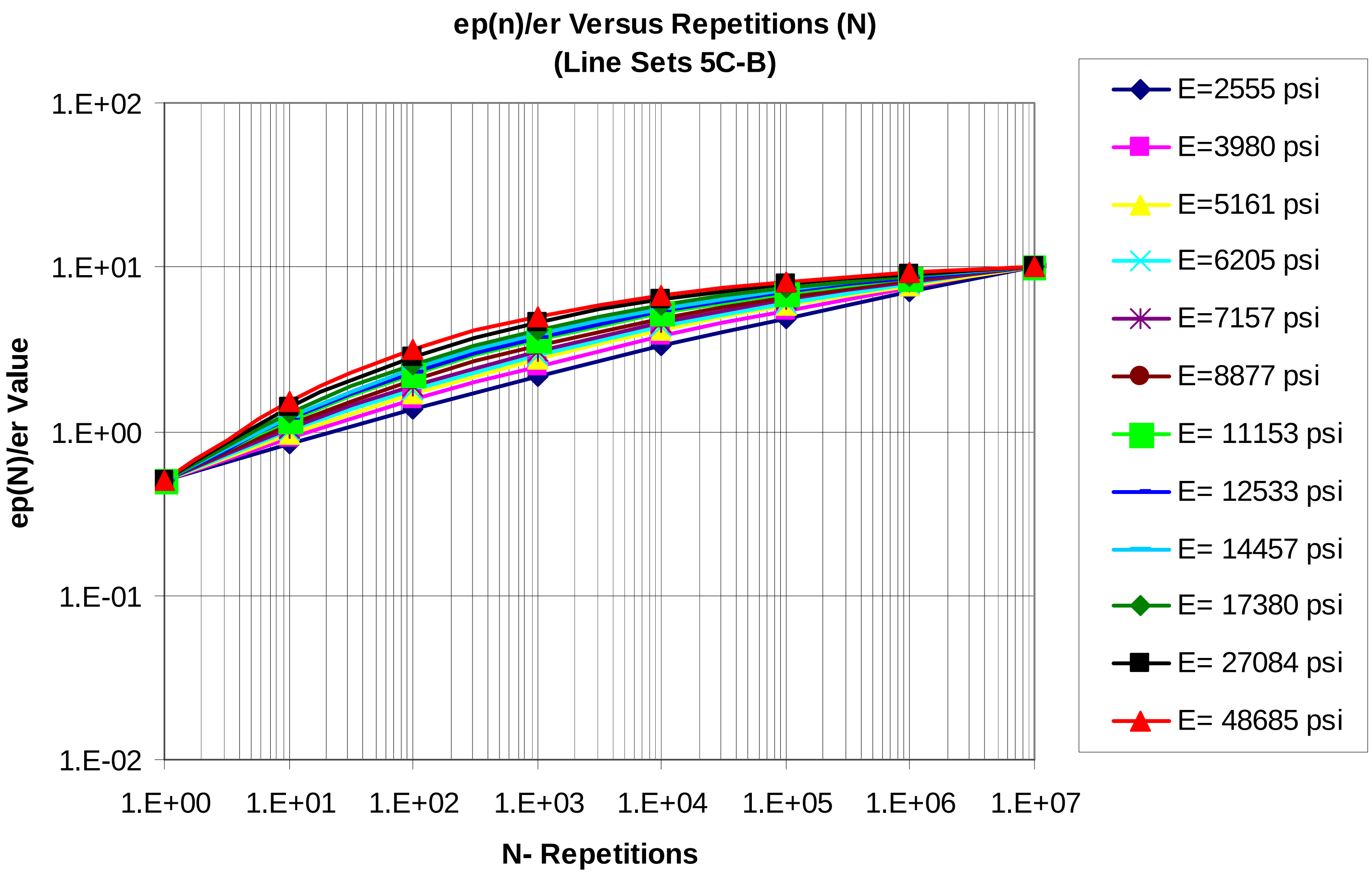


Figure B-52 Subgrade Material $\varepsilon_p / \varepsilon_r$ vs. Number of Load Repetitions Set 5-C-B

Table B-32 Unbound Material Rut Model Set 5-C-B Computations

N=1 Repetition

	ep(1)/er	E (psi)
Data Set 1	0.5	1000
Data Set 2	0.5	200000

b(1)=	0
a(1)1=	0.5
a(1)2=	0.5
a(1)(avg)=	0.5

N=10^7 Repetition

	ep(10^7)/er	E (psi)
Data Set 1	10	1000
Data Set 2	10	100000

b(10^7)=	0
a(10^7)1=	10
a(10^7)2=	10
a(10^7)(avg)=	10

CBR=	1	2	3	4	5	7	10	12	15	20	40	100
GWT (ft)=	10	10	10	10	10	10	10	10	10	10	10	10
E (psi)=	2555	3981.5	5161.2	6204.5	7157	8876.7	11153	12533.3	14457.4	17380	27083.8	48684.5
ep(1)/er=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
ep(10^7)=	10	10	10	10	10	10	10	10	10	10	10	10
Beta=	0.0299719	0.0538458	0.0700934	0.0821515	0.0916235	0.1058432	0.1205232	0.127772481	0.1363509	0.146865	0.1693629	0.1927432
C0=	-2.9957323	-2.9957323	-2.9957323	-2.9957323	-2.9957323	-2.9957323	-2.9957323	-2.99573227	-2.9957323	-2.9957323	-2.9957323	-2.9957323
Rho=	6.31E+29	1.74E+13	1.644E+09	27250854	2688382.8	210974.36	32439.896	15595.41312	7406.9222	3432.2184	969.35053	376.16315
X1=	1243.9536	87.395574	41.786046	29.619365	24.268654	19.439235	16.507321	15.49398876	14.539135	13.63265	12.325117	11.506659
X2=	1243.9536	87.395574	41.786046	29.619365	24.268654	19.439235	16.507321	15.49398876	14.539135	13.63265	12.325117	11.506659
X(avg)=	1243.9536	87.395574	41.786046	29.619365	24.268654	19.439235	16.507321	15.49398876	14.539135	13.63265	12.325117	11.506659

N	ep(0)/er=											
1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
10	0.8422131	0.9129825	0.9670381	1.0103519	1.0463229	1.1035807	1.1668279	1.199615344	1.2397404	1.2908715	1.4074181	1.5385744
100	1.3701654	1.5540435	1.6951952	1.8085187	1.9026739	2.0524433	2.2174567	2.3027252	2.4067468	2.5386786	2.8361999	3.1645295
1000	2.1578935	2.486152	2.7331422	2.928164	3.0879315	3.3377663	3.6068542	3.743353183	3.9075196	4.1120215	4.5580615	5.0263044
10000	3.2971057	3.7652771	4.1038029	4.3631526	4.5705741	4.8861194	5.2143831	5.376448889	5.5675006	5.799722	6.2847366	6.7634679
100000	4.8973236	5.4330741	5.7996354	6.0695166	6.2788742	6.5868065	6.8942267	7.041328474	7.2108881	7.4115008	7.8116681	8.1824523
1000000	7.0847818	7.5114689	7.7844193	7.9762962	8.1201079	8.3239777	8.5187736	8.608994716	8.710642	8.8277065	9.051032	9.2459575
10000000	10	10	10	10	10	10	10	10	10	10	10	10
100000000	13.794073	12.876085	12.375467	12.057978	11.836863	11.546163	11.291478	11.18068423	11.061048	10.929858	10.698396	10.515862

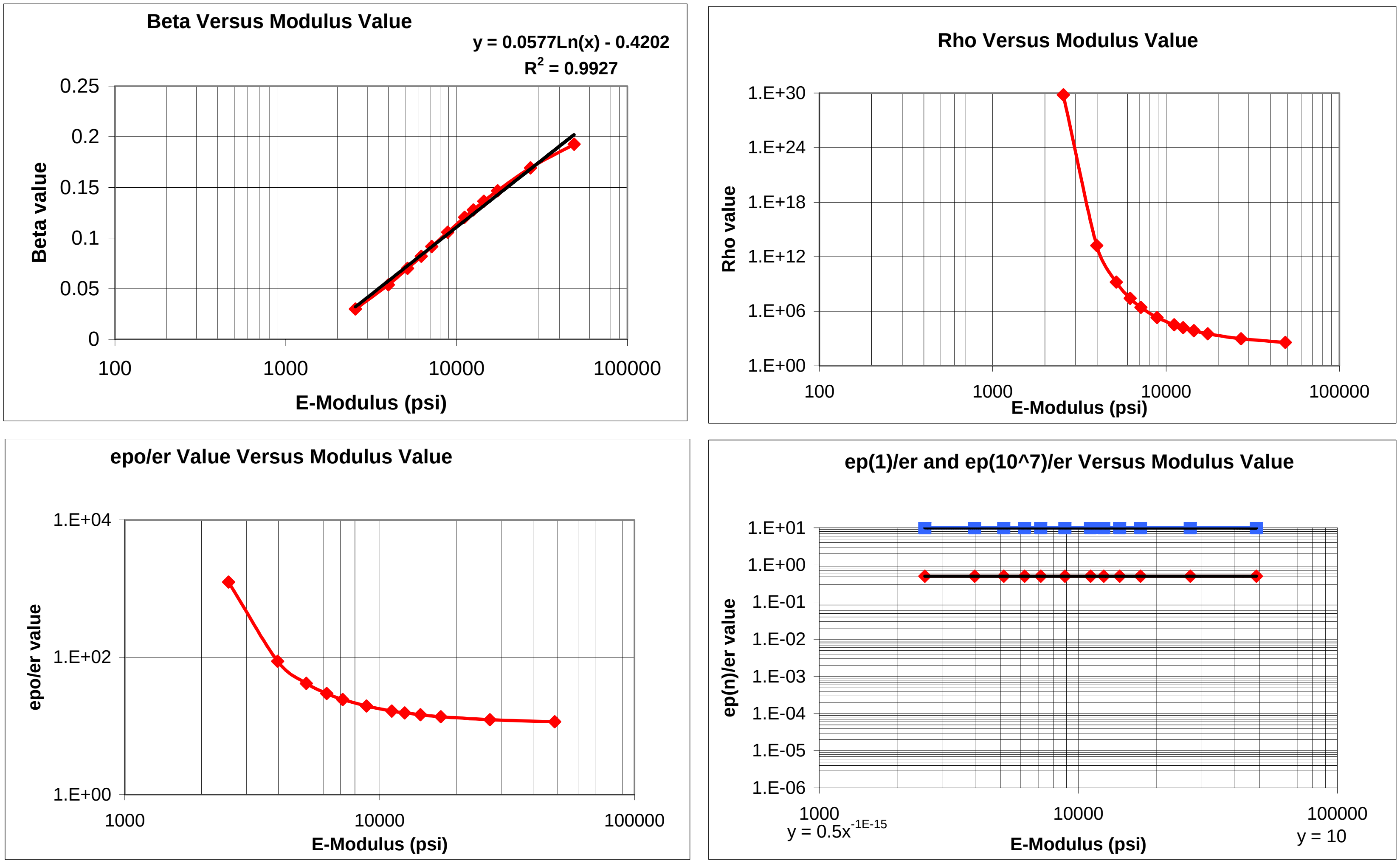


Figure B-53 Subgrade Material Set 5-C-B graphs

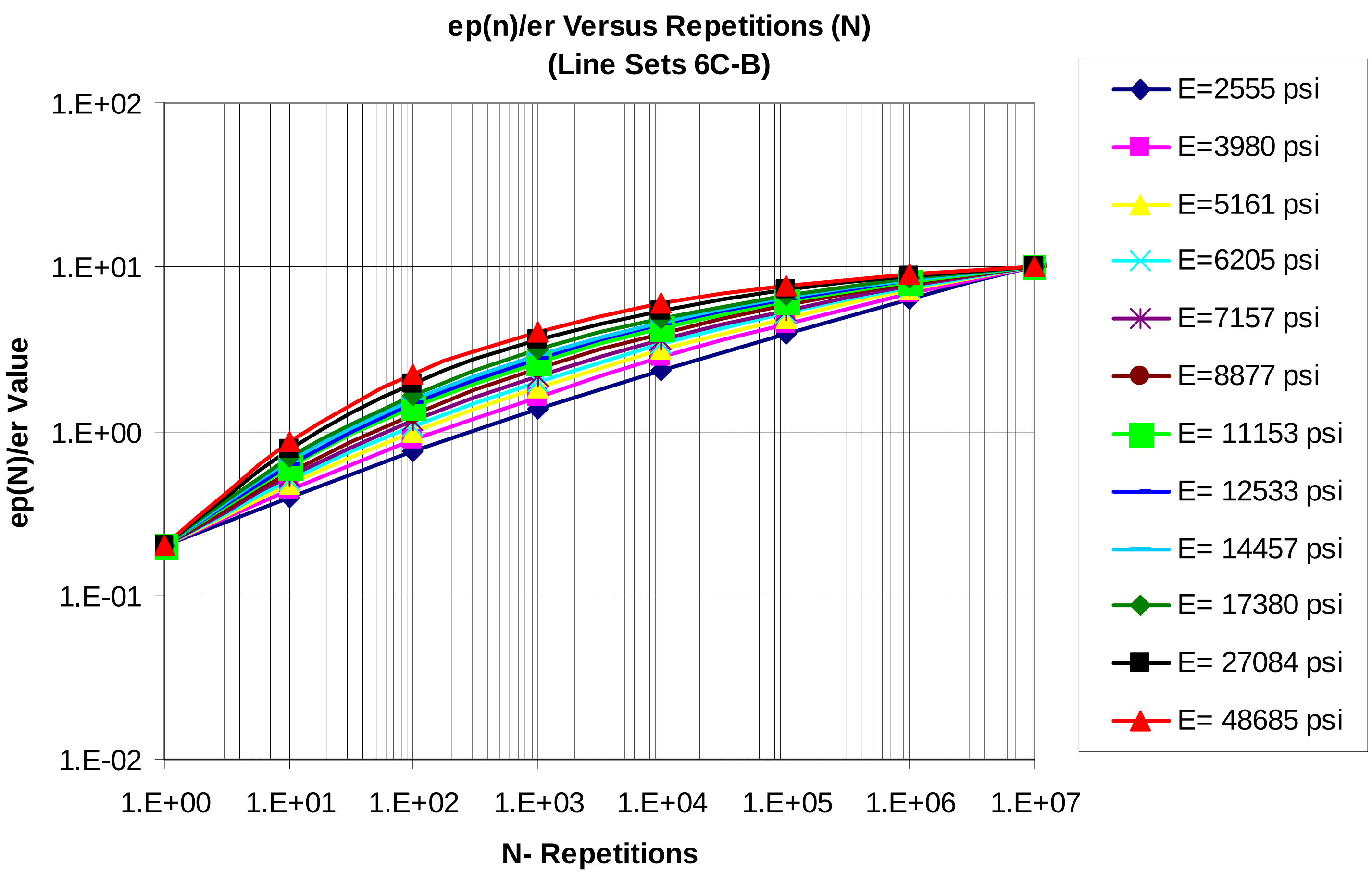


Figure B-54 Subgrade Material $\varepsilon_p / \varepsilon_r$ vs. Number of Load Repetitions Set 6-C-B

Table B-33 Unbound Material Rut Model Set 6-C-B Computations

N=1 Repetition

	ep(1)/er	E (psi)
Data Set 1	0.2	1000
Data Set 2	0.2	200000

b(1)=	0
a(1)1=	0.2
a(1)2=	0.2
a(1)(avg)=	0.2

N=10^7 Repetition

	ep(10^7)/er	E (psi)
Data Set 1	10	1000
Data Set 2	10	100000

b(10^7)=	0
a(10^7)1=	10
a(10^7)2=	10
a(10^7)(avg)=	10

CBR=	1	2	3	4	5	7	10	12	15	20	40	100
GWT (ft)=	10	10	10	10	10	10	10	10	10	10	10	10
E (psi)=	2555	3981.5	5161.2	6204.5	7157	8876.7	11153	12533.3	14457.4	17380	27083.8	48684.5
ep(1)/er=	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
ep(10^7)=	10	10	10	10	10	10	10	10	10	10	10	10
Beta=	0.0299719	0.0538458	0.0700934	0.0821515	0.0916235	0.1058432	0.1205232	0.127772481	0.1363509	0.146865	0.1693629	0.1927432
C0=	-3.912023	-3.912023	-3.912023	-3.912023	-3.912023	-3.912023	-3.912023	-3.91202301	-3.912023	-3.912023	-3.912023	-3.912023
Rho=	4.644E+33	2.472E+15	7.405E+10	701727126	49480308	2625613.9	296966.23	125911.5178	52437.081	21121.467	4685.983	1502.0566
X1=	5439.1647	169.61273	64.711763	41.287104	31.828621	23.821886	19.242271	17.71444635	16.302474	14.988002	13.138957	12.011341
X2=	5439.1647	169.61273	64.711763	41.287104	31.828621	23.821886	19.242271	17.71444635	16.302474	14.988002	13.138957	12.011341
X(avg)=	5439.1647	169.61273	64.711763	41.287104	31.828621	23.821886	19.242271	17.71444635	16.302474	14.988002	13.138957	12.011341

N	ep(0)/er=											
1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
10	0.3951353	0.4390398	0.4732885	0.5011588	0.5245845	0.5623815	0.6048344	0.627123197	0.6546543	0.6901332	0.772601	0.867933
100	0.746005	0.8793459	0.9850646	1.0719236	1.1453728	1.2644997	1.3988621	1.46951515	1.5567948	1.6691596	1.92907	2.2257226
1000	1.3499971	1.6242039	1.8380475	2.0111544	2.1556322	2.3861492	2.640399	2.771635189	2.9314188	3.1333455	3.5843702	4.0725943
10000	2.3482612	2.792852	3.1251699	3.385539	3.5972248	3.9249033	4.2727267	4.446962192	4.6544306	4.9095493	5.4524299	6.0010071
100000	3.9366603	4.5082217	4.9094536	5.2098888	5.4457891	5.7971406	6.1529571	6.324954782	6.5245781	6.7626196	7.2433225	7.6955126
1000000	6.3759739	6.8819802	7.2103458	7.4433028	7.6190335	7.8697854	8.1111388	8.223499043	8.3505212	8.4973719	8.7791718	9.0268819
10000000	10	10	10	10	10	10	10	10	10	10	10	10
100000000	15.220174	13.911146	13.209092	12.768314	12.463419	12.065219	11.718862	11.56892967	11.407541	11.231179	10.921599	10.678899

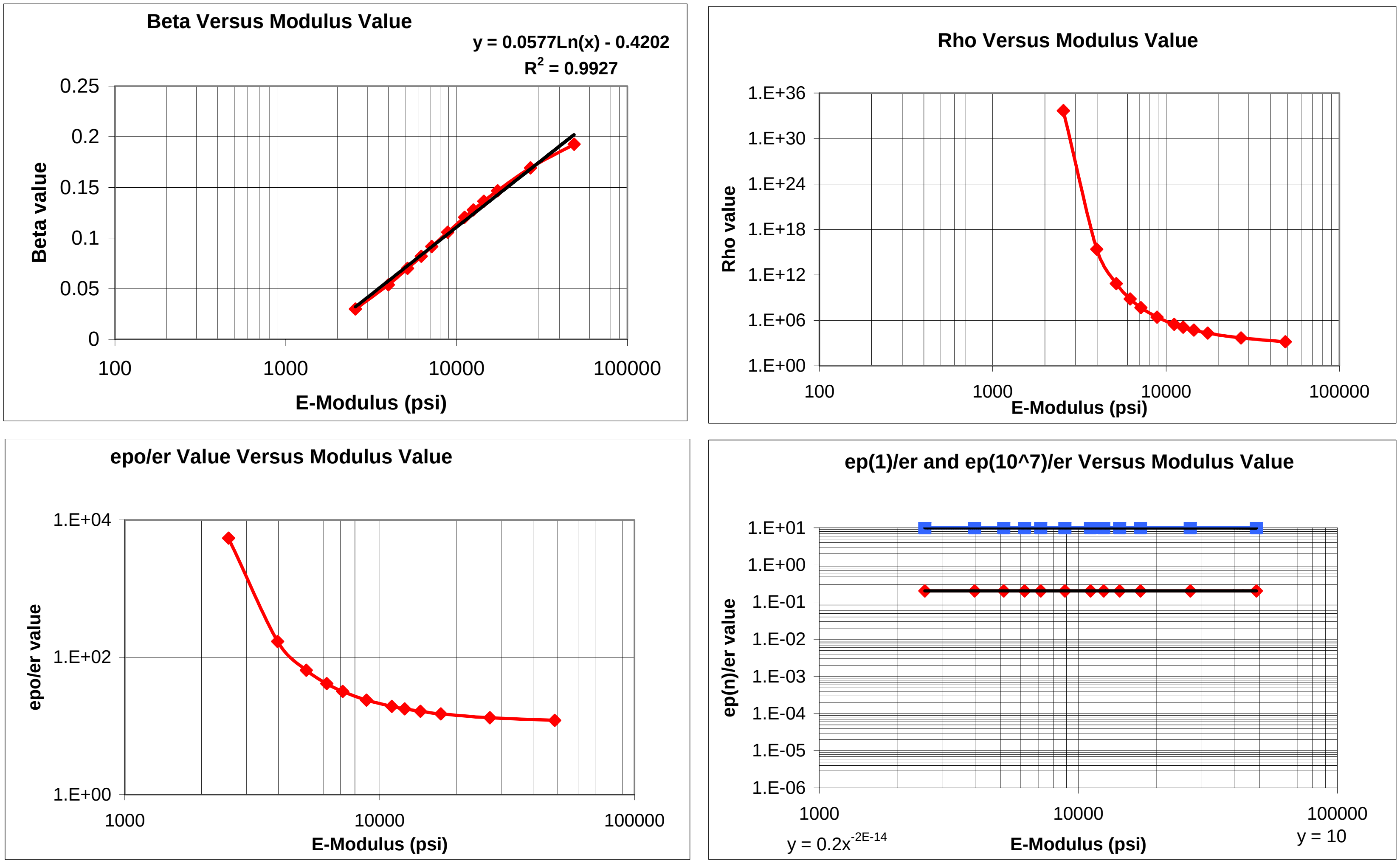


Figure B-55 Subgrade Material Set 6-C-B graphs

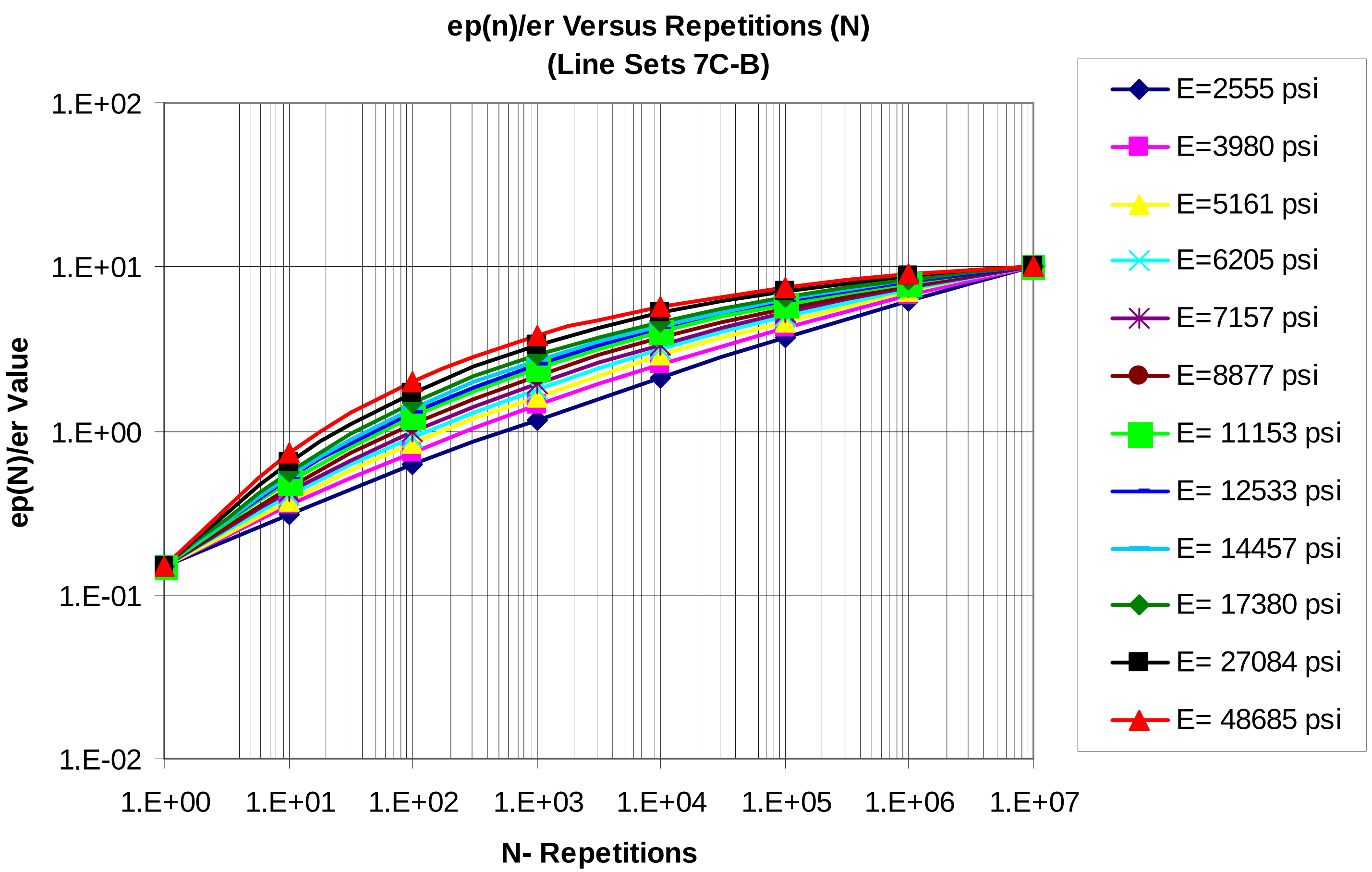


Figure B-56 Subgrade Material $\varepsilon_p / \varepsilon_r$ vs. Number of Load Repetitions Set 7-C-B

Table B-34 Unbound Material Rut Model Set 7-C-B Computations

N=1 Repetition

	ep(1)/er	E (psi)
Data Set 1	0.15	1000
Data Set 2	0.15	200000

b(1)=	0
a(1)1=	0.15
a(1)2=	0.15
a(1)(avg)=	0.15

N=10^7 Repetition

	ep(10^7)/er	E (psi)
Data Set 1	10	1000
Data Set 2	10	100000

b(10^7)=	0
a(10^7)1=	10
a(10^7)2=	10
a(10^7)(avg)=	10

CBR=	1	2	3	4	5	7	10	12	15	20	40	100
GWT (ft)=	10	10	10	10	10	10	10	10	10	10	10	10
E (psi)=	2555	3981.5	5161.2	6204.5	7157	8876.7	11153	12533.3	14457.4	17380	27083.8	48684.5
ep(1)/er=	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
ep(10^7)=	10	10	10	10	10	10	10	10	10	10	10	10
Beta=	0.0299719	0.0538458	0.0700934	0.0821515	0.0916235	0.1058432	0.1205232	0.127772481	0.1363509	0.146865	0.1693629	0.1927432
C0=	-4.1997051	-4.1997051	-4.1997051	-4.1997051	-4.1997051	-4.1997051	-4.1997051	-4.19970508	-4.1997051	-4.1997051	-4.1997051	-4.1997051
Rho=	4.956E+34	9.233E+15	2.038E+11	1.665E+09	107344642	5133242.3	535061.76	219409.3131	88237.615	34241.983	7124.6151	2170.5744
X1=	8643.6581	208.86722	74.237145	45.824754	34.657243	25.392075	20.191098	18.47519708	16.899046	15.440721	13.405395	12.174314
X2=	8643.6581	208.86722	74.237145	45.824754	34.657243	25.392075	20.191098	18.47519708	16.899046	15.440721	13.405395	12.174314
X(avg)=	8643.6581	208.86722	74.237145	45.824754	34.657243	25.392075	20.191098	18.47519708	16.899046	15.440721	13.405395	12.174314

N	ep(0)/er=											
1	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
10	0.3115684	0.3488803	0.378179	0.4021372	0.4223508	0.4551042	0.4920855	0.511578972	0.5357276	0.5669574	0.6399968	0.7251447
100	0.6163757	0.7353862	0.8307038	0.9095867	0.9766608	1.0861147	1.2104781	1.276232421	1.3577811	1.4632615	1.7092043	1.9928995
1000	1.1651432	1.4209954	1.6227777	1.7874019	1.9256047	2.1475079	2.3940893	2.52206358	2.6784767	2.8770392	3.3238798	3.8122544
10000	2.110923	2.5427955	2.8689811	3.1263502	3.3366785	3.6640382	4.0137279	4.189698303	4.3998934	4.6593085	5.2145816	5.7798319
100000	3.6758221	4.2516894	4.659211	4.9659759	5.2077638	5.5693059	5.9370889	6.115438456	6.322881	6.5708563	7.0735583	7.5486919
1000000	6.1684108	6.6954412	7.0389921	7.2834241	7.4681846	7.7323627	7.9872247	8.106065112	8.2405569	8.3962307	8.6955136	8.9591766
10000000	10	10	10	10	10	10	10	10	10	10	10	10
100000000	15.69764	14.252975	13.48223	12.999852	12.666894	12.232948	11.856354	11.69358375	11.51855	11.327485	10.992632	10.730606

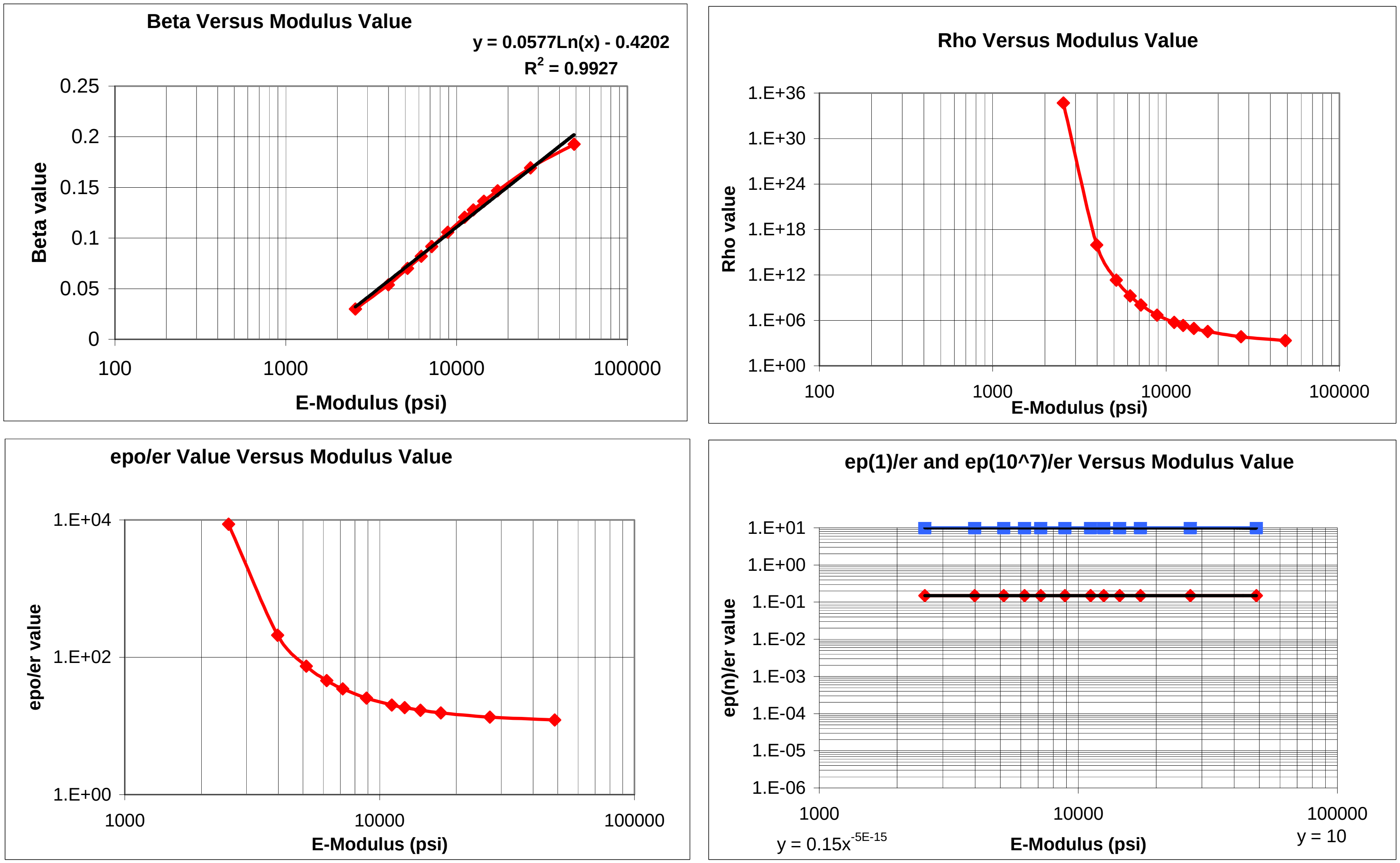


Figure B-57 Subgrade Material Set 7-C-B graphs

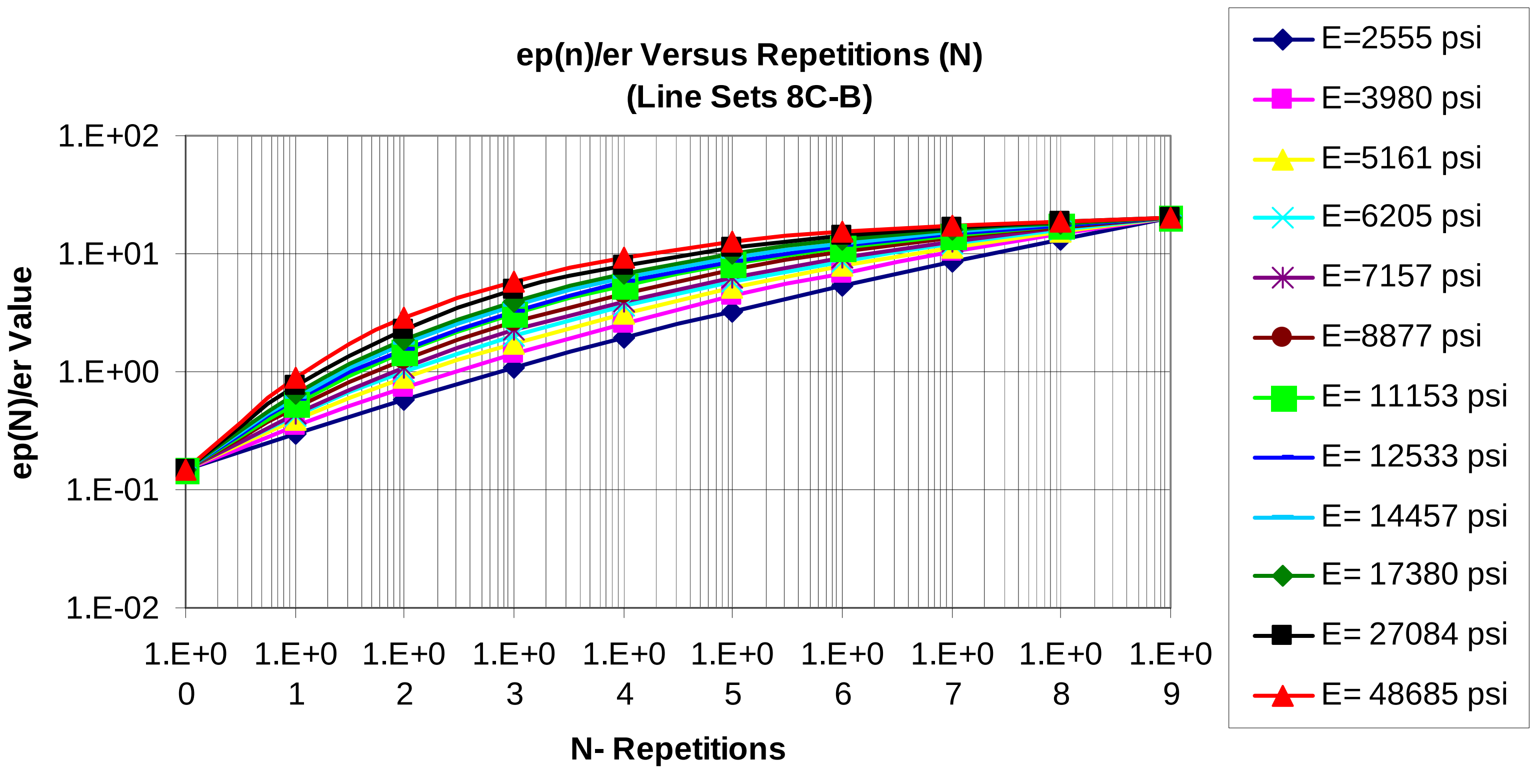


Figure B-58 Subgrade Material ε_p/ ε_r vs. Number of Load Repetitions Set 8-C-B

Table B-35 Unbound Material Rut Model Set 8-C-B Computations

N=1 Repetition

	ep(1)/er	E (psi)
Data Set 1	0.15	1000
Data Set 2	0.15	200000

b(1)= 0
a(1)1= 0.15
a(1)2= 0.15

a(1)(avg)= 0.15

N=10^9 Repetition

	ep(10^9)/er	E (psi)
Data Set 1	20	1000
Data Set 2	20	100000

b(10^9)= 0
a(10^9)1= 20
a(10^9)2= 20

a(10^9)(avg)= 20

CBR=	1	2	3	4	5	7	10	12	15	20	40	100
GWT (ft)=	10	10	10	10	10	10	10	10	10	10	10	10
E (psi)=	2555	3981.5	5161.2	6204.5	7157	8876.7	11153	12533.3	14457.4	17380	27083.8	48684.5
ep(1)/er=	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
ep(10^9)=	20	20	20	20	20	20	20	20	20	20	20	20
Beta=	0.0299719	0.0538458	0.0700934	0.0821515	0.0916235	0.1058432	0.1205232	0.127772481	0.1363509	0.146865	0.1693629	0.1927432
C0=	-4.8928523	-4.8928523	-4.8928523	-4.8928523	-4.8928523	-4.8928523	-4.8928523	-4.89285226	-4.8928523	-4.8928523	-4.8928523	-4.8928523
Rho=	1.498E+34	1.018E+16	3.085E+11	2.866E+09	197251804	10004263	1073506.5	442991.9335	178595.56	69125.054	14104.545	4164.0422
X1=	5875.0878	217.00829	89.135905	59.507036	47.348443	36.964774	31.013034	29.0365214	27.221519	25.54986	23.255928	21.923401
X2=	5875.0878	217.00829	89.135905	59.507036	47.348443	36.964774	31.013034	29.0365214	27.221519	25.54986	23.255928	21.923401
X(avg)=	5875.0878	217.00829	89.135905	59.507036	47.348443	36.964774	31.013034	29.0365214	27.221519	25.54986	23.255928	21.923401

N	ep(0)/er=											
1	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
10	0.3036487	0.3504393	0.38863	0.4206589	0.4481754	0.4936114	0.5460195	0.574062713	0.6091637	0.6550992	0.764608	0.8953351
100	0.5864449	0.7415875	0.8736941	0.9876099	1.0874034	1.2554369	1.4532702	1.560512678	1.6958093	1.874255	2.3033848	2.8170257
1000	1.0839784	1.4379731	1.7407846	2.0015181	2.2290322	2.6092736	3.0511141	3.287606408	3.5826989	3.966091	4.8600047	5.8772895
10000	1.923193	2.5810975	3.1297435	3.5913865	3.9861259	4.6293976	5.3519404	5.728101409	6.1875225	6.7685044	8.0573475	9.4208865
100000	3.2841301	4.3274669	5.1558612	5.8264697	6.3822232	7.2555899	8.1925931	8.663286491	9.2231801	9.9087474	11.346128	12.751544
1000000	5.4115335	6.8311397	7.8846397	8.6962363	9.3435431	10.318412	11.311526	11.79126124	12.346146	13.003228	14.305358	15.485067
10000000	8.6249446	10.224315	11.317919	12.113835	12.722286	13.597967	14.443412	14.83595222	15.277628	15.784001	16.735823	17.54007
100000000	13.325785	14.599995	15.394072	15.937588	16.335085	16.881485	17.381803	17.60537242	17.850466	18.12315	18.611812	18.999972
1E+09	20	20	20	20	20	20	20	20	20	20	20	20

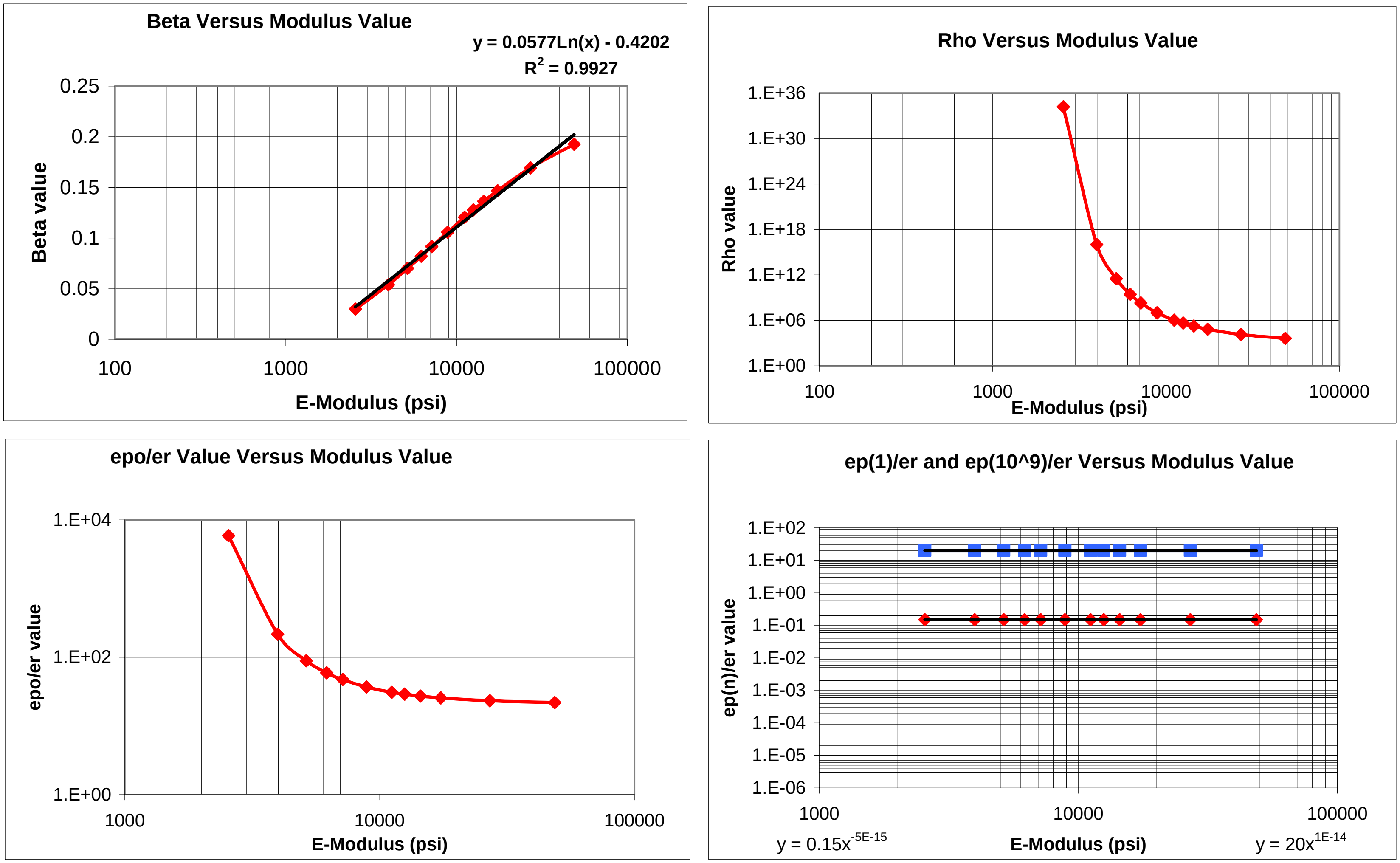


Figure B-59 Subgrade Material Set 8-C-B graphs

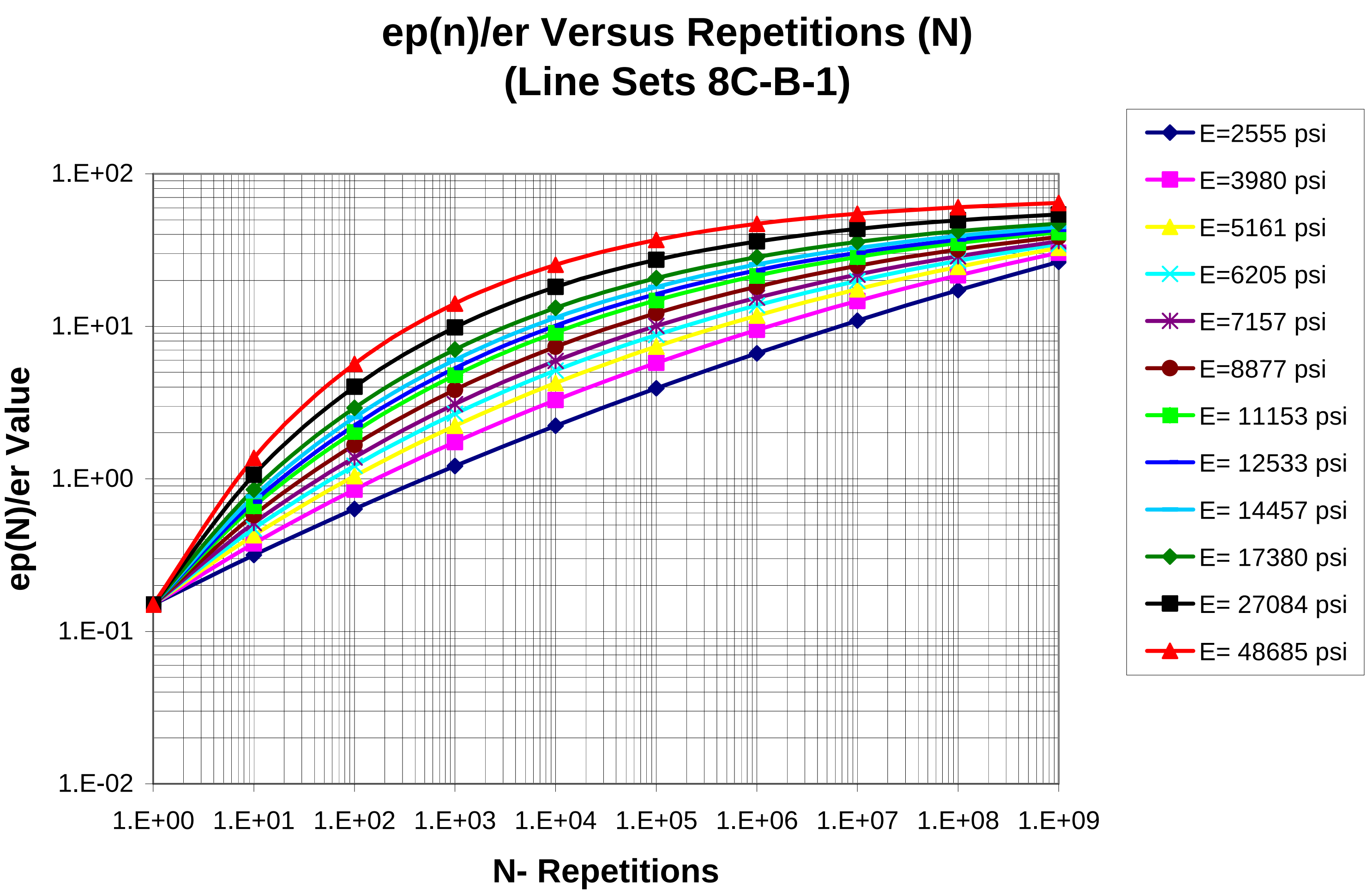


Figure B-60 Subgrade Material ε_p/ ε_r vs. Number of Load Repetitions Set 8-C-B-1

Table B-36 Unbound Material Rut Model Set 8-C-B-1Computations

N=1 Repetition

	ep(1)/er	E (psi)
Data Set 1	0.15	1.E+03
Data Set 2	0.15	1.E+05

b(1)=	0
a(1)1=	0.15
a(1)2=	0.15
a(1)(avg)=	0.15

N=10^9 Repetition

	ep(10^9)/er	E (psi)
Data Set 1	20	1.E+03
Data Set 2	80	1.E+05

b(10^9)=	0.30103
a(10^9)1=	2.5
a(10^9)2=	2.5
a(10^9)(avg)=	2.5

CBR=	1	2	3	4	5	7	10	12	15	20	40	100
GWT (ft)=	10	10	10	10	10	10	10	10	10	10	10	10
E (psi)=	2555	3981.5	5161.2	6204.5	7157	8876.7	11153	12533.3	14457.4	17380	27083.8	48684.5
ep(1)/er=	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
ep(10^9)=	26.525701	30.315313	32.778519	34.646432	36.168431	38.590655	41.335797	42.81348975	44.69428	47.241336	53.99065	64.414734
Beta=	0.0299719	0.0538458	0.0700934	0.0821515	0.0916235	0.1058432	0.1205232	0.127772481	0.1363509	0.146865	0.1693629	0.1927432
C0=	-5.1752341	-5.308773	-5.3868934	-5.4423147	-5.4853067	-5.5501301	-5.6188489	-5.65397322	-5.6969655	-5.7523893	-5.8859309	-6.0624624
Rho=	9.74E+34	4.633E+16	1.217E+12	1.047E+10	686736510	32913602	3383308.6	1373501.264	545146.64	208071.28	41996.363	12661.164
X1=	10816.49	402.8351	169.88113	116.51309	95.044022	77.459551	68.408316	65.86918421	63.993685	63.003535	64.731727	72.176489
X2=	10816.49	402.8351	169.88113	116.51309	95.044022	77.459551	68.408316	65.86918421	63.993685	63.003535	64.731727	72.176489
X(avg)=	10816.49	402.8351	169.88113	116.51309	95.044022	77.459551	68.408316	65.86918421	63.993685	63.003535	64.731727	72.176489

N	ep(0)/er											
1	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
10	0.3162626	0.3766512	0.4278412	0.4723044	0.5116899	0.5792626	0.6614029	0.707341226	0.7669394	0.8487407	1.0641571	1.3723314
100	0.6344556	0.8494982	1.0438307	1.220398	1.3821673	1.6701122	2.0355695	2.246450696	2.5262639	2.9207521	4.0099509	5.6788691
1000	1.2150444	1.7425991	2.229694	2.6774788	3.0905217	3.8295848	4.7708161	5.3143461	6.0352681	7.0504348	9.8452061	14.125236
10000	2.228256	3.2873592	4.2533682	5.1302871	5.9296997	7.3384857	9.0961544	10.09463186	11.402578	13.21675	18.085991	25.345109
100000	3.9244152	5.7590958	7.3691165	8.7878757	10.050927	12.217147	14.832171	16.28215287	18.149236	20.6885	27.30045	36.880142
1000000	6.6556875	9.4507638	11.763145	13.7196	15.409559	18.216085	21.482875	23.24957965	25.487277	28.477143	36.078586	46.914425
10000000	10.897129	14.63848	17.512947	19.836143	21.780897	24.912518	28.444037	30.31712093	32.662832	35.764152	43.574218	54.747123
100000000	17.264448	21.545988	24.571672	26.91396	28.825484	31.840011	35.184359	36.9470969	39.152195	42.073414	49.514947	60.448146
1E+09	26.525701	30.315313	32.778519	34.646432	36.168431	38.590655	41.335797	42.81348975	44.69428	47.241336	53.99065	64.414734

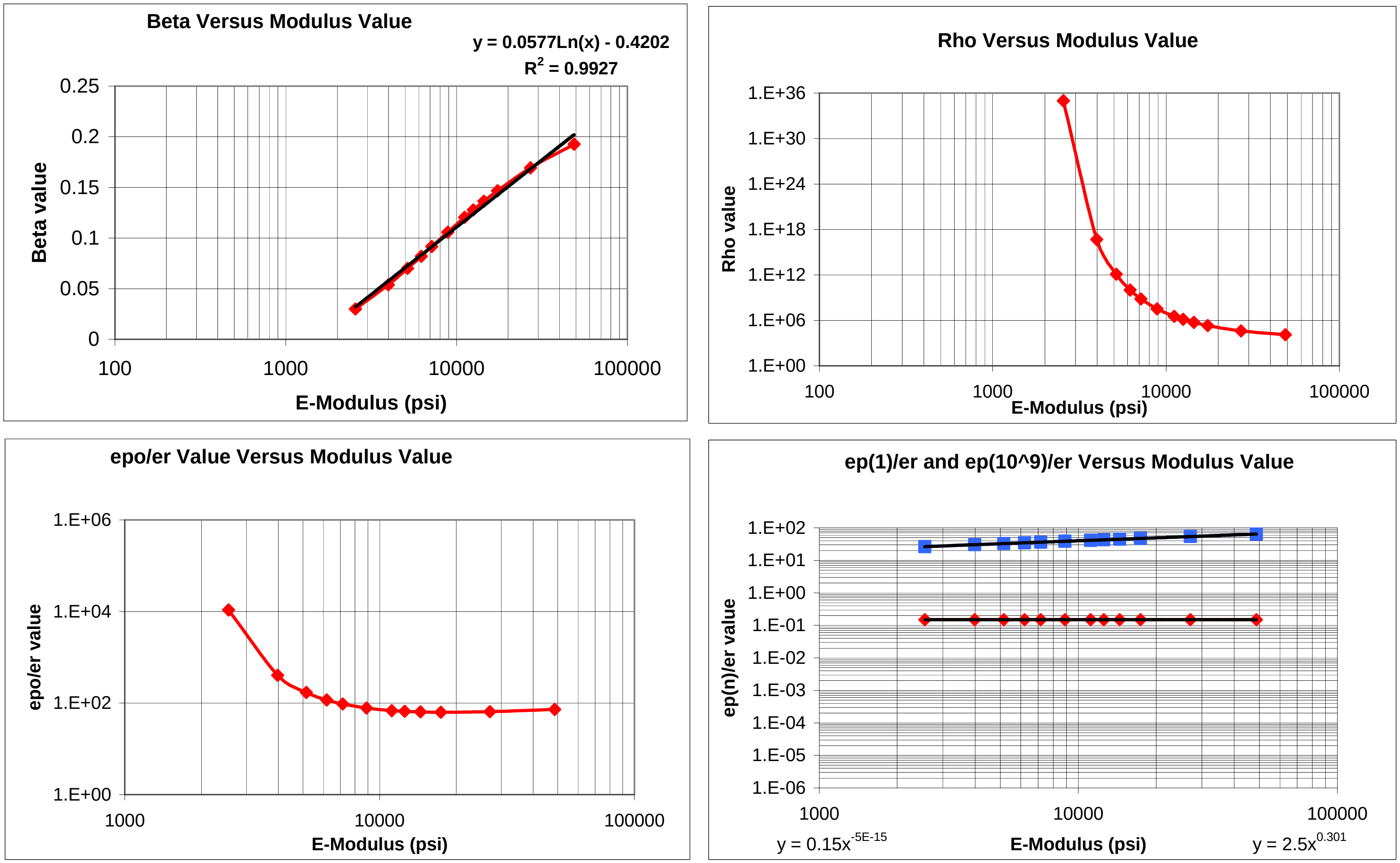


Figure B-61 Subgrade Material Set 8-C-B-1 graphs

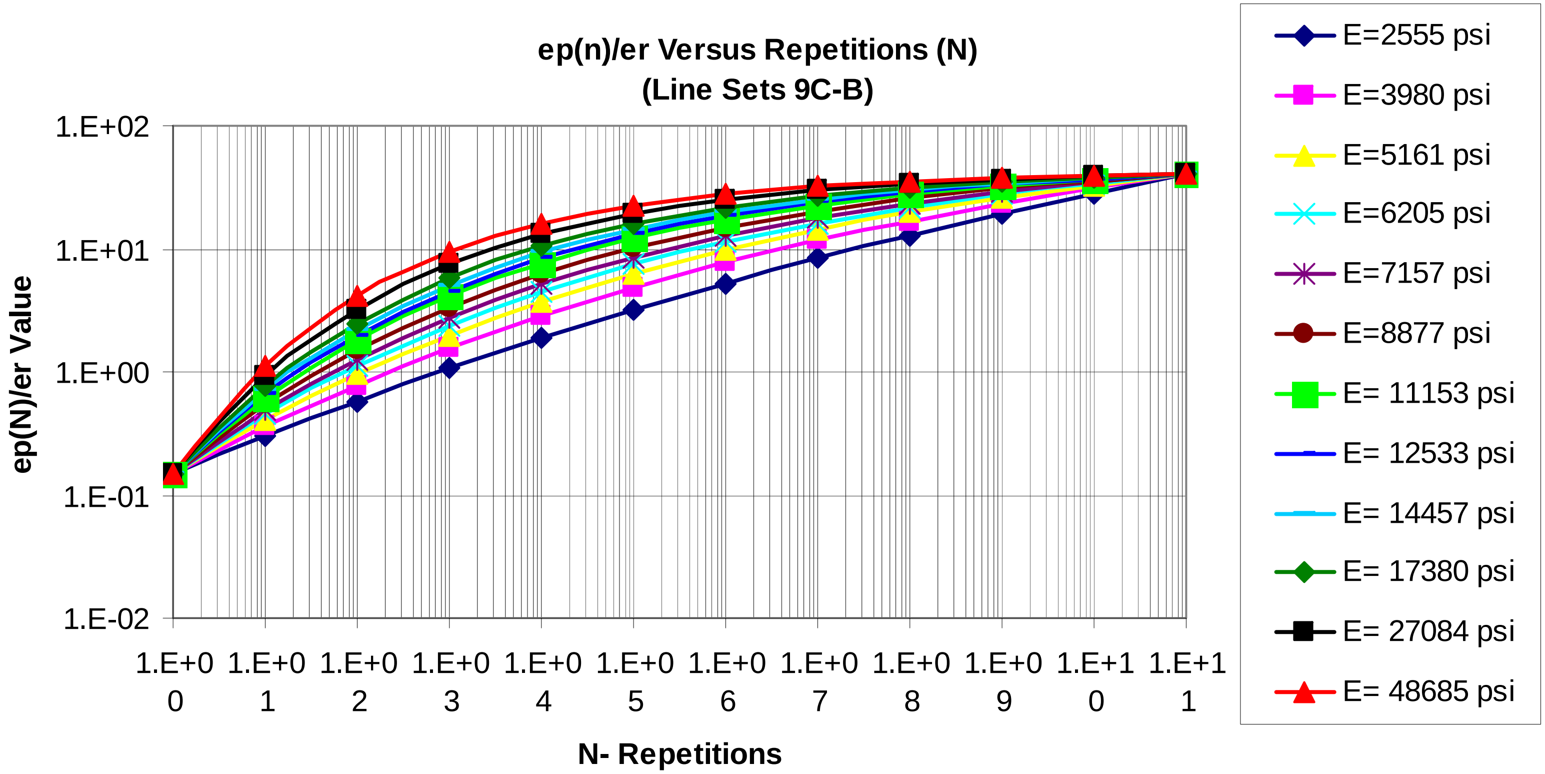


Figure B-62 Subgrade Material $\varepsilon_p/\ \varepsilon_r$ vs. Number of Load Repetitions Set 9-C-B

Table B-37 Unbound Material Rut Model Set 9-C-B Computations

N=1 Repetition

	ep(1)/er	E (psi)
Data Set 1	0.15	1000
Data Set 2	0.15	200000

b(1)=	0
a(1)1=	0.15
a(1)2=	0.15
a(1)(avg)=	0.15

N=10^11 Repetition

	ep(10^11)/er	E (psi)
Data Set 1	40	1000
Data Set 2	40	100000

b(10^11)=	0
a(10^11)1=	40
a(10^11)2=	40
a(10^11)(avg)	40

CBR=	1	2	3	4	5	7	10	12	15	20	40	100
GWT (ft)=	10	10	10	10	10	10	10	10	10	10	10	10
E (psi)=	2555	3981.5	5161.2	6204.5	7157	8876.7	11153	12533.3	14457.4	17380	27083.8	48684.5
ep(1)/er=	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
ep(10^11)=	40	40	40	40	40	40	40	40	40	40	40	40
Beta=	0.0299719	0.0538458	0.0700934	0.0821515	0.0916235	0.1058432	0.1205232	0.127772481	0.1363509	0.146865	0.1693629	0.1927432
C0=	-5.5859994	-5.5859994	-5.5859994	-5.5859994	-5.5859994	-5.5859994	-5.5859994	-5.58599944	-5.5859994	-5.5859994	-5.5859994	-5.5859994
Rho=	1.184E+34	1.805E+16	6.439E+11	6.296E+09	440554526	22374180	2361382.3	962563.3105	381621.33	144392.74	27966.606	7821.6414
X1=	5454.7004	272.51974	125.00146	88.736305	73.493972	60.321817	52.762603	50.27208877	48.007308	45.9536	43.229483	41.744186
X2=	5454.7004	272.51974	125.00146	88.736305	73.493972	60.321817	52.762603	50.27208877	48.007308	45.9536	43.229483	41.744186
X(avg)=	5454.7004	272.51974	125.00146	88.736305	73.493972	60.321817	52.762603	50.27208877	48.007308	45.9536	43.229483	41.744186

N	ep(0)/er=											
1	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
10	0.3021491	0.3598718	0.4087195	0.4506485	0.4872663	0.5487652	0.6210618	0.660264123	0.7097828	0.7752704	0.9340821	1.1277918
100	0.5808584	0.7796276	0.9591248	1.1200736	1.2650848	1.51652	1.8224127	1.992040056	2.2093816	2.5011143	3.2224184	4.1148036
1000	1.0690321	1.5433954	1.9820345	2.3796213	2.7394406	3.3637767	4.1196833	4.535697258	5.0645078	5.7658132	7.4526547	9.4405909
10000	1.8890564	2.8215182	3.6758936	4.4398341	5.1213348	6.280226	7.6426061	8.373567032	9.2838777	10.459526	13.147824	16.083785
100000	3.2137413	4.8076955	6.2177475	7.4395044	8.5000681	10.244186	12.206233	13.2224382	14.454533	15.993731	19.309988	22.638357
1000000	5.2770136	7.6984268	9.7248008	11.404731	12.811785	15.032046	17.403846	18.58423012	19.974228	21.650489	25.049839	28.189869
10000000	8.3830688	11.668769	14.229077	16.242345	17.860977	20.301966	22.770561	23.94959922	25.298059	26.868894	29.87652	32.449141
100000000	12.912583	16.849472	19.671441	21.764377	23.375205	25.693796	27.913528	28.93184985	30.064504	31.341762	33.662259	35.514916
1E+09	19.324684	23.309967	25.913797	27.7293	29.065677	30.902553	32.570418	33.30690738	34.105227	34.979153	36.494275	37.632749
1E+10	28.153678	31.049935	32.763177	33.884568	34.674288	35.712606	36.609463	36.99172417	37.396489	37.827957	38.545843	39.05757
1E+11	40	40	40	40	40	40	40	40	40	40	40	40

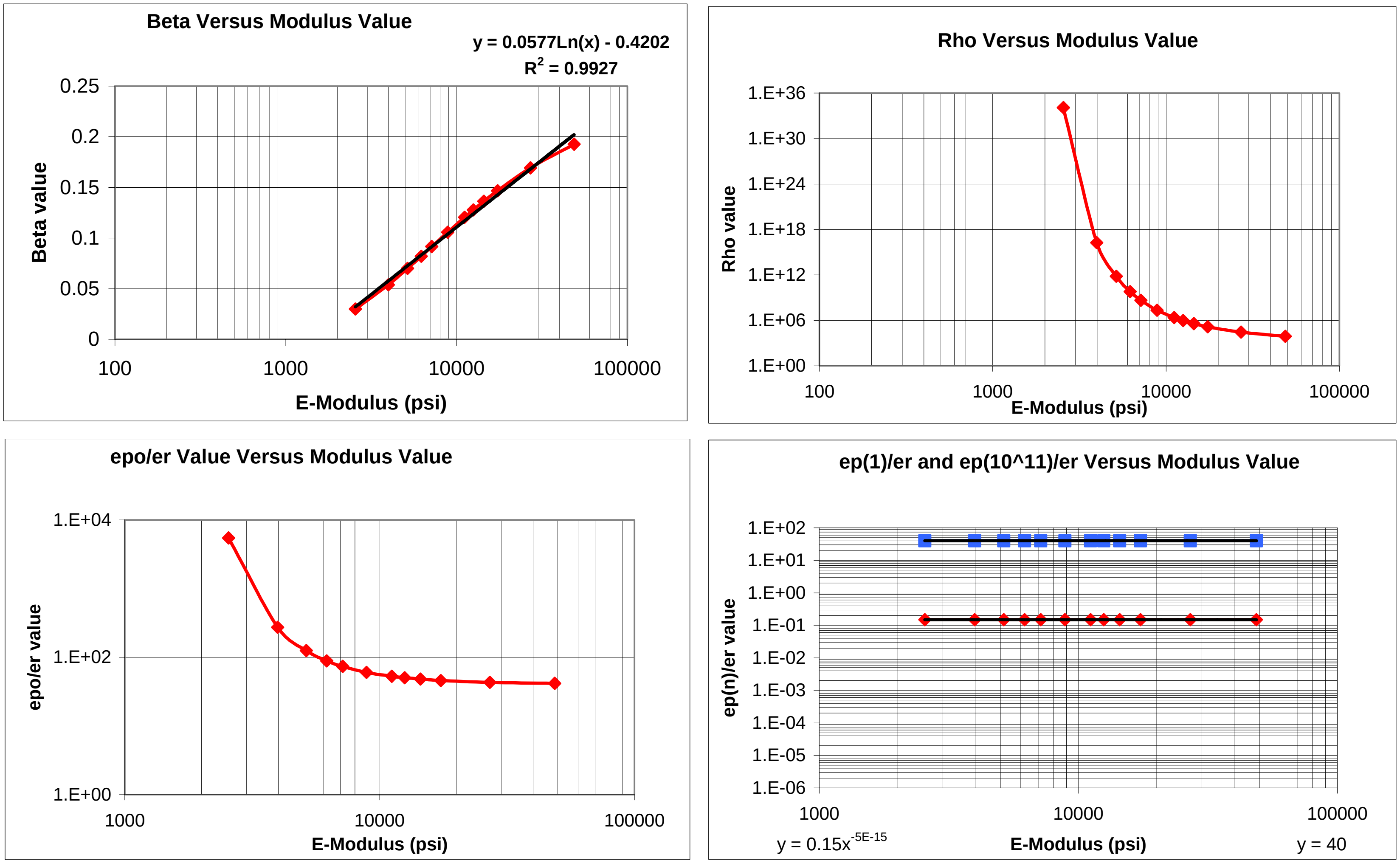


Figure B-63 Subgrade Material Set 9-C-B graphs

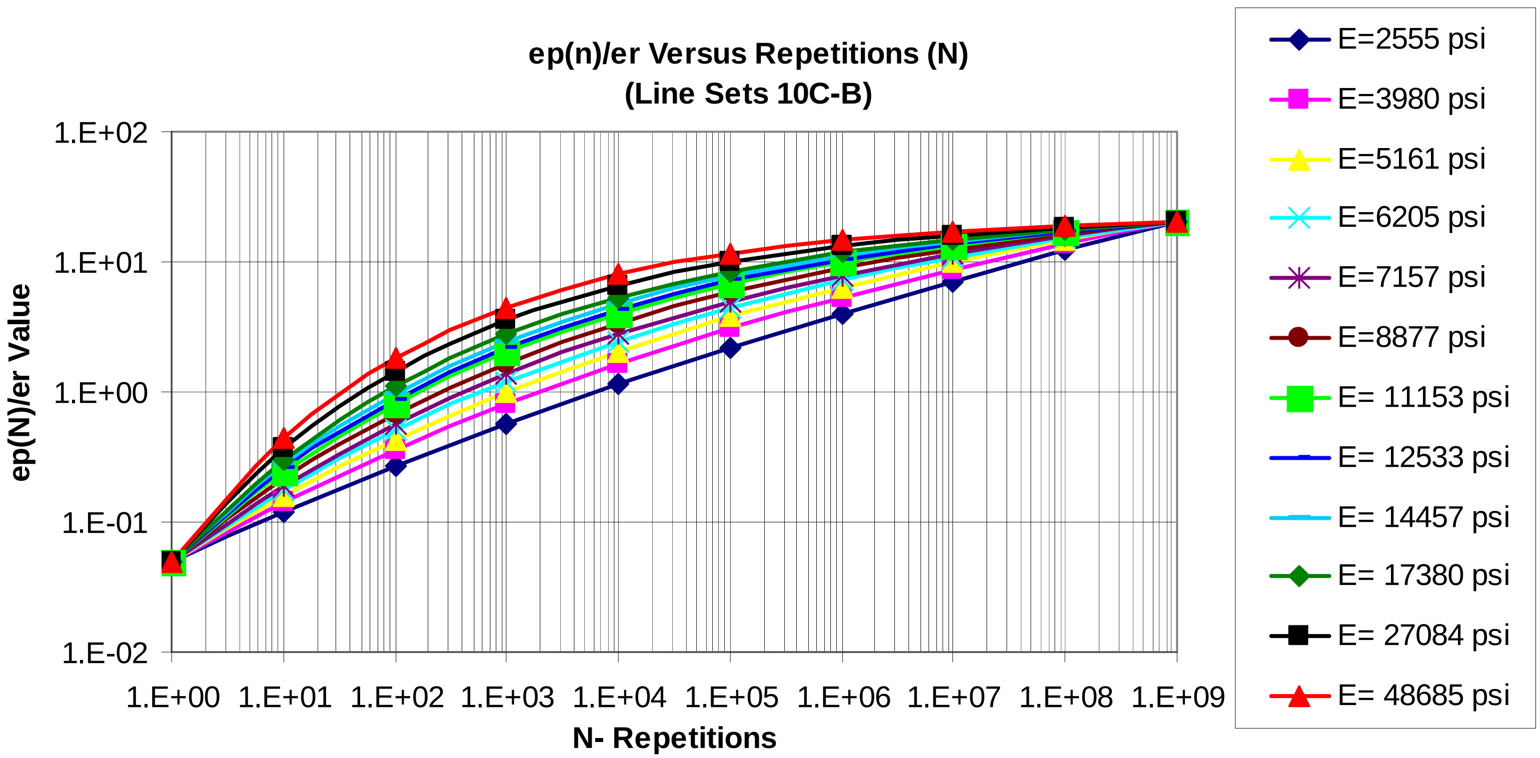


Figure B-64 Subgrade Material $\varepsilon_p / \varepsilon_r$ vs. Number of Load Repetitions Set 10-C-B

Table B-38 Unbound Material Rut Model Set 10-C-B Computations

N=1 Repetition

	ep(1)/er	E (psi)
Data Set 1	0.05	1000
Data Set 2	0.05	200000

b(1)=	0
a(1)1=	0.05
a(1)2=	0.05
a(1)(avg)=	0.05

N=10^9 Repetition

	ep(10^9)/er	E (psi)
Data Set 1	20	1000
Data Set 2	20	100000

b(10^9)=	0
a(10^9)1=	20
a(10^9)2=	20
a(10^9)(avg)=	20

CBR=	1	2	3	4	5	7	10	12	15	20	40	100
GWT (ft)=	10	10	10	10	10	10	10	10	10	10	10	10
E (psi)=	2555	3981.5	5161.2	6204.5	7157	8876.7	11153	12533.3	14457.4	17380	27083.8	48684.5
ep(1)/er=	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
ep(10^9)=	20	20	20	20	20	20	20	20	20	20	20	20
Beta=	0.0299719	0.0538458	0.0700934	0.0821515	0.0916235	0.1058432	0.1205232	0.127772481	0.1363509	0.146865	0.1693629	0.1927432
C0=	-5.9914645	-5.9914645	-5.9914645	-5.9914645	-5.9914645	-5.9914645	-5.9914645	-5.99146455	-5.9914645	-5.9914645	-5.9914645	-5.9914645
Rho=	1.29E+37	4.381E+17	5.549E+12	3.374E+10	1.8E+09	67815480	5763857.9	2162181.804	788951.99	274553.49	46642.465	11910.506
X1=	21045.588	370.65457	124.6753	76.014043	57.457056	42.431105	34.223247	31.57184318	29.17249	26.994149	24.057001	22.380093
X2=	21045.588	370.65457	124.6753	76.014043	57.457056	42.431105	34.223247	31.57184318	29.17249	26.994149	24.057001	22.380093
X(avg)=	21045.588	370.65457	124.6753	76.014043	57.457056	42.431105	34.223247	31.57184318	29.17249	26.994149	24.057001	22.380093

N	ep(0)/er=											
1	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
10	0.1185825	0.1413309	0.1604159	0.1767518	0.1910119	0.2149879	0.2432634	0.258649627	0.2781466	0.3040437	0.3674017	0.4457374
100	0.2654976	0.3539026	0.4325805	0.5026249	0.5655044	0.6742983	0.8066275	0.880109638	0.9744383	1.1014439	1.4177658	1.8140889
1000	0.5633241	0.7962429	1.0061781	1.1937115	1.3619297	1.6516456	2.0003697	2.191852607	2.4351393	2.7579722	3.5374021	4.4643472
10000	1.1367634	1.6298323	2.0636771	2.442372	2.7750421	3.3329731	3.9807168	4.325978299	4.7545968	5.3069016	6.5695786	7.9557841
100000	2.1890149	3.0687698	3.8028703	4.4171232	4.9384429	5.7782656	6.7048648	7.179576131	7.7518203	8.4631751	9.9901346	11.525869
1000000	4.0350615	5.3671006	6.3975597	7.2130284	7.8758771	8.8936067	9.9528398	10.472165	11.078778	11.805056	13.268505	14.620544
10000000	7.1406856	8.7943946	9.9597285	10.824048	11.493495	12.469583	13.425474	13.87362907	14.381072	14.966908	16.079479	17.030726
100000000	12.164635	13.603918	14.515409	15.145439	15.609282	16.251019	16.842742	17.1084019	17.40051	17.72656	18.313608	18.782397
1E+09	20	20	20	20	20	20	20	20	20	20	20	20

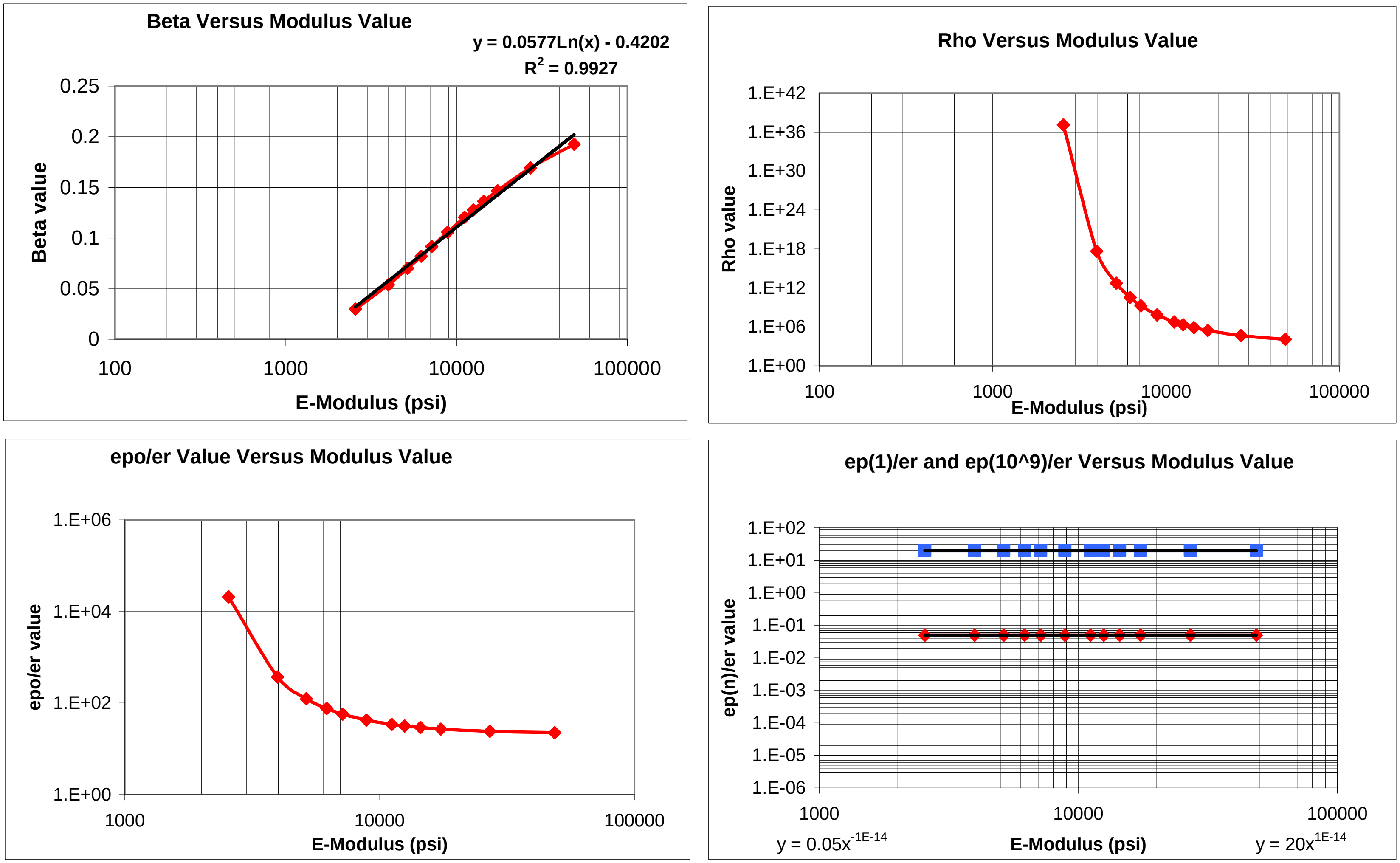


Figure B-65 Subgrade Material Set 10-C-B graphs

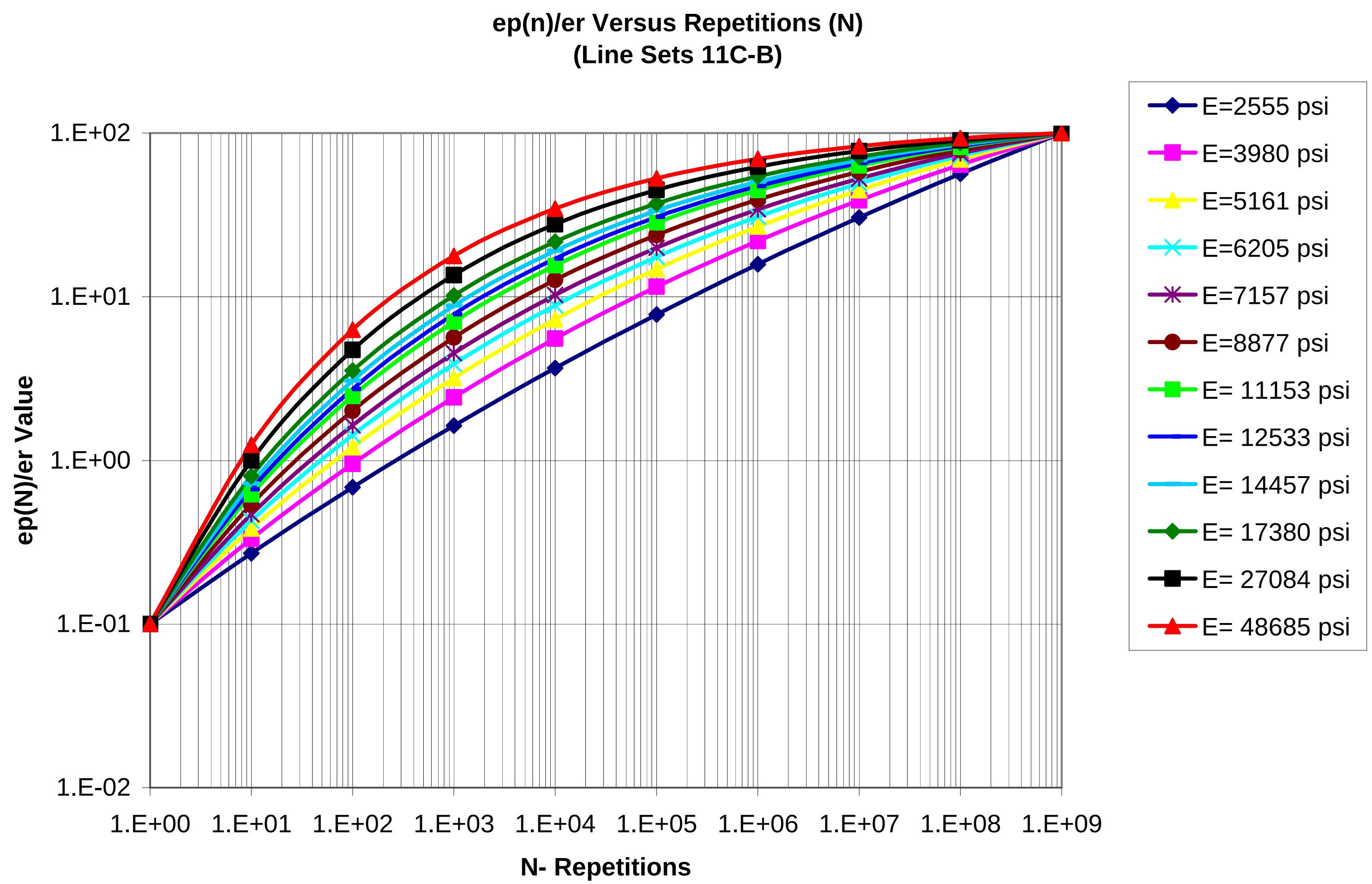


Figure B-66 Subgrade Material $\varepsilon_p/\ \varepsilon_r$ vs. Number of Load Repetitions Set 11-C-B

Table B-39 Unbound Material Rut Model Set 11-C-B Computations

N=1 Repetition

	ep(1)/er	E (psi)
Data Set 1	0.1	1.E+03
Data Set 2	0.1	1.E+05

b(1)= 0
a(1)1= 0.1
a(1)2= 0.1

a(1)(avg)= 0.1

N=10^9 Repetition

	ep(10^9)/er	E (psi)
Data Set 1	100	1.E+03
Data Set 2	100	1.E+05

b(10^9)= 0
a(10^9)1= 100
a(10^9)2= 100

a(10^9)(avg)= 100

CBR=	1	2	3	4	5	7	10	12	15	20	40	100
GWT (ft)=	10	10	10	10	10	10	10	10	10	10	10	10
E (psi)=	2555	3981.5	5161.2	6204.5	7157	8876.7	11153	12533.3	14457.4	17380	27083.8	48684.5
ep(1)/er=	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
ep(10^9)=	100	100	100	100	100	100	100	100	100	100	100	100
Beta=	0.0299719	0.0538458	0.0700934	0.0821515	0.0916235	0.1058432	0.1205232	0.127772481	0.1363509	0.146865	0.1693629	0.1927432
C0=	-6.9077553	-6.9077553	-6.9077553	-6.9077553	-6.9077553	-6.9077553	-6.9077553	-6.90775528	-6.9077553	-6.9077553	-6.9077553	-6.9077553
Rho=	1.488E+39	6.157E+18	4.226E+13	1.908E+11	8.505E+09	260164999	18772000	6585599.936	2240380.2	723516.49	108069.14	24922.101
X1=	305009.71	2896.3346	824.69571	466.16962	337.60157	238.01837	185.76721	169.2746384	154.53108	141.30501	123.73098	113.84131
X2=	305009.71	2896.3346	824.69571	466.16962	337.60157	238.01837	185.76721	169.2746384	154.53108	141.30501	123.73098	113.84131
X(avg)=	305009.71	2896.3346	824.69571	466.16962	337.60157	238.01837	185.76721	169.2746384	154.53108	141.30501	123.73098	113.84131

N	ep(0)/er=											
1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
10	0.27065	0.3313453	0.3834457	0.4288064	0.4689334	0.5374256	0.6197091	0.665114334	0.7232444	0.8014199	0.9968667	1.2456954
100	0.6854578	0.9547582	1.2033991	1.4307194	1.6389865	2.0076037	2.4683134	2.72932113	3.0692659	3.5349219	4.729223	6.2837068
1000	1.6317031	2.4317122	3.1848131	3.8784645	4.5151412	5.6395372	7.0333117	7.815063999	8.8233992	10.185222	13.570511	17.747091
10000	3.6659273	5.5537524	7.2905576	8.8536207	10.257936	12.670387	15.549448	17.11442919	19.083872	21.661719	27.705482	34.548313
100000	7.8033999	11.519591	14.751274	17.530828	19.937129	23.894681	28.3643	30.69193642	33.529153	37.100818	44.919867	52.971016
1000000	15.794448	21.945263	26.870781	30.85687	34.148555	39.284655	44.726583	47.42784462	50.609119	54.45306	62.307189	69.682631
10000000	30.500337	38.779829	44.762277	49.269901	52.799509	58.002073	63.157789	65.59462735	68.368394	71.589314	77.758949	83.08621
100000000	56.36976	64.126608	69.105233	72.574747	75.143286	78.716143	82.029752	83.52326622	85.169567	87.012159	90.342752	93.014182
1E+09	100	100	100	100	100	100	100	100	100	100	100	100

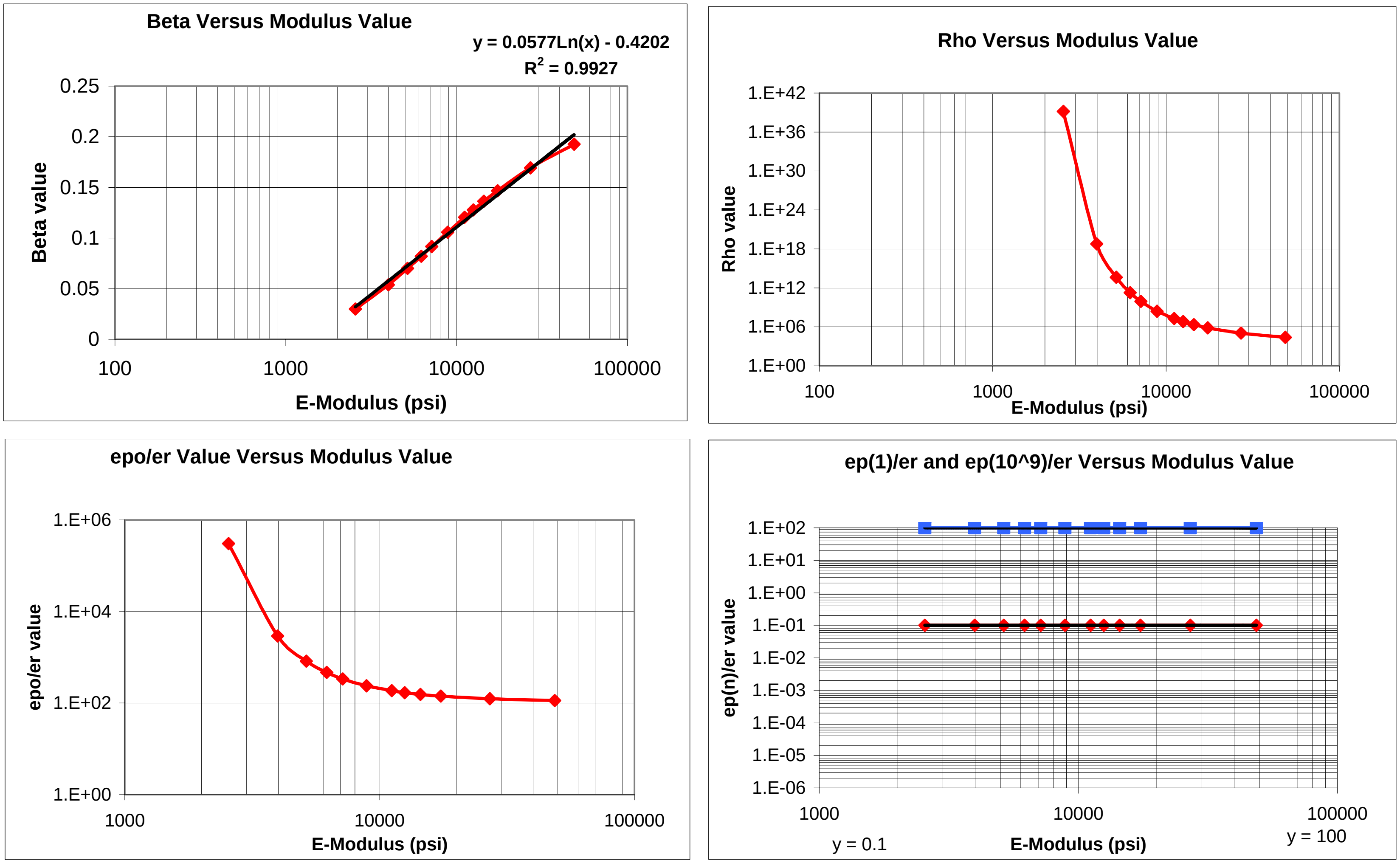


Figure B-67 Subgrade Material Set 11-C-B graphs

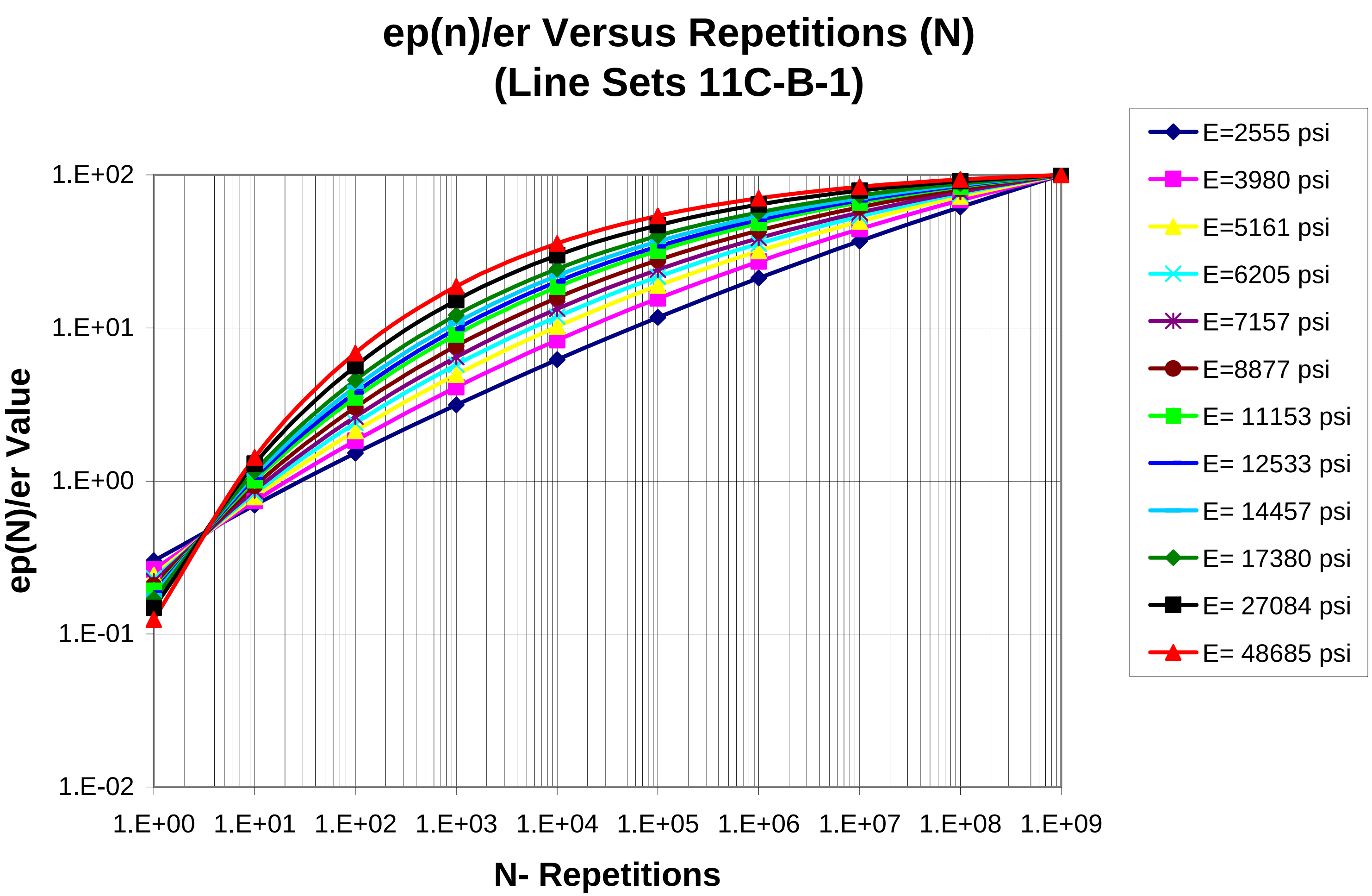


Figure B-68 Subgrade Material $\varepsilon_p / \varepsilon_r$ vs. Number of Load Repetitions Set 11-C-B-1

Table B-40 Unbound Material Rut Model Set 11-C-B-1 Computations

N=1 Repetition

	ep(1)/er	E (psi)
Data Set 1	0.4	1.E+03
Data Set 2	0.1	1.E+05

b(1)=	-0.30103
a(1)1=	3.2
a(1)2=	3.2
a(1)(avg)=	3.2

N=10^9 Repetition

	ep(10^9)/er	E (psi)
Data Set 1	100	1.E+03
Data Set 2	100	1.E+05

b(10^9)=	0
a(10^9)1=	100
a(10^9)2=	100
a(10^9)(avg)=	100

CBR=	1	2	3	4	5	7	10	12	15	20	40	100
GWT (ft)=	10	10	10	10	10	10	10	10	10	10	10	10
E (psi)=	2555	3981.5	5161.2	6204.5	7157	8876.7	11153	12533.3	14457.4	17380	27083.8	48684.5
ep(1)/er=	0.3015943	0.263893	0.2440623	0.230904	0.2211874	0.2073041	0.1935369	0.186856994	0.1789938	0.1693432	0.1481738	0.1241952
ep(10^9)=	100	100	100	100	100	100	100	100	100	100	100	100
Beta=	0.0299719	0.0538458	0.0700934	0.0821515	0.0916235	0.1058432	0.1205232	0.127772481	0.1363509	0.146865	0.1693629	0.1927432
C0=	-5.8038428	-5.9373816	-6.015502	-6.0709234	-6.1139153	-6.1787388	-6.2474575	-6.28258188	-6.3255742	-6.3809979	-6.5145395	-6.691071
Rho=	4.463E+36	3.702E+17	5.876E+12	3.961E+10	2.244E+09	90702231	8155964.1	3134416.425	1174602.8	421590.28	76456.37	21123.822
X1=	84623.992	1805.0702	627.97004	386.86015	293.5487	217.20236	175.08901	161.4000315	148.9655	137.62811	122.24025	113.37932
X2=	84623.992	1805.0702	627.97004	386.86015	293.5487	217.20236	175.08901	161.4000315	148.9655	137.62811	122.24025	113.37932
X(avg)=	84623.992	1805.0702	627.97004	386.86015	293.5487	217.20236	175.08901	161.4000315	148.9655	137.62811	122.24025	113.37932

N	ep(0)/er=											
1	0.3015943	0.263893	0.2440623	0.230904	0.2211874	0.2073041	0.1935369	0.186856994	0.1789938	0.1693432	0.1481738	0.1241952
10	0.6961919	0.7389614	0.7867004	0.8300385	0.868455	0.9329349	1.0074603	1.046962153	1.095729	1.1579858	1.2958726	1.4294055
100	1.5198743	1.8351427	2.12989	2.3933029	2.628794	3.0325395	3.5161498	3.780912017	4.116672	4.5611513	5.6263379	6.8535215
1000	3.149741	4.0987624	4.9709104	5.7495647	6.4457974	7.6389236	9.0647832	9.842957219	10.826724	12.123238	15.2045	18.736167
10000	6.2178227	8.3356976	10.22479	11.876014	13.326284	15.757155	18.57707	20.07915866	21.942771	24.341665	29.80554	35.719518
100000	11.730201	15.605677	18.888141	21.647667	23.996365	27.791552	31.994876	34.15467773	36.763738	40.014791	47.013544	54.037436
1000000	21.21239	27.156049	31.841856	35.580639	38.636451	43.355781	48.302255	50.74034051	53.598938	57.036407	64.007937	70.476682
10000000	36.873701	44.299302	49.659547	53.681361	56.820531	61.433991	65.993884	68.14629706	70.594954	73.437332	78.880433	83.570536
100000000	61.777584	68.256616	72.483775	75.448482	77.652045	80.729602	83.59777	84.89539576	86.329658	87.940176	90.866549	93.225716
1E+09	100	100	100	100	100	100	100	100	100	100	100	100

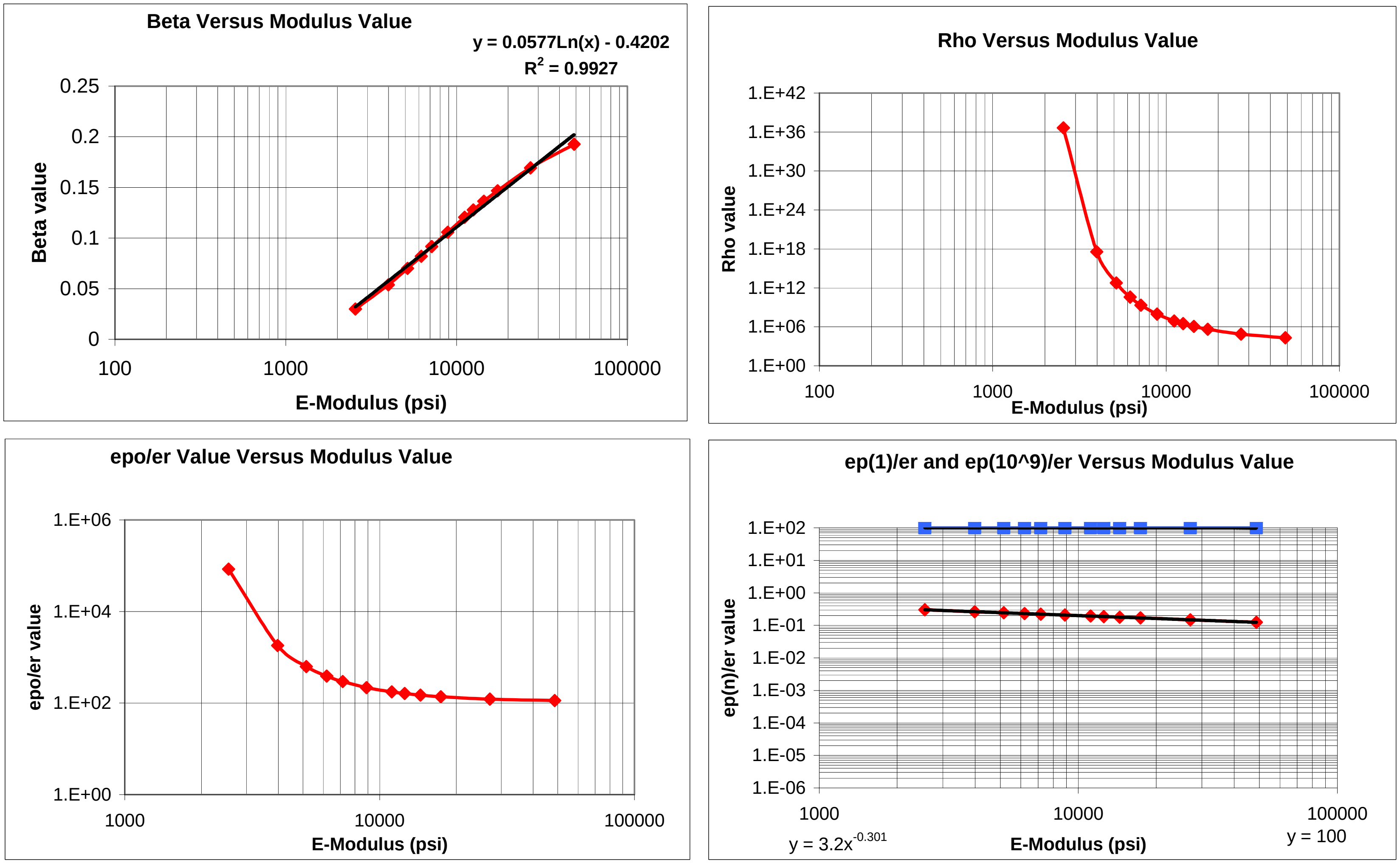


Figure B-69 Subgrade Material Set 11-C-B-1 graphs

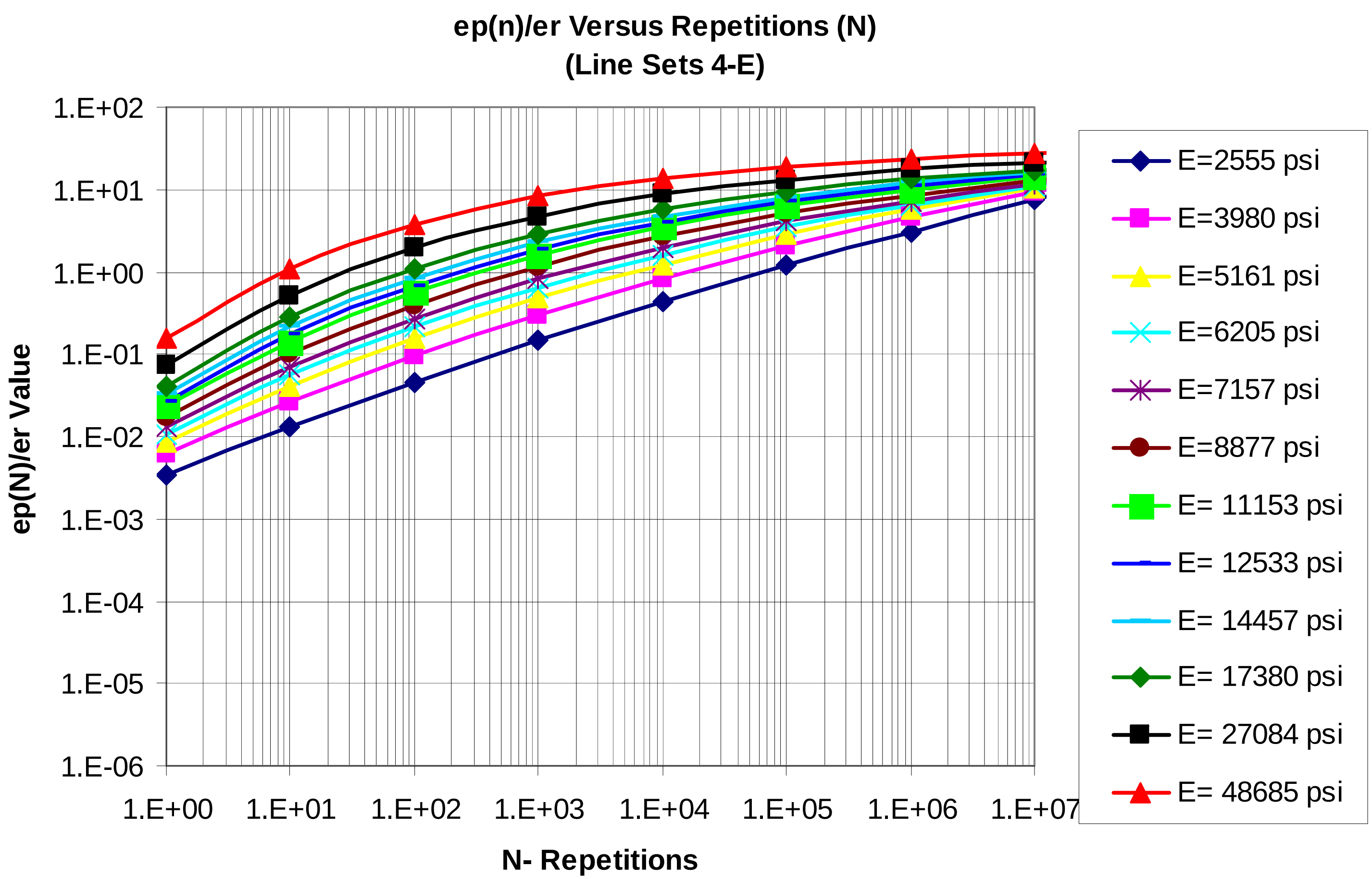


Figure B-70 Subgrade Material $\varepsilon_p/\ \varepsilon_r$ vs. Number of Load Repetitions Set 4-E

Table B-41 Unbound Material Rut Model Set 4-E Computations

N=1 Repetition

	ep(1)/er	E (psi)
Data Set 1	0.001	1000
Data Set 2	1	200000

b(1)=	1.303764
a(1)1=	1.227E-07
a(1)2=	1.227E-07
a(1)(avg)=	1.227E-07

N=10^7 Repetition

	ep(10^7)/er	E (psi)
Data Set 1	5	1000
Data Set 2	50	200000

b(10^7)=	0.434588
a(10^7)1=	0.2484311
a(10^7)2=	0.2484311
a(10^7)(avg)=	0.2484311

CBR=	1	2	3	4	5	7	10	12	15	20	40	100
GWT (ft)=	10	10	10	10	10	10	10	10	10	10	10	10
E (psi)=	2555	3981.5	5161.2	6204.5	7157	8876.7	11153	12533.3	14457.4	17380	27083.8	48684.5
ep(1)/er=	0.0033974	0.0060579	0.0084969	0.010802	0.0130127	0.0172304	0.0232034	0.02701582	0.032545	0.0413744	0.073776	0.1584744
ep(10^7)=	7.5165266	9.1147152	10.202883	11.052763	11.760501	12.914237	14.261127	15.00292901	15.963616	17.293414	20.970481	27.057629
Beta=	0.0299719	0.0538458	0.0700934	0.0821515	0.0916235	0.1058432	0.1205232	0.127772481	0.1363509	0.146865	0.1693629	0.1927432
C0=	-7.7018607	-7.3162887	-7.0907284	-6.9307081	-6.8065759	-6.6194084	-6.4209941	-6.31957812	-6.1954448	-6.0354175	-5.6498375	-5.140131
Rho=	3.038E+43	2.77E+20	3.585E+14	7.406E+11	2.087E+10	377840411	18124380	5372825.802	1527669.7	404477.29	41054.411	6192.5812
X1=	1826593.8	1815.8652	301.07085	136.29319	88.162647	56.096782	41.755878	37.78596659	34.615908	32.286122	31.105477	34.424492
X2=	1826593.8	1815.8652	301.07085	136.29319	88.162647	56.096782	41.755878	37.78596659	34.615908	32.286122	31.105477	34.424492
X(avg)=	1826593.8	1815.8652	301.07085	136.29319	88.162647	56.096782	41.755878	37.78596659	34.615908	32.286122	31.105477	34.424492

N	ep(0)/er=											
1	0.0033974	0.0060579	0.0084969	0.010802	0.0130127	0.0172304	0.0232034	0.02701582	0.032545	0.0413744	0.073776	0.1584744
10	0.0129819	0.02636	0.0404879	0.054991	0.0696654	0.0990915	0.1426903	0.171155285	0.212842	0.2796416	0.5194775	1.0902677
100	0.0453637	0.0966283	0.1528726	0.2114791	0.2710667	0.3903501	0.5650313	0.677342885	0.8392155	1.0923472	1.9475599	3.7576061
1000	0.1458295	0.3044236	0.4735157	0.6447996	0.8145249	1.1431174	1.6029203	1.887809639	2.2863675	2.8862169	4.7651958	8.3116467
10000	0.4336743	0.8389549	1.2392452	1.6223303	1.9854022	2.653382	3.5319305	4.051810078	4.7548164	5.7706381	8.7334427	13.832205
100000	1.1992744	2.0542897	2.8099963	3.481705	4.0850266	5.1334635	6.4263883	7.158125837	8.1178159	9.4576741	13.162162	19.178457
1000000	3.0989525	4.5314143	5.6397718	6.5506656	7.3272672	8.6105499	10.114058	10.9384673	11.999125	13.451849	17.375713	23.652083
10000000	7.5165266	9.1147152	10.202883	11.052763	11.760501	12.914237	14.261127	15.00292901	15.963616	17.293414	20.970481	27.057629
100000000	17.185369	16.89901	16.897052	17.041257	17.251471	17.743194	18.50201	18.9854727	19.665541	20.685989	23.817834	29.496575

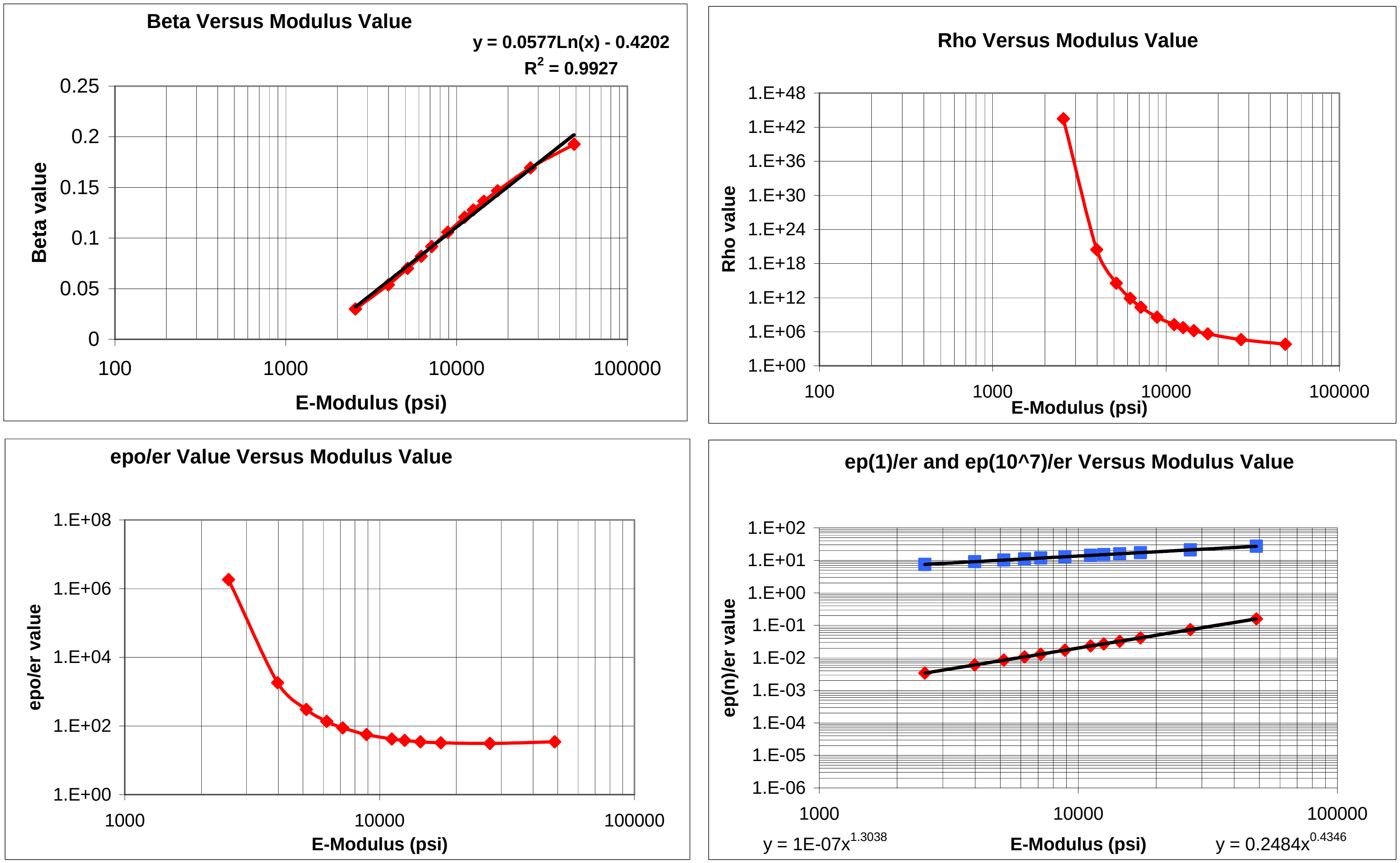


Figure B-71 Subgrade Material Set 4-E graphs

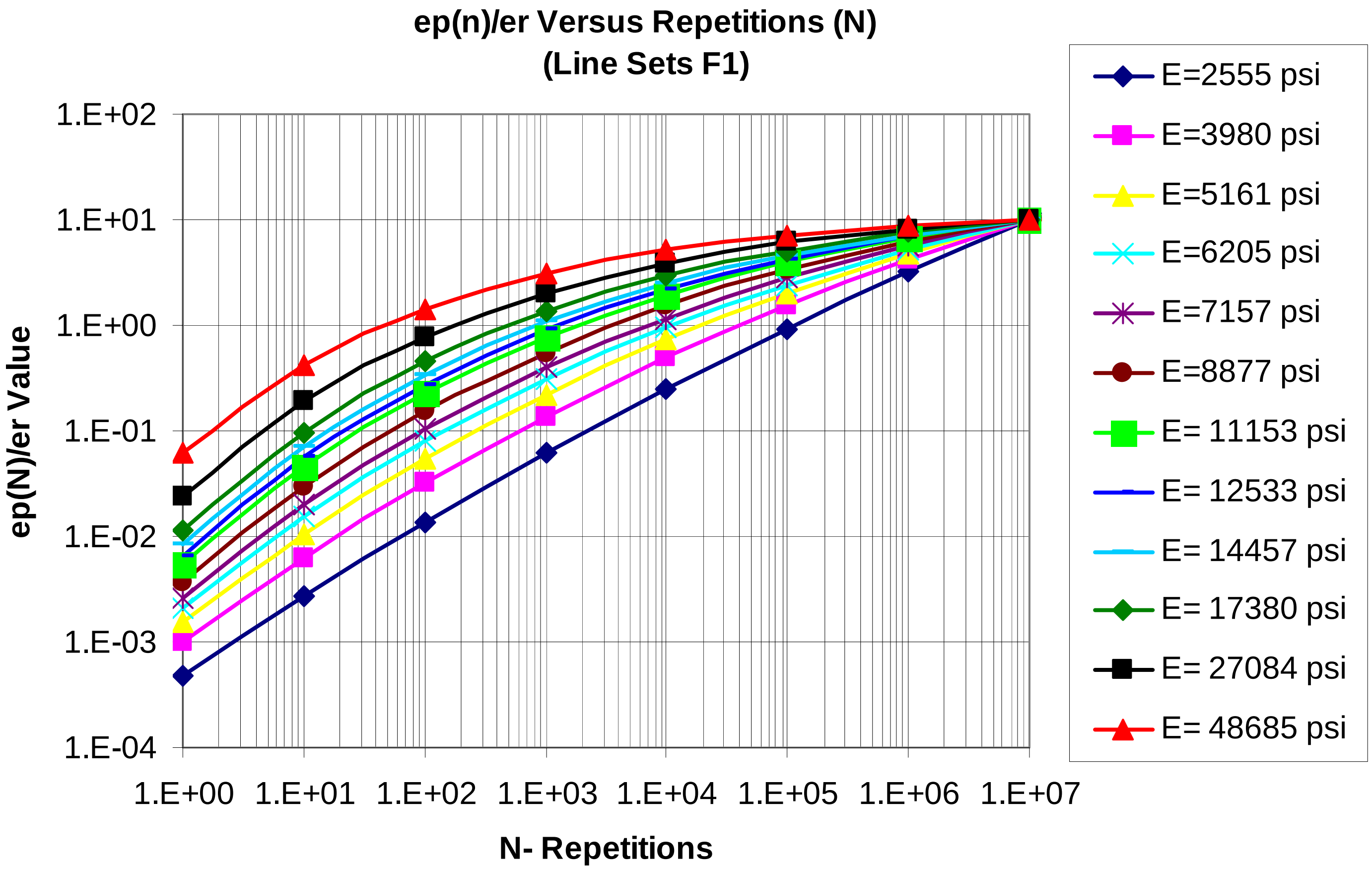


Figure B-72 Subgrade Material $\varepsilon_p / \varepsilon_r$ vs. Number of Load Repetitions Set 1-F

Table B-42 Unbound Material Rut Model Set 1-F Computations

N=1 Repetition

	ep(1)/er	E (psi)
Data Set 1	0.001	4000
Data Set 2	0.1	65000

b(1)=	1.6517277
a(1)1=	1.123E-09
a(1)2=	1.123E-09
a(1)(avg)=	1.123E-09

N=10^7 Repetition

	ep(10^7)/er	E (psi)
Data Set 1	10	1000
Data Set 2	10	100000

b(10^7)=	0
a(10^7)1=	10
a(10^7)2=	10
a(10^7)(avg)=	10

CBR=	1	2	3	4	5	7	10	12	15	20	40	100
GWT (ft)=	10	10	10	10	10	10	10	10	10	10	10	10
E (psi)=	2555	3981.5	5161.2	6204.5	7157	8876.7	11153	12533.3	14457.4	17380	27083.8	48684.5
ep(1)/er=	0.0004769	0.0009924	0.0015235	0.0020649	0.0026142	0.0037309	0.0054396	0.006595776	0.0083505	0.0113184	0.0235509	0.0620399
ep(10^7)=	10	10	10	10	10	10	10	10	10	10	10	10
Beta=	0.0299719	0.0538458	0.0700934	0.0821515	0.0916235	0.1058432	0.1205232	0.127772481	0.1363509	0.146865	0.1693629	0.1927432
C0=	-9.9507143	-9.2179973	-8.7893567	-8.4852642	-8.2493709	-7.8936896	-7.5166354	-7.32391089	-7.0880156	-6.7839099	-6.0511777	-5.0825634
Rho=	1.566E+47	2.023E+22	7.674E+15	8.697E+12	1.702E+11	1.994E+09	66983057	17042106.35	4099384.5	896611.82	61565.393	5841.0909
X1=	90816439	7888.6664	663.86615	216.62824	114.89557	57.631959	35.170254	29.16806143	24.242222	20.172532	15.254283	12.688391
X2=	90816439	7888.6664	663.86615	216.62824	114.89557	57.631959	35.170254	29.16806143	24.242222	20.172532	15.254283	12.688391
X(avg)=	90816439	7888.6664	663.86615	216.62824	114.89557	57.631959	35.170254	29.16806143	24.242222	20.172532	15.254283	12.688391

N	ep(0)/er=											
1	0.0004769	0.0009924	0.0015235	0.0020649	0.0026142	0.0037309	0.0054396	0.006595776	0.0083505	0.0113184	0.0235509	0.0620399
10	0.0026956	0.0063285	0.0105519	0.0151432	0.0199731	0.0300476	0.0456051	0.056034943	0.0715791	0.0969555	0.1904899	0.4176997
100	0.0135731	0.032516	0.0547724	0.0787778	0.1036526	0.1541166	0.2283892	0.275944223	0.343907	0.4484556	0.7844499	1.4197891
1000	0.0613612	0.1380424	0.2224282	0.3084308	0.3932728	0.5550303	0.7740783	0.905140301	1.0824872	1.3366535	2.045309	3.1127074
10000	0.2508509	0.4951182	0.7330015	0.9544482	1.1578675	1.5150504	1.9517751	2.193413096	2.5016273	2.912257	3.9133931	5.1506878
100000	0.9335935	1.5301147	2.0222146	2.4310544	2.7760387	3.3282221	3.9331614	4.241786372	4.6131337	5.0745704	6.0722502	7.1153783
1000000	3.1830242	4.1457211	4.7958121	5.2705622	5.6358526	6.166996	6.6881824	6.933825864	7.2136725	7.5399973	8.175853	8.7545523
10000000	10	10	10	10	10	10	10	10	10	10	10	10
100000000	29.107629	21.767552	18.688393	16.990495	15.910077	14.605684	13.563064	13.13695174	12.694734	12.23048	11.460979	10.890857

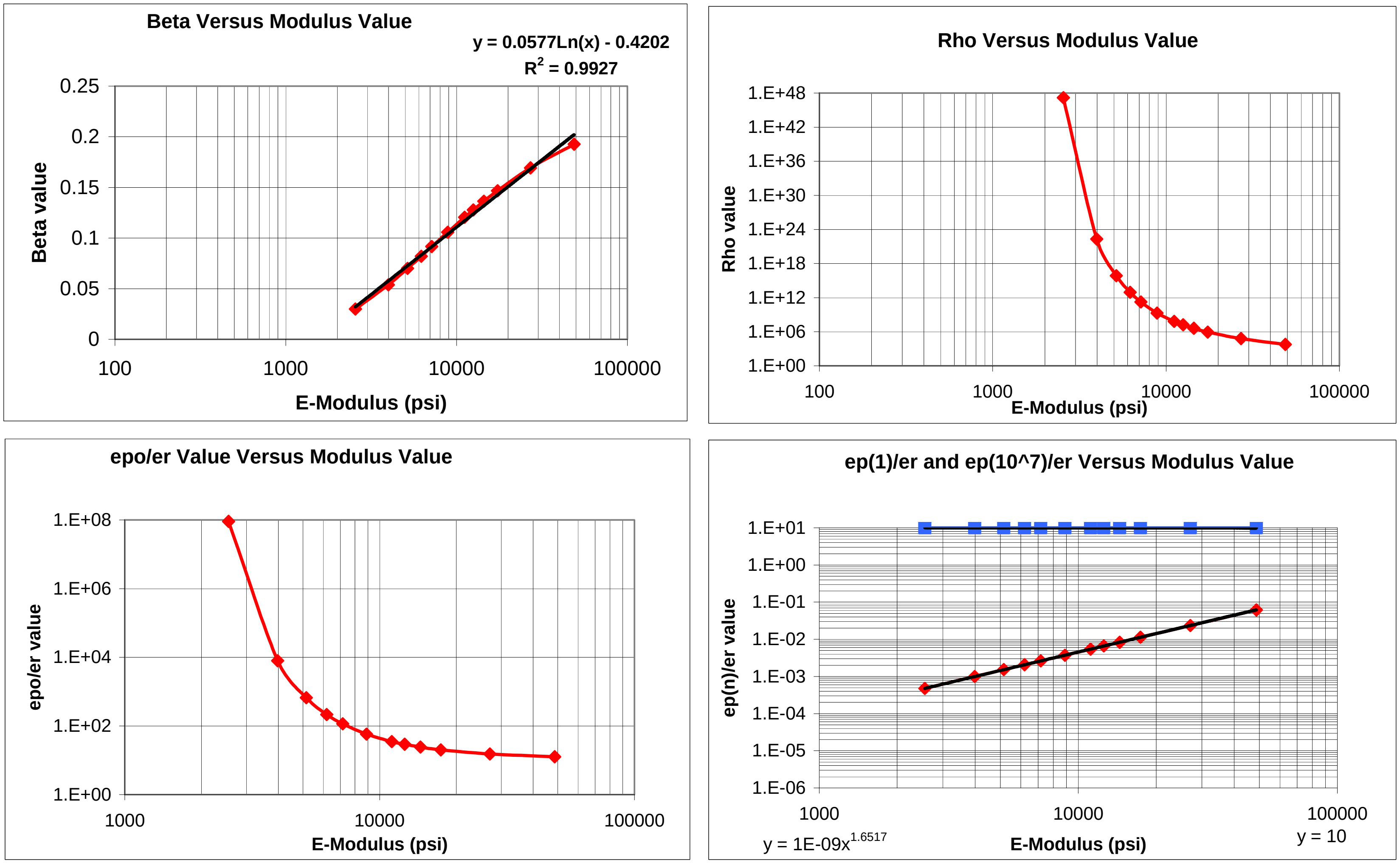


Figure B-73 Subgrade Material Set 1-F graphs

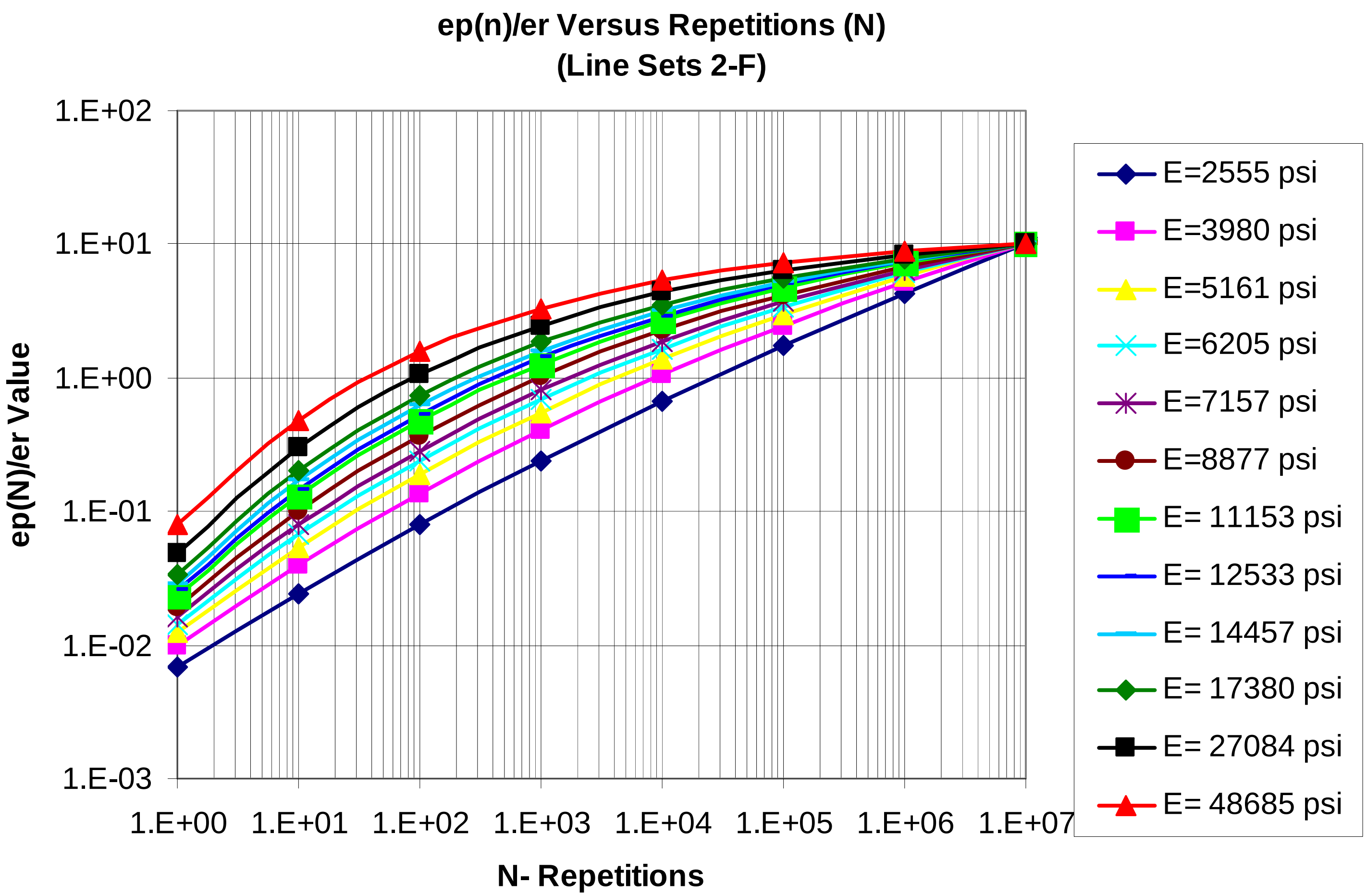


Figure B-74 Subgrade Material $\varepsilon_p / \varepsilon_r$ vs. Number of Load Repetitions Set 2-F

Table B-43 Unbound Material Rut Model Set 2-F Computations

N=1 Repetition

	ep(1)/er	**E (psi)**
Data Set 1	0.01	4000
Data Set 2	0.1	65000

b(1)=	0.8258638
a(1)1=	1.06E-05
a(1)2=	1.06E-05
a(1)(avg)=	1.06E-05

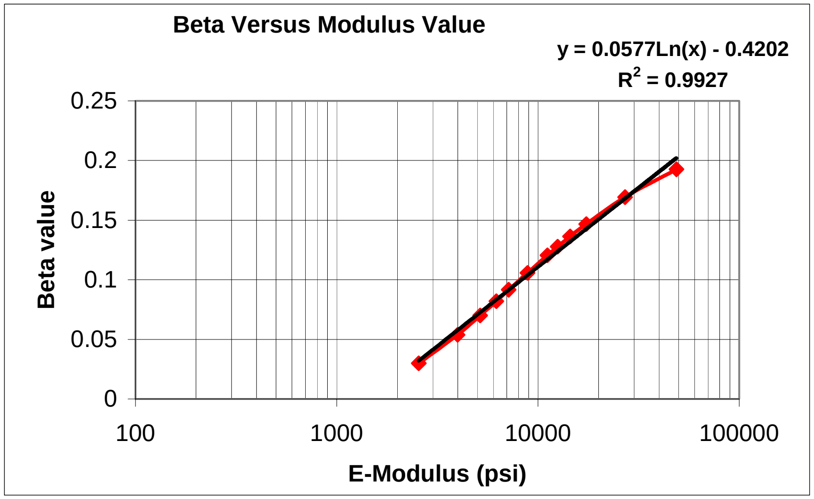
N=10^7 Repetition

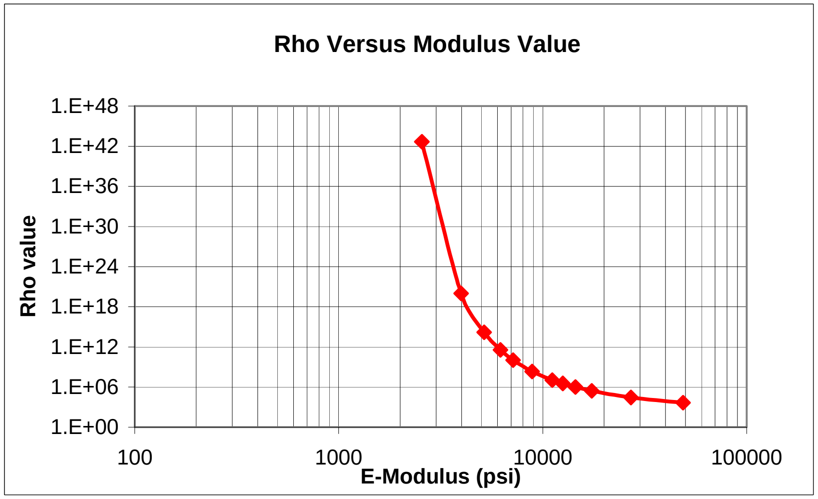
	ep(10^7)/er	**E (psi)**
Data Set 1	10	1000
Data Set 2	10	100000

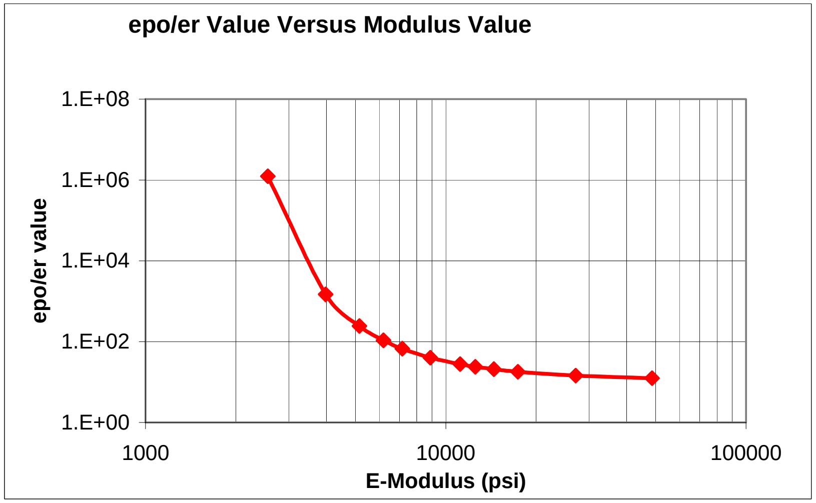
b(10^7)=	0
a(10^7)1=	10
a(10^7)2=	10
a(10^7)(avg)=	10

CBR=	1	2	3	4	5	7	10	12	15	20	40	100
GWT (ft)=	10	10	10	10	10	10	10	10	10	10	10	10
E (psi)=	2555	3981.5	5161.2	6204.5	7157	8876.7	11153	12533.3	14457.4	17380	27083.8	48684.5
ep(1)/er=	0.0069061	0.0099618	0.0123428	0.0143697	0.0161686	0.0193156	0.0233229	0.025682243	0.0288973	0.0336428	0.0485292	0.0787654
ep(10^7)=	10	10	10	10	10	10	10	10	10	10	10	10
Beta=	0.0299719	0.0538458	0.0700934	0.0821515	0.0916235	0.1058432	0.1205232	0.127772481	0.1363509	0.146865	0.1693629	0.1927432
C0=	-7.2779422	-6.9115838	-6.6972634	-6.5452172	-6.4272706	-6.2494299	-6.0609028	-5.96454054	-5.8465929	-5.69454	-5.3281739	-4.8438668
Rho=	4.595E+42	9.627E+19	1.588E+14	3.69E+11	1.116E+10	219437283	11227815	3417220.667	998699.8	272255.47	29043.312	4551.0146
X1=	1227988.7	1486.4527	244.55606	107.23114	67.004835	40.014445	27.567585	23.9120819	20.759501	18.022771	14.503736	12.547298
X2=	1227988.7	1486.4527	244.55606	107.23114	67.004835	40.014445	27.567585	23.9120819	20.759501	18.022771	14.503736	12.547298
X(avg)=	1227988.7	1486.4527	244.55606	107.23114	67.004835	40.014445	27.567585	23.9120819	20.759501	18.022771	14.503736	12.547298

N	ep(0)/er=											
1	0.0069061	0.0099618	0.0123428	0.0143697	0.0161686	0.0193156	0.0233229	0.025682243	0.0288973	0.0336428	0.0485292	0.0787654
10	0.0245121	0.0399611	0.0539332	0.0668228	0.0788346	0.1007356	0.1295352	0.146676687	0.1700229	0.2041228	0.3057704	0.4848793
100	0.0799548	0.1363294	0.1891657	0.2384318	0.2843766	0.3675542	0.4748406	0.537299019	0.6205466	0.7382922	1.0632716	1.5561041
1000	0.2410283	0.4030842	0.5503022	0.6832702	0.8037008	1.0136224	1.2705502	1.413698861	1.5978563	1.8465623	2.472353	3.2880807
10000	0.6750474	1.0502743	1.3653348	1.6331231	1.8641272	2.2446289	2.6782487	2.906786954	3.1887483	3.5502951	4.3775972	5.3137013
100000	1.7651211	2.4474413	2.9584092	3.3591149	3.684345	4.185388	4.7122396	4.973686484	5.2825678	5.6585698	6.4451846	7.2300174
1000000	4.3289008	5.167488	5.7124865	6.1016992	6.3968629	6.8202679	7.2300343	7.421462451	7.6383483	7.8897474	8.3749795	8.8094106
10000000	10	10	10	10	10	10	10	10	10	10	10	10
100000000	21.84611	17.917897	16.103891	15.051243	14.359106	13.497456	12.785695	12.4882377	12.175157	11.841363	11.27576	10.847296







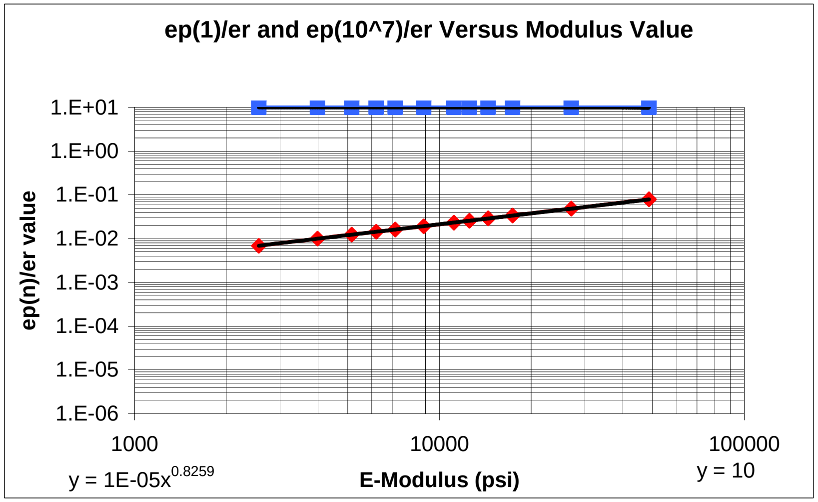


Figure B-75 Subgrade Material Set 2-F graphs

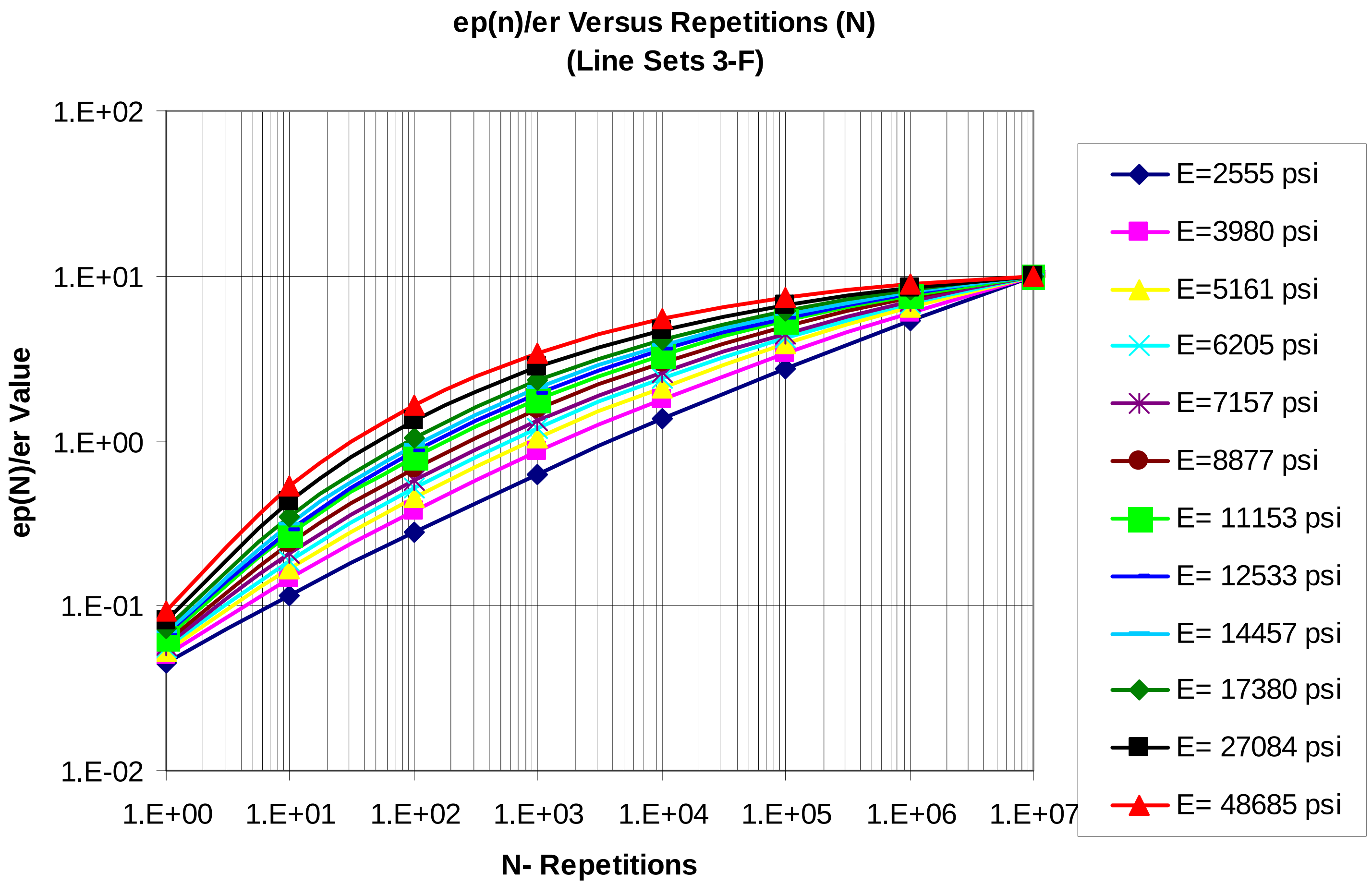


Figure B-76 Subgrade Material ε_p/ ε_r vs. Number of Load Repetitions Set 3-F

Table B-44 Unbound Material Rut Model Set 3-F Computations

N=1 Repetition

	ep(1)/er	E (psi)
Data Set 1	0.05	4000
Data Set 2	0.1	65000

b(1)= 0.2486098
a(1)1= 0.0063601
a(1)2= 0.0063601

a(1)(avg)= 0.0063601

N=10^7 Repetition

	ep(10^7)/er	E (psi)
Data Set 1	10	1000
Data Set 2	10	100000

b(10^7)= 0
a(10^7)1= 10
a(10^7)2= 10

a(10^7)(avg)= 10

CBR=	1	2	3	4	5	7	10	12	15	20	40	100
GWT (ft)=	10	10	10	10	10	10	10	10	10	10	10	10
E (psi)=	2555	3981.5	5161.2	6204.5	7157	8876.7	11153	12533.3	14457.4	17380	27083.8	48684.5
ep(1)/er=	0.0447274	0.0499424	0.0532707	0.0557656	0.0577812	0.0609588	0.0645184	0.066417391	0.068818	0.0720411	0.080441	0.0930666
ep(10^7)=	10	10	10	10	10	10	10	10	10	10	10	10
Beta=	0.0299719	0.0538458	0.0700934	0.0821515	0.0916235	0.1058432	0.1205232	0.127772481	0.1363509	0.146865	0.1693629	0.1927432
C0=	-5.4097547	-5.2994699	-5.234953	-5.1891825	-5.1536771	-5.1001417	-5.0433894	-5.01438144	-4.9788757	-4.9331032	-4.822816	-4.677025
Rho=	2.311E+38	6.94E+17	4.725E+12	2.186E+10	1.002E+09	32170113	2443761.9	878774.7592	307417.88	102450.89	16125.523	3794.2862
X1=	60651.328	462.91466	121.68406	65.593314	45.963106	31.007545	23.252194	20.81148856	18.626764	16.657689	14.001163	12.44961
X2=	60651.328	462.91466	121.68406	65.593314	45.963106	31.007545	23.252194	20.81148856	18.626764	16.657689	14.001163	12.44961
X(avg)=	60651.328	462.91466	121.68406	65.593314	45.963106	31.007545	23.252194	20.81148856	18.626764	16.657689	14.001163	12.44961

N	ep(0)/er=											
1	0.0447274	0.0499424	0.0532707	0.0557656	0.0577812	0.0609588	0.0645184	0.066417391	0.068818	0.0720411	0.080441	0.0930666
10	0.1146846	0.1448943	0.1686914	0.1886062	0.2058221	0.2346408	0.2687094	0.287383723	0.3112614	0.3434645	0.4256476	0.5381528
100	0.2761639	0.3712728	0.4498673	0.5170602	0.5757871	0.6747811	0.7920105	0.856040457	0.9374407	1.0460716	1.3151142	1.6590826
1000	0.6271591	0.8524807	1.0365351	1.1913544	1.3245093	1.5441818	1.7964495	1.930661618	2.0977031	2.3145204	2.8227456	3.4164955
10000	1.3484488	1.7765688	2.1088947	2.3771975	2.6003643	2.9544113	3.3412129	3.539094673	3.7782443	4.0775581	4.7343818	5.4306966
100000	2.7549977	3.3985526	3.8596662	4.2109622	4.4904309	4.9124667	5.3467077	5.559016106	5.8073607	6.1062297	6.7193722	7.3112416
1000000	5.3668133	6.0277676	6.4553688	6.7592885	6.9890086	7.3175522	7.6346316	7.782527917	7.9499427	8.143801	8.5170356	8.847959
10000000	10	10	10	10	10	10	10	10	10	10	10	10
100000000	17.875557	15.638976	14.512714	13.828753	13.365705	12.773156	12.268947	12.05392254	11.824667	11.576756	11.148077	10.816951

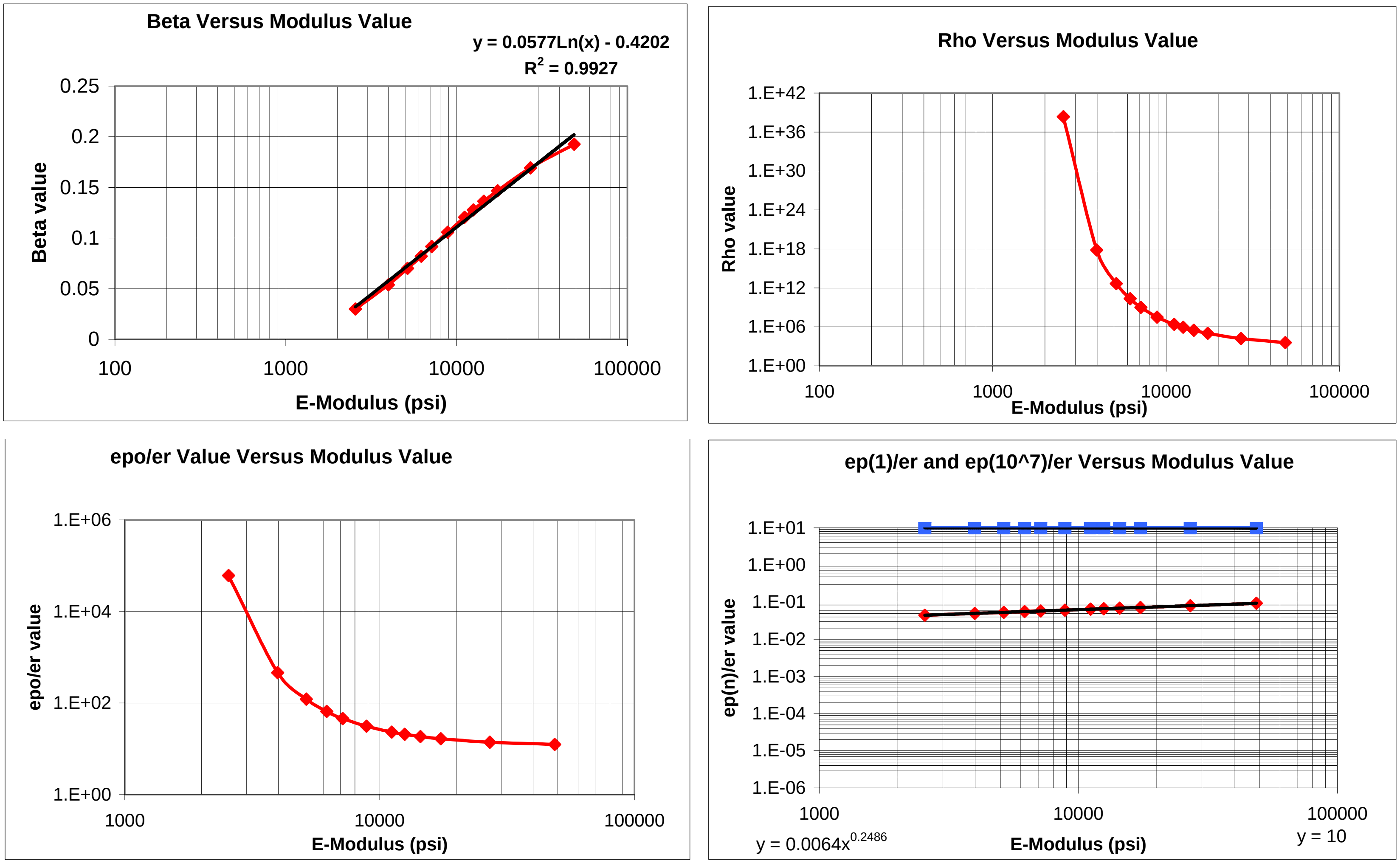


Figure B-77 Subgrade Material Set 3-F graphs

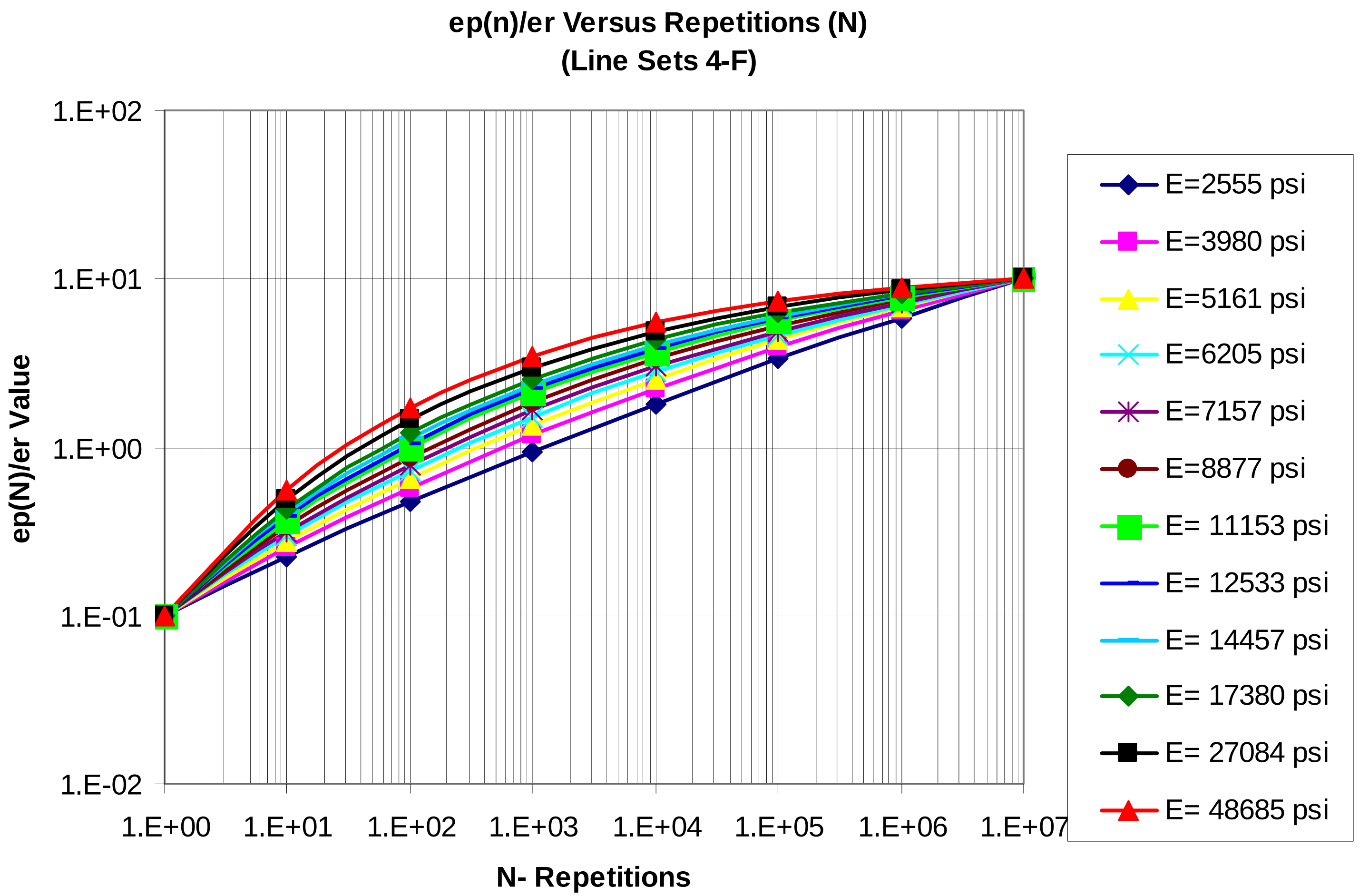


Figure B-78 Subgrade Material $\varepsilon_p / \varepsilon_r$ vs. Number of Load Repetitions Set 4-F

Table B-45 Unbound Material Rut Model Set 4-F Computations

N=1 Repetition

	ep(1)/er	E (psi)
Data Set 1	0.1	4000
Data Set 2	0.1	65000

b(1)= 0
a(1)1= 0.1
a(1)2= 0.1

a(1)(avg)= 0.1

N=10^7 Repetition

	ep(10^7)/er	E (psi)
Data Set 1	10	1000
Data Set 2	10	100000

b(10^7)= 0
a(10^7)1= 10
a(10^7)2= 10

a(10^7)(avg)= 10

CBR=	1	2	3	4	5	7	10	12	15	20	40	100
GWT (ft)=	10	10	10	10	10	10	10	10	10	10	10	10
E (psi)=	2555	3981.5	5161.2	6204.5	7157	8876.7	11153	12533.3	14457.4	17380	27083.8	48684.5
ep(1)/er=	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
ep(10^7)=	10	10	10	10	10	10	10	10	10	10	10	10
Beta=	0.0299719	0.0538458	0.0700934	0.0821515	0.0916235	0.1058432	0.1205232	0.127772481	0.1363509	0.146865	0.1693629	0.1927432
C0=	-4.6051702	-4.6051702	-4.6051702	-4.6051702	-4.6051702	-4.6051702	-4.6051702	-4.60517019	-4.6051702	-4.6051702	-4.6051702	-4.6051702
Rho=	1.073E+36	5.113E+16	7.59E+11	5.111E+09	293523503	12262060	1149511.8	451358.8626	173464.9	64135.865	12277.202	3501.4202
X1=	16604.441	280.09064	90.089949	53.079494	39.075902	27.782429	21.608367	19.60321094	17.777119	16.102107	13.790117	12.407773
X2=	16604.441	280.09064	90.089949	53.079494	39.075902	27.782429	21.608367	19.60321094	17.777119	16.102107	13.790117	12.407773
X(avg)=	16604.441	280.09064	90.089949	53.079494	39.075902	27.782429	21.608367	19.60321094	17.777119	16.102107	13.790117	12.407773

N	ep(0)/er=											
1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
10	0.2229009	0.2523351	0.2756638	0.294871	0.3111626	0.33772	0.3679275	0.383939904	0.4038578	0.4297448	0.4908163	0.5628636
100	0.470988	0.5715865	0.6533155	0.7216466	0.7802028	0.8765835	0.9872338	1.046190538	1.1197159	1.2154499	1.4411966	1.7055068
1000	0.9467643	1.1770064	1.3614843	1.5136561	1.6424603	1.8511247	2.0854451	2.207994128	2.3585913	2.550992	2.9885603	3.4733346
10000	1.816573	2.2279045	2.5431584	2.7943801	3.0011812	3.3255389	3.6751243	3.852174681	4.0646007	4.3281191	4.8968648	5.481874
100000	3.3372686	3.914719	4.3280198	4.6414646	4.8898447	5.2633125	5.6456372	5.831872486	6.0491469	6.309778	6.8410233	7.3465035
1000000	5.8872888	6.4410825	6.8043745	7.0639016	7.2606325	7.5427411	7.8157851	7.943393155	8.0880252	8.255721	8.5789558	8.8646128
10000000	10	10	10	10	10	10	10	10	10	10	10	10
100000000	16.396132	14.749065	13.876812	13.333332	12.95933	12.473316	12.05288	11.87155773	11.676845	11.464626	11.093534	10.803909

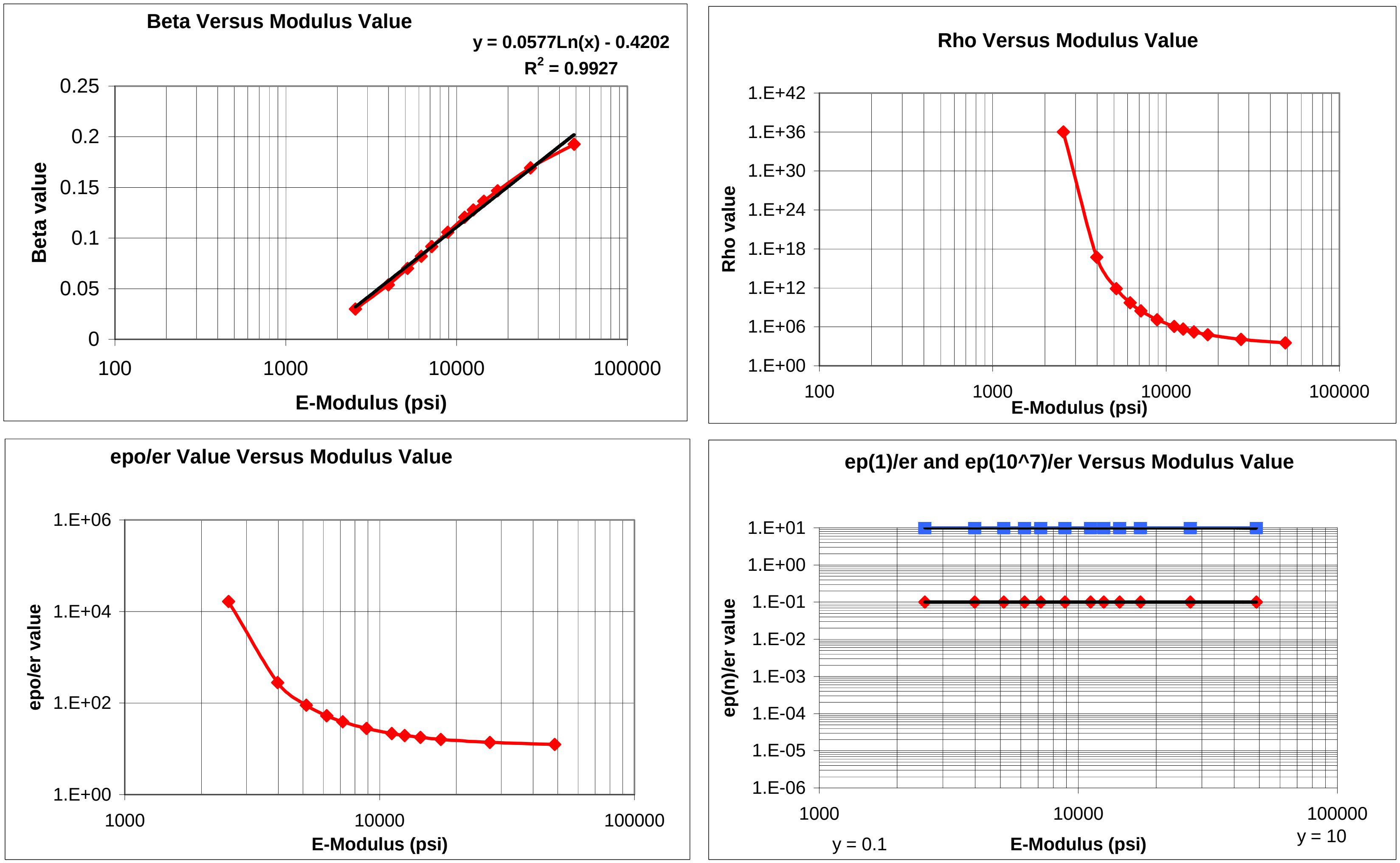


Figure B-79 Subgrade Material Set 4-F graphs

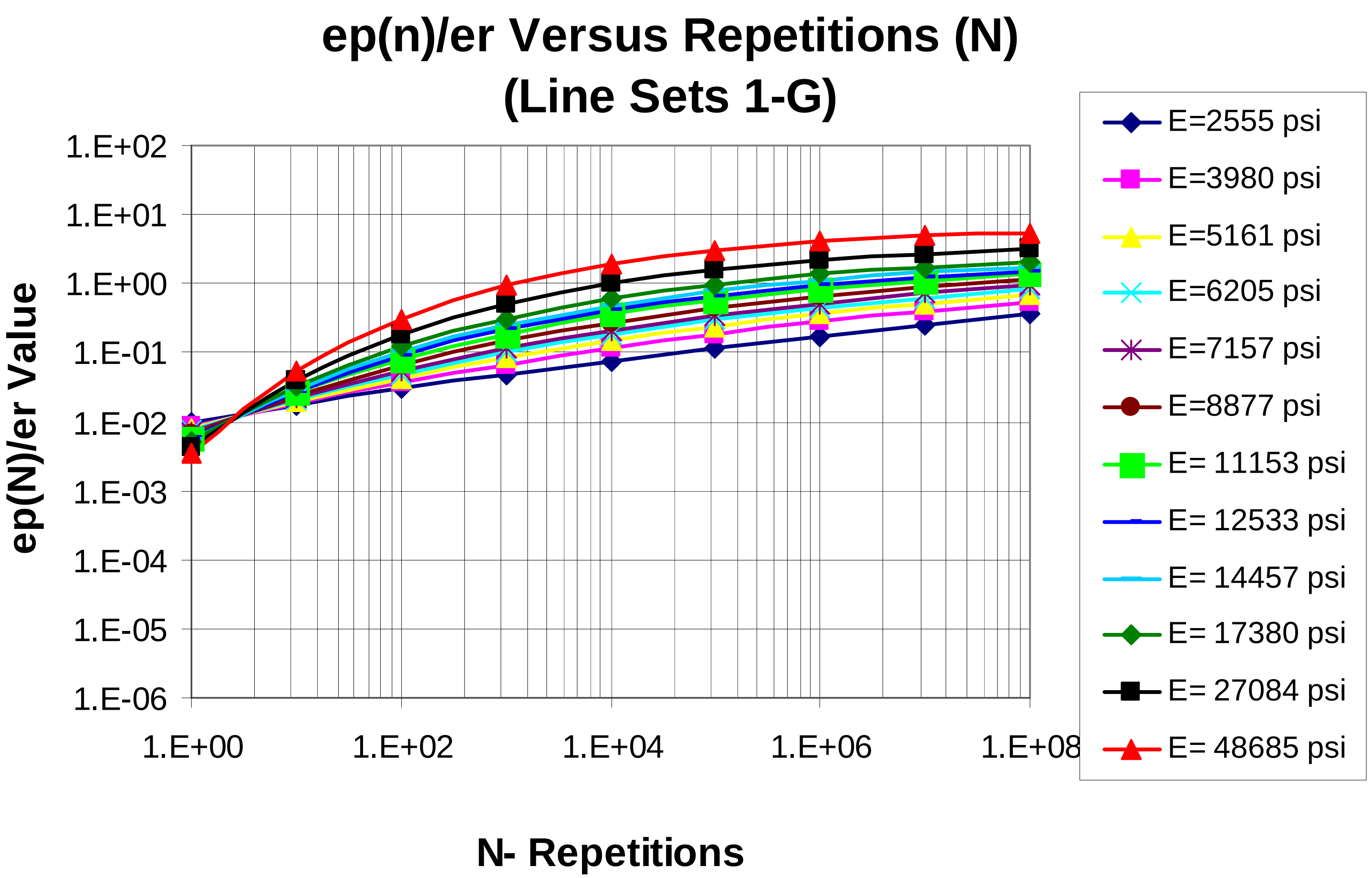


Figure B-80 Subgrade Material ε_p/ ε_r vs. Number of Load Repetitions Set 1-G

Table B-46 Unbound Material Rut Model Set 1-G Computations

N=1 Repetition

	ep(1)/er	E (psi)
Data Set 1	0.01	2500
Data Set 2	0.0035	50000

b(1)=	-0.3504392
a(1)1=	0.155157
a(1)2=	0.155157
a(1)(avg)=	0.155157

N=10^7 Repetition

	ep(10^7)/er	E (psi)
Data Set 1	0.1	1000
Data Set 2	10	100,000

b(10^7)=	1
a(10^7)1=	0.0001
a(10^7)2=	0.0001
a(10^7)(avg)=	0.0001

CBR=	1	2	3	4	5	7	10	12	15	20	40	100
GWT (ft)=	10	10	10	10	10	10	10	10	10	10	10	10
E (psi)=	2555	3981.5	5161.2	6204.5	7157	8876.7	11153	12533.3	14457.4	17380	27083.8	48684.5
ep(1)/er=	0.009924	0.0084952	0.0077567	0.0072721	0.0069171	0.0064143	0.0059212	0.005683928	0.0054065	0.0050686	0.0043389	0.0035329
ep(10^7)=	0.2555	0.39815	0.51612	0.62045	0.7157	0.88767	1.1153	1.25333	1.44574	1.738	2.70838	4.86845
Beta=	0.0299719	0.0538458	0.0700934	0.0821515	0.0916235	0.1058432	0.1205232	0.127772481	0.1363509	0.146865	0.1693629	0.1927432
C0=	-3.2482634	-3.8473269	-4.19778	-4.4464036	-4.639268	-4.9300702	-5.2383467	-5.39591671	-5.5887828	-5.8374172	-6.4364932	-7.2284244
Rho=	9.391E+30	1.814E+15	2.025E+11	3.335E+09	318133692	23350307	3347553.6	1560026.99	717453.37	322296.32	88640.518	36315.603
X1=	47.72882	6.4442544	3.8280084	3.1091465	2.8250275	2.6505149	2.679302	2.757958293	2.9061577	3.1789957	4.2440363	6.8305486
X2=	47.72882	6.4442544	3.8280084	3.1091465	2.8250275	2.6505149	2.679302	2.757958293	2.9061577	3.1789957	4.2440363	6.8305486
X(avg)=	47.72882	6.4442544	3.8280084	3.1091465	2.8250275	2.6505149	2.679302	2.757958293	2.9061577	3.1789957	4.2440363	6.8305486

N	ep(0)/er=											
1	0.009924	0.0084952	0.0077567	0.0072721	0.0069171	0.0064143	0.0059212	0.005683928	0.0054065	0.0050686	0.0043389	0.0035329
10	0.0174674	0.0184077	0.0195479	0.0206585	0.021705	0.0236046	0.026059	0.027493799	0.0294188	0.0321763	0.0400913	0.0532087
100	0.0296071	0.0364475	0.0429232	0.049022	0.0547944	0.0655326	0.0800851	0.088988756	0.1014141	0.1201937	0.1806696	0.3031677
1000	0.0484486	0.066641	0.0838246	0.1002313	0.1159891	0.1458828	0.1874931	0.213511987	0.2504659	0.3076144	0.5007032	0.925831
10000	0.0767192	0.1135679	0.1481586	0.1811682	0.2128889	0.2731369	0.3571839	0.409858203	0.4848403	0.6012156	0.9984319	1.8949829
100000	0.1178187	0.1818754	0.2405554	0.2957019	0.3481173	0.4465244	0.5820591	0.666286046	0.7855189	0.9695089	1.5931762	3.0004516
1000000	0.175833	0.2757046	0.3633549	0.4435634	0.5184132	0.6563573	0.8426531	0.956977421	1.1175035	1.3631077	2.1861156	4.0293574
10000000	0.2555	0.39815	0.51612	0.62045	0.7157	0.88767	1.1153	1.25333	1.44574	1.738	2.70838	4.86845
100000000	0.3621255	0.5508568	0.6957496	0.8191023	0.9292812	1.1246181	1.3792148	1.532380953	1.7450011	2.0667747	3.1311388	5.4966793

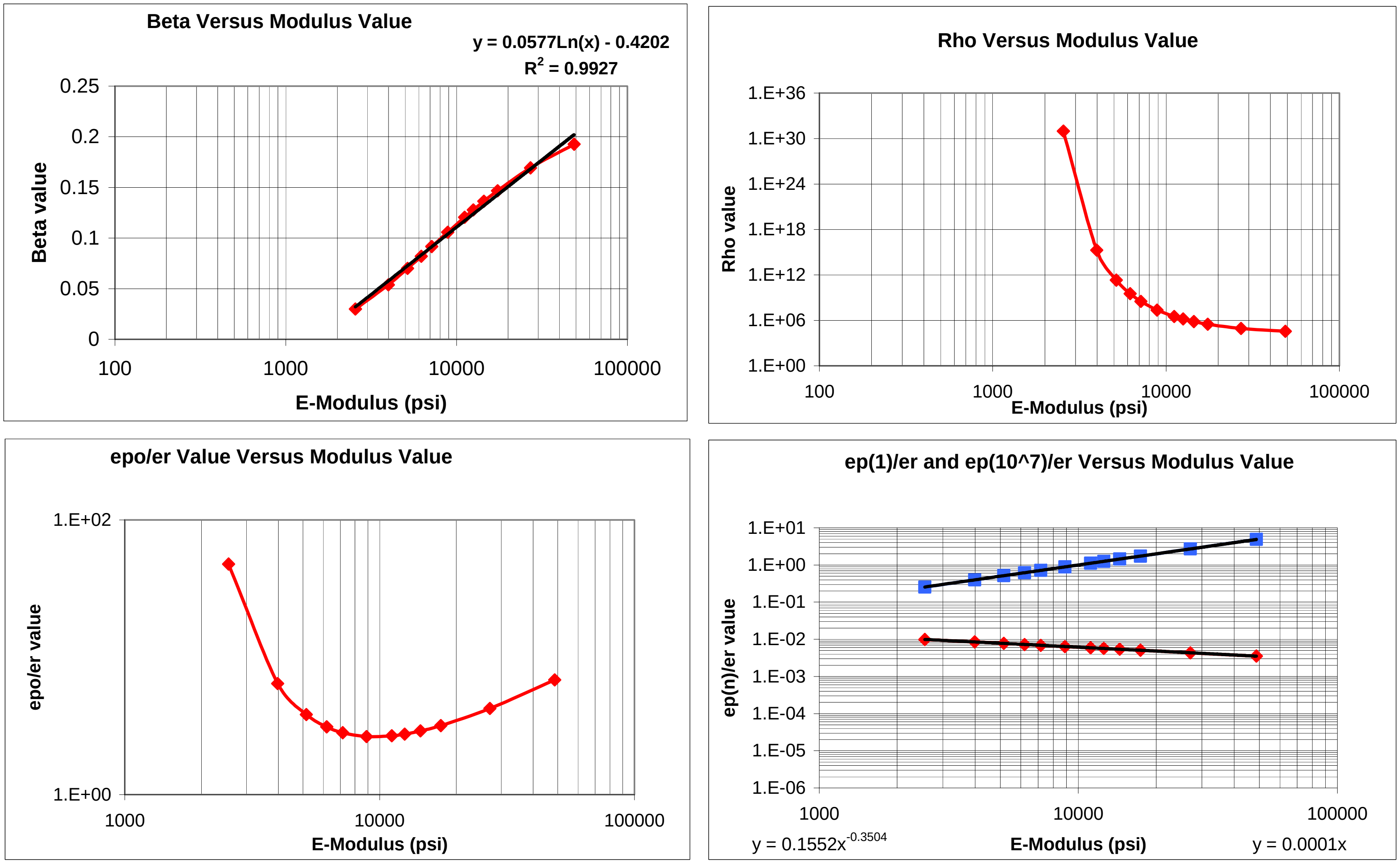


Figure B-81 Subgrade Material Set 1-G graphs

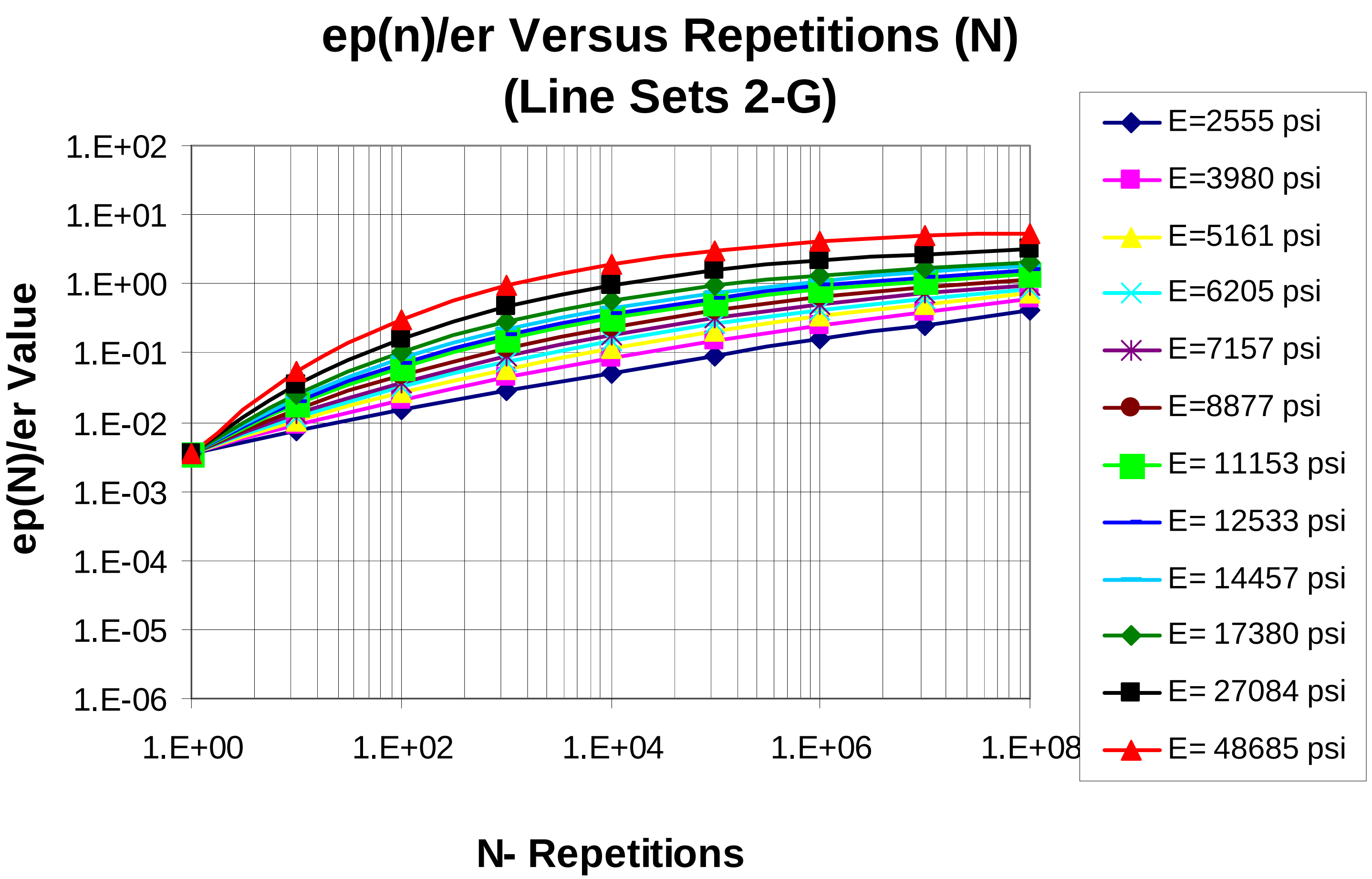


Figure B-82 Subgrade Material ε_p/ ε_r vs. Number of Load Repetitions Set 2-G

Table B-47 Unbound Material Rut Model Set 2-G Computations

N=1 Repetition

	ep(1)/er	E (psi)
Data Set 1	0.0035	2500
Data Set 2	0.0035	50000

b(1)= 0
a(1)1= 0.0035
a(1)2= 0.0035

a(1)(avg)= 0.0035

N=10^7 Repetition

	ep(10^7)/er	E (psi)
Data Set 1	0.1	1000
Data Set 2	10	100,000

b(10^7)= 1
a(10^7)1= 0.0001
a(10^7)2= 0.0001

a(10^7)(avg)= 0.0001

CBR=	1	2	3	4	5	7	10	12	15	20	40	100
GWT (ft)=	10	10	10	10	10	10	10	10	10	10	10	10
E (psi)=	2555	3981.5	5161.2	6204.5	7157	8876.7	11153	12533.3	14457.4	17380	27083.8	48684.5
ep(1)/er=	0.0035	0.0035	0.0035	0.0035	0.0035	0.0035	0.0035	0.0035	0.0035	0.0035	0.0035	0.0035
ep(10^7)=	0.2555	0.39815	0.51612	0.62045	0.7157	0.88767	1.1153	1.25333	1.44574	1.738	2.70838	4.86845
Beta=	0.0299719	0.0538458	0.0700934	0.0821515	0.0916235	0.1058432	0.1205232	0.127772481	0.1363509	0.146865	0.1693629	0.1927432
C0=	-4.2904594	-4.7340659	-4.9935763	-5.1776821	-5.3204981	-5.5358371	-5.7641157	-5.88079632	-6.0236136	-6.2077273	-6.651343	-7.2377679
Rho=	1.011E+35	8.538E+16	2.41E+12	2.128E+10	1.419E+09	69792584	7402506	3059230.162	1242915.6	489932.19	107604.48	36559.809
X1=	255.5934	12.242053	5.5968761	4.0528078	3.4560669	3.0318245	2.9256692	2.960512541	3.0683978	3.3031307	4.3081468	6.8335391
X2=	255.5934	12.242053	5.5968761	4.0528078	3.4560669	3.0318245	2.9256692	2.960512541	3.0683978	3.3031307	4.3081468	6.8335391
X(avg)=	255.5934	12.242053	5.5968761	4.0528078	3.4560669	3.0318245	2.9256692	2.960512541	3.0683978	3.3031307	4.3081468	6.8335391

N	ep(0)/er=											
1	0.0035	0.0035	0.0035	0.0035	0.0035	0.0035	0.0035	0.0035	0.0035	0.0035	0.0035	0.0035
10	0.0073857	0.0090635	0.0105097	0.0118055	0.0129907	0.0151162	0.0178736	0.019506145	0.0217281	0.0249822	0.0348319	0.052899
100	0.0148281	0.0210058	0.026788	0.0322923	0.0375719	0.0475765	0.0614817	0.070163249	0.0824732	0.1014574	0.1650578	0.3020817
1000	0.0284181	0.0441385	0.0593916	0.0742669	0.0887907	0.1168536	0.1567685	0.182117478	0.218531	0.2756126	0.4732695	0.9238468
10000	0.0521513	0.0850533	0.1169425	0.1479636	0.1781682	0.236312	0.3186099	0.370691393	0.4453293	0.5620623	0.9657215	1.892673
100000	0.0919079	0.1518264	0.2081441	0.2617704	0.3131582	0.4103737	0.5452809	0.629509925	0.7491067	0.9342661	1.5652061	2.998575
1000000	0.155966	0.2533136	0.3399664	0.4197442	0.4944364	0.6324561	0.8192748	0.934056834	1.0953355	1.3422589	2.1705389	4.0283723
10000000	0.2555	0.39815	0.51612	0.62045	0.7157	0.88767	1.1153	1.25333	1.44574	1.738	2.70838	4.86845
100000000	0.405002	0.5936559	0.7362771	0.8573888	0.9656087	1.1577922	1.4089319	1.560312838	1.7707316	2.0896154	3.1463354	5.4975417

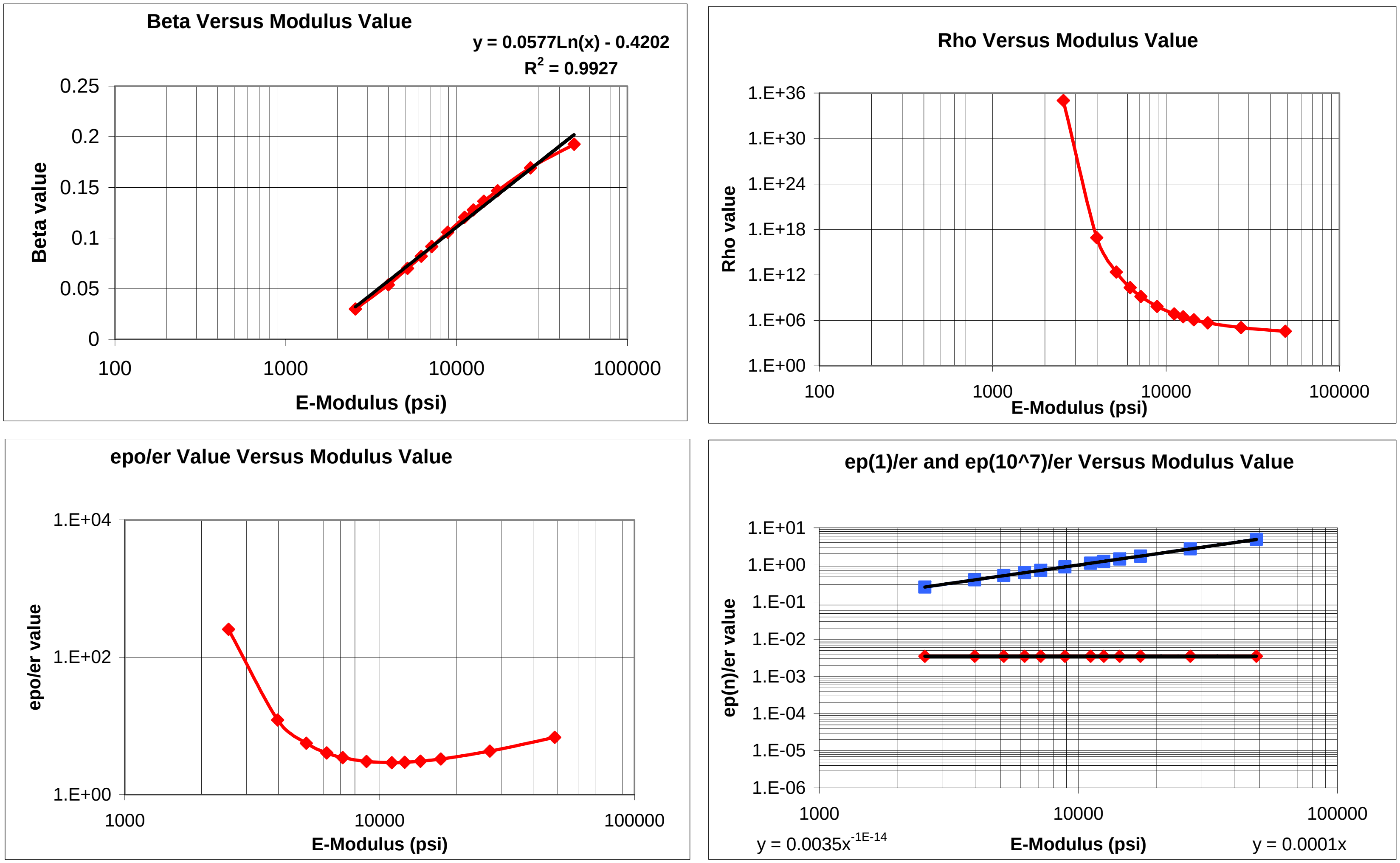


Figure B-83 Subgrade Material Set 2-G graphs

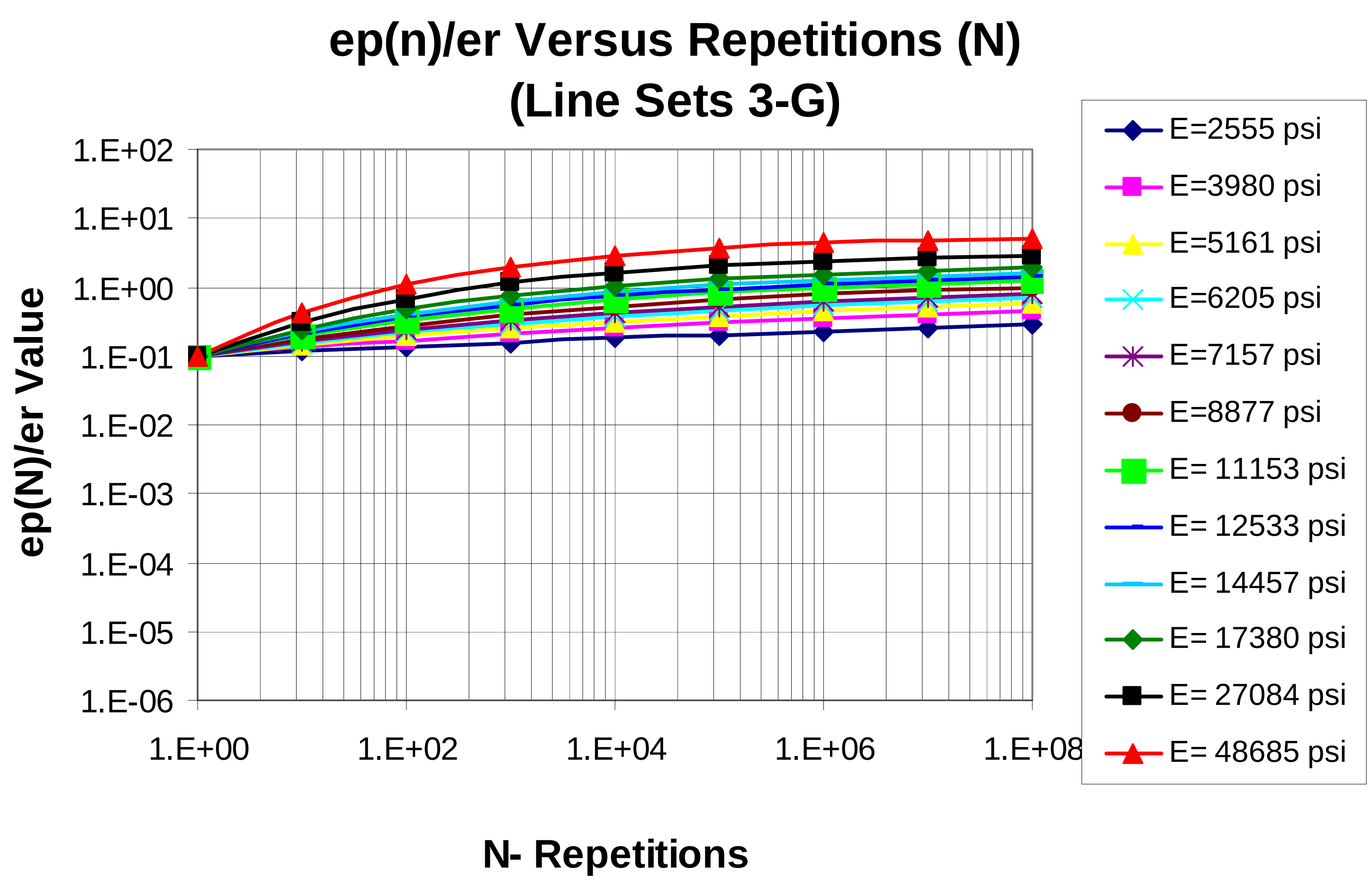


Figure B-84 Subgrade Material $\varepsilon_p/ \varepsilon_r$ vs. Number of Load Repetitions Set 3-G

Table B-48 Unbound Material Rut Model Set 3-G Computations

N=1 Repetition

	ep(1)/er	E (psi)
Data Set 1	0.1	2500
Data Set 2	0.1	50000

b(1)= 0
a(1)1= 0.1
a(1)2= 0.1

a(1)(avg)= 0.1

N=10^7 Repetition

	ep(10^7)/er	E (psi)
Data Set 1	0.1	1000
Data Set 2	10	100,000

b(10^7)= 1
a(10^7)1= 0.0001
a(10^7)2= 0.0001

a(10^7)(avg)= 0.0001

CBR=	1	2	3	4	5	7	10	12	15	20	40	100
GWT (ft)=	10	10	10	10	10	10	10	10	10	10	10	10
E (psi)=	2555	3981.5	5161.2	6204.5	7157	8876.7	11153	12533.3	14457.4	17380	27083.8	48684.5
ep(1)/er=	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
ep(10^7)=	0.2555	0.39815	0.51612	0.62045	0.7157	0.88767	1.1153	1.25333	1.44574	1.738	2.70838	4.86845
Beta=	0.0299719	0.0538458	0.0700934	0.0821515	0.0916235	0.1058432	0.1205232	0.127772481	0.1363509	0.146865	0.1693629	0.1927432
C0=	-0.9380522	-1.3816586	-1.6411691	-1.8252748	-1.9680909	-2.1834299	-2.4117085	-2.5283891	-2.6712064	-2.8553201	-3.2989358	-3.8853607
Rho=	9.442E+12	9969641.7	307212.91	65484.442	27422.375	10627.354	5366.2141	4135.333631	3194.7465	2475.256	1712.7995	1449.6958
X1=	1.1570069	1.0821068	1.1297278	1.2023585	1.281423	1.4409683	1.6696745	1.81368825	2.0184643	2.3351898	3.4094928	5.840362
X2=	1.1570069	1.0821068	1.1297278	1.2023585	1.281423	1.4409683	1.6696745	1.81368825	2.0184643	2.3351898	3.4094928	5.840362
X(avg)=	1.1570069	1.0821068	1.1297278	1.2023585	1.281423	1.4409683	1.6696745	1.81368825	2.0184643	2.3351898	3.4094928	5.840362

N	ep(0)/er=											
1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
10	0.1177359	0.1320087	0.1435293	0.1535113	0.1624373	0.1780748	0.1978278	0.209305018	0.224719	0.2469485	0.312567	0.4296469
100	0.1371163	0.1687106	0.1952045	0.2188769	0.2406017	0.2798998	0.3317215	0.362910624	0.4060036	0.4705047	0.6761716	1.0947351
1000	0.1580724	0.209536	0.2535912	0.2935674	0.3307201	0.398955	0.4907484	0.546888545	0.6254613	0.7450658	1.1401298	1.9948984
10000	0.1805112	0.2537467	0.3168403	0.3743175	0.4279014	0.5266887	0.6602775	0.742342729	0.8576359	1.0340612	1.623981	2.9317462
100000	0.2043186	0.300502	0.3829421	0.4577037	0.5271649	0.6547769	0.8267321	0.932151227	1.0800975	1.3063319	2.0634682	3.7532165
1000000	0.2293632	0.3489233	0.4499461	0.5405989	0.6241893	0.7765778	0.9802614	1.104499414	1.2783056	1.5432483	2.42675	4.3977598
10000000	0.2555	0.39815	0.51612	0.62045	0.7157	0.88767	1.1153	1.25333	1.44574	1.738	2.70838	4.86845
100000000	0.2825744	0.4473835	0.5800417	0.6953872	0.7995487	0.9857324	1.2298684	1.377122598	1.5817653	1.8917092	2.9173978	5.1966417

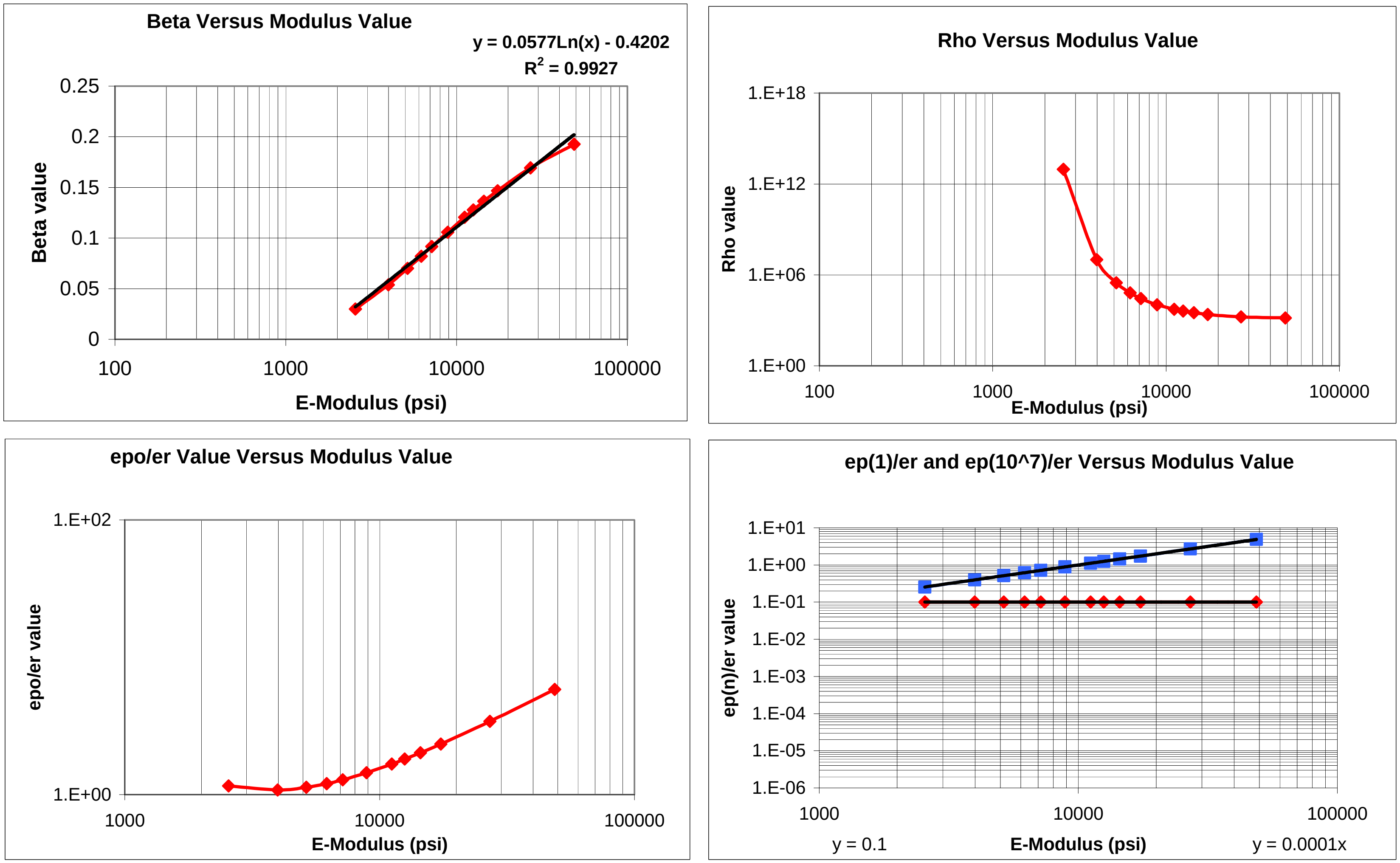


Figure B-85 Subgrade Material Set 3-G graphs

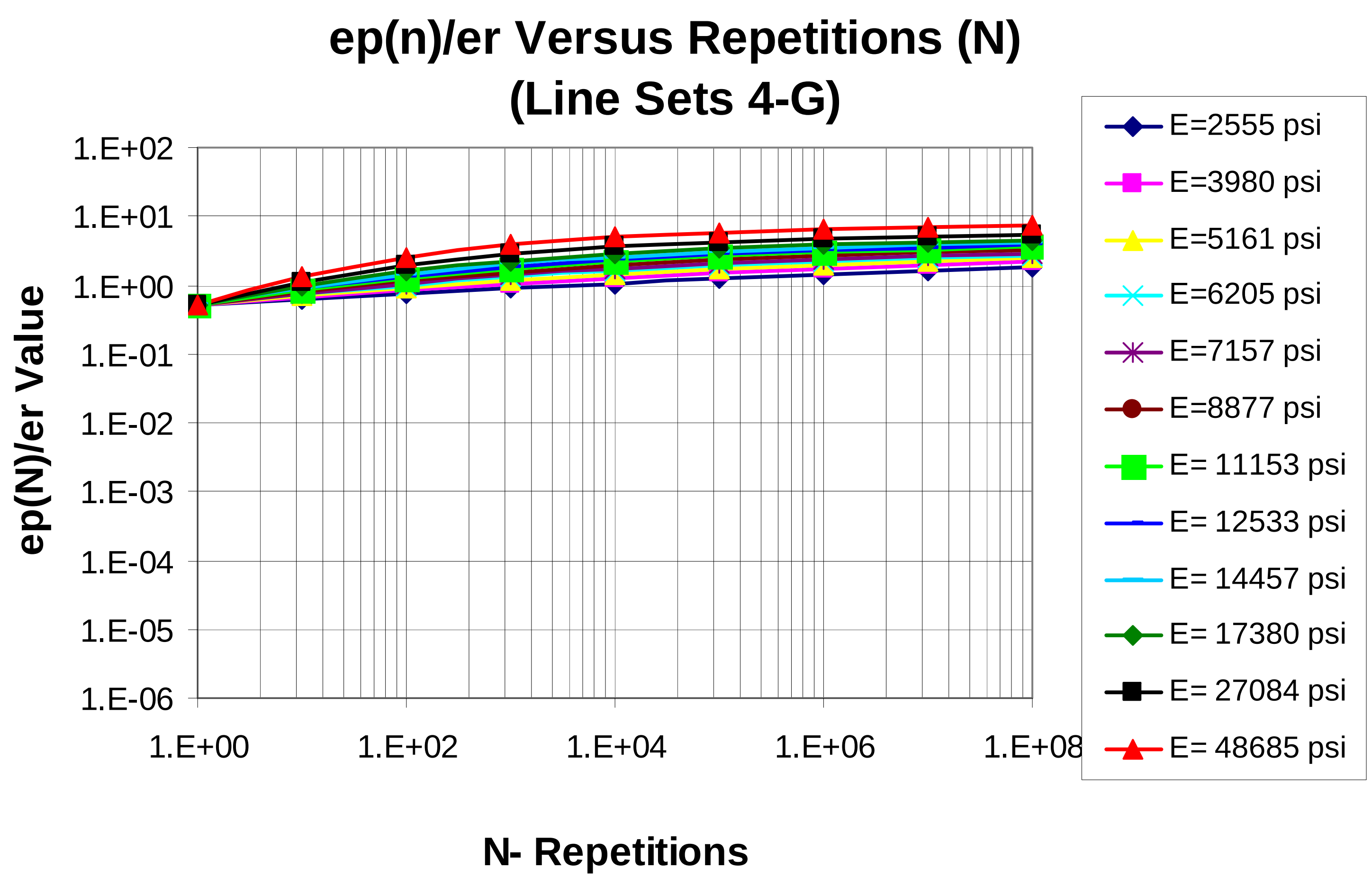


Figure B-86 Subgrade Material $\varepsilon_p / \varepsilon_r$ vs. Number of Load Repetitions Set 4-G

Table B-49 Unbound Material Rut Model Set 4-G Computations

N=1 Repetition

	ep(1)/er	E (psi)
Data Set 1	0.5	2500
Data Set 2	0.5	50000

b(1)=	0
a(1)1=	0.5
a(1)2=	0.5
a(1)(avg)=	0.5

N=10^7 Repetition

	ep(10^7)/er	E (psi)
Data Set 1	1	1000
Data Set 2	10	100,000

b(10^7)=	0.5
a(10^7)1=	0.0316228
a(10^7)2=	0.0316228
a(10^7)(avg)=	0.0316228

CBR=	1	2	3	4	5	7	10	12	15	20	40	100
GWT (ft)=	10	10	10	10	10	10	10	10	10	10	10	10
E (psi)=	2555	3981.5	5161.2	6204.5	7157	8876.7	11153	12533.3	14457.4	17380	27083.8	48684.5
ep(1)/er=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
ep(10^7)=	1.5984367	1.9953696	2.2718275	2.4908834	2.675257	2.9793791	3.3396108	3.540240105	3.8022888	4.1689327	5.2042098	6.9774279
Beta=	0.0299719	0.0538458	0.0700934	0.0821515	0.0916235	0.1058432	0.1205232	0.127772481	0.1363509	0.146865	0.1693629	0.1927432
C0=	-1.1621733	-1.3839765	-1.5137317	-1.6057846	-1.6771926	-1.7848621	-1.8990014	-1.95734173	-2.0287504	-2.1208072	-2.3426151	-2.6358275
Rho=	1.201E+16	10284872	96965.216	13767.06	4786.068	1582.7185	738.62961	557.6884144	424.79241	326.75076	226.91862	193.6342
X1=	10.383889	5.4321931	4.6792905	4.4578899	4.394783	4.42712	4.5886141	4.712821051	4.8991239	5.1915859	6.1284685	7.894456
X2=	10.383889	5.4321931	4.6792905	4.4578899	4.394783	4.42712	4.5886141	4.712821051	4.8991239	5.1915859	6.1284685	7.894456
X(avg)=	10.383889	5.4321931	4.6792905	4.4578899	4.394783	4.42712	4.5886141	4.712821051	4.8991239	5.1915859	6.1284685	7.894456

N	ep(0)/er=											
1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
10	0.6120973	0.6603512	0.6977888	0.7289988	0.755988	0.8013586	0.8555972	0.885727659	0.9247757	0.9785452	1.1231434	1.3442274
100	0.7392862	0.8442933	0.926623	0.996003	1.0565984	1.1597806	1.2853812	1.356240036	1.4492436	1.5795057	1.9426909	2.5353443
1000	0.8817329	1.048981	1.179568	1.2895426	1.3856403	1.5495302	1.7496801	1.862993163	2.0122181	2.2222768	2.8153106	3.8092183
10000	1.039342	1.2707171	1.448505	1.5969001	1.725824	1.9445095	2.2101928	2.360178039	2.5574244	2.834854	3.6192493	4.9461592
100000	1.2117615	1.505286	1.7251332	1.9059819	2.0616146	2.3232288	2.6382229	2.815099713	3.047005	3.3722975	4.2902455	5.848506
1000000	1.3983976	1.7482776	2.0017617	2.2065639	2.3808537	2.6709072	3.0169056	3.210200491	3.4629503	3.8167023	4.8138594	6.5123504
10000000	1.5984367	1.9953696	2.2718275	2.4908834	2.675257	2.9793791	3.3396108	3.540240105	3.8022888	4.1689327	5.2042098	6.9774279
100000000	1.8108738	2.2425472	2.5301505	2.7537118	2.9401387	3.2458335	3.606905	3.808034112	4.071032	4.439783	5.4863249	7.2931613

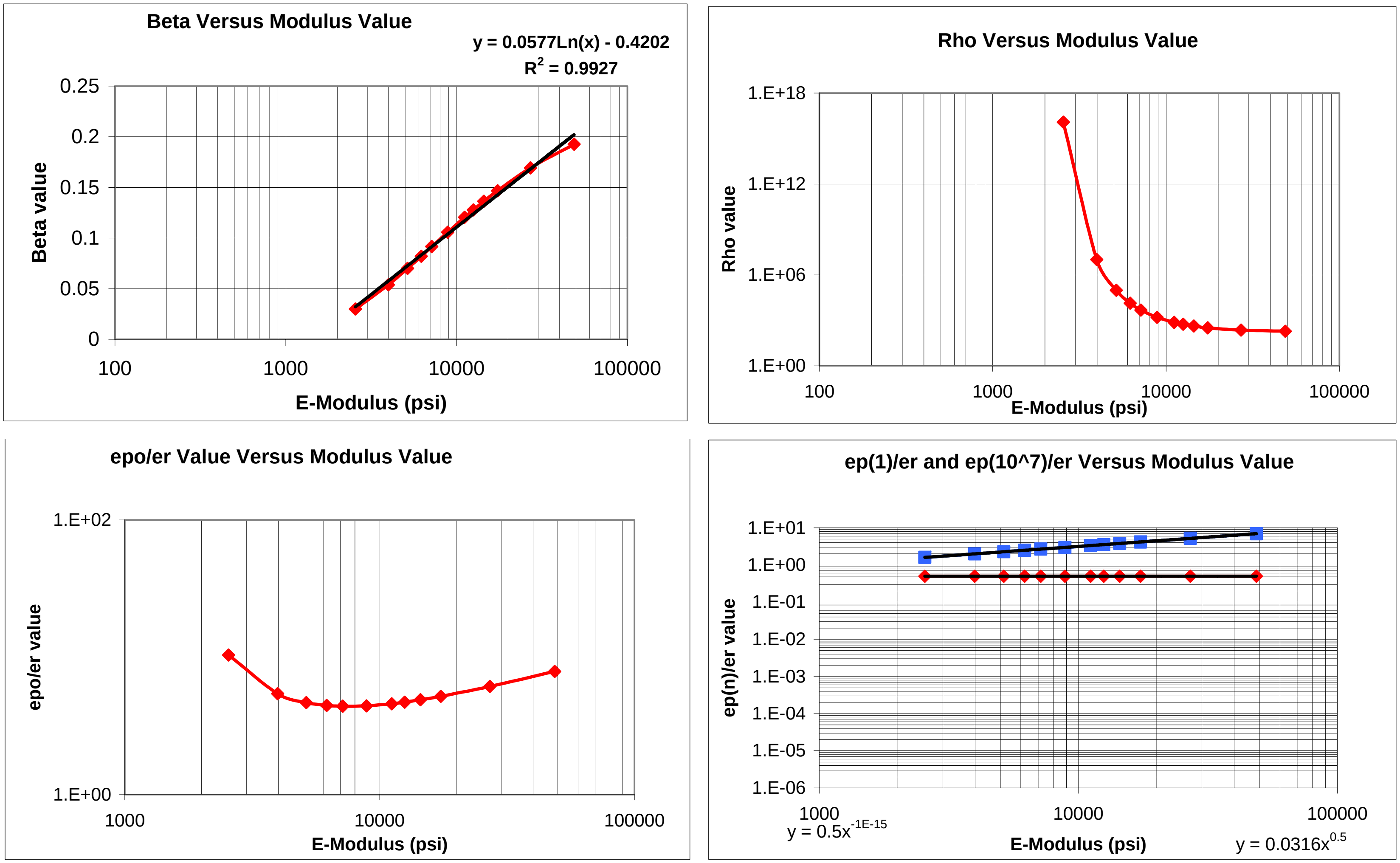


Figure B-87 Subgrade Material Set 4-G graphs

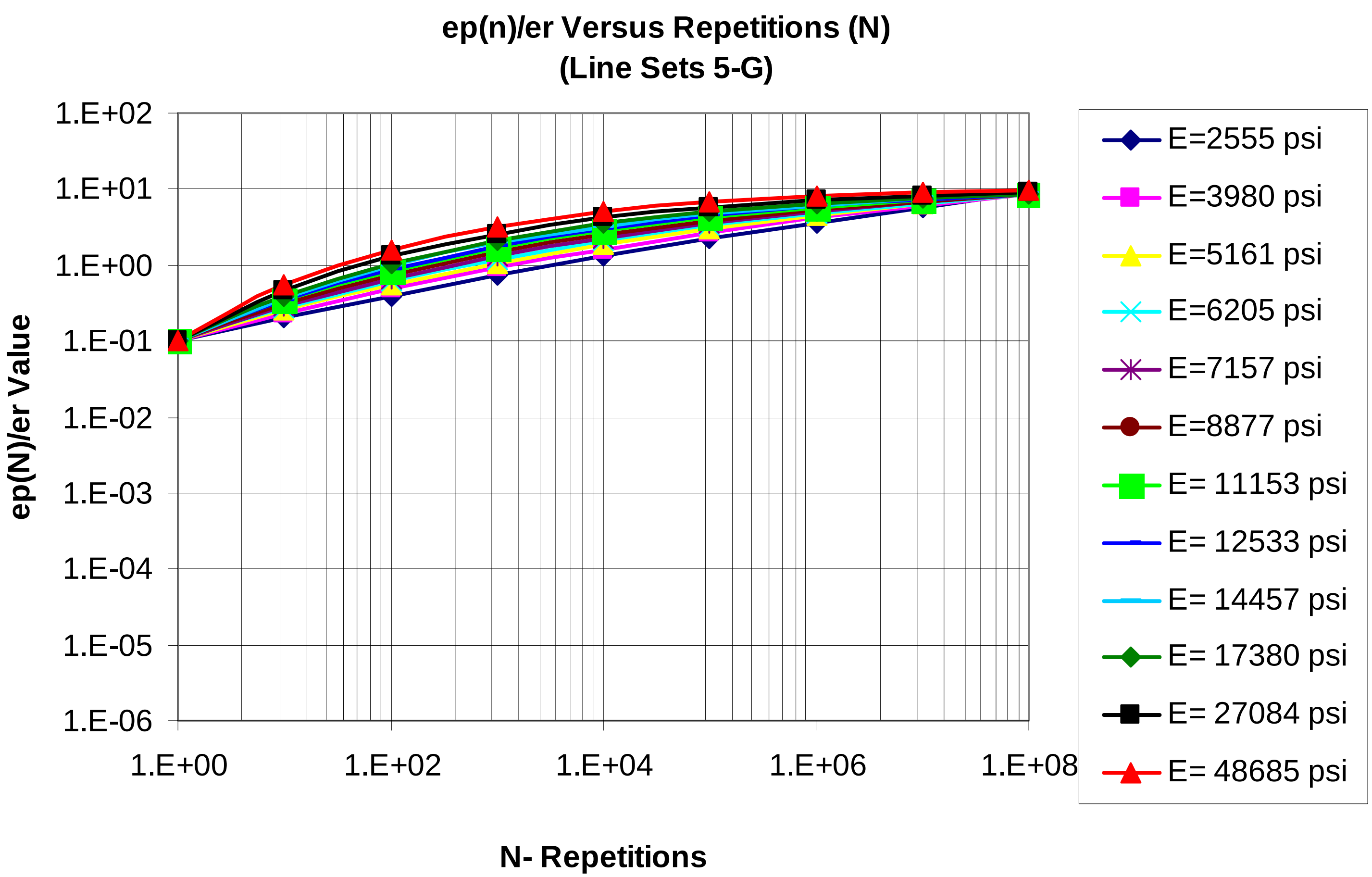


Figure B-88 Subgrade Material $\varepsilon_p / \varepsilon_r$ vs. Number of Load Repetitions Set 5-G

Table B-50 Unbound Material Rut Model Set 5-G Computations

N=1 Repetition

	ep(1)/er	E (psi)
Data Set 1	0.1	2500
Data Set 2	0.1	50000

b(1)=	0
a(1)1=	0.1
a(1)2=	0.1
a(1)(avg)=	0.1

N=10^7 Repetition

	ep(10^7)/er	E (psi)
Data Set 1	5	1000
Data Set 2	10	100,000

b(10^7)=	0.150515
a(10^7)1=	1.767767
a(10^7)2=	1.767767
a(10^7)(avg)=	1.767767

CBR=	1	2	3	4	5	7	10	12	15	20	40	100
GWT (ft)=	10	10	10	10	10	10	10	10	10	10	10	10
E (psi)=	2555	3981.5	5161.2	6204.5	7157	8876.7	11153	12533.3	14457.4	17380	27083.8	48684.5
ep(1)/er=	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
ep(10^7)=	5.7582225	6.1558217	6.4010272	6.5808844	6.7238783	6.9453811	7.1881671	7.315522004	7.4744799	7.6845085	8.2151271	8.9732055
Beta=	0.0299719	0.0538458	0.0700934	0.0821515	0.0916235	0.1058432	0.1205232	0.127772481	0.1363509	0.146865	0.1693629	0.1927432
C0=	-4.0532139	-4.1199834	-4.1590436	-4.1867542	-4.2082502	-4.2406619	-4.2750213	-4.29258349	-4.3140796	-4.3417915	-4.4085623	-4.4968281
Rho=	1.516E+34	6.468E+15	1.774E+11	1.603E+09	109752648	5626178.5	620088.62	260378.8054	107457.58	42948.672	9488.9284	3094.5736
X1=	3931.427	121.36728	46.605974	30.015511	23.362116	17.796763	14.697747	13.700302	12.812939	12.041117	11.174386	11.077383
X2=	3931.427	121.36728	46.605974	30.015511	23.362116	17.796763	14.697747	13.700302	12.812939	12.041117	11.174386	11.077383
X(avg)=	3931.427	121.36728	46.605974	30.015511	23.362116	17.796763	14.697747	13.700302	12.812939	12.041117	11.174386	11.077383

N	ep(0)/er=											
1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
10	0.202483	0.2288898	0.2498721	0.2672774	0.2821609	0.3067047	0.3351214	0.350433016	0.3697508	0.395363	0.4585869	0.5404419
100	0.3911521	0.4756835	0.5447005	0.6030301	0.653594	0.738192	0.8377784	0.892076954	0.9611568	1.053656	1.2860386	1.5954112
1000	0.7231588	0.9077469	1.0571947	1.1825308	1.2904206	1.4693176	1.6773519	1.789661565	1.9314701	2.1196134	2.5850583	3.195205
10000	1.283288	1.6065205	1.8587785	2.0648051	2.2385371	2.5200182	2.8382866	3.006577962	3.2159749	3.4891212	4.1473499	4.9890593
100000	2.1918152	2.6601031	3.0045086	3.2751132	3.4969916	3.8460783	4.2279618	4.425370832	4.6673902	4.9781475	5.7118199	6.6401657
1000000	3.6122746	4.1531003	4.5210213	4.7978248	5.0185346	5.3569684	5.7182569	5.902536781	6.1270116	6.4140456	7.0939903	7.9769845
10000000	5.7582225	6.1558217	6.4010272	6.5808844	6.7238783	6.9453811	7.1881671	7.315522004	7.4744799	7.6845085	8.2151271	8.9732055
100000000	8.8979888	8.7150525	8.6050827	8.5481337	8.5211633	8.5129648	8.5486104	8.58411732	8.6427289	8.7414017	9.0731907	9.6769499

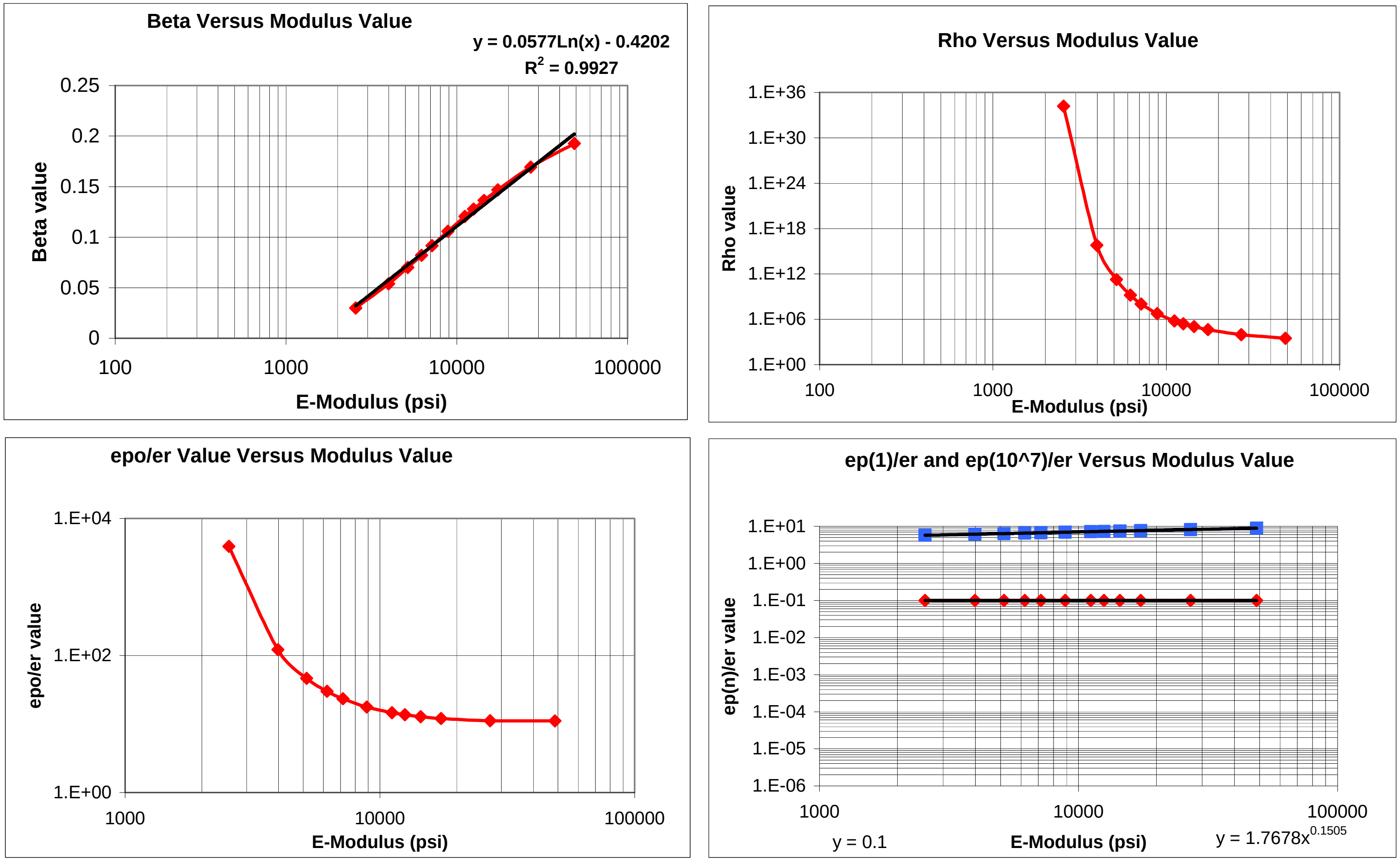


Figure B-89 Subgrade Material Set 5-G graphs

Annex C

Permanent Deformation Simulation Runs Results

Table C-51 Permanent Deformation Simulation (β_{r2} = 0.8 and β_{r3} = 0.8) Summary

	AC	GB	SG	Total
Average Predicted (in)=	0.216	0.037	0.083	0.336
Sum of error =	0.324	-0.008	-0.041	0.000
Sum of error^2 =	2.817	0.110	0.416	6.622
Predicted % =	63.01%	10.92%	26.07%	100.00%
Se =	0.077	0.015	0.030	0.119
Average Measured (in) =	0.037	0.083	0.336	0.346
Calibration Factor β_1 =	10.732	1.082	0.969	

Table C-52 Permanent Deformation Simulation (β_{r2} = 0.8 and β_{r3} = 0.8) Data

Section	Month	Time	Predicted							Measured			
			AC	GB	SG	Total	%AC	%GB	%SG	AC	GB	SG	Total
11001	04/05/89	103	0.499	0.112	0.085	0.696	71.71%	16.11%	12.18%	0.240	0.054	0.041	0.335
11001	02/12/91	125	0.539	0.114	0.087	0.740	72.83%	15.45%	11.72%	0.229	0.049	0.037	0.315
11001	04/02/92	139	0.547	0.115	0.088	0.750	72.96%	15.35%	11.69%	0.215	0.045	0.035	0.295
11019	05/15/89	32	0.212	0.016	0.098	0.326	65.13%	4.91%	29.96%	0.333	0.025	0.153	0.512
11019	04/16/90	43	0.236	0.017	0.101	0.354	66.72%	4.68%	28.60%	0.368	0.026	0.158	0.551
11019	01/15/91	52	0.256	0.017	0.104	0.377	67.99%	4.50%	27.50%	0.375	0.025	0.152	0.551
11019	03/31/92	66	0.268	0.017	0.106	0.392	68.50%	4.39%	27.10%	0.378	0.024	0.149	0.551
11019	03/22/94	90	0.295	0.020	0.110	0.425	69.48%	4.69%	25.84%	0.410	0.028	0.153	0.591
11019	01/08/96	112	0.318	0.022	0.113	0.452	70.27%	4.84%	24.90%	0.415	0.029	0.147	0.591
11019	01/23/98	136	0.332	0.022	0.115	0.468	70.82%	4.71%	24.47%	0.502	0.033	0.173	0.709
14126	06/05/89	15	0.092	0.009	0.035	0.136	68.10%	6.31%	25.59%	0.121	0.011	0.045	0.177
14126	03/03/91	36	0.123	0.009	0.040	0.173	71.37%	5.44%	23.19%	0.155	0.012	0.050	0.217
14126	04/08/92	49	0.132	0.010	0.042	0.184	71.75%	5.24%	23.01%	0.113	0.008	0.036	0.157
14126	04/08/94	73	0.147	0.010	0.045	0.202	72.77%	4.98%	22.25%	0.143	0.010	0.044	0.197
14126	12/11/95	93	0.161	0.010	0.046	0.218	73.89%	4.77%	21.34%	0.160	0.010	0.046	0.217
14126	12/05/97	117	0.171	0.011	0.048	0.229	74.45%	4.63%	20.92%	0.147	0.009	0.041	0.197
21001	08/21/91	98	0.057	0.029	0.091	0.178	32.02%	16.57%	51.41%	0.057	0.029	0.091	0.177
21001	08/26/93	122	0.060	0.030	0.093	0.184	32.74%	16.33%	50.92%	0.077	0.039	0.120	0.236
21001	06/15/95	144	0.061	0.031	0.099	0.190	32.14%	16.09%	51.76%	0.089	0.044	0.143	0.276
21001	08/22/97	170	0.065	0.031	0.100	0.197	33.31%	15.97%	50.72%	0.118	0.057	0.180	0.354
21001	08/26/98	182	0.067	0.032	0.101	0.199	33.42%	15.88%	50.70%	0.118	0.056	0.180	0.354
21002	08/22/91	83	0.084	0.038	0.040	0.161	51.97%	23.38%	24.65%	0.092	0.041	0.044	0.177
21002	07/30/92	94	0.085	0.038	0.040	0.163	51.86%	23.37%	24.77%	0.123	0.055	0.059	0.236
21002	06/14/95	129	0.100	0.040	0.042	0.182	54.97%	21.94%	23.10%	0.130	0.052	0.055	0.236
21002	08/21/97	155	0.102	0.041	0.043	0.186	54.92%	21.92%	23.16%	0.162	0.065	0.068	0.295
21002	05/14/98	164	0.103	0.041	0.043	0.187	55.09%	21.82%	23.10%	0.141	0.056	0.059	0.256
40114	03/30/95	20	0.192	0.034	0.128	0.354	54.26%	9.60%	36.14%	0.214	0.038	0.142	0.394
40114	11/07/95	28	0.221	0.036	0.135	0.392	56.41%	9.14%	34.45%	0.222	0.036	0.136	0.394
40114	02/04/96	31	0.221	0.036	0.136	0.393	56.30%	9.12%	34.58%	0.244	0.040	0.150	0.433
40114	04/04/96	33	0.221	0.036	0.137	0.394	56.17%	9.10%	34.73%	0.265	0.043	0.164	0.472
40114	07/09/96	36	0.243	0.037	0.139	0.418	57.96%	8.79%	33.24%	0.251	0.038	0.144	0.433

Table C-2 (Cont'd) Permanent Deformation Simulation (β_{r2} = 0.8 and β_{r3} = 0.8) Data

Section	Month	Time	Predicted							Measured			
			AC	GB	SG	Total	%AC	%GB	%SG	AC	GB	SG	Total
40114	08/13/96	37	0.250	0.037	0.140	0.427	58.54%	8.69%	32.77%	0.254	0.038	0.142	0.433
40114	01/07/98	54	0.274	0.038	0.146	0.458	59.78%	8.37%	31.85%	0.259	0.036	0.138	0.433
40114	04/21/98	57	0.274	0.038	0.146	0.458	59.72%	8.36%	31.92%	0.259	0.036	0.138	0.433
40114	06/12/98	59	0.277	0.039	0.147	0.462	59.87%	8.33%	31.80%	0.283	0.039	0.150	0.472
40114	10/23/98	63	0.293	0.039	0.149	0.481	60.93%	8.13%	30.94%	0.264	0.035	0.134	0.433
40114	02/12/99	65	0.293	0.039	0.149	0.481	60.90%	8.12%	30.98%	0.288	0.038	0.146	0.472
40115	02/15/95	19	0.108	0.000	0.056	0.165	65.86%	0.00%	34.14%	0.052	0.000	0.027	0.079
40115	03/30/95	20	0.108	0.000	0.056	0.165	65.82%	0.00%	34.18%	0.104	0.000	0.054	0.157
40115	01/07/98	54	0.155	0.000	0.064	0.218	70.77%	0.00%	29.23%	0.070	0.000	0.029	0.098
40115	02/11/99	65	0.166	0.000	0.065	0.232	71.84%	0.00%	28.16%	0.071	0.000	0.028	0.098
40116	03/30/95	20	0.080	0.000	0.078	0.158	50.89%	0.00%	49.11%	0.180	0.000	0.174	0.354
40116	01/08/98	54	0.115	0.000	0.089	0.204	56.41%	0.00%	43.59%	0.200	0.000	0.154	0.354
40116	02/12/99	65	0.122	0.000	0.091	0.213	57.46%	0.00%	42.54%	0.204	0.000	0.151	0.354
40117	03/30/95	20	0.133	0.006	0.050	0.189	70.57%	2.93%	26.50%	0.306	0.013	0.115	0.433
40117	01/08/98	54	0.190	0.006	0.056	0.253	75.20%	2.49%	22.32%	0.296	0.010	0.088	0.394
40117	02/11/99	65	0.203	0.006	0.058	0.267	76.04%	2.39%	21.57%	0.359	0.011	0.102	0.472
40118	03/30/95	20	0.130	0.008	0.078	0.216	60.18%	3.81%	36.00%	0.237	0.015	0.142	0.394
40118	01/08/98	54	0.182	0.009	0.090	0.282	64.72%	3.22%	32.06%	0.229	0.011	0.114	0.354
40118	02/12/99	65	0.195	0.009	0.093	0.297	65.72%	3.10%	31.19%	0.233	0.011	0.111	0.354
41007	11/20/89	140	0.681	0.031	0.084	0.796	85.56%	3.86%	10.58%	0.758	0.034	0.094	0.886
41007	09/05/91	162	0.730	0.031	0.086	0.847	86.17%	3.69%	10.13%	0.763	0.033	0.090	0.886
41007	09/20/91	163	0.730	0.031	0.086	0.847	86.17%	3.69%	10.13%	0.712	0.031	0.084	0.827
41007	09/16/94	198	0.790	0.032	0.088	0.909	86.85%	3.50%	9.65%	0.872	0.035	0.097	1.004
41016	11/30/89	122	0.296	0.000	0.121	0.417	70.95%	0.00%	29.05%	0.265	0.000	0.109	0.374
41016	07/02/90	130	0.300	0.000	0.122	0.422	71.13%	0.00%	28.87%	0.196	0.000	0.080	0.276
41016	09/25/91	144	0.312	0.000	0.124	0.436	71.65%	0.00%	28.35%	0.169	0.000	0.067	0.236
41016	09/18/96	204	0.358	0.000	0.129	0.488	73.49%	0.00%	26.51%	0.231	0.000	0.084	0.315
41024	11/03/89	149	0.352	0.021	0.112	0.485	72.54%	4.30%	23.15%	0.171	0.010	0.055	0.236
41024	08/26/90	158	0.364	0.021	0.113	0.498	73.03%	4.22%	22.75%	0.187	0.011	0.058	0.256
41024	09/04/91	171	0.380	0.021	0.115	0.516	73.65%	4.13%	22.21%	0.159	0.009	0.048	0.217
41024	08/22/95	218	0.426	0.022	0.118	0.566	75.21%	3.88%	20.91%	0.192	0.010	0.054	0.256
41024	11/09/95	221	0.427	0.022	0.119	0.568	75.23%	3.87%	20.90%	0.207	0.011	0.058	0.276
41024	02/08/96	224	0.427	0.022	0.119	0.568	75.22%	3.87%	20.91%	0.222	0.011	0.062	0.295
41024	04/04/96	226	0.427	0.022	0.119	0.568	75.22%	3.87%	20.91%	0.192	0.010	0.054	0.256
41024	06/13/96	228	0.428	0.022	0.119	0.569	75.24%	3.86%	20.90%	0.207	0.011	0.058	0.276
41024	07/11/96	229	0.436	0.022	0.119	0.577	75.51%	3.83%	20.66%	0.208	0.011	0.057	0.276
41024	08/15/96	230	0.440	0.022	0.119	0.582	75.65%	3.81%	20.53%	0.208	0.011	0.057	0.276
41024	01/15/98	247	0.455	0.022	0.120	0.598	76.10%	3.75%	20.15%	0.210	0.010	0.056	0.276
41024	04/22/98	250	0.455	0.022	0.121	0.598	76.09%	3.75%	20.17%	0.210	0.010	0.056	0.276
41024	06/15/98	252	0.458	0.022	0.121	0.602	76.18%	3.72%	20.10%	0.210	0.010	0.055	0.276
41024	10/26/98	256	0.463	0.022	0.121	0.606	76.31%	3.70%	19.99%	0.225	0.011	0.059	0.295
81029	10/20/89	209	0.199	0.054	0.078	0.331	59.94%	16.44%	23.63%	0.142	0.039	0.056	0.236
81029	08/25/91	231	0.206	0.055	0.079	0.340	60.52%	16.15%	23.33%	0.131	0.035	0.051	0.217
81029	10/21/91	233	0.206	0.055	0.080	0.341	60.50%	16.14%	23.35%	0.107	0.029	0.041	0.177
81029	09/08/95	280	0.220	0.056	0.082	0.358	61.48%	15.67%	22.85%	0.145	0.037	0.054	0.236
81047	10/20/89	73	0.163	0.078	0.094	0.335	48.75%	23.19%	28.05%	0.182	0.087	0.105	0.374
81047	08/25/91	95	0.176	0.079	0.098	0.353	49.80%	22.36%	27.85%	0.176	0.079	0.099	0.354
81047	10/22/91	97	0.177	0.079	0.099	0.355	49.90%	22.29%	27.81%	0.167	0.075	0.093	0.335

Table C-2 (Cont'd) Permanent Deformation Simulation (β_{r2} = 0.8 and β_{r3} = 0.8) Data

Section	Month	Time	Predicted							Measured			
			AC	GB	SG	Total	%AC	%GB	%SG	AC	GB	SG	Total
81053	10/19/89	60	0.174	0.070	0.076	0.319	54.42%	21.78%	23.80%	0.193	0.077	0.084	0.354
81053	07/07/90	69	0.185	0.070	0.078	0.333	55.50%	21.02%	23.47%	0.240	0.091	0.102	0.433
81053	12/06/93	110	0.230	0.080	0.088	0.398	57.72%	20.18%	22.10%	0.227	0.079	0.087	0.394
81053	03/14/94	113	0.230	0.080	0.089	0.399	57.62%	20.17%	22.21%	0.227	0.079	0.087	0.394
81053	08/08/94	118	0.237	0.083	0.090	0.410	57.78%	20.25%	21.97%	0.227	0.080	0.086	0.394
81053	10/21/94	120	0.238	0.083	0.091	0.412	57.78%	20.24%	21.99%	0.239	0.084	0.091	0.413
81053	02/13/95	124	0.238	0.083	0.091	0.413	57.71%	20.21%	22.08%	0.239	0.084	0.091	0.413
81053	05/08/95	127	0.238	0.084	0.091	0.413	57.65%	20.22%	22.13%	0.238	0.084	0.091	0.413
81053	05/10/96	139	0.250	0.084	0.093	0.427	58.61%	19.66%	21.73%	0.254	0.085	0.094	0.433
81053	10/21/96	144	0.258	0.084	0.093	0.435	59.22%	19.34%	21.45%	0.280	0.091	0.101	0.472
81053	11/14/96	145	0.258	0.084	0.093	0.435	59.21%	19.33%	21.46%	0.280	0.091	0.101	0.472
81053	03/20/97	149	0.258	0.084	0.094	0.436	59.11%	19.33%	21.56%	0.279	0.091	0.102	0.472
81053	08/05/97	154	0.270	0.086	0.095	0.452	59.81%	19.13%	21.06%	0.294	0.094	0.104	0.492
81053	09/26/97	155	0.272	0.087	0.095	0.454	59.86%	19.11%	21.03%	0.306	0.098	0.108	0.512
81053	08/25/98	166	0.282	0.090	0.098	0.469	60.13%	19.09%	20.78%	0.308	0.098	0.106	0.512
91803	09/05/90	63	0.088	0.022	0.054	0.164	53.78%	13.36%	32.86%	0.095	0.024	0.058	0.177
91803	08/22/91	74	0.099	0.023	0.056	0.177	55.73%	12.83%	31.44%	0.077	0.018	0.043	0.138
91803	09/30/92	87	0.101	0.023	0.058	0.182	55.43%	12.85%	31.72%	0.109	0.025	0.062	0.197
91803	05/12/94	107	0.108	0.024	0.060	0.193	56.20%	12.51%	31.29%	0.077	0.017	0.043	0.138
91803	09/25/94	111	0.114	0.025	0.061	0.200	56.98%	12.36%	30.66%	0.079	0.017	0.042	0.138
91803	05/25/95	119	0.114	0.025	0.062	0.200	56.75%	12.37%	30.88%	0.101	0.022	0.055	0.177
91803	10/30/95	124	0.118	0.025	0.063	0.206	57.24%	12.28%	30.48%	0.113	0.024	0.060	0.197
91803	10/08/96	136	0.128	0.026	0.064	0.218	58.56%	11.91%	29.53%	0.104	0.021	0.052	0.177
91803	05/08/97	143	0.128	0.026	0.065	0.219	58.40%	11.88%	29.72%	0.103	0.021	0.053	0.177
91803	10/16/97	148	0.131	0.026	0.066	0.223	58.66%	11.83%	29.51%	0.104	0.021	0.052	0.177
91803	06/17/98	156	0.133	0.027	0.067	0.226	58.85%	11.73%	29.43%	0.104	0.021	0.052	0.177
123995	04/18/89	161	0.672	0.079	0.066	0.817	82.27%	9.62%	8.11%	0.324	0.038	0.032	0.394
123995	02/05/91	183	0.695	0.079	0.067	0.842	82.60%	9.44%	7.96%	0.325	0.037	0.031	0.394
123995	04/15/92	197	0.705	0.080	0.068	0.852	82.71%	9.37%	7.92%	0.358	0.041	0.034	0.433
123995	03/09/94	220	0.731	0.081	0.068	0.880	83.07%	9.18%	7.75%	0.327	0.036	0.031	0.394
123995	01/21/96	242	0.750	0.081	0.069	0.900	83.31%	9.04%	7.65%	0.328	0.036	0.030	0.394
123997	12/14/89	187	0.379	0.085	0.049	0.513	73.80%	16.55%	9.64%	0.465	0.104	0.061	0.630
123997	02/09/91	201	0.389	0.086	0.050	0.525	74.07%	16.36%	9.57%	0.467	0.103	0.060	0.630
123997	04/13/92	215	0.397	0.087	0.051	0.535	74.29%	16.22%	9.50%	0.526	0.115	0.067	0.709
123997	03/08/94	238	0.419	0.088	0.052	0.559	74.92%	15.81%	9.28%	0.560	0.118	0.069	0.748
124105	04/12/89	53	0.264	0.098	0.078	0.440	60.00%	22.21%	17.79%	0.224	0.083	0.067	0.374
124105	02/09/91	75	0.299	0.102	0.082	0.483	61.98%	21.06%	16.96%	0.232	0.079	0.063	0.374
124105	04/13/92	89	0.314	0.104	0.084	0.502	62.67%	20.64%	16.68%	0.271	0.089	0.072	0.433
124106	04/18/89	21	0.222	0.039	0.062	0.322	68.89%	11.98%	19.13%	0.163	0.028	0.045	0.236
124106	02/05/91	43	0.264	0.042	0.068	0.374	70.58%	11.17%	18.26%	0.195	0.031	0.050	0.276
124106	04/15/92	57	0.280	0.043	0.071	0.394	71.13%	10.88%	17.98%	0.140	0.021	0.035	0.197
124106	03/09/94	80	0.311	0.044	0.074	0.430	72.41%	10.35%	17.24%	0.171	0.024	0.041	0.236
124106	01/21/96	102	0.329	0.045	0.077	0.451	72.98%	10.07%	16.95%	0.172	0.024	0.040	0.236
124106	01/17/97	114	0.343	0.046	0.078	0.467	73.50%	9.87%	16.63%	0.232	0.031	0.052	0.315
124107	12/06/89	75	0.162	0.061	0.074	0.297	54.52%	20.68%	24.80%	0.097	0.037	0.044	0.177
124107	02/05/91	89	0.171	0.063	0.076	0.309	55.23%	20.32%	24.45%	0.087	0.032	0.039	0.157
124107	04/15/92	103	0.180	0.064	0.077	0.322	56.07%	19.89%	24.04%	0.088	0.031	0.038	0.157
124107	03/09/94	126	0.196	0.066	0.080	0.342	57.44%	19.25%	23.31%	0.079	0.027	0.032	0.138
124107	01/22/96	148	0.207	0.067	0.082	0.356	58.17%	18.88%	22.96%	0.103	0.033	0.041	0.177

Table C-2 (Cont'd) Permanent Deformation Simulation (β_{r2} = 0.8 and β_{r3} = 0.8) Data

Section	Month	Time	Predicted							Measured			
			AC	GB	SG	Total	%AC	%GB	%SG	AC	GB	SG	Total
124108	04/27/89	35	0.177	0.021	0.037	0.235	75.29%	9.07%	15.65%	0.267	0.032	0.055	0.354
124108	01/16/91	56	0.223	0.023	0.039	0.285	78.19%	8.00%	13.81%	0.354	0.036	0.063	0.453
124108	04/01/92	71	0.233	0.023	0.041	0.297	78.40%	7.91%	13.70%	0.309	0.031	0.054	0.394
124108	03/21/94	94	0.265	0.024	0.043	0.332	79.80%	7.36%	12.83%	0.393	0.036	0.063	0.492
124108	01/16/96	116	0.278	0.025	0.044	0.347	80.07%	7.23%	12.70%	0.426	0.038	0.067	0.531
124135	12/10/89	227	0.389	0.182	0.109	0.679	57.22%	26.75%	16.03%	0.282	0.132	0.079	0.492
124135	01/29/91	240	0.393	0.182	0.109	0.684	57.39%	26.62%	15.99%	0.339	0.157	0.094	0.591
131031	01/09/90	104	0.131	0.017	0.039	0.187	69.84%	9.18%	20.98%	0.275	0.036	0.083	0.394
131031	03/04/91	118	0.138	0.018	0.040	0.197	70.39%	9.02%	20.59%	0.305	0.039	0.089	0.433
131031	04/28/92	131	0.146	0.018	0.042	0.206	70.92%	8.84%	20.24%	0.279	0.035	0.080	0.394
131031	04/04/94	155	0.162	0.019	0.044	0.225	72.12%	8.48%	19.40%	0.355	0.042	0.095	0.492
131031	01/13/96	176	0.175	0.020	0.045	0.240	72.90%	8.21%	18.89%	0.301	0.034	0.078	0.413
134111	03/20/89	101	0.202	0.029	0.108	0.339	59.49%	8.52%	31.99%	0.164	0.023	0.088	0.276
134111	03/04/91	125	0.225	0.031	0.116	0.372	60.61%	8.24%	31.15%	0.155	0.021	0.080	0.256
134111	04/27/92	138	0.236	0.031	0.119	0.386	61.11%	8.10%	30.79%	0.156	0.021	0.079	0.256
134112	05/04/89	144	0.192	0.000	0.088	0.280	68.50%	0.00%	31.50%	0.162	0.000	0.074	0.236
134112	02/10/91	165	0.206	0.000	0.090	0.296	69.58%	0.00%	30.42%	0.164	0.000	0.072	0.236
134112	04/13/92	179	0.214	0.000	0.091	0.305	70.11%	0.00%	29.89%	0.138	0.000	0.059	0.197
134112	02/24/94	201	0.228	0.000	0.093	0.320	71.09%	0.00%	28.91%	0.168	0.000	0.068	0.236
134112	01/25/96	224	0.240	0.000	0.094	0.334	71.92%	0.00%	28.08%	0.184	0.000	0.072	0.256
134112	04/23/98	251	0.254	0.000	0.095	0.350	72.74%	0.00%	27.26%	0.243	0.000	0.091	0.335
134113	05/04/89	144	0.222	0.000	0.119	0.341	65.09%	0.00%	34.91%	0.103	0.000	0.055	0.157
134113	02/10/91	165	0.235	0.000	0.121	0.356	66.00%	0.00%	34.00%	0.091	0.000	0.047	0.138
134113	04/13/92	179	0.244	0.000	0.122	0.366	66.59%	0.00%	33.41%	0.118	0.000	0.059	0.177
134113	02/24/94	201	0.255	0.000	0.124	0.379	67.32%	0.00%	32.68%	0.119	0.000	0.058	0.177
134113	01/25/96	224	0.269	0.000	0.126	0.395	68.21%	0.00%	31.79%	0.121	0.000	0.056	0.177
134113	04/23/98	251	0.283	0.000	0.127	0.411	69.00%	0.00%	31.00%	0.122	0.000	0.055	0.177
134119	01/08/90	140	0.335	0.009	0.026	0.370	90.61%	2.34%	7.05%	0.250	0.006	0.019	0.276
134119	03/04/91	154	0.348	0.009	0.026	0.383	90.83%	2.29%	6.88%	0.250	0.006	0.019	0.276
134119	04/28/92	167	0.352	0.009	0.026	0.387	90.91%	2.26%	6.83%	0.233	0.006	0.017	0.256
134119	04/07/94	191	0.364	0.009	0.027	0.399	91.08%	2.22%	6.69%	0.215	0.005	0.016	0.236
161001	07/17/89	192	0.232	0.082	0.065	0.379	61.09%	21.65%	17.26%	0.180	0.064	0.051	0.295
161001	08/02/90	205	0.240	0.084	0.066	0.391	61.52%	21.49%	16.98%	0.121	0.042	0.033	0.197
161001	07/04/91	216	0.244	0.085	0.067	0.395	61.64%	21.44%	16.91%	0.121	0.042	0.033	0.197
161001	08/25/94	253	0.266	0.086	0.068	0.421	63.26%	20.55%	16.18%	0.149	0.049	0.038	0.236
161001	05/17/95	262	0.266	0.087	0.068	0.421	63.22%	20.57%	16.22%	0.162	0.053	0.042	0.256
161001	07/09/97	288	0.281	0.089	0.069	0.439	63.99%	20.20%	15.81%	0.189	0.060	0.047	0.295
161001	09/23/98	302	0.291	0.089	0.070	0.449	64.73%	19.75%	15.52%	0.242	0.074	0.058	0.374
161009	09/20/89	180	0.273	0.015	0.057	0.345	78.99%	4.39%	16.62%	0.342	0.019	0.072	0.433
161009	07/19/90	190	0.277	0.015	0.058	0.350	79.16%	4.36%	16.48%	0.312	0.017	0.065	0.394
161009	07/26/91	202	0.285	0.015	0.058	0.359	79.55%	4.28%	16.17%	0.313	0.017	0.064	0.394
161021	09/21/89	48	0.241	0.015	0.066	0.322	74.88%	4.70%	20.42%	0.118	0.007	0.032	0.157
161021	07/21/90	58	0.253	0.015	0.067	0.336	75.39%	4.61%	20.01%	0.134	0.008	0.035	0.177
161021	07/28/91	70	0.267	0.016	0.069	0.352	75.98%	4.49%	19.53%	0.090	0.005	0.023	0.118
161021	09/12/95	120	0.323	0.017	0.073	0.413	78.19%	4.06%	17.75%	0.123	0.006	0.028	0.157
161021	06/05/96	129	0.325	0.017	0.074	0.416	78.19%	4.06%	17.75%	0.108	0.006	0.024	0.138
161021	07/29/97	142	0.339	0.017	0.075	0.431	78.70%	3.97%	17.33%	0.139	0.007	0.031	0.177

Table C-2 (Cont'd) Permanent Deformation Simulation (β_{r2} = 0.8 and β_{r3} = 0.8) Data

Section	Month	Time	Predicted							Measured			
			AC	GB	SG	Total	%AC	%GB	%SG	AC	GB	SG	Total
169034	07/17/89	10	0.075	0.018	0.037	0.130	57.92%	13.85%	28.23%	0.046	0.011	0.022	0.079
169034	08/02/90	23	0.129	0.021	0.042	0.192	67.12%	11.17%	21.71%	0.106	0.018	0.034	0.157
169034	07/04/91	34	0.138	0.022	0.044	0.204	67.83%	10.82%	21.36%	0.053	0.009	0.017	0.079
169034	05/17/95	80	0.173	0.024	0.048	0.245	70.48%	9.85%	19.68%	0.111	0.016	0.031	0.157
169034	07/09/97	106	0.193	0.025	0.050	0.268	72.01%	9.36%	18.63%	0.113	0.015	0.029	0.157
169034	09/24/98	120	0.201	0.026	0.051	0.277	72.45%	9.22%	18.32%	0.171	0.022	0.043	0.236
201009	05/02/89	53	0.087	0.000	0.056	0.143	60.70%	0.00%	39.30%	0.155	0.000	0.101	0.256
201009	12/10/90	72	0.101	0.000	0.059	0.160	62.99%	0.00%	37.01%	0.174	0.000	0.102	0.276
201009	04/08/93	100	0.111	0.000	0.062	0.172	64.11%	0.00%	35.89%	0.139	0.000	0.078	0.217
201009	04/23/96	136	0.123	0.000	0.065	0.188	65.54%	0.00%	34.46%	0.065	0.000	0.034	0.098
251003	08/04/89	180	0.119	0.035	0.031	0.185	64.48%	18.69%	16.83%	0.102	0.029	0.027	0.157
251003	09/06/90	193	0.120	0.035	0.031	0.186	64.47%	18.69%	16.83%	0.152	0.044	0.040	0.236
251003	08/23/91	204	0.123	0.035	0.032	0.190	64.90%	18.50%	16.60%	0.102	0.029	0.026	0.157
251003	09/30/92	217	0.129	0.036	0.032	0.196	65.55%	18.18%	16.27%	0.129	0.036	0.032	0.197
251003	10/27/95	254	0.135	0.036	0.033	0.204	66.18%	17.85%	15.97%	0.117	0.032	0.028	0.177
251003	10/23/96	266	0.137	0.037	0.033	0.207	66.33%	17.77%	15.90%	0.118	0.031	0.028	0.177
251003	06/16/98	286	0.144	0.037	0.033	0.214	67.12%	17.38%	15.51%	0.106	0.027	0.024	0.157
251004	08/04/89	178	0.116	0.047	0.033	0.196	59.08%	23.89%	17.03%	0.209	0.085	0.060	0.354
251004	09/05/90	191	0.120	0.048	0.034	0.202	59.59%	23.61%	16.81%	0.176	0.070	0.050	0.295
251004	08/22/91	202	0.123	0.048	0.034	0.206	59.89%	23.42%	16.69%	0.200	0.078	0.056	0.335
251004	09/30/92	215	0.129	0.049	0.035	0.213	60.49%	23.08%	16.43%	0.286	0.109	0.078	0.472
251004	10/29/95	252	0.140	0.051	0.036	0.227	61.54%	22.48%	15.98%	0.254	0.093	0.066	0.413
251004	06/05/97	272	0.144	0.052	0.037	0.233	61.84%	22.29%	15.87%	0.219	0.079	0.056	0.354
251004	06/15/98	284	0.149	0.052	0.037	0.239	62.43%	21.97%	15.61%	0.233	0.082	0.058	0.374
261001	09/07/89	217	0.130	0.054	0.064	0.247	52.53%	21.76%	25.71%	0.114	0.047	0.056	0.217
261001	07/21/90	227	0.131	0.054	0.064	0.249	52.61%	21.70%	25.69%	0.135	0.056	0.066	0.256
261001	07/16/91	239	0.133	0.054	0.064	0.252	52.82%	21.61%	25.57%	0.104	0.043	0.050	0.197
261001	06/09/93	262	0.136	0.055	0.065	0.257	53.10%	21.50%	25.40%	0.136	0.055	0.065	0.256
261001	07/05/96	299	0.143	0.056	0.066	0.265	53.79%	21.17%	25.04%	0.116	0.046	0.054	0.217
261004	10/21/90	64	0.135	0.019	0.048	0.202	67.00%	9.44%	23.56%	0.119	0.017	0.042	0.177
261004	05/13/93	95	0.141	0.020	0.050	0.210	66.92%	9.43%	23.65%	0.066	0.009	0.023	0.098
261004	07/07/94	109	0.151	0.020	0.051	0.223	67.94%	9.18%	22.88%	0.080	0.011	0.027	0.118
261004	06/15/95	120	0.153	0.021	0.052	0.226	67.98%	9.16%	22.87%	0.107	0.014	0.036	0.157
271018	06/22/89	126	0.247	0.021	0.074	0.342	72.10%	6.23%	21.67%	0.284	0.025	0.085	0.394
271018	10/30/90	142	0.261	0.022	0.075	0.358	72.91%	6.05%	21.04%	0.258	0.021	0.075	0.354
271018	06/02/93	174	0.280	0.022	0.077	0.379	73.81%	5.85%	20.34%	0.203	0.016	0.056	0.276
271018	03/08/94	183	0.291	0.022	0.078	0.391	74.44%	5.71%	19.86%	0.205	0.016	0.055	0.276
271087	06/09/89	126	0.052	0.000	0.039	0.090	57.20%	0.00%	42.80%	0.113	0.000	0.084	0.197
271087	11/13/90	143	0.054	0.000	0.039	0.093	57.89%	0.00%	42.11%	0.125	0.000	0.091	0.217
271087	05/11/93	173	0.056	0.000	0.040	0.096	58.42%	0.00%	41.58%	0.069	0.000	0.049	0.118
271087	06/25/96	210	0.060	0.000	0.040	0.101	59.75%	0.00%	40.25%	0.082	0.000	0.055	0.138
271087	08/03/99	240	0.062	0.000	0.041	0.103	60.25%	0.00%	39.75%	0.095	0.000	0.063	0.157
291008	03/13/89	35	0.094	0.006	0.070	0.170	55.40%	3.68%	40.91%	0.131	0.009	0.097	0.236
291008	11/07/90	55	0.109	0.007	0.076	0.192	57.03%	3.55%	39.41%	0.168	0.010	0.116	0.295
291008	03/05/93	85	0.122	0.007	0.081	0.210	58.21%	3.45%	38.34%	0.172	0.010	0.113	0.295
291008	04/17/96	120	0.138	0.008	0.085	0.232	59.79%	3.32%	36.89%	0.141	0.008	0.087	0.236
307088	09/27/89	100	0.248	0.088	0.105	0.441	56.25%	19.99%	23.76%	0.244	0.087	0.103	0.433
307088	07/29/90	110	0.255	0.089	0.106	0.451	56.69%	19.79%	23.52%	0.223	0.078	0.093	0.394
307088	05/20/91	120	0.260	0.090	0.107	0.457	56.82%	19.72%	23.46%	0.201	0.070	0.083	0.354

Table C-2 (Cont'd) Permanent Deformation Simulation (β_{r2} = 0.8 and β_{r3} = 0.8) Data

Section	Month	Time	Predicted							Measured			
			AC	GB	SG	Total	%AC	%GB	%SG	AC	GB	SG	Total
308129	10/03/89	17	0.116	0.064	0.097	0.277	41.86%	23.02%	35.12%	0.148	0.082	0.124	0.354
308129	07/29/90	26	0.124	0.077	0.106	0.308	40.46%	25.08%	34.47%	0.127	0.079	0.109	0.315
308129	07/30/91	38	0.136	0.082	0.115	0.333	40.94%	24.58%	34.48%	0.097	0.058	0.081	0.236
308129	12/14/93	67	0.167	0.086	0.127	0.380	44.03%	22.63%	33.34%	0.130	0.067	0.098	0.295
308129	03/17/94	70	0.167	0.086	0.128	0.382	43.85%	22.62%	33.54%	0.138	0.071	0.106	0.315
308129	08/22/94	75	0.176	0.091	0.131	0.398	44.22%	22.95%	32.83%	0.131	0.068	0.097	0.295
308129	10/31/94	77	0.177	0.092	0.132	0.400	44.23%	22.92%	32.85%	0.139	0.072	0.103	0.315
308129	02/17/95	81	0.177	0.092	0.133	0.402	44.10%	22.88%	33.02%	0.182	0.095	0.137	0.413
308129	05/18/95	84	0.177	0.092	0.133	0.402	44.02%	22.87%	33.11%	0.147	0.077	0.111	0.335
308129	06/10/96	97	0.186	0.093	0.136	0.415	44.70%	22.44%	32.86%	0.158	0.080	0.116	0.354
308129	10/28/96	101	0.192	0.094	0.138	0.424	45.34%	22.12%	32.53%	0.152	0.074	0.109	0.335
308129	01/23/97	104	0.192	0.094	0.138	0.424	45.29%	22.12%	32.59%	0.178	0.087	0.128	0.394
308129	03/25/97	106	0.192	0.094	0.139	0.425	45.25%	22.10%	32.65%	0.151	0.074	0.109	0.335
308129	08/11/97	111	0.202	0.094	0.140	0.435	46.34%	21.60%	32.06%	0.173	0.081	0.120	0.374
308129	10/01/97	113	0.203	0.094	0.140	0.437	46.43%	21.55%	32.02%	0.174	0.081	0.120	0.374
321020	08/29/89	63	0.182	0.015	0.060	0.258	70.73%	5.87%	23.39%	0.223	0.019	0.074	0.315
321020	08/22/90	75	0.190	0.015	0.062	0.267	71.16%	5.76%	23.08%	0.238	0.019	0.077	0.335
321020	07/23/91	86	0.196	0.016	0.063	0.275	71.53%	5.68%	22.79%	0.225	0.018	0.072	0.315
321020	09/14/94	124	0.231	0.016	0.065	0.313	73.80%	5.26%	20.94%	0.203	0.015	0.058	0.276
321020	04/25/95	131	0.231	0.016	0.066	0.313	73.75%	5.26%	20.99%	0.261	0.019	0.074	0.354
321020	06/05/97	157	0.246	0.017	0.067	0.330	74.48%	5.12%	20.40%	0.235	0.016	0.064	0.315
321020	06/09/98	169	0.251	0.017	0.068	0.336	74.74%	5.06%	20.21%	0.250	0.017	0.068	0.335
321020	04/13/99	175	0.261	0.017	0.068	0.346	75.31%	4.97%	19.72%	0.282	0.019	0.074	0.374
341003	09/11/90	195	0.176	0.018	0.039	0.233	75.57%	7.67%	16.76%	0.610	0.062	0.135	0.807
341003	08/15/91	206	0.180	0.018	0.039	0.238	75.82%	7.60%	16.58%	0.537	0.054	0.117	0.709
341003	09/28/92	219	0.184	0.018	0.040	0.242	75.92%	7.57%	16.51%	0.628	0.063	0.137	0.827
341011	04/17/99	214	0.370	0.019	0.090	0.479	77.36%	3.94%	18.70%	0.228	0.012	0.055	0.295
341011	04/18/99	227	0.377	0.019	0.091	0.486	77.46%	3.92%	18.62%	0.290	0.015	0.070	0.374
341011	04/19/99	244	0.389	0.019	0.092	0.499	77.78%	3.84%	18.38%	0.230	0.011	0.054	0.295
341011	04/20/99	254	0.401	0.019	0.093	0.513	78.17%	3.77%	18.05%	0.292	0.014	0.068	0.374
341011	04/21/99	287	0.428	0.020	0.095	0.544	78.78%	3.66%	17.55%	0.310	0.014	0.069	0.394
341011	04/22/99	307	0.448	0.020	0.097	0.565	79.27%	3.59%	17.14%	0.265	0.012	0.057	0.335
341031	10/05/89	194	0.279	0.045	0.084	0.408	68.40%	11.04%	20.56%	0.337	0.054	0.101	0.492
341031	09/12/90	205	0.289	0.046	0.085	0.420	68.80%	10.91%	20.29%	0.325	0.052	0.096	0.472
341031	04/06/92	224	0.303	0.047	0.087	0.436	69.35%	10.69%	19.96%	0.328	0.051	0.094	0.472
341031	02/24/93	234	0.311	0.047	0.088	0.446	69.72%	10.60%	19.68%	0.316	0.048	0.089	0.453
341031	10/26/95	266	0.341	0.049	0.091	0.481	70.88%	10.21%	18.91%	0.405	0.058	0.108	0.571
341031	11/04/95	267	0.341	0.049	0.091	0.481	70.88%	10.21%	18.91%	0.377	0.054	0.101	0.531
341033	10/05/89	181	0.205	0.033	0.052	0.290	70.73%	11.39%	17.88%	0.195	0.031	0.049	0.276
341033	09/12/90	192	0.207	0.033	0.052	0.293	70.80%	11.36%	17.85%	0.251	0.040	0.063	0.354
341033	04/05/92	211	0.216	0.034	0.053	0.302	71.32%	11.16%	17.52%	0.197	0.031	0.048	0.276
341033	02/24/93	221	0.221	0.034	0.053	0.308	71.68%	11.02%	17.30%	0.240	0.037	0.058	0.335
341033	11/03/95	254	0.233	0.035	0.054	0.322	72.31%	10.79%	16.90%	0.256	0.038	0.060	0.354
341033	07/23/97	274	0.235	0.035	0.055	0.325	72.34%	10.76%	16.90%	0.214	0.032	0.050	0.295
341034	10/05/89	48	0.135	0.000	0.053	0.189	71.70%	0.00%	28.30%	0.099	0.000	0.039	0.138
341034	09/12/90	59	0.147	0.000	0.055	0.202	72.87%	0.00%	27.13%	0.201	0.000	0.075	0.276
341034	04/06/92	78	0.157	0.000	0.056	0.213	73.67%	0.00%	26.33%	0.131	0.000	0.047	0.177
341034	02/24/93	88	0.165	0.000	0.057	0.222	74.37%	0.00%	25.63%	0.176	0.000	0.061	0.236
341034	11/04/95	121	0.190	0.000	0.059	0.249	76.19%	0.00%	23.81%	0.195	0.000	0.061	0.256
341034	07/30/97	141	0.201	0.000	0.060	0.261	76.85%	0.00%	23.15%	0.136	0.000	0.041	0.177

Table C-2 (Cont'd) Permanent Deformation Simulation (β_{r2} = 0.8 and β_{r3} = 0.8) Data

Section	Month	Time	Predicted							Measured			
			AC	GB	SG	Total	%AC	%GB	%SG	AC	GB	SG	Total
350101	05/01/97	19	0.175	0.032	0.130	0.338	51.81%	9.55%	38.64%	0.102	0.019	0.076	0.197
350101	03/19/99	38	0.237	0.036	0.147	0.420	56.46%	8.66%	34.89%	0.133	0.020	0.082	0.236
350102	05/01/97	19	0.181	0.054	0.157	0.393	46.16%	13.80%	40.04%	0.091	0.027	0.079	0.197
350102	03/19/99	38	0.248	0.061	0.180	0.488	50.76%	12.41%	36.83%	0.120	0.029	0.087	0.236
350103	05/01/97	19	0.099	0.000	0.130	0.229	43.20%	0.00%	56.80%	0.085	0.000	0.112	0.197
350103	03/19/99	38	0.132	0.000	0.152	0.284	46.50%	0.00%	53.50%	0.128	0.000	0.147	0.276
350104	05/01/97	19	0.077	0.000	0.086	0.163	47.41%	0.00%	52.59%	0.112	0.000	0.124	0.236
350104	03/19/99	38	0.103	0.000	0.101	0.204	50.44%	0.00%	49.56%	0.139	0.000	0.137	0.276
350105	05/02/97	19	0.146	0.012	0.147	0.305	47.84%	3.87%	48.29%	0.113	0.009	0.114	0.236
350105	03/22/99	38	0.195	0.013	0.171	0.380	51.46%	3.51%	45.04%	0.122	0.008	0.106	0.236
350106	05/02/96	19	0.076	0.005	0.099	0.180	42.37%	2.59%	55.04%	0.083	0.005	0.108	0.197
350106	03/22/99	38	0.101	0.005	0.116	0.222	45.40%	2.39%	52.22%	0.107	0.006	0.123	0.236
351005	10/31/89	73	0.175	0.018	0.102	0.295	59.28%	6.13%	34.60%	0.280	0.029	0.163	0.472
351005	08/21/91	95	0.186	0.018	0.106	0.311	59.79%	5.93%	34.28%	0.282	0.028	0.162	0.472
351005	10/24/92	109	0.195	0.019	0.110	0.324	60.34%	5.78%	33.87%	0.249	0.024	0.140	0.413
351005	03/18/95	138	0.230	0.020	0.114	0.363	63.24%	5.39%	31.37%	0.361	0.031	0.179	0.571
351005	03/16/99	183	0.266	0.020	0.120	0.406	65.52%	5.01%	29.47%	0.400	0.031	0.180	0.610
351022	10/31/89	37	0.132	0.026	0.092	0.250	52.72%	10.37%	36.91%	0.093	0.018	0.065	0.177
351022	08/22/91	59	0.184	0.028	0.101	0.313	58.70%	9.11%	32.19%	0.081	0.013	0.044	0.138
351022	10/24/92	73	0.192	0.029	0.104	0.325	59.06%	8.95%	31.99%	0.116	0.018	0.063	0.197
351022	03/18/95	102	0.219	0.030	0.110	0.359	60.94%	8.44%	30.63%	0.132	0.018	0.066	0.217
351022	03/17/99	147	0.272	0.032	0.118	0.422	64.39%	7.67%	27.93%	0.101	0.012	0.044	0.157
351112	12/05/89	67	0.313	0.024	0.064	0.401	78.16%	5.99%	15.85%	0.123	0.009	0.025	0.157
351112	01/22/91	80	0.320	0.024	0.065	0.409	78.26%	5.96%	15.79%	0.139	0.011	0.028	0.177
351112	09/27/91	88	0.328	0.025	0.065	0.418	78.52%	5.87%	15.61%	0.108	0.008	0.022	0.138
351112	01/27/93	104	0.339	0.025	0.066	0.430	78.83%	5.79%	15.38%	0.093	0.007	0.018	0.118
351112	03/15/95	130	0.364	0.025	0.068	0.457	79.63%	5.57%	14.80%	0.157	0.011	0.029	0.197
351112	09/09/97	160	0.381	0.026	0.069	0.476	80.03%	5.46%	14.51%	0.110	0.008	0.020	0.138
351112	03/15/99	175	0.391	0.026	0.070	0.486	80.32%	5.39%	14.30%	0.126	0.008	0.023	0.157
371006	10/13/89	88	0.375	0.024	0.109	0.508	73.72%	4.75%	21.53%	0.058	0.004	0.017	0.079
371006	03/19/91	105	0.392	0.024	0.111	0.528	74.25%	4.64%	21.11%	0.058	0.004	0.017	0.079
371006	10/11/92	124	0.428	0.025	0.114	0.568	75.41%	4.44%	20.15%	0.134	0.008	0.036	0.177
371006	04/18/94	142	0.441	0.026	0.116	0.583	75.69%	4.38%	19.93%	0.074	0.004	0.020	0.098
371006	09/20/94	147	0.451	0.026	0.117	0.593	75.96%	4.34%	19.70%	0.090	0.005	0.023	0.118
371024	11/03/89	109	0.142	0.038	0.083	0.263	53.96%	14.39%	31.65%	0.191	0.051	0.112	0.354
371024	03/09/91	125	0.146	0.038	0.085	0.269	54.20%	14.19%	31.62%	0.235	0.061	0.137	0.433
371024	04/10/92	138	0.151	0.039	0.087	0.277	54.66%	14.00%	31.35%	0.194	0.050	0.111	0.354
371802	10/13/89	49	0.158	0.061	0.213	0.432	36.53%	14.24%	49.23%	0.129	0.050	0.174	0.354
371802	03/18/91	66	0.173	0.064	0.225	0.461	37.46%	13.82%	48.72%	0.118	0.044	0.153	0.315
371802	10/10/92	85	0.190	0.067	0.237	0.494	38.46%	13.50%	48.04%	0.136	0.048	0.170	0.354
371802	04/15/94	103	0.200	0.068	0.246	0.513	38.89%	13.24%	47.87%	0.168	0.057	0.207	0.433
371802	07/18/95	118	0.212	0.070	0.253	0.536	39.68%	13.04%	47.28%	0.187	0.062	0.223	0.472
371802	02/09/96	125	0.216	0.070	0.256	0.542	39.82%	12.97%	47.22%	0.204	0.066	0.242	0.512
371802	04/02/96	127	0.216	0.070	0.256	0.542	39.77%	12.95%	47.28%	0.204	0.066	0.242	0.512
371817	10/15/89	71	0.177	0.037	0.058	0.272	65.00%	13.71%	21.30%	0.256	0.054	0.084	0.394
371817	03/18/91	88	0.184	0.038	0.060	0.282	65.17%	13.57%	21.26%	0.167	0.035	0.054	0.256
371817	10/18/92	107	0.208	0.040	0.062	0.310	67.11%	12.87%	20.01%	0.238	0.046	0.071	0.354

Table C-2 (Cont'd) Permanent Deformation Simulation (β_{r2} = 0.8 and β_{r3} = 0.8) Data

Section	Month	Time	Predicted							Measured			
			AC	GB	SG	Total	%AC	%GB	%SG	AC	GB	SG	Total
371992	10/15/92	33	0.216	0.097	0.059	0.372	57.94%	26.16%	15.90%	0.137	0.062	0.038	0.236
371992	04/20/94	51	0.250	0.102	0.063	0.416	60.14%	24.65%	15.21%	0.024	0.010	0.006	0.039
371992	02/06/96	73	0.291	0.108	0.067	0.466	62.44%	23.12%	14.43%	0.098	0.036	0.023	0.157
371992	04/22/98	99	0.332	0.113	0.071	0.515	64.36%	21.84%	13.80%	0.152	0.052	0.033	0.236
404087	01/17/90	43	0.132	0.022	0.082	0.236	56.00%	9.32%	34.68%	0.342	0.057	0.212	0.610
404087	10/13/91	64	0.151	0.024	0.091	0.266	56.87%	8.95%	34.18%	0.246	0.039	0.148	0.433
404087	02/08/93	80	0.160	0.025	0.096	0.280	57.09%	8.77%	34.13%	0.214	0.033	0.128	0.374
404087	02/09/95	104	0.174	0.026	0.103	0.302	57.51%	8.52%	33.97%	0.328	0.049	0.194	0.571
404163	01/23/90	34	0.114	0.000	0.080	0.194	58.68%	0.00%	41.32%	0.266	0.000	0.187	0.453
404163	03/17/91	48	0.124	0.000	0.084	0.208	59.74%	0.00%	40.26%	0.223	0.000	0.151	0.374
404163	10/28/91	55	0.130	0.000	0.086	0.216	60.13%	0.00%	39.87%	0.178	0.000	0.118	0.295
404163	03/10/93	72	0.141	0.000	0.089	0.230	61.20%	0.00%	38.80%	0.169	0.000	0.107	0.276
404163	04/22/96	109	0.156	0.000	0.094	0.250	62.30%	0.00%	37.70%	0.196	0.000	0.119	0.315
404163	08/20/97	125	0.168	0.000	0.097	0.265	63.50%	0.00%	36.50%	0.250	0.000	0.144	0.394
404163	01/11/99	141	0.172	0.000	0.098	0.270	63.61%	0.00%	36.39%	0.288	0.000	0.165	0.453
421599	07/18/89	24	0.091	0.017	0.080	0.188	48.46%	9.14%	42.40%	0.086	0.016	0.075	0.177
421599	09/27/90	38	0.101	0.017	0.085	0.203	49.61%	8.57%	41.82%	0.107	0.019	0.091	0.217
421599	08/07/91	49	0.107	0.017	0.088	0.213	50.48%	8.20%	41.32%	0.099	0.016	0.081	0.197
421599	03/01/93	68	0.118	0.018	0.092	0.227	51.93%	7.76%	40.31%	0.164	0.024	0.127	0.315
421599	06/21/95	95	0.135	0.018	0.096	0.250	54.19%	7.16%	38.66%	0.149	0.020	0.107	0.276
421599	07/19/96	108	0.143	0.018	0.099	0.259	55.07%	6.93%	38.00%	0.152	0.019	0.105	0.276
421599	03/26/98	128	0.155	0.018	0.101	0.274	56.43%	6.64%	36.93%	0.156	0.018	0.102	0.276
451011	04/11/89	34	0.356	0.048	0.066	0.470	75.86%	10.14%	14.00%	0.254	0.034	0.047	0.335
451011	03/05/91	57	0.406	0.050	0.069	0.525	77.33%	9.51%	13.16%	0.381	0.047	0.065	0.492
451011	10/24/92	76	0.448	0.052	0.071	0.570	78.49%	9.04%	12.47%	0.494	0.057	0.079	0.630
451011	01/27/96	115	0.499	0.053	0.074	0.626	79.70%	8.52%	11.77%	0.533	0.057	0.079	0.669
451011	02/11/99	150	0.536	0.055	0.075	0.666	80.47%	8.20%	11.34%	0.570	0.058	0.080	0.709
473104	11/01/89	42	0.016	0.039	0.067	0.122	13.19%	31.57%	55.24%	0.036	0.087	0.152	0.276
473104	05/06/91	60	0.017	0.041	0.074	0.132	13.01%	31.00%	55.99%	0.041	0.098	0.176	0.315
473104	10/26/92	77	0.019	0.043	0.079	0.142	13.64%	30.27%	56.09%	0.048	0.107	0.199	0.354
473104	11/30/95	114	0.021	0.047	0.090	0.159	13.49%	29.72%	56.79%	0.085	0.187	0.358	0.630
480001	04/10/89	1	0.044	0.055	0.064	0.162	27.09%	33.72%	39.19%	0.064	0.080	0.093	0.236
480001	10/11/90	19	0.208	0.095	0.120	0.423	49.17%	22.47%	28.36%	0.136	0.062	0.078	0.276
480001	03/11/92	36	0.249	0.102	0.135	0.486	51.25%	21.03%	27.72%	0.161	0.066	0.087	0.315
480001	02/17/93	47	0.281	0.106	0.142	0.529	53.14%	20.09%	26.78%	0.105	0.040	0.053	0.197
480001	02/20/95	71	0.313	0.112	0.154	0.579	54.12%	19.36%	26.51%	0.170	0.061	0.084	0.315
480001	03/19/98	108	0.373	0.119	0.168	0.660	56.55%	18.08%	25.37%	0.089	0.028	0.040	0.157
481060	06/18/90	52	0.212	0.040	0.066	0.318	66.73%	12.61%	20.66%	0.276	0.052	0.085	0.413
481060	02/14/91	60	0.223	0.041	0.067	0.331	67.41%	12.32%	20.27%	0.226	0.041	0.068	0.335
481060	03/18/92	73	0.234	0.042	0.069	0.345	67.84%	12.08%	20.08%	0.160	0.029	0.047	0.236
481060	02/23/93	84	0.246	0.042	0.071	0.359	68.42%	11.81%	19.77%	0.148	0.026	0.043	0.217
481060	02/23/95	108	0.264	0.044	0.074	0.382	69.18%	11.43%	19.39%	0.259	0.043	0.073	0.374
481060	01/05/99	154	0.299	0.046	0.078	0.423	70.71%	10.79%	18.51%	0.278	0.042	0.073	0.394
481077	04/25/89	88	0.300	0.027	0.068	0.396	75.97%	6.79%	17.24%	0.404	0.036	0.092	0.531
481077	10/13/91	118	0.332	0.028	0.070	0.430	77.15%	6.47%	16.38%	0.471	0.039	0.100	0.610
481077	10/12/92	130	0.338	0.028	0.071	0.437	77.27%	6.43%	16.30%	0.472	0.039	0.099	0.610
481077	03/10/95	159	0.357	0.029	0.073	0.459	77.89%	6.25%	15.86%	0.552	0.044	0.112	0.709
481077	03/26/98	195	0.380	0.029	0.074	0.484	78.54%	6.06%	15.40%	0.541	0.042	0.106	0.689

Table C-2 (Cont'd) Permanent Deformation Simulation (β_{r2} = 0.8 and β_{r3} = 0.8) Data

Section	Month	Time	Predicted							Measured			
			AC	GB	SG	Total	%AC	%GB	%SG	AC	GB	SG	Total
481109	01/04/90	68	0.320	0.000	0.146	0.466	68.66%	0.00%	31.34%	0.216	0.000	0.099	0.315
481109	09/21/90	76	0.334	0.000	0.149	0.483	69.13%	0.00%	30.87%	0.218	0.000	0.097	0.315
481109	03/10/92	94	0.348	0.000	0.153	0.501	69.42%	0.00%	30.58%	0.178	0.000	0.078	0.256
481109	02/12/93	105	0.363	0.000	0.156	0.519	69.92%	0.00%	30.08%	0.179	0.000	0.077	0.256
481109	02/16/95	129	0.385	0.000	0.161	0.546	70.54%	0.00%	29.46%	0.278	0.000	0.116	0.394
481130	04/11/89	201	0.464	0.117	0.137	0.718	64.61%	16.27%	19.11%	0.343	0.087	0.102	0.531
481130	10/12/90	219	0.482	0.119	0.140	0.741	65.07%	16.03%	18.90%	0.448	0.110	0.130	0.689
481130	03/12/92	236	0.490	0.120	0.142	0.752	65.19%	15.92%	18.89%	0.449	0.110	0.130	0.689
481169	03/04/90	212	0.097	0.079	0.057	0.233	41.44%	33.99%	24.56%	0.131	0.107	0.077	0.315
481169	09/18/90	218	0.098	0.080	0.058	0.235	41.60%	33.89%	24.51%	0.131	0.107	0.077	0.315
481169	03/07/91	224	0.098	0.080	0.058	0.235	41.57%	33.90%	24.53%	0.131	0.107	0.077	0.315
481169	01/30/92	234	0.100	0.080	0.058	0.238	41.93%	33.69%	24.38%	0.140	0.113	0.082	0.335
481169	02/27/93	247	0.102	0.081	0.058	0.241	42.29%	33.49%	24.23%	0.133	0.105	0.076	0.315
481169	03/03/95	272	0.104	0.082	0.059	0.245	42.53%	33.34%	24.14%	0.201	0.157	0.114	0.472
481174	10/17/90	186	0.455	0.051	0.129	0.635	71.63%	8.09%	20.28%	0.282	0.032	0.080	0.394
481174	02/14/91	190	0.455	0.051	0.129	0.636	71.60%	8.09%	20.32%	0.310	0.035	0.088	0.433
481174	03/16/92	203	0.463	0.052	0.131	0.645	71.72%	8.02%	20.26%	0.226	0.025	0.064	0.315
481174	02/18/93	214	0.468	0.052	0.132	0.652	71.79%	7.99%	20.23%	0.254	0.028	0.072	0.354
481174	02/21/95	238	0.484	0.053	0.134	0.671	72.12%	7.85%	20.03%	0.483	0.053	0.134	0.669
481174	03/20/98	275	0.499	0.053	0.138	0.690	72.29%	7.75%	19.97%	0.484	0.052	0.134	0.669
481178	04/10/89	10	0.172	0.021	0.068	0.261	65.82%	7.97%	26.21%	0.117	0.014	0.046	0.177
481178	02/22/91	32	0.255	0.025	0.088	0.369	69.20%	6.86%	23.93%	0.095	0.009	0.033	0.138
481178	03/10/92	45	0.284	0.026	0.094	0.405	70.18%	6.52%	23.30%	0.097	0.009	0.032	0.138
481178	02/16/93	56	0.300	0.027	0.099	0.427	70.45%	6.37%	23.18%	0.111	0.010	0.037	0.157
481178	02/17/95	80	0.338	0.029	0.107	0.474	71.34%	6.03%	22.63%	0.169	0.014	0.053	0.236
481183	12/06/89	179	0.278	0.056	0.158	0.491	56.59%	11.30%	32.11%	0.145	0.029	0.082	0.256
481183	09/15/90	188	0.287	0.056	0.161	0.504	56.89%	11.22%	31.89%	0.168	0.033	0.094	0.295
483749	10/17/90	116	0.344	0.161	0.139	0.644	53.47%	24.97%	21.56%	0.137	0.064	0.055	0.256
483749	02/14/91	120	0.346	0.161	0.140	0.647	53.43%	24.95%	21.61%	0.116	0.054	0.047	0.217
483749	03/16/92	133	0.352	0.164	0.142	0.659	53.45%	24.91%	21.64%	0.105	0.049	0.043	0.197
483749	02/21/93	144	0.358	0.166	0.145	0.669	53.55%	24.84%	21.61%	0.116	0.054	0.047	0.217
483749	02/21/95	168	0.371	0.171	0.149	0.691	53.75%	24.69%	21.55%	0.180	0.083	0.072	0.335
483749	03/28/97	193	0.382	0.174	0.153	0.709	53.87%	24.60%	21.53%	0.244	0.111	0.097	0.453
489005	10/14/90	50	0.070	0.134	0.190	0.393	17.75%	34.01%	48.24%	0.059	0.114	0.161	0.335
489005	03/12/92	67	0.075	0.139	0.200	0.414	18.14%	33.46%	48.40%	0.025	0.046	0.067	0.138
489005	02/17/93	78	0.078	0.141	0.206	0.426	18.39%	33.20%	48.42%	0.025	0.046	0.067	0.138
489005	02/20/95	102	0.084	0.146	0.217	0.447	18.74%	32.71%	48.55%	0.044	0.077	0.115	0.236
489005	07/10/98	143	0.091	0.153	0.231	0.476	19.18%	32.22%	48.59%	0.030	0.051	0.077	0.157
501002	08/09/89	58	0.105	0.027	0.041	0.174	60.57%	15.83%	23.60%	0.179	0.047	0.070	0.295
501002	08/08/90	70	0.114	0.028	0.042	0.184	61.68%	15.37%	22.95%	0.231	0.058	0.086	0.374
501002	09/04/91	83	0.117	0.029	0.043	0.189	61.77%	15.26%	22.97%	0.195	0.048	0.072	0.315
501002	04/27/93	102	0.122	0.030	0.045	0.197	62.19%	15.02%	22.80%	0.233	0.056	0.085	0.374
501002	05/25/94	115	0.128	0.030	0.046	0.204	62.69%	14.82%	22.49%	0.234	0.055	0.084	0.374
501002	08/17/94	118	0.131	0.031	0.046	0.208	63.08%	14.71%	22.21%	0.236	0.055	0.083	0.374
501002	04/27/95	126	0.131	0.031	0.046	0.208	62.93%	14.72%	22.35%	0.248	0.058	0.088	0.394
501002	10/12/95	132	0.138	0.031	0.047	0.217	63.92%	14.39%	21.69%	0.277	0.062	0.094	0.433
501002	10/17/96	144	0.140	0.031	0.048	0.218	63.86%	14.37%	21.77%	0.226	0.051	0.077	0.354
501002	05/15/97	151	0.141	0.031	0.048	0.220	63.92%	14.32%	21.76%	0.277	0.062	0.094	0.433
501002	10/23/97	156	0.145	0.032	0.048	0.225	64.41%	14.15%	21.44%	0.292	0.064	0.097	0.453
501002	06/06/98	164	0.146	0.032	0.049	0.226	64.46%	14.10%	21.43%	0.279	0.061	0.093	0.433

Table C-2 (Cont'd) Permanent Deformation Simulation (β_{r2} = 0.8 and β_{r3} = 0.8) Data

Section	Month	Time	Predicted							Measured			
			AC	GB	SG	Total	%AC	%GB	%SG	AC	GB	SG	Total
501004	08/09/89	58	0.073	0.029	0.046	0.148	49.34%	19.68%	30.98%	0.078	0.031	0.049	0.157
501004	08/07/90	70	0.082	0.030	0.047	0.158	51.56%	18.75%	29.70%	0.132	0.048	0.076	0.256
501004	09/20/91	83	0.090	0.030	0.048	0.169	53.34%	18.00%	28.66%	0.105	0.035	0.056	0.197
501004	04/27/93	102	0.100	0.031	0.050	0.181	55.16%	17.17%	27.68%	0.141	0.044	0.071	0.256
501004	10/12/95	132	0.117	0.032	0.053	0.202	57.85%	15.95%	26.20%	0.137	0.038	0.062	0.236
501004	11/04/97	157	0.131	0.033	0.055	0.219	59.68%	15.15%	25.17%	0.153	0.039	0.064	0.256
511002	10/15/89	121	0.203	0.041	0.081	0.325	62.47%	12.53%	25.00%	0.246	0.049	0.098	0.394
511023	10/12/89	107	0.344	0.040	0.108	0.493	69.85%	8.21%	21.94%	0.399	0.047	0.125	0.571
511023	03/20/91	124	0.358	0.041	0.110	0.509	70.41%	8.04%	21.56%	0.388	0.044	0.119	0.551
511023	10/10/92	143	0.382	0.042	0.112	0.536	71.30%	7.80%	20.90%	0.421	0.046	0.123	0.591
511023	12/07/93	157	0.396	0.042	0.113	0.551	71.82%	7.66%	20.52%	0.438	0.047	0.125	0.610
511023	09/18/95	178	0.416	0.043	0.115	0.574	72.50%	7.46%	20.04%	0.400	0.041	0.110	0.551
511023	02/09/96	183	0.416	0.043	0.115	0.574	72.49%	7.46%	20.05%	0.485	0.050	0.134	0.669
511023	03/24/97	196	0.423	0.043	0.116	0.582	72.68%	7.39%	19.93%	0.429	0.044	0.118	0.591
512021	10/15/89	54	0.160	0.011	0.079	0.250	63.96%	4.50%	31.54%	0.252	0.018	0.124	0.394
512021	03/11/91	71	0.174	0.012	0.081	0.267	65.23%	4.39%	30.38%	0.282	0.019	0.132	0.433
512021	10/20/92	90	0.192	0.012	0.085	0.289	66.45%	4.19%	29.35%	0.353	0.022	0.156	0.531
531008	07/17/89	129	0.222	0.049	0.069	0.340	65.35%	14.36%	20.29%	0.502	0.110	0.156	0.768
531008	07/17/89	142	0.235	0.050	0.070	0.355	66.27%	14.01%	19.72%	0.496	0.105	0.148	0.748
531008	08/02/90	151	0.236	0.050	0.070	0.356	66.26%	14.00%	19.74%	0.509	0.108	0.152	0.768
531008	08/02/90	153	0.238	0.050	0.071	0.359	66.41%	13.94%	19.65%	0.549	0.115	0.163	0.827
531008	05/28/91	188	0.251	0.051	0.072	0.375	67.04%	13.67%	19.29%	0.726	0.148	0.209	1.083
531801	07/17/89	190	0.104	0.006	0.046	0.156	66.82%	3.96%	29.22%	0.132	0.008	0.058	0.197
531801	08/09/90	203	0.107	0.006	0.046	0.160	67.20%	3.93%	28.87%	0.119	0.007	0.051	0.177
531801	06/05/91	213	0.108	0.006	0.046	0.161	67.34%	3.90%	28.76%	0.146	0.008	0.062	0.217
531801	06/22/94	249	0.117	0.006	0.048	0.171	68.36%	3.79%	27.85%	0.108	0.006	0.044	0.157
531801	05/08/95	260	0.119	0.006	0.048	0.174	68.60%	3.74%	27.67%	0.108	0.006	0.044	0.157
531801	10/31/95	265	0.122	0.007	0.048	0.177	68.97%	3.72%	27.30%	0.122	0.007	0.048	0.177
531801	03/27/97	282	0.124	0.007	0.049	0.180	69.15%	3.73%	27.12%	0.136	0.007	0.053	0.197
561007	09/26/89	111	0.180	0.025	0.072	0.277	64.98%	8.97%	26.04%	0.294	0.041	0.118	0.453
561007	07/22/90	121	0.181	0.025	0.073	0.280	64.87%	8.98%	26.15%	0.255	0.035	0.103	0.394
561007	05/13/91	131	0.182	0.025	0.074	0.282	64.77%	8.99%	26.24%	0.242	0.034	0.098	0.374
561007	08/03/91	134	0.192	0.026	0.074	0.292	65.80%	8.79%	25.41%	0.207	0.028	0.080	0.315
561007	12/09/93	162	0.204	0.026	0.076	0.307	66.50%	8.58%	24.92%	0.183	0.024	0.069	0.276
561007	03/16/94	165	0.204	0.026	0.077	0.307	66.46%	8.57%	24.97%	0.183	0.024	0.069	0.276
561007	04/19/94	166	0.204	0.026	0.077	0.307	66.44%	8.57%	24.99%	0.196	0.025	0.074	0.295
561007	08/19/94	170	0.206	0.027	0.077	0.310	66.56%	8.57%	24.87%	0.170	0.022	0.064	0.256
561007	02/16/95	176	0.206	0.027	0.077	0.310	66.48%	8.55%	24.97%	0.183	0.024	0.069	0.276
561007	05/17/95	179	0.206	0.027	0.078	0.310	66.41%	8.58%	25.01%	0.170	0.022	0.064	0.256
561007	09/08/95	183	0.208	0.027	0.078	0.313	66.58%	8.55%	24.87%	0.183	0.024	0.069	0.276
561007	06/11/96	192	0.209	0.027	0.078	0.314	66.57%	8.54%	24.89%	0.144	0.018	0.054	0.217
561007	10/24/96	196	0.216	0.027	0.079	0.321	67.13%	8.42%	24.45%	0.185	0.023	0.067	0.276
561007	11/19/96	197	0.216	0.027	0.079	0.321	67.11%	8.42%	24.47%	0.185	0.023	0.067	0.276
561007	03/10/97	201	0.216	0.027	0.079	0.322	67.07%	8.41%	24.52%	0.198	0.025	0.072	0.295
561007	03/24/97	202	0.216	0.027	0.079	0.322	67.05%	8.41%	24.54%	0.185	0.023	0.068	0.276
561007	08/07/97	206	0.224	0.027	0.079	0.331	67.80%	8.24%	23.95%	0.187	0.023	0.066	0.276
561007	09/30/97	207	0.224	0.027	0.079	0.331	67.78%	8.27%	23.94%	0.187	0.023	0.066	0.276
841684	08/29/90	144	0.209	0.057	0.052	0.318	65.85%	17.81%	16.34%	0.363	0.098	0.090	0.551
841684	08/28/91	156	0.215	0.057	0.052	0.324	66.21%	17.63%	16.16%	0.365	0.097	0.089	0.551
841684	05/03/93	177	0.220	0.058	0.053	0.331	66.43%	17.48%	16.09%	0.432	0.114	0.104	0.650

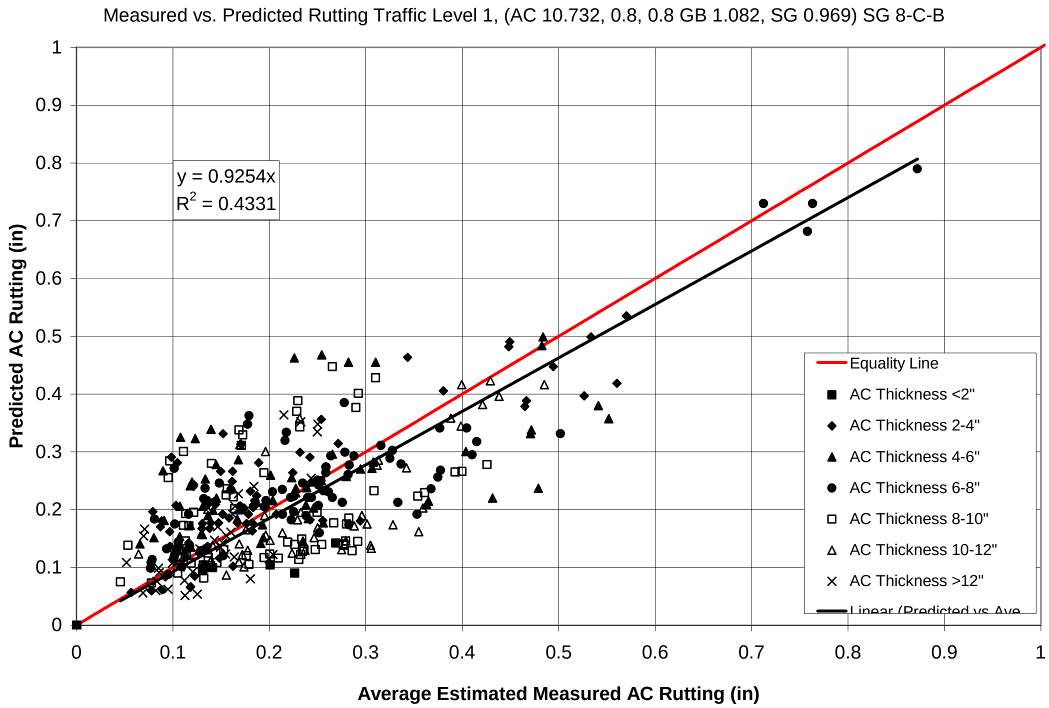


Figure C-90 Asphalt Concrete Layers Rut Depth (β_{r2} = 0.8 and β_{r3} = 0.8)

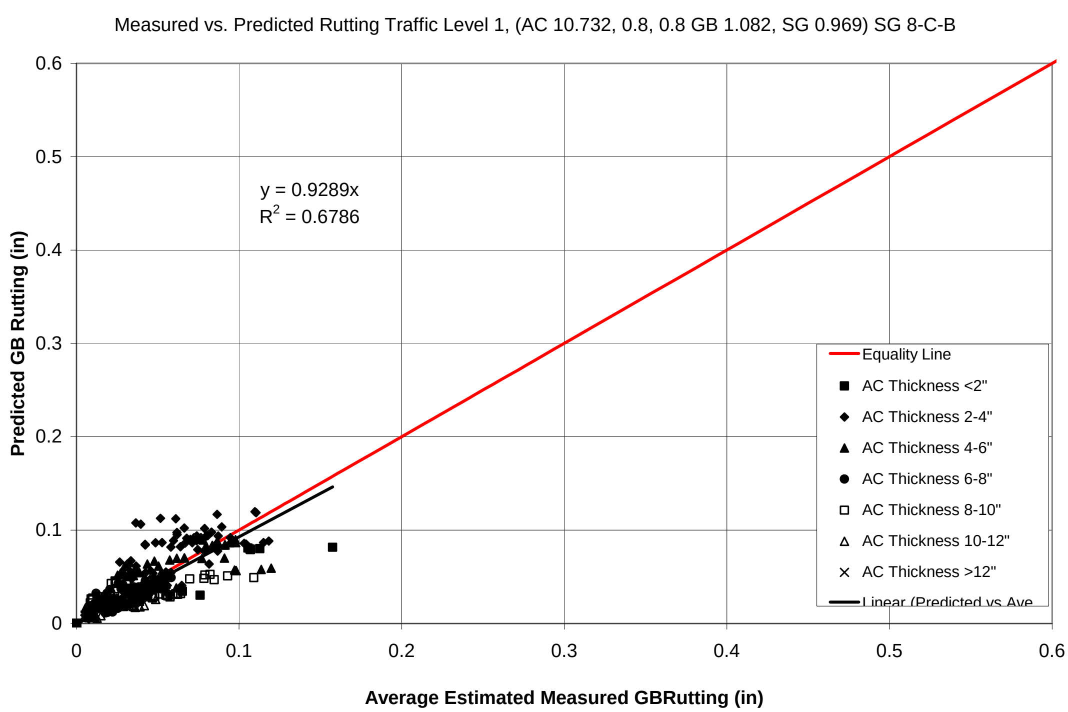


Figure C-91 Granular Base Layers Rut Depth (β_{r2} = 0.8 and β_{r3} = 0.8)

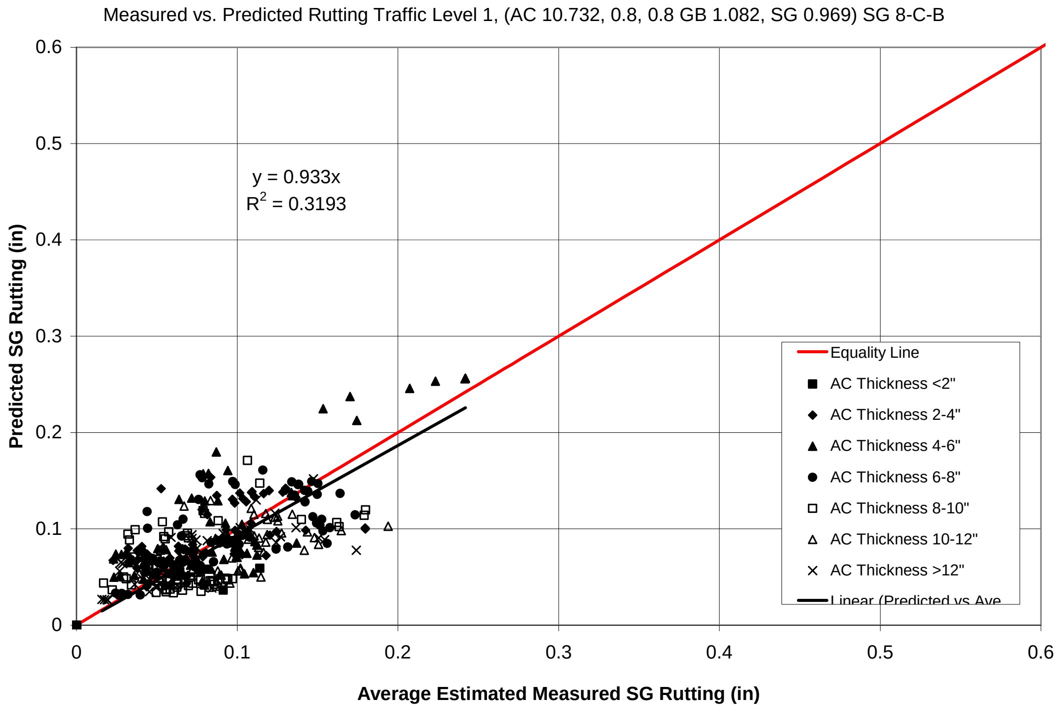


Figure C-92 Granular Subgrade Rut Depth (β_{r2} = 0.8 and β_{r3} = 0.8)

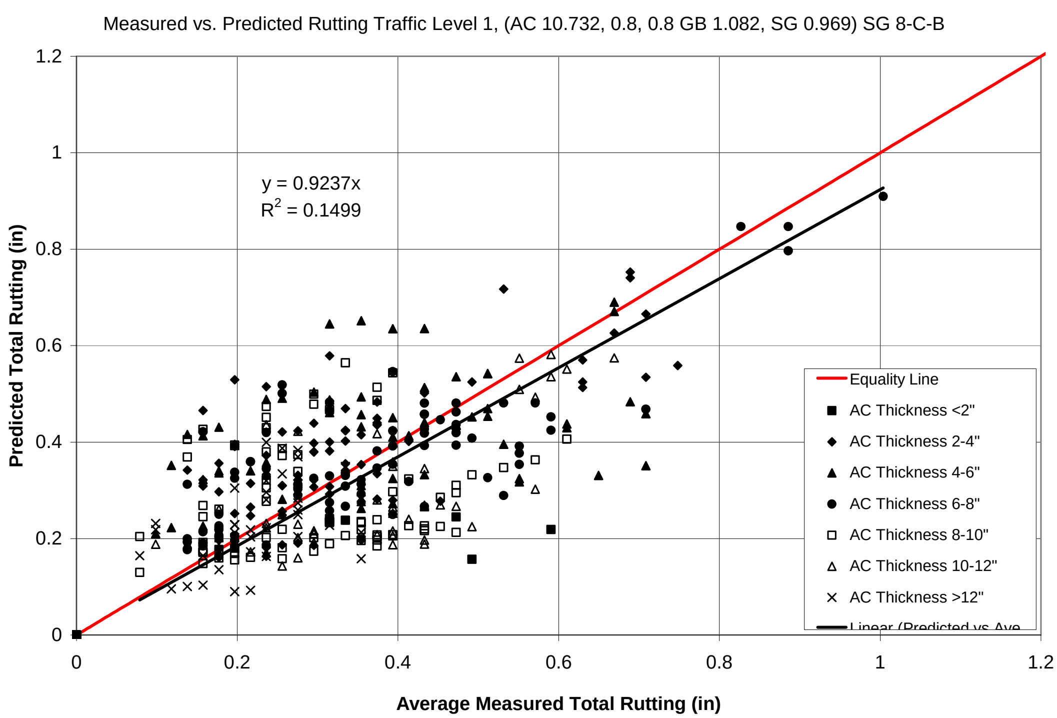


Figure C-93 Total Asphalt Pavement Rut Depth (β_{r2} = 0.8 and β_{r3} = 0.8)

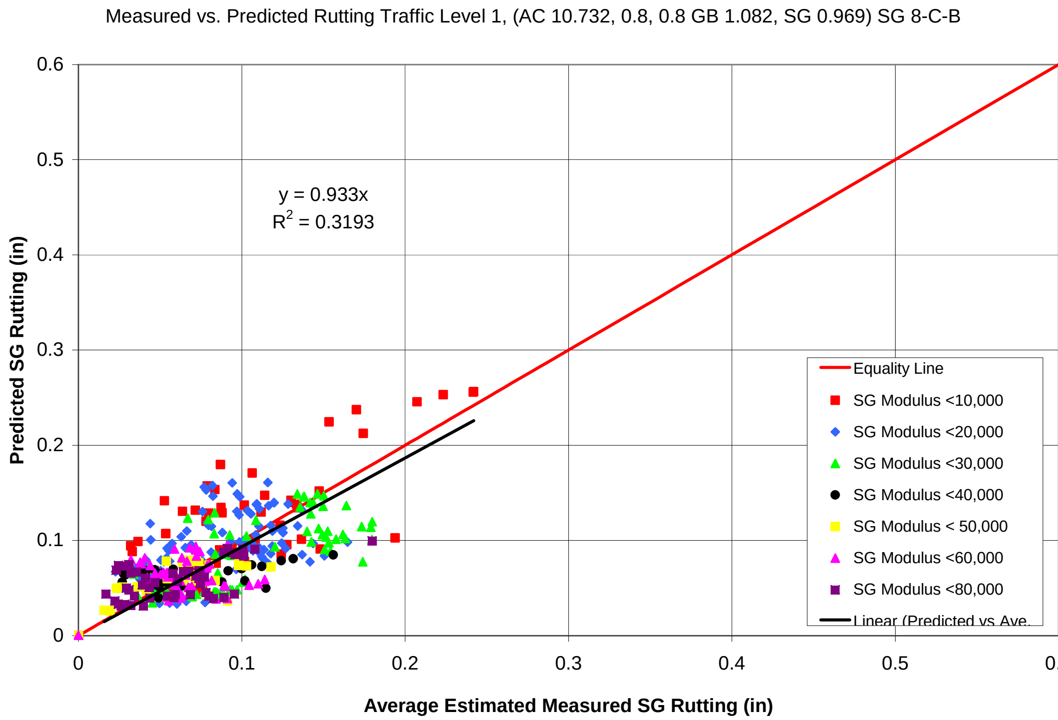


Figure C-94 Subgrade Rut Depth (β_{r2} = 0.8 and β_{r3} = 0.8) (By Subgrade Modulus)

Table C-53 Permanent Deformation Simulation (β_{r2} = 0.8 and β_{r3} = 1.0) Summary

	AC	GB	SG	Total
Average Predicted=	0.185	0.045	0.106	0.336
Sum of error =	0.335	-0.005	-0.054	0.000
Sum of error^2 =	2.219	0.166	0.714	6.908
Predicted % =	53.39%	13.22%	33.39%	100.00%
Se =	0.069	0.019	0.039	0.121
Average Measured =	0.045	0.106	0.336	0.346
Calibration Factor β_1 =	3.515	1.306	1.236	

Table C-54 Permanent Deformation Simulation (β_{r2} = 0.8 and β_{r3} = 1.0) Data

Section	Month	Time	Predicted							Measured			
			AC	GB	SG	Total	%AC	%GB	%SG	AC	GB	SG	Total
11001	04/05/89	103	0.449	0.135	0.108	0.692	64.82%	19.55%	15.63%	0.217	0.065	0.052	0.335
11001	02/12/91	125	0.492	0.138	0.111	0.741	66.44%	18.62%	14.94%	0.209	0.059	0.047	0.315
11001	04/02/92	139	0.504	0.139	0.112	0.755	66.79%	18.40%	14.81%	0.197	0.054	0.044	0.295
11019	05/15/89	32	0.170	0.019	0.125	0.315	54.20%	6.15%	39.65%	0.277	0.031	0.203	0.512
11019	04/16/90	43	0.194	0.020	0.129	0.344	56.58%	5.82%	37.60%	0.312	0.032	0.207	0.551
11019	01/15/91	52	0.215	0.021	0.132	0.368	58.50%	5.57%	35.94%	0.322	0.031	0.198	0.551
11019	03/31/92	66	0.230	0.021	0.135	0.386	59.50%	5.38%	35.12%	0.328	0.030	0.194	0.551
11019	03/22/94	90	0.258	0.024	0.140	0.422	61.16%	5.69%	33.15%	0.361	0.034	0.196	0.591
11019	01/08/96	112	0.284	0.026	0.144	0.454	62.56%	5.81%	31.63%	0.369	0.034	0.187	0.591
11019	01/23/98	136	0.301	0.027	0.146	0.474	63.54%	5.62%	30.84%	0.450	0.040	0.219	0.709
14126	06/05/89	15	0.079	0.010	0.044	0.134	59.17%	7.72%	33.11%	0.105	0.014	0.059	0.177
14126	03/03/91	36	0.112	0.011	0.051	0.175	64.27%	6.49%	29.24%	0.139	0.014	0.063	0.217
14126	04/08/92	49	0.124	0.012	0.054	0.189	65.34%	6.14%	28.52%	0.103	0.010	0.045	0.157
14126	04/08/94	73	0.143	0.012	0.057	0.212	67.25%	5.72%	27.03%	0.132	0.011	0.053	0.197
14126	12/11/95	93	0.159	0.013	0.059	0.231	68.90%	5.43%	25.67%	0.149	0.012	0.056	0.217
14126	12/05/97	117	0.173	0.013	0.061	0.247	70.08%	5.18%	24.74%	0.138	0.010	0.049	0.197
21001	08/21/91	98	0.044	0.036	0.117	0.196	22.55%	18.09%	59.36%	0.040	0.032	0.105	0.177
21001	08/26/93	122	0.048	0.036	0.119	0.203	23.52%	17.80%	58.68%	0.056	0.042	0.139	0.236
21001	06/15/95	144	0.050	0.037	0.126	0.213	23.48%	17.39%	59.13%	0.065	0.048	0.163	0.276
21001	08/22/97	170	0.054	0.038	0.127	0.219	24.70%	17.28%	58.02%	0.088	0.061	0.206	0.354
21001	08/26/98	182	0.055	0.038	0.129	0.222	24.85%	17.17%	57.98%	0.088	0.061	0.205	0.354
21002	08/22/91	83	0.060	0.045	0.051	0.157	38.61%	29.03%	32.36%	0.068	0.051	0.057	0.177
21002	07/30/92	94	0.062	0.046	0.052	0.160	38.75%	28.88%	32.37%	0.092	0.068	0.076	0.236
21002	06/14/95	129	0.075	0.048	0.054	0.176	42.32%	27.29%	30.39%	0.100	0.064	0.072	0.236
21002	08/21/97	155	0.078	0.049	0.055	0.182	42.87%	26.98%	30.15%	0.127	0.080	0.089	0.295
21002	05/14/98	164	0.078	0.049	0.055	0.183	42.89%	26.94%	30.17%	0.110	0.069	0.077	0.256
40114	03/30/95	20	0.150	0.041	0.163	0.354	42.30%	11.58%	46.12%	0.167	0.046	0.182	0.394
40114	11/07/95	28	0.181	0.043	0.172	0.397	45.70%	10.89%	43.41%	0.180	0.043	0.171	0.394
40114	02/04/96	31	0.181	0.043	0.173	0.398	45.58%	10.86%	43.55%	0.197	0.047	0.189	0.433
40114	04/04/96	33	0.182	0.043	0.174	0.400	45.60%	10.81%	43.59%	0.215	0.051	0.206	0.472
40114	07/09/96	36	0.204	0.044	0.177	0.425	47.84%	10.44%	41.72%	0.207	0.045	0.181	0.433
40114	08/13/96	37	0.212	0.045	0.179	0.435	48.69%	10.29%	41.02%	0.211	0.045	0.178	0.433
40114	01/07/98	54	0.239	0.046	0.186	0.471	50.72%	9.81%	39.47%	0.220	0.042	0.171	0.433
40114	04/21/98	57	0.239	0.046	0.187	0.472	50.65%	9.80%	39.55%	0.219	0.042	0.171	0.433
40114	06/12/98	59	0.243	0.046	0.188	0.477	50.92%	9.75%	39.33%	0.241	0.046	0.186	0.472
40114	10/23/98	63	0.260	0.047	0.190	0.497	52.32%	9.48%	38.19%	0.227	0.041	0.165	0.433
40114	02/12/99	65	0.260	0.047	0.190	0.497	52.29%	9.48%	38.24%	0.247	0.045	0.181	0.472
40115	02/15/95	19	0.085	0.000	0.072	0.157	54.37%	0.00%	45.63%	0.043	0.000	0.036	0.079
40115	03/30/95	20	0.085	0.000	0.072	0.157	54.33%	0.00%	45.67%	0.086	0.000	0.072	0.157
40115	01/07/98	54	0.136	0.000	0.081	0.218	62.61%	0.00%	37.39%	0.062	0.000	0.037	0.098
40115	02/11/99	65	0.148	0.000	0.083	0.232	64.07%	0.00%	35.93%	0.063	0.000	0.035	0.098
40116	03/30/95	20	0.063	0.000	0.099	0.162	38.96%	0.00%	61.04%	0.138	0.000	0.216	0.354
40116	01/08/98	54	0.101	0.000	0.113	0.214	47.12%	0.00%	52.88%	0.167	0.000	0.187	0.354
40116	02/12/99	65	0.110	0.000	0.116	0.225	48.69%	0.00%	51.31%	0.173	0.000	0.182	0.354

Table C-4 (Cont'd) Permanent Deformation Simulation (β_{r2} = 0.8 and β_{r3} = 1.0) Data

Section	Month	Time	Predicted							Measured			
			AC	GB	SG	Total	%AC	%GB	%SG	AC	GB	SG	Total
40117	03/30/95	20	0.104	0.007	0.064	0.175	59.71%	3.81%	36.48%	0.259	0.016	0.158	0.433
40117	01/08/98	54	0.166	0.008	0.072	0.246	67.65%	3.08%	29.27%	0.266	0.012	0.115	0.394
40117	02/11/99	65	0.181	0.008	0.073	0.262	69.05%	2.94%	28.01%	0.326	0.014	0.132	0.472
40118	03/30/95	20	0.101	0.010	0.099	0.210	48.05%	4.73%	47.22%	0.189	0.019	0.186	0.394
40118	01/08/98	54	0.159	0.011	0.115	0.285	55.71%	3.85%	40.44%	0.197	0.014	0.143	0.354
40118	02/12/99	65	0.173	0.011	0.118	0.303	57.25%	3.67%	39.08%	0.203	0.013	0.138	0.354
41007	11/20/89	140	0.695	0.037	0.108	0.840	82.77%	4.42%	12.81%	0.733	0.039	0.113	0.886
41007	09/05/91	162	0.759	0.038	0.110	0.906	83.76%	4.16%	12.08%	0.742	0.037	0.107	0.886
41007	09/20/91	163	0.759	0.038	0.110	0.906	83.76%	4.16%	12.08%	0.692	0.034	0.100	0.827
41007	09/16/94	198	0.841	0.038	0.112	0.992	84.84%	3.87%	11.29%	0.852	0.039	0.113	1.004
41016	11/30/89	122	0.250	0.000	0.155	0.405	61.79%	0.00%	38.21%	0.231	0.000	0.143	0.374
41016	07/02/90	130	0.255	0.000	0.156	0.411	62.12%	0.00%	37.88%	0.171	0.000	0.104	0.276
41016	09/25/91	144	0.269	0.000	0.158	0.427	63.03%	0.00%	36.97%	0.149	0.000	0.087	0.236
41016	09/18/96	204	0.322	0.000	0.165	0.487	66.14%	0.00%	33.86%	0.208	0.000	0.107	0.315
41024	11/03/89	149	0.342	0.025	0.143	0.511	66.98%	4.94%	28.08%	0.158	0.012	0.066	0.236
41024	08/26/90	158	0.357	0.025	0.145	0.527	67.73%	4.81%	27.46%	0.173	0.012	0.070	0.256
41024	09/04/91	171	0.376	0.026	0.146	0.548	68.61%	4.70%	26.70%	0.149	0.010	0.058	0.217
41024	08/22/95	218	0.435	0.027	0.151	0.612	70.99%	4.33%	24.68%	0.182	0.011	0.063	0.256
41024	11/09/95	221	0.437	0.027	0.151	0.615	71.06%	4.31%	24.63%	0.196	0.012	0.068	0.276
41024	02/08/96	224	0.437	0.027	0.152	0.615	71.05%	4.31%	24.64%	0.210	0.013	0.073	0.295
41024	04/04/96	226	0.437	0.027	0.152	0.615	71.05%	4.31%	24.64%	0.182	0.011	0.063	0.256
41024	06/13/96	228	0.440	0.027	0.152	0.618	71.15%	4.29%	24.56%	0.196	0.012	0.068	0.276
41024	07/11/96	229	0.447	0.027	0.152	0.626	71.43%	4.26%	24.31%	0.197	0.012	0.067	0.276
41024	08/15/96	230	0.453	0.027	0.152	0.632	71.65%	4.24%	24.12%	0.197	0.012	0.066	0.276
41024	01/15/98	247	0.472	0.027	0.154	0.653	72.29%	4.14%	23.56%	0.199	0.011	0.065	0.276
41024	04/22/98	250	0.472	0.027	0.154	0.653	72.28%	4.14%	23.58%	0.199	0.011	0.065	0.276
41024	06/15/98	252	0.476	0.027	0.154	0.657	72.40%	4.12%	23.48%	0.200	0.011	0.065	0.276
41024	10/26/98	256	0.483	0.027	0.155	0.664	72.65%	4.07%	23.28%	0.215	0.012	0.069	0.295
81029	10/20/89	209	0.148	0.066	0.100	0.314	47.20%	20.95%	31.85%	0.111	0.049	0.075	0.236
81029	08/25/91	231	0.155	0.066	0.101	0.323	48.09%	20.54%	31.37%	0.104	0.044	0.068	0.217
81029	10/21/91	233	0.155	0.066	0.101	0.323	48.07%	20.53%	31.40%	0.085	0.036	0.056	0.177
81029	09/08/95	280	0.168	0.068	0.104	0.340	49.47%	19.88%	30.65%	0.117	0.047	0.072	0.236
81047	10/20/89	73	0.116	0.094	0.120	0.330	35.28%	28.40%	36.32%	0.132	0.106	0.136	0.374
81047	08/25/91	95	0.129	0.095	0.126	0.350	36.93%	27.22%	35.85%	0.131	0.096	0.127	0.354
81047	10/22/91	97	0.130	0.095	0.126	0.351	36.94%	27.19%	35.87%	0.124	0.091	0.120	0.335
81053	10/19/89	60	0.129	0.084	0.097	0.310	41.68%	27.06%	31.26%	0.148	0.096	0.111	0.354
81053	07/07/90	69	0.138	0.084	0.100	0.322	42.88%	26.19%	30.93%	0.186	0.113	0.134	0.433
81053	12/06/93	110	0.182	0.097	0.112	0.391	46.54%	24.77%	28.69%	0.183	0.098	0.113	0.394
81053	03/14/94	113	0.182	0.097	0.113	0.392	46.44%	24.75%	28.81%	0.183	0.097	0.113	0.394
81053	08/08/94	118	0.191	0.100	0.115	0.406	46.98%	24.69%	28.33%	0.185	0.097	0.112	0.394
81053	10/21/94	120	0.192	0.101	0.116	0.408	46.96%	24.68%	28.36%	0.194	0.102	0.117	0.413
81053	02/13/95	124	0.192	0.101	0.116	0.409	46.89%	24.65%	28.47%	0.194	0.102	0.118	0.413
81053	05/08/95	127	0.192	0.101	0.117	0.409	46.88%	24.63%	28.50%	0.194	0.102	0.118	0.413
81053	05/10/96	139	0.204	0.101	0.118	0.423	48.11%	23.93%	27.96%	0.208	0.104	0.121	0.433
81053	10/21/96	144	0.212	0.101	0.119	0.432	49.01%	23.47%	27.52%	0.232	0.111	0.130	0.472
81053	11/14/96	145	0.212	0.101	0.119	0.433	49.00%	23.46%	27.54%	0.231	0.111	0.130	0.472
81053	03/20/97	149	0.212	0.102	0.120	0.433	48.90%	23.44%	27.66%	0.231	0.111	0.131	0.472

Table C-4 (Cont'd) Permanent Deformation Simulation (β_{r2} = 0.8 and β_{r3} = 1.0) Data

Section	Month	Time	Predicted							Measured			
			AC	GB	SG	Total	%AC	%GB	%SG	AC	GB	SG	Total
81053	08/05/97	154	0.225	0.104	0.121	0.450	49.86%	23.17%	26.97%	0.245	0.114	0.133	0.492
81053	09/26/97	155	0.225	0.105	0.122	0.452	49.88%	23.16%	26.95%	0.255	0.119	0.138	0.512
81053	08/25/98	166	0.237	0.108	0.124	0.469	50.42%	23.05%	26.53%	0.258	0.118	0.136	0.512
91803	09/05/90	63	0.059	0.026	0.069	0.154	38.48%	17.09%	44.43%	0.068	0.030	0.079	0.177
91803	08/22/91	74	0.067	0.027	0.071	0.165	40.41%	16.59%	43.00%	0.056	0.023	0.059	0.138
91803	09/30/92	87	0.070	0.028	0.074	0.172	40.71%	16.42%	42.87%	0.080	0.032	0.084	0.197
91803	05/12/94	107	0.077	0.029	0.077	0.183	41.93%	15.94%	42.13%	0.058	0.022	0.058	0.138
91803	09/25/94	111	0.080	0.030	0.078	0.188	42.73%	15.81%	41.47%	0.059	0.022	0.057	0.138
91803	05/25/95	119	0.081	0.030	0.079	0.190	42.72%	15.73%	41.55%	0.076	0.028	0.074	0.177
91803	10/30/95	124	0.085	0.031	0.080	0.196	43.54%	15.58%	40.89%	0.086	0.031	0.080	0.197
91803	10/08/96	136	0.093	0.031	0.082	0.207	45.07%	15.17%	39.77%	0.080	0.027	0.070	0.177
91803	05/08/97	143	0.093	0.031	0.083	0.207	44.91%	15.11%	39.98%	0.080	0.027	0.071	0.177
91803	10/16/97	148	0.096	0.032	0.084	0.212	45.29%	15.04%	39.67%	0.080	0.027	0.070	0.177
91803	06/17/98	156	0.098	0.032	0.085	0.215	45.62%	14.88%	39.50%	0.081	0.026	0.070	0.177
123995	04/18/89	161	0.776	0.095	0.085	0.956	81.24%	9.92%	8.84%	0.320	0.039	0.035	0.394
123995	02/05/91	183	0.812	0.096	0.086	0.994	81.75%	9.65%	8.61%	0.322	0.038	0.034	0.394
123995	04/15/92	197	0.828	0.096	0.086	1.010	81.93%	9.54%	8.53%	0.355	0.041	0.037	0.433
123995	03/09/94	220	0.865	0.097	0.087	1.050	82.43%	9.28%	8.29%	0.325	0.037	0.033	0.394
123995	01/21/96	242	0.895	0.098	0.088	1.081	82.79%	9.08%	8.13%	0.326	0.036	0.032	0.394
123997	12/14/89	187	0.342	0.103	0.063	0.508	67.37%	20.19%	12.44%	0.424	0.127	0.078	0.630
123997	02/09/91	201	0.354	0.104	0.064	0.522	67.87%	19.86%	12.28%	0.428	0.125	0.077	0.630
123997	04/13/92	215	0.364	0.105	0.065	0.534	68.25%	19.61%	12.14%	0.484	0.139	0.086	0.709
123997	03/08/94	238	0.389	0.107	0.066	0.561	69.24%	18.98%	11.78%	0.518	0.142	0.088	0.748
124105	04/12/89	53	0.220	0.118	0.100	0.437	50.22%	26.96%	22.83%	0.188	0.101	0.085	0.374
124105	02/09/91	75	0.257	0.123	0.105	0.484	53.02%	25.37%	21.61%	0.198	0.095	0.081	0.374
124105	04/13/92	89	0.273	0.125	0.107	0.505	54.13%	24.74%	21.14%	0.234	0.107	0.092	0.433
124106	04/18/89	21	0.202	0.047	0.079	0.327	61.68%	14.25%	24.07%	0.146	0.034	0.057	0.236
124106	02/05/91	43	0.255	0.050	0.087	0.393	64.98%	12.84%	22.19%	0.179	0.035	0.061	0.276
124106	04/15/92	57	0.276	0.052	0.090	0.418	65.98%	12.38%	21.63%	0.130	0.024	0.043	0.197
124106	03/09/94	80	0.315	0.054	0.095	0.463	67.97%	11.60%	20.43%	0.161	0.027	0.048	0.236
124106	01/21/96	102	0.341	0.055	0.098	0.493	69.07%	11.12%	19.80%	0.163	0.026	0.047	0.236
124106	01/17/97	114	0.357	0.056	0.099	0.512	69.77%	10.87%	19.37%	0.220	0.034	0.061	0.315
124107	12/06/89	75	0.131	0.074	0.094	0.299	43.80%	24.78%	31.42%	0.078	0.044	0.056	0.177
124107	02/05/91	89	0.141	0.076	0.096	0.313	44.96%	24.22%	30.83%	0.071	0.038	0.049	0.157
124107	04/15/92	103	0.150	0.077	0.099	0.326	46.11%	23.66%	30.23%	0.073	0.037	0.048	0.157
124107	03/09/94	126	0.167	0.079	0.102	0.348	48.02%	22.79%	29.19%	0.066	0.031	0.040	0.138
124107	01/22/96	148	0.180	0.081	0.104	0.365	49.25%	22.20%	28.55%	0.087	0.039	0.051	0.177
124108	04/27/89	35	0.136	0.026	0.047	0.208	65.11%	12.35%	22.54%	0.231	0.044	0.080	0.354
124108	01/16/91	56	0.174	0.028	0.050	0.252	69.04%	10.96%	20.00%	0.313	0.050	0.091	0.453
124108	04/01/92	71	0.185	0.028	0.052	0.265	69.77%	10.67%	19.55%	0.275	0.042	0.077	0.394
124108	03/21/94	94	0.215	0.030	0.054	0.299	71.91%	9.88%	18.21%	0.354	0.049	0.090	0.492
124108	01/16/96	116	0.230	0.030	0.056	0.317	72.68%	9.57%	17.75%	0.386	0.051	0.094	0.531
124135	12/10/89	227	0.419	0.219	0.139	0.777	53.90%	28.21%	17.89%	0.265	0.139	0.088	0.492
124135	01/29/91	240	0.425	0.220	0.140	0.784	54.17%	28.02%	17.81%	0.320	0.165	0.105	0.591

Table C-4 (Cont'd) Permanent Deformation Simulation (β_{r2} = 0.8 and β_{r3} = 1.0) Data

Section	Month	Time	Predicted							Measured			
			AC	GB	SG	Total	%AC	%GB	%SG	AC	GB	SG	Total
131031	01/09/90	104	0.101	0.021	0.050	0.172	58.71%	12.09%	29.20%	0.231	0.048	0.115	0.394
131031	03/04/91	118	0.108	0.021	0.052	0.181	59.70%	11.81%	28.49%	0.259	0.051	0.123	0.433
131031	04/28/92	131	0.116	0.022	0.053	0.191	60.78%	11.46%	27.76%	0.239	0.045	0.109	0.394
131031	04/04/94	155	0.133	0.023	0.056	0.211	62.77%	10.89%	26.35%	0.309	0.054	0.130	0.492
131031	01/13/96	176	0.146	0.024	0.058	0.228	64.18%	10.43%	25.39%	0.265	0.043	0.105	0.413
134111	03/20/89	101	0.147	0.035	0.138	0.320	45.82%	10.90%	43.28%	0.126	0.030	0.119	0.276
134111	03/04/91	125	0.169	0.037	0.148	0.354	47.83%	10.43%	41.73%	0.122	0.027	0.107	0.256
134111	04/27/92	138	0.180	0.038	0.152	0.369	48.66%	10.22%	41.12%	0.125	0.026	0.105	0.256
134112	05/04/89	144	0.188	0.000	0.113	0.301	62.57%	0.00%	37.43%	0.148	0.000	0.088	0.236
134112	02/10/91	165	0.206	0.000	0.115	0.321	64.18%	0.00%	35.82%	0.152	0.000	0.085	0.236
134112	04/13/92	179	0.216	0.000	0.116	0.332	65.04%	0.00%	34.96%	0.128	0.000	0.069	0.197
134112	02/24/94	201	0.233	0.000	0.118	0.351	66.41%	0.00%	33.59%	0.157	0.000	0.079	0.236
134112	01/25/96	224	0.251	0.000	0.120	0.370	67.66%	0.00%	32.34%	0.173	0.000	0.083	0.256
134112	04/23/98	251	0.270	0.000	0.122	0.391	68.91%	0.00%	31.09%	0.231	0.000	0.104	0.335
134113	05/04/89	144	0.220	0.000	0.152	0.372	59.18%	0.00%	40.82%	0.093	0.000	0.064	0.157
134113	02/10/91	165	0.237	0.000	0.155	0.391	60.53%	0.00%	39.47%	0.083	0.000	0.054	0.138
134113	04/13/92	179	0.247	0.000	0.156	0.403	61.30%	0.00%	38.70%	0.109	0.000	0.069	0.177
134113	02/24/94	201	0.264	0.000	0.158	0.422	62.50%	0.00%	37.50%	0.111	0.000	0.066	0.177
134113	01/25/96	224	0.280	0.000	0.160	0.441	63.65%	0.00%	36.35%	0.113	0.000	0.064	0.177
134113	04/23/98	251	0.299	0.000	0.162	0.462	64.84%	0.00%	35.16%	0.115	0.000	0.062	0.177
134119	01/08/90	140	0.360	0.010	0.033	0.404	89.17%	2.59%	8.24%	0.246	0.007	0.023	0.276
134119	03/04/91	154	0.376	0.011	0.034	0.420	89.48%	2.52%	8.00%	0.247	0.007	0.022	0.276
134119	04/28/92	167	0.382	0.011	0.034	0.426	89.61%	2.48%	7.91%	0.229	0.006	0.020	0.256
134119	04/07/94	191	0.401	0.011	0.034	0.446	89.94%	2.40%	7.66%	0.212	0.006	0.018	0.236
161001	07/17/89	192	0.199	0.099	0.084	0.382	52.18%	25.95%	21.87%	0.154	0.077	0.065	0.295
161001	08/02/90	205	0.209	0.101	0.085	0.395	52.93%	25.65%	21.43%	0.104	0.050	0.042	0.197
161001	07/04/91	216	0.213	0.102	0.085	0.401	53.22%	25.51%	21.27%	0.105	0.050	0.042	0.197
161001	08/25/94	253	0.237	0.104	0.087	0.429	55.37%	24.35%	20.28%	0.131	0.058	0.048	0.236
161001	05/17/95	262	0.238	0.104	0.087	0.430	55.43%	24.30%	20.27%	0.142	0.062	0.052	0.256
161001	07/09/97	288	0.256	0.107	0.089	0.452	56.66%	23.71%	19.62%	0.167	0.070	0.058	0.295
161001	09/23/98	302	0.267	0.107	0.089	0.463	57.64%	23.14%	19.23%	0.216	0.087	0.072	0.374
161009	09/20/89	180	0.248	0.018	0.073	0.340	73.07%	5.38%	21.55%	0.316	0.023	0.093	0.433
161009	07/19/90	190	0.253	0.018	0.074	0.345	73.35%	5.34%	21.31%	0.289	0.021	0.084	0.394
161009	07/26/91	202	0.263	0.019	0.074	0.356	73.98%	5.21%	20.81%	0.291	0.021	0.082	0.394
161021	09/21/89	48	0.191	0.018	0.084	0.293	65.10%	6.24%	28.67%	0.103	0.010	0.045	0.157
161021	07/21/90	58	0.203	0.019	0.086	0.307	66.01%	6.08%	27.92%	0.117	0.011	0.049	0.177
161021	07/28/91	70	0.217	0.019	0.088	0.324	67.06%	5.89%	27.05%	0.079	0.007	0.032	0.118
161021	09/12/95	120	0.276	0.020	0.094	0.390	70.80%	5.19%	24.01%	0.111	0.008	0.038	0.157
161021	06/05/96	129	0.278	0.020	0.094	0.393	70.85%	5.18%	23.97%	0.098	0.007	0.033	0.138
161021	07/29/97	142	0.293	0.021	0.095	0.409	71.64%	5.05%	23.32%	0.127	0.009	0.041	0.177
169034	07/17/89	10	0.052	0.022	0.047	0.120	43.03%	18.06%	38.91%	0.034	0.014	0.031	0.079
169034	08/02/90	23	0.096	0.026	0.053	0.175	54.84%	14.78%	30.38%	0.086	0.023	0.048	0.157
169034	07/04/91	34	0.105	0.027	0.056	0.188	56.18%	14.19%	29.63%	0.044	0.011	0.023	0.079
169034	05/17/95	80	0.141	0.029	0.062	0.232	60.91%	12.55%	26.53%	0.096	0.020	0.042	0.157
169034	07/09/97	106	0.162	0.030	0.064	0.256	63.22%	11.85%	24.94%	0.100	0.019	0.039	0.157
169034	09/24/98	120	0.170	0.031	0.065	0.266	64.07%	11.58%	24.34%	0.151	0.027	0.058	0.236

Table C-4 (Cont'd) Permanent Deformation Simulation (β_{r2} = 0.8 and β_{r3} = 1.0) Data

Section	Month	Time	Predicted							Measured			
			AC	GB	SG	Total	%AC	%GB	%SG	AC	GB	SG	Total
201009	05/02/89	53	0.063	0.000	0.072	0.134	46.56%	0.00%	53.44%	0.119	0.000	0.137	0.256
201009	12/10/90	72	0.074	0.000	0.076	0.150	49.51%	0.00%	50.49%	0.136	0.000	0.139	0.276
201009	04/08/93	100	0.084	0.000	0.079	0.163	51.44%	0.00%	48.56%	0.111	0.000	0.105	0.217
201009	04/23/96	136	0.096	0.000	0.083	0.179	53.77%	0.00%	46.23%	0.053	0.000	0.046	0.098
251003	08/04/89	180	0.089	0.042	0.040	0.171	52.33%	24.42%	23.25%	0.082	0.038	0.037	0.157
251003	09/06/90	193	0.091	0.042	0.040	0.173	52.48%	24.34%	23.18%	0.124	0.057	0.055	0.236
251003	08/23/91	204	0.093	0.042	0.040	0.176	53.05%	24.08%	22.86%	0.084	0.038	0.036	0.157
251003	09/30/92	217	0.098	0.043	0.041	0.182	53.99%	23.64%	22.37%	0.106	0.047	0.044	0.197
251003	10/27/95	254	0.105	0.044	0.042	0.190	55.01%	23.11%	21.88%	0.097	0.041	0.039	0.177
251003	10/23/96	266	0.108	0.044	0.042	0.194	55.45%	22.89%	21.66%	0.098	0.041	0.038	0.177
251003	06/16/98	286	0.113	0.045	0.042	0.200	56.37%	22.45%	21.18%	0.089	0.035	0.033	0.157
251004	08/04/89	178	0.095	0.057	0.043	0.194	48.80%	29.19%	22.01%	0.173	0.103	0.078	0.354
251004	09/05/90	191	0.099	0.057	0.043	0.199	49.51%	28.80%	21.68%	0.146	0.085	0.064	0.295
251004	08/22/91	202	0.102	0.058	0.044	0.204	50.04%	28.50%	21.47%	0.167	0.095	0.072	0.335
251004	09/30/92	215	0.108	0.059	0.045	0.211	50.86%	28.04%	21.10%	0.240	0.132	0.100	0.472
251004	10/29/95	252	0.118	0.062	0.046	0.226	52.37%	27.19%	20.44%	0.216	0.112	0.084	0.413
251004	06/05/97	272	0.124	0.063	0.047	0.234	53.09%	26.76%	20.15%	0.188	0.095	0.071	0.354
251004	06/15/98	284	0.128	0.063	0.048	0.239	53.63%	26.48%	19.89%	0.201	0.099	0.074	0.374
261001	09/07/89	217	0.099	0.065	0.081	0.245	40.44%	26.48%	33.08%	0.088	0.057	0.072	0.217
261001	07/21/90	227	0.100	0.065	0.082	0.247	40.49%	26.43%	33.08%	0.104	0.068	0.085	0.256
261001	07/16/91	239	0.102	0.066	0.082	0.250	40.80%	26.30%	32.90%	0.080	0.052	0.065	0.197
261001	06/09/93	262	0.105	0.067	0.083	0.255	41.31%	26.10%	32.59%	0.106	0.067	0.083	0.256
261001	07/05/96	299	0.111	0.068	0.085	0.264	42.13%	25.71%	32.16%	0.091	0.056	0.070	0.217
261004	10/21/90	64	0.097	0.023	0.061	0.180	53.60%	12.75%	33.65%	0.095	0.023	0.060	0.177
261004	05/13/93	95	0.103	0.024	0.063	0.191	54.21%	12.54%	33.26%	0.053	0.012	0.033	0.098
261004	07/07/94	109	0.113	0.025	0.065	0.203	55.79%	12.17%	32.05%	0.066	0.014	0.038	0.118
261004	06/15/95	120	0.116	0.025	0.066	0.206	56.01%	12.08%	31.91%	0.088	0.019	0.050	0.157
271018	06/22/89	126	0.205	0.026	0.095	0.325	62.95%	7.92%	29.13%	0.248	0.031	0.115	0.394
271018	10/30/90	142	0.220	0.026	0.096	0.343	64.34%	7.63%	28.04%	0.228	0.027	0.099	0.354
271018	06/02/93	174	0.241	0.027	0.099	0.367	65.84%	7.30%	26.86%	0.181	0.020	0.074	0.276
271018	03/08/94	183	0.252	0.027	0.099	0.378	66.65%	7.13%	26.22%	0.184	0.020	0.072	0.276
271087	06/09/89	126	0.042	0.000	0.049	0.091	46.16%	0.00%	53.84%	0.091	0.000	0.106	0.197
271087	11/13/90	143	0.045	0.000	0.050	0.094	47.26%	0.00%	52.74%	0.102	0.000	0.114	0.217
271087	05/11/93	173	0.047	0.000	0.051	0.098	48.36%	0.00%	51.64%	0.057	0.000	0.061	0.118
271087	06/25/96	210	0.051	0.000	0.052	0.103	49.83%	0.00%	50.17%	0.069	0.000	0.069	0.138
271087	08/03/99	240	0.054	0.000	0.052	0.107	50.97%	0.00%	49.03%	0.080	0.000	0.077	0.157
291008	03/13/89	35	0.067	0.008	0.089	0.164	41.01%	4.63%	54.36%	0.097	0.011	0.128	0.236
291008	11/07/90	55	0.082	0.008	0.097	0.186	43.77%	4.42%	51.81%	0.129	0.013	0.153	0.295
291008	03/05/93	85	0.095	0.009	0.103	0.206	45.87%	4.24%	49.89%	0.135	0.013	0.147	0.295
291008	04/17/96	120	0.110	0.009	0.109	0.229	48.27%	4.06%	47.68%	0.114	0.010	0.113	0.236
307088	09/27/89	100	0.215	0.106	0.134	0.455	47.32%	23.34%	29.34%	0.205	0.101	0.127	0.433
307088	07/29/90	110	0.223	0.108	0.135	0.466	47.85%	23.11%	29.04%	0.188	0.091	0.114	0.394
307088	05/20/91	120	0.228	0.109	0.137	0.474	48.15%	22.96%	28.88%	0.171	0.081	0.102	0.354
308129	10/03/89	17	0.089	0.077	0.124	0.290	30.59%	26.56%	42.85%	0.108	0.094	0.152	0.354
308129	07/29/90	26	0.098	0.093	0.135	0.326	29.96%	28.55%	41.49%	0.094	0.090	0.131	0.315
308129	07/30/91	38	0.110	0.099	0.146	0.356	31.04%	27.77%	41.19%	0.073	0.066	0.097	0.236
308129	12/14/93	67	0.141	0.104	0.162	0.407	34.72%	25.52%	39.76%	0.103	0.075	0.117	0.295

Table C-4 (Cont'd) Permanent Deformation Simulation (β_{r2} = 0.8 and β_{r3} = 1.0) Data

Section	Month	Time	Predicted							Measured			
			AC	GB	SG	Total	%AC	%GB	%SG	AC	GB	SG	Total
308129	03/17/94	70	0.141	0.104	0.163	0.409	34.56%	25.49%	39.96%	0.109	0.080	0.126	0.315
308129	08/22/94	75	0.151	0.110	0.167	0.428	35.31%	25.75%	38.95%	0.104	0.076	0.115	0.295
308129	10/31/94	77	0.151	0.111	0.168	0.430	35.22%	25.75%	39.03%	0.111	0.081	0.123	0.315
308129	02/17/95	81	0.151	0.111	0.169	0.432	35.10%	25.69%	39.21%	0.145	0.106	0.162	0.413
308129	05/18/95	84	0.152	0.111	0.170	0.433	35.08%	25.65%	39.27%	0.117	0.086	0.131	0.335
308129	06/10/96	97	0.162	0.112	0.174	0.449	36.12%	25.06%	38.82%	0.128	0.089	0.138	0.354
308129	10/28/96	101	0.168	0.113	0.176	0.457	36.81%	24.73%	38.46%	0.123	0.083	0.129	0.335
308129	01/23/97	104	0.168	0.113	0.176	0.458	36.76%	24.72%	38.51%	0.145	0.097	0.152	0.394
308129	03/25/97	106	0.168	0.113	0.177	0.458	36.72%	24.70%	38.58%	0.123	0.083	0.129	0.335
308129	08/11/97	111	0.178	0.113	0.178	0.470	37.93%	24.16%	37.91%	0.142	0.090	0.142	0.374
308129	10/01/97	113	0.180	0.114	0.178	0.472	38.12%	24.07%	37.81%	0.143	0.090	0.141	0.374
321020	08/29/89	63	0.140	0.018	0.077	0.236	59.54%	7.76%	32.69%	0.188	0.024	0.103	0.315
321020	08/22/90	75	0.149	0.019	0.079	0.246	60.48%	7.54%	31.98%	0.202	0.025	0.107	0.335
321020	07/23/91	86	0.156	0.019	0.080	0.254	61.22%	7.39%	31.39%	0.193	0.023	0.099	0.315
321020	09/14/94	124	0.190	0.020	0.084	0.293	64.73%	6.77%	28.50%	0.178	0.019	0.079	0.276
321020	04/25/95	131	0.190	0.020	0.084	0.293	64.68%	6.76%	28.56%	0.229	0.024	0.101	0.354
321020	06/05/97	157	0.207	0.020	0.086	0.313	66.08%	6.50%	27.42%	0.208	0.020	0.086	0.315
321020	06/09/98	169	0.213	0.021	0.087	0.321	66.57%	6.40%	27.03%	0.223	0.021	0.090	0.335
321020	04/13/99	175	0.222	0.021	0.087	0.330	67.31%	6.29%	26.40%	0.252	0.024	0.099	0.374
341003	09/11/90	195	0.148	0.022	0.050	0.219	67.47%	9.82%	22.71%	0.545	0.079	0.183	0.807
341003	08/15/91	206	0.152	0.022	0.050	0.224	67.85%	9.72%	22.43%	0.481	0.069	0.159	0.709
341003	09/28/92	219	0.156	0.022	0.051	0.229	68.18%	9.62%	22.20%	0.564	0.080	0.184	0.827
341011	04/17/99	214	0.342	0.023	0.114	0.479	71.43%	4.74%	23.83%	0.211	0.014	0.070	0.295
341011	04/18/99	227	0.351	0.023	0.116	0.490	71.71%	4.69%	23.60%	0.268	0.018	0.088	0.374
341011	04/19/99	244	0.365	0.023	0.117	0.505	72.25%	4.57%	23.18%	0.213	0.014	0.068	0.295
341011	04/20/99	254	0.379	0.023	0.118	0.521	72.81%	4.49%	22.71%	0.272	0.017	0.085	0.374
341011	04/21/99	287	0.413	0.024	0.122	0.558	73.90%	4.30%	21.80%	0.291	0.017	0.086	0.394
341011	04/22/99	307	0.436	0.024	0.123	0.584	74.66%	4.18%	21.15%	0.250	0.014	0.071	0.335
341031	10/05/89	194	0.232	0.054	0.107	0.394	59.01%	13.80%	27.19%	0.290	0.068	0.134	0.492
341031	09/12/90	205	0.243	0.055	0.109	0.407	59.71%	13.58%	26.71%	0.282	0.064	0.126	0.472
341031	04/06/92	224	0.258	0.056	0.111	0.425	60.62%	13.24%	26.14%	0.286	0.063	0.124	0.472
341031	02/24/93	234	0.267	0.057	0.112	0.436	61.23%	13.08%	25.69%	0.277	0.059	0.116	0.453
341031	10/26/95	266	0.300	0.059	0.116	0.476	63.11%	12.47%	24.43%	0.360	0.071	0.139	0.571
341031	11/04/95	267	0.300	0.059	0.116	0.476	63.11%	12.47%	24.43%	0.335	0.066	0.130	0.531
341033	10/05/89	181	0.169	0.040	0.066	0.275	61.52%	14.46%	24.01%	0.170	0.040	0.066	0.276
341033	09/12/90	192	0.172	0.040	0.067	0.279	61.74%	14.37%	23.88%	0.219	0.051	0.085	0.354
341033	04/05/92	211	0.181	0.041	0.068	0.289	62.56%	14.08%	23.36%	0.172	0.039	0.064	0.276
341033	02/24/93	221	0.186	0.041	0.068	0.295	63.02%	13.90%	23.08%	0.211	0.047	0.077	0.335
341033	11/03/95	254	0.198	0.042	0.069	0.310	64.03%	13.54%	22.43%	0.227	0.048	0.079	0.354
341033	07/23/97	274	0.202	0.042	0.070	0.314	64.25%	13.43%	22.32%	0.190	0.040	0.066	0.295
341034	10/05/89	48	0.114	0.000	0.068	0.182	62.65%	0.00%	37.35%	0.086	0.000	0.051	0.138
341034	09/12/90	59	0.128	0.000	0.070	0.197	64.63%	0.00%	35.37%	0.178	0.000	0.097	0.276
341034	04/06/92	78	0.138	0.000	0.071	0.209	65.86%	0.00%	34.14%	0.117	0.000	0.060	0.177
341034	02/24/93	88	0.148	0.000	0.073	0.221	67.06%	0.00%	32.94%	0.158	0.000	0.078	0.236
341034	11/04/95	121	0.176	0.000	0.076	0.252	69.88%	0.00%	30.12%	0.179	0.000	0.077	0.256
341034	07/30/97	141	0.189	0.000	0.077	0.266	71.03%	0.00%	28.97%	0.126	0.000	0.051	0.177

Table C-4 (Cont'd) Permanent Deformation Simulation (β_{r2} = 0.8 and β_{r3} = 1.0) Data

Section	Month	Time	Predicted							Measured			
			AC	GB	SG	Total	%AC	%GB	%SG	AC	GB	SG	Total
350101	05/01/97	19	0.139	0.039	0.166	0.345	40.39%	11.29%	48.31%	0.080	0.022	0.095	0.197
350101	03/19/99	38	0.203	0.044	0.187	0.434	46.81%	10.11%	43.08%	0.111	0.024	0.102	0.236
350102	05/01/97	19	0.147	0.065	0.201	0.413	35.51%	15.85%	48.63%	0.070	0.031	0.096	0.197
350102	03/19/99	38	0.217	0.073	0.230	0.519	41.70%	14.09%	44.21%	0.099	0.033	0.104	0.236
350103	05/01/97	19	0.077	0.000	0.166	0.243	31.83%	0.00%	68.17%	0.063	0.000	0.134	0.197
350103	03/19/99	38	0.112	0.000	0.194	0.306	36.72%	0.00%	63.28%	0.101	0.000	0.174	0.276
350104	05/01/97	19	0.061	0.000	0.109	0.171	35.86%	0.00%	64.14%	0.085	0.000	0.152	0.236
350104	03/19/99	38	0.089	0.000	0.129	0.218	40.78%	0.00%	59.22%	0.112	0.000	0.163	0.276
350105	05/02/97	19	0.115	0.014	0.188	0.317	36.17%	4.49%	59.34%	0.085	0.011	0.140	0.236
350105	03/22/99	38	0.166	0.016	0.218	0.400	41.46%	4.01%	54.52%	0.098	0.009	0.129	0.236
350106	05/02/96	19	0.060	0.006	0.126	0.192	31.42%	2.92%	65.66%	0.062	0.006	0.129	0.197
350106	03/22/99	38	0.087	0.006	0.148	0.241	35.98%	2.65%	61.37%	0.085	0.006	0.145	0.236
351005	10/31/89	73	0.143	0.022	0.130	0.295	48.47%	7.39%	44.14%	0.229	0.035	0.209	0.472
351005	08/21/91	95	0.156	0.022	0.136	0.314	49.69%	7.07%	43.25%	0.235	0.033	0.204	0.472
351005	10/24/92	109	0.168	0.023	0.140	0.331	50.83%	6.84%	42.33%	0.210	0.028	0.175	0.413
351005	03/18/95	138	0.203	0.024	0.145	0.372	54.59%	6.35%	39.06%	0.312	0.036	0.223	0.571
351005	03/16/99	183	0.247	0.025	0.153	0.424	58.19%	5.79%	36.02%	0.355	0.035	0.220	0.610
351022	10/31/89	37	0.102	0.031	0.118	0.251	40.58%	12.48%	46.94%	0.072	0.022	0.083	0.177
351022	08/22/91	59	0.149	0.034	0.128	0.312	47.80%	11.02%	41.19%	0.066	0.015	0.057	0.138
351022	10/24/92	73	0.159	0.035	0.133	0.327	48.62%	10.75%	40.63%	0.096	0.021	0.080	0.197
351022	03/18/95	102	0.188	0.037	0.140	0.365	51.47%	10.03%	38.50%	0.111	0.022	0.083	0.217
351022	03/17/99	147	0.246	0.039	0.150	0.435	56.48%	8.98%	34.55%	0.089	0.014	0.054	0.157
351112	12/05/89	67	0.251	0.029	0.081	0.361	69.54%	8.02%	22.44%	0.110	0.013	0.035	0.157
351112	01/22/91	80	0.259	0.029	0.082	0.371	69.90%	7.92%	22.18%	0.124	0.014	0.039	0.177
351112	09/27/91	88	0.270	0.030	0.083	0.383	70.47%	7.75%	21.78%	0.097	0.011	0.030	0.138
351112	01/27/93	104	0.281	0.030	0.084	0.395	71.05%	7.60%	21.36%	0.084	0.009	0.025	0.118
351112	03/15/95	130	0.307	0.031	0.086	0.424	72.43%	7.24%	20.34%	0.143	0.014	0.040	0.197
351112	09/09/97	160	0.329	0.031	0.088	0.448	73.36%	6.99%	19.65%	0.101	0.010	0.027	0.138
351112	03/15/99	175	0.340	0.032	0.089	0.460	73.85%	6.87%	19.28%	0.116	0.011	0.030	0.157
371006	10/13/89	88	0.360	0.029	0.140	0.529	68.11%	5.51%	26.38%	0.054	0.004	0.021	0.079
371006	03/19/91	105	0.381	0.030	0.142	0.553	68.94%	5.34%	25.72%	0.054	0.004	0.020	0.079
371006	10/11/92	124	0.426	0.030	0.146	0.603	70.73%	5.05%	24.22%	0.125	0.009	0.043	0.177
371006	04/18/94	142	0.443	0.031	0.148	0.622	71.23%	4.95%	23.82%	0.070	0.005	0.023	0.098
371006	09/20/94	147	0.456	0.031	0.149	0.637	71.68%	4.88%	23.44%	0.085	0.006	0.028	0.118
371024	11/03/89	109	0.104	0.046	0.106	0.255	40.61%	17.85%	41.54%	0.144	0.063	0.147	0.354
371024	03/09/91	125	0.108	0.046	0.109	0.263	41.16%	17.53%	41.31%	0.178	0.076	0.179	0.433
371024	04/10/92	138	0.113	0.047	0.111	0.271	41.81%	17.27%	40.91%	0.148	0.061	0.145	0.354
371802	10/13/89	49	0.120	0.074	0.271	0.465	25.70%	15.95%	58.35%	0.091	0.057	0.207	0.354
371802	03/18/91	66	0.133	0.077	0.287	0.497	26.76%	15.49%	57.75%	0.084	0.049	0.182	0.315
371802	10/10/92	85	0.150	0.080	0.303	0.533	28.14%	15.08%	56.78%	0.100	0.053	0.201	0.354
371802	04/15/94	103	0.159	0.082	0.314	0.555	28.70%	14.78%	56.52%	0.124	0.064	0.245	0.433
371802	07/18/95	118	0.172	0.084	0.323	0.580	29.72%	14.53%	55.75%	0.140	0.069	0.263	0.472
371802	02/09/96	125	0.175	0.085	0.326	0.587	29.90%	14.45%	55.65%	0.153	0.074	0.285	0.512
371802	04/02/96	127	0.175	0.085	0.327	0.587	29.86%	14.43%	55.71%	0.153	0.074	0.285	0.512
371817	10/15/89	71	0.130	0.045	0.074	0.249	52.27%	18.06%	29.67%	0.206	0.071	0.117	0.394
371817	03/18/91	88	0.138	0.046	0.076	0.261	53.00%	17.69%	29.31%	0.136	0.045	0.075	0.256
371817	10/18/92	107	0.160	0.048	0.079	0.287	55.60%	16.79%	27.61%	0.197	0.059	0.098	0.354

Table C-4 (Cont'd) Permanent Deformation Simulation (β_{r2} = 0.8 and β_{r3} = 1.0) Data

Section	Month	Time	Predicted							Measured			
			AC	GB	SG	Total	%AC	%GB	%SG	AC	GB	SG	Total
371992	10/15/92	33	0.171	0.118	0.076	0.364	46.95%	32.30%	20.75%	0.111	0.076	0.049	0.236
371992	04/20/94	51	0.205	0.124	0.081	0.409	50.07%	30.22%	19.72%	0.020	0.012	0.008	0.039
371992	02/06/96	73	0.247	0.130	0.086	0.462	53.35%	28.10%	18.55%	0.084	0.044	0.029	0.157
371992	04/22/98	99	0.292	0.136	0.091	0.518	56.29%	26.21%	17.50%	0.133	0.062	0.041	0.236
404087	01/17/90	43	0.094	0.027	0.104	0.225	41.77%	11.80%	46.43%	0.255	0.072	0.283	0.610
404087	10/13/91	64	0.113	0.029	0.116	0.258	43.80%	11.15%	45.05%	0.190	0.048	0.195	0.433
404087	02/08/93	80	0.121	0.030	0.122	0.272	44.29%	10.89%	44.82%	0.166	0.041	0.168	0.374
404087	02/09/95	104	0.135	0.031	0.131	0.297	45.44%	10.46%	44.10%	0.259	0.060	0.252	0.571
404163	01/23/90	34	0.084	0.000	0.102	0.186	45.01%	0.00%	54.99%	0.204	0.000	0.249	0.453
404163	03/17/91	48	0.093	0.000	0.107	0.201	46.62%	0.00%	53.38%	0.174	0.000	0.200	0.374
404163	10/28/91	55	0.099	0.000	0.110	0.209	47.51%	0.00%	52.49%	0.140	0.000	0.155	0.295
404163	03/10/93	72	0.110	0.000	0.114	0.223	49.09%	0.00%	50.91%	0.135	0.000	0.140	0.276
404163	04/22/96	109	0.124	0.000	0.120	0.245	50.88%	0.00%	49.12%	0.160	0.000	0.155	0.315
404163	08/20/97	125	0.137	0.000	0.124	0.261	52.59%	0.00%	47.41%	0.207	0.000	0.187	0.394
404163	01/11/99	141	0.141	0.000	0.125	0.267	53.00%	0.00%	47.00%	0.240	0.000	0.213	0.453
421599	07/18/89	24	0.067	0.021	0.102	0.190	35.38%	10.94%	53.67%	0.063	0.019	0.095	0.177
421599	09/27/90	38	0.077	0.021	0.109	0.207	37.38%	10.16%	52.46%	0.081	0.022	0.114	0.217
421599	08/07/91	49	0.084	0.021	0.112	0.217	38.79%	9.67%	51.54%	0.076	0.019	0.101	0.197
421599	03/01/93	68	0.095	0.021	0.117	0.233	40.80%	9.12%	50.08%	0.129	0.029	0.158	0.315
421599	06/21/95	95	0.112	0.022	0.123	0.257	43.67%	8.39%	47.94%	0.120	0.023	0.132	0.276
421599	07/19/96	108	0.121	0.022	0.126	0.268	45.00%	8.09%	46.91%	0.124	0.022	0.129	0.276
421599	03/26/98	128	0.133	0.022	0.129	0.283	46.74%	7.74%	45.52%	0.129	0.021	0.125	0.276
451011	04/11/89	34	0.322	0.057	0.084	0.463	69.49%	12.40%	18.11%	0.233	0.042	0.061	0.335
451011	03/05/91	57	0.383	0.060	0.088	0.531	72.07%	11.34%	16.59%	0.355	0.056	0.082	0.492
451011	10/24/92	76	0.434	0.062	0.091	0.587	73.94%	10.60%	15.46%	0.466	0.067	0.097	0.630
451011	01/27/96	115	0.499	0.064	0.094	0.657	75.89%	9.80%	14.31%	0.508	0.066	0.096	0.669
451011	02/11/99	150	0.547	0.066	0.096	0.709	77.13%	9.29%	13.59%	0.547	0.066	0.096	0.709
473104	11/01/89	42	0.008	0.046	0.086	0.141	5.98%	32.98%	61.03%	0.016	0.091	0.168	0.276
473104	05/06/91	60	0.009	0.049	0.094	0.153	5.98%	32.31%	61.71%	0.019	0.102	0.194	0.315
473104	10/26/92	77	0.011	0.052	0.101	0.164	6.45%	31.61%	61.95%	0.023	0.112	0.219	0.354
473104	11/30/95	114	0.012	0.057	0.115	0.185	6.66%	30.90%	62.44%	0.042	0.195	0.393	0.630
480001	04/10/89	1	0.027	0.066	0.081	0.174	15.35%	37.98%	46.67%	0.036	0.090	0.110	0.236
480001	10/11/90	19	0.154	0.115	0.153	0.422	36.43%	27.22%	36.35%	0.100	0.075	0.100	0.276
480001	03/11/92	36	0.191	0.123	0.172	0.486	39.23%	25.39%	35.38%	0.124	0.080	0.111	0.315
480001	02/17/93	47	0.220	0.128	0.181	0.529	41.59%	24.24%	34.18%	0.082	0.048	0.067	0.197
480001	02/20/95	71	0.256	0.135	0.196	0.587	43.59%	23.05%	33.37%	0.137	0.073	0.105	0.315
480001	03/19/98	108	0.319	0.144	0.214	0.677	47.14%	21.28%	31.58%	0.074	0.034	0.050	0.157
481060	06/18/90	52	0.177	0.048	0.084	0.310	57.23%	15.65%	27.11%	0.237	0.065	0.112	0.413
481060	02/14/91	60	0.188	0.049	0.086	0.323	58.19%	15.26%	26.55%	0.195	0.051	0.089	0.335
481060	03/18/92	73	0.201	0.050	0.088	0.339	59.14%	14.82%	26.04%	0.140	0.035	0.062	0.236
481060	02/23/93	84	0.214	0.051	0.091	0.356	60.11%	14.40%	25.48%	0.130	0.031	0.055	0.217
481060	02/23/95	108	0.236	0.053	0.094	0.383	61.56%	13.76%	24.68%	0.230	0.051	0.092	0.374
481060	01/05/99	154	0.279	0.055	0.100	0.434	64.25%	12.70%	23.05%	0.253	0.050	0.091	0.394
481077	04/25/89	88	0.264	0.032	0.087	0.383	68.86%	8.45%	22.70%	0.366	0.045	0.121	0.531
481077	10/13/91	118	0.301	0.034	0.090	0.424	70.91%	7.91%	21.18%	0.433	0.048	0.129	0.610
481077	10/12/92	130	0.308	0.034	0.091	0.433	71.16%	7.84%	21.00%	0.434	0.048	0.128	0.610

Table C-4 (Cont'd) Permanent Deformation Simulation (β_{r2} = 0.8 and β_{r3} = 1.0) Data

Section	Month	Time	Predicted							Measured			
			AC	GB	SG	Total	%AC	%GB	%SG	AC	GB	SG	Total
481077	03/10/95	159	0.332	0.035	0.093	0.460	72.27%	7.53%	20.20%	0.512	0.053	0.143	0.709
481077	03/26/98	195	0.360	0.035	0.095	0.490	73.38%	7.22%	19.40%	0.506	0.050	0.134	0.689
481109	01/04/90	68	0.251	0.000	0.186	0.438	57.43%	0.00%	42.57%	0.181	0.000	0.134	0.315
481109	09/21/90	76	0.266	0.000	0.190	0.456	58.31%	0.00%	41.69%	0.184	0.000	0.131	0.315
481109	03/10/92	94	0.281	0.000	0.195	0.477	59.00%	0.00%	41.00%	0.151	0.000	0.105	0.256
481109	02/12/93	105	0.297	0.000	0.199	0.496	59.84%	0.00%	40.16%	0.153	0.000	0.103	0.256
481109	02/16/95	129	0.322	0.000	0.205	0.527	61.04%	0.00%	38.96%	0.240	0.000	0.153	0.394
481130	04/11/89	201	0.383	0.141	0.175	0.699	54.83%	20.15%	25.02%	0.291	0.107	0.133	0.531
481130	10/12/90	219	0.403	0.143	0.179	0.725	55.61%	19.76%	24.63%	0.383	0.136	0.170	0.689
481130	03/12/92	236	0.412	0.145	0.181	0.738	55.83%	19.59%	24.57%	0.385	0.135	0.169	0.689
481169	03/04/90	212	0.085	0.096	0.073	0.254	33.62%	37.63%	28.75%	0.106	0.119	0.091	0.315
481169	09/18/90	218	0.087	0.096	0.073	0.257	33.97%	37.41%	28.61%	0.107	0.118	0.090	0.315
481169	03/07/91	224	0.087	0.096	0.074	0.257	33.94%	37.43%	28.63%	0.107	0.118	0.090	0.315
481169	01/30/92	234	0.089	0.097	0.074	0.260	34.33%	37.21%	28.47%	0.115	0.125	0.095	0.335
481169	02/27/93	247	0.091	0.097	0.075	0.263	34.70%	37.00%	28.30%	0.109	0.117	0.089	0.315
481169	03/03/95	272	0.095	0.098	0.075	0.268	35.23%	36.69%	28.09%	0.166	0.173	0.133	0.472
481174	10/17/90	186	0.406	0.062	0.164	0.633	64.22%	9.80%	25.98%	0.253	0.039	0.102	0.394
481174	02/14/91	190	0.407	0.062	0.165	0.633	64.20%	9.79%	26.01%	0.278	0.042	0.113	0.433
481174	03/16/92	203	0.415	0.062	0.167	0.644	64.43%	9.69%	25.88%	0.203	0.031	0.082	0.315
481174	02/18/93	214	0.422	0.063	0.168	0.653	64.61%	9.62%	25.77%	0.229	0.034	0.091	0.354
481174	02/21/95	238	0.439	0.064	0.172	0.675	65.14%	9.43%	25.43%	0.436	0.063	0.170	0.669
481174	03/20/98	275	0.459	0.065	0.176	0.700	65.65%	9.22%	25.13%	0.439	0.062	0.168	0.669
481178	04/10/89	10	0.115	0.025	0.087	0.227	50.57%	11.03%	38.39%	0.090	0.020	0.068	0.177
481178	02/22/91	32	0.192	0.031	0.113	0.336	57.30%	9.11%	33.59%	0.079	0.013	0.046	0.138
481178	03/10/92	45	0.220	0.032	0.121	0.372	59.05%	8.56%	32.39%	0.081	0.012	0.045	0.138
481178	02/16/93	56	0.237	0.033	0.126	0.396	59.88%	8.27%	31.85%	0.094	0.013	0.050	0.157
481178	02/17/95	80	0.278	0.034	0.137	0.449	61.85%	7.68%	30.47%	0.146	0.018	0.072	0.236
481183	12/06/89	179	0.229	0.067	0.201	0.497	46.08%	13.47%	40.45%	0.118	0.034	0.104	0.256
481183	09/15/90	188	0.238	0.068	0.205	0.511	46.60%	13.33%	40.07%	0.138	0.039	0.118	0.295
483749	10/17/90	116	0.297	0.194	0.177	0.668	44.44%	29.04%	26.52%	0.114	0.074	0.068	0.256
483749	02/14/91	120	0.297	0.195	0.178	0.670	44.35%	29.04%	26.60%	0.096	0.063	0.058	0.217
483749	03/16/92	133	0.305	0.198	0.182	0.685	44.55%	28.91%	26.55%	0.088	0.057	0.052	0.197
483749	02/21/93	144	0.313	0.201	0.185	0.698	44.85%	28.73%	26.43%	0.097	0.062	0.057	0.217
483749	02/21/95	168	0.329	0.206	0.190	0.725	45.39%	28.40%	26.21%	0.152	0.095	0.088	0.335
483749	03/28/97	193	0.342	0.211	0.195	0.747	45.76%	28.17%	26.07%	0.207	0.128	0.118	0.453
489005	10/14/90	50	0.052	0.161	0.242	0.456	11.50%	35.41%	53.10%	0.038	0.118	0.178	0.335
489005	03/12/92	67	0.058	0.167	0.256	0.481	12.00%	34.79%	53.22%	0.017	0.048	0.073	0.138
489005	02/17/93	78	0.060	0.171	0.263	0.494	12.23%	34.52%	53.25%	0.017	0.048	0.073	0.138
489005	02/20/95	102	0.066	0.176	0.277	0.519	12.67%	33.99%	53.34%	0.030	0.080	0.126	0.236
489005	07/10/98	143	0.074	0.185	0.295	0.554	13.33%	33.40%	53.27%	0.021	0.053	0.084	0.157
501002	08/09/89	58	0.078	0.033	0.052	0.163	47.62%	20.33%	32.05%	0.141	0.060	0.095	0.295
501002	08/08/90	70	0.085	0.034	0.054	0.174	49.19%	19.71%	31.11%	0.184	0.074	0.116	0.374
501002	09/04/91	83	0.089	0.035	0.055	0.179	49.60%	19.45%	30.95%	0.156	0.061	0.097	0.315
501002	04/27/93	102	0.095	0.036	0.057	0.187	50.45%	19.02%	30.53%	0.189	0.071	0.114	0.374
501002	05/25/94	115	0.099	0.036	0.058	0.194	51.18%	18.75%	30.08%	0.191	0.070	0.112	0.374
501002	08/17/94	118	0.103	0.037	0.059	0.199	51.84%	18.54%	29.62%	0.194	0.069	0.111	0.374

Table C-4 (Cont'd) Permanent Deformation Simulation (β_{r2} = 0.8 and β_{r3} = 1.0) Data

Section	Month	Time	Predicted							Measured			
			AC	GB	SG	Total	%AC	%GB	%SG	AC	GB	SG	Total
501002	04/27/95	126	0.103	0.037	0.059	0.200	51.77%	18.51%	29.72%	0.204	0.073	0.117	0.394
501002	10/12/95	132	0.109	0.038	0.060	0.207	52.84%	18.18%	28.98%	0.229	0.079	0.125	0.433
501002	10/17/96	144	0.112	0.038	0.061	0.210	53.14%	18.01%	28.85%	0.188	0.064	0.102	0.354
501002	05/15/97	151	0.112	0.038	0.061	0.211	53.09%	18.00%	28.91%	0.230	0.078	0.125	0.433
501002	10/23/97	156	0.116	0.038	0.062	0.216	53.72%	17.78%	28.50%	0.243	0.081	0.129	0.453
501002	06/06/98	164	0.117	0.039	0.062	0.218	53.89%	17.68%	28.42%	0.233	0.077	0.123	0.433
501004	08/09/89	58	0.051	0.035	0.058	0.144	35.10%	24.36%	40.54%	0.055	0.038	0.064	0.157
501004	08/07/90	70	0.058	0.036	0.060	0.153	37.58%	23.33%	39.08%	0.096	0.060	0.100	0.256
501004	09/20/91	83	0.066	0.037	0.062	0.164	40.02%	22.35%	37.63%	0.079	0.044	0.074	0.197
501004	04/27/93	102	0.074	0.037	0.064	0.175	42.13%	21.39%	36.47%	0.108	0.055	0.093	0.256
501004	10/12/95	132	0.090	0.039	0.068	0.197	45.89%	19.77%	34.34%	0.108	0.047	0.081	0.236
501004	11/04/97	157	0.103	0.040	0.070	0.214	48.32%	18.75%	32.94%	0.124	0.048	0.084	0.256
511002	10/15/89	121	0.167	0.049	0.104	0.320	52.23%	15.36%	32.40%	0.206	0.060	0.128	0.394
511023	10/12/89	107	0.336	0.049	0.138	0.523	64.23%	9.35%	26.42%	0.367	0.053	0.151	0.571
511023	03/20/91	124	0.353	0.049	0.140	0.542	65.07%	9.10%	25.82%	0.359	0.050	0.142	0.551
511023	10/10/92	143	0.383	0.050	0.143	0.576	66.45%	8.75%	24.80%	0.392	0.052	0.146	0.591
511023	12/07/93	157	0.399	0.051	0.144	0.595	67.15%	8.57%	24.28%	0.410	0.052	0.148	0.610
511023	09/18/95	178	0.426	0.052	0.147	0.625	68.23%	8.28%	23.50%	0.376	0.046	0.130	0.551
511023	02/09/96	183	0.426	0.052	0.147	0.625	68.21%	8.27%	23.51%	0.457	0.055	0.157	0.669
511023	03/24/97	196	0.436	0.052	0.148	0.635	68.55%	8.16%	23.29%	0.405	0.048	0.138	0.591
512021	10/15/89	54	0.124	0.014	0.101	0.238	52.07%	5.70%	42.22%	0.205	0.022	0.166	0.394
512021	03/11/91	71	0.137	0.014	0.103	0.255	53.86%	5.54%	40.60%	0.233	0.024	0.176	0.433
512021	10/20/92	90	0.156	0.015	0.108	0.279	55.94%	5.24%	38.81%	0.297	0.028	0.206	0.531
531008	07/17/89	129	0.177	0.059	0.088	0.324	54.67%	18.18%	27.16%	0.420	0.140	0.208	0.768
531008	07/17/89	142	0.189	0.060	0.089	0.339	55.95%	17.70%	26.35%	0.418	0.132	0.197	0.748
531008	08/02/90	151	0.191	0.060	0.090	0.340	55.96%	17.68%	26.36%	0.430	0.136	0.202	0.768
531008	08/02/90	153	0.193	0.060	0.090	0.343	56.21%	17.58%	26.21%	0.465	0.145	0.217	0.827
531008	05/28/91	188	0.207	0.062	0.092	0.361	57.35%	17.11%	25.54%	0.621	0.185	0.277	1.083
531801	07/17/89	190	0.081	0.007	0.058	0.147	55.34%	5.07%	39.59%	0.109	0.010	0.078	0.197
531801	08/09/90	203	0.084	0.008	0.059	0.151	55.95%	5.02%	39.02%	0.099	0.009	0.069	0.177
531801	06/05/91	213	0.085	0.008	0.059	0.152	56.17%	4.98%	38.85%	0.122	0.011	0.084	0.217
531801	06/22/94	249	0.095	0.008	0.061	0.163	57.94%	4.80%	37.26%	0.091	0.008	0.059	0.157
531801	05/08/95	260	0.096	0.008	0.061	0.165	58.21%	4.74%	37.05%	0.092	0.007	0.058	0.157
531801	10/31/95	265	0.099	0.008	0.062	0.169	58.78%	4.71%	36.52%	0.104	0.008	0.065	0.177
531801	03/27/97	282	0.102	0.008	0.062	0.173	59.24%	4.69%	36.08%	0.117	0.009	0.071	0.197
561007	09/26/89	111	0.127	0.030	0.092	0.249	50.93%	12.06%	37.01%	0.231	0.055	0.168	0.453
561007	07/22/90	121	0.128	0.030	0.093	0.252	50.93%	12.03%	37.04%	0.201	0.047	0.146	0.394
561007	05/13/91	131	0.130	0.031	0.094	0.255	50.95%	12.00%	37.05%	0.191	0.045	0.139	0.374
561007	08/03/91	134	0.137	0.031	0.095	0.263	52.24%	11.77%	35.99%	0.165	0.037	0.113	0.315
561007	12/09/93	162	0.148	0.032	0.098	0.277	53.32%	11.46%	35.22%	0.147	0.032	0.097	0.276
561007	03/16/94	165	0.148	0.032	0.098	0.277	53.27%	11.45%	35.28%	0.147	0.032	0.097	0.276
561007	04/19/94	166	0.148	0.032	0.098	0.277	53.25%	11.45%	35.31%	0.157	0.034	0.104	0.295
561007	08/19/94	170	0.150	0.032	0.098	0.280	53.48%	11.43%	35.09%	0.137	0.029	0.090	0.256
561007	02/16/95	176	0.150	0.032	0.099	0.281	53.44%	11.39%	35.16%	0.147	0.031	0.097	0.276
561007	05/17/95	179	0.150	0.032	0.099	0.281	53.37%	11.42%	35.20%	0.137	0.029	0.090	0.256
561007	09/08/95	183	0.152	0.032	0.099	0.284	53.65%	11.37%	34.98%	0.148	0.031	0.096	0.276
561007	06/11/96	192	0.153	0.032	0.100	0.286	53.68%	11.34%	34.98%	0.116	0.025	0.076	0.217

Table C-4 (Cont'd) Permanent Deformation Simulation (β_{r2} = 0.8 and β_{r3} = 1.0) Data

Section	Month	Time	Predicted							Measured			
			AC	GB	SG	Total	%AC	%GB	%SG	AC	GB	SG	Total
561007	10/24/96	196	0.159	0.033	0.100	0.291	54.40%	11.20%	34.40%	0.150	0.031	0.095	0.276
561007	11/19/96	197	0.159	0.033	0.100	0.292	54.38%	11.20%	34.43%	0.150	0.031	0.095	0.276
561007	03/10/97	201	0.159	0.033	0.101	0.292	54.33%	11.19%	34.48%	0.160	0.033	0.102	0.295
561007	03/24/97	202	0.159	0.033	0.101	0.292	54.31%	11.18%	34.51%	0.150	0.031	0.095	0.276
561007	08/07/97	206	0.165	0.033	0.101	0.299	55.16%	11.01%	33.83%	0.152	0.030	0.093	0.276
561007	09/30/97	207	0.165	0.033	0.101	0.299	55.19%	11.04%	33.77%	0.152	0.030	0.093	0.276
841684	08/29/90	144	0.173	0.068	0.066	0.307	56.24%	22.21%	21.55%	0.310	0.122	0.119	0.551
841684	08/28/91	156	0.179	0.069	0.067	0.314	56.80%	21.93%	21.27%	0.313	0.121	0.117	0.551
841684	05/03/93	177	0.184	0.070	0.068	0.322	57.19%	21.70%	21.11%	0.372	0.141	0.137	0.650
841684	10/24/95	206	0.202	0.072	0.070	0.343	58.84%	20.87%	20.29%	0.417	0.148	0.144	0.709

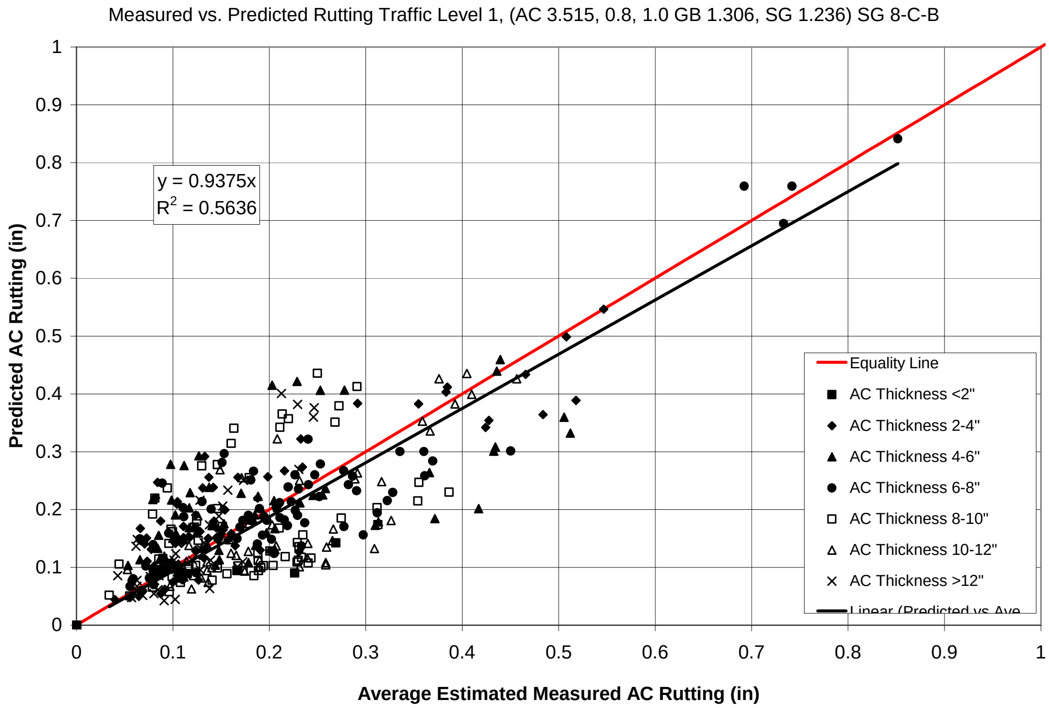


Figure C-95 Asphalt Concrete Layers Rut Depth (β_{r2} = 0.8 and β_{r3} = 1.0)

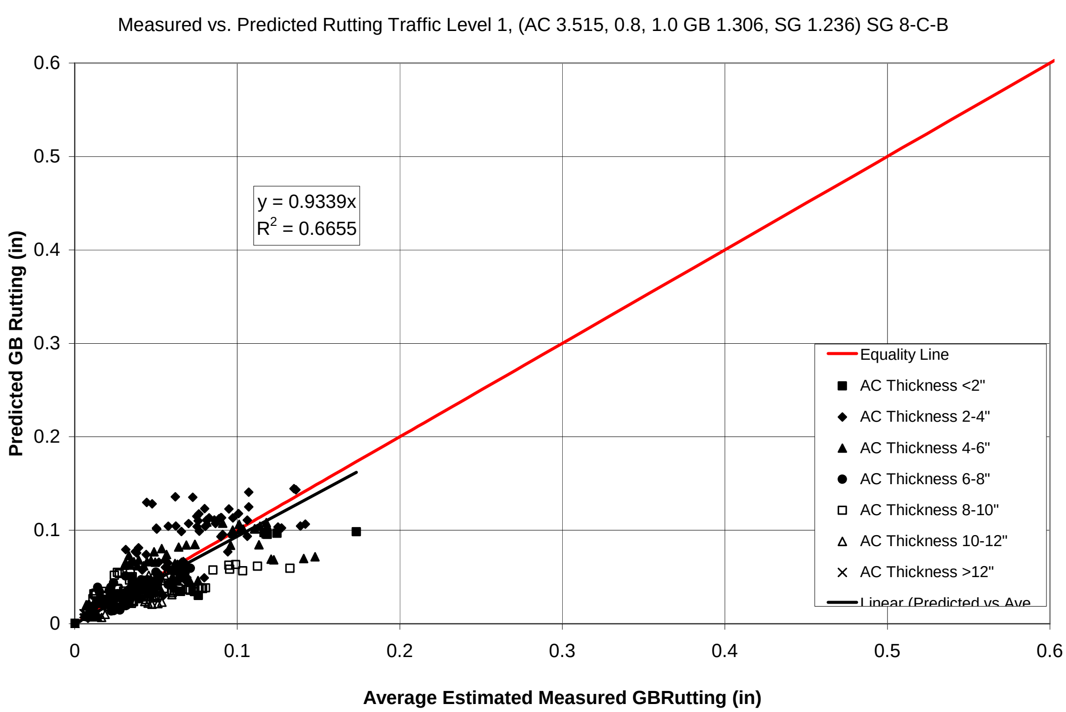


Figure C-96 Granular Base Layers Rut Depth (β_{r2} = 0.8 and β_{r3} = 1.0)

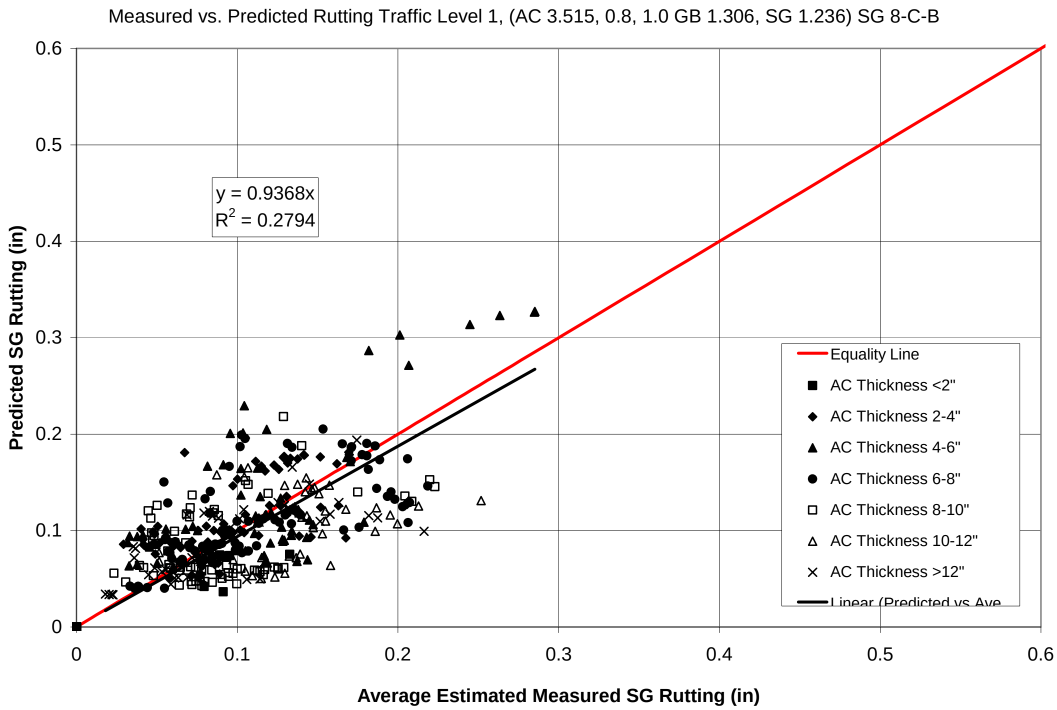


Figure C-97 Granular Subgrade Rut Depth (β_{r2} = 0.8 and β_{r3} = 1.0)

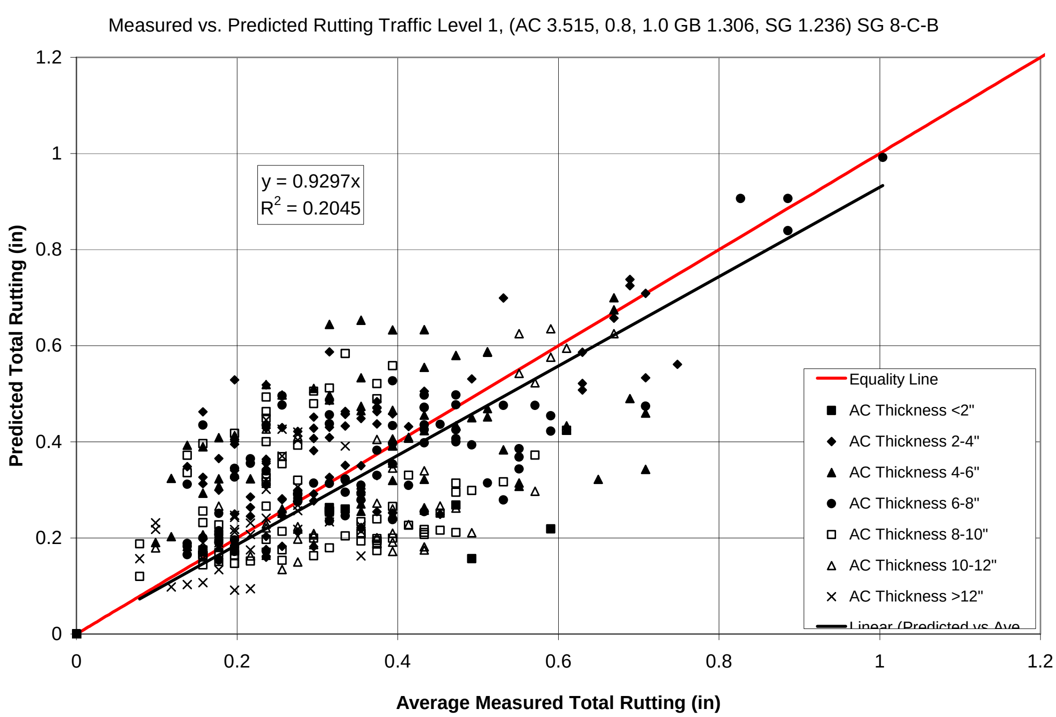


Figure C-98 Total Asphalt Pavement Rut Depth (β_{r2} = 0.8 and β_{r3} = 1.0)

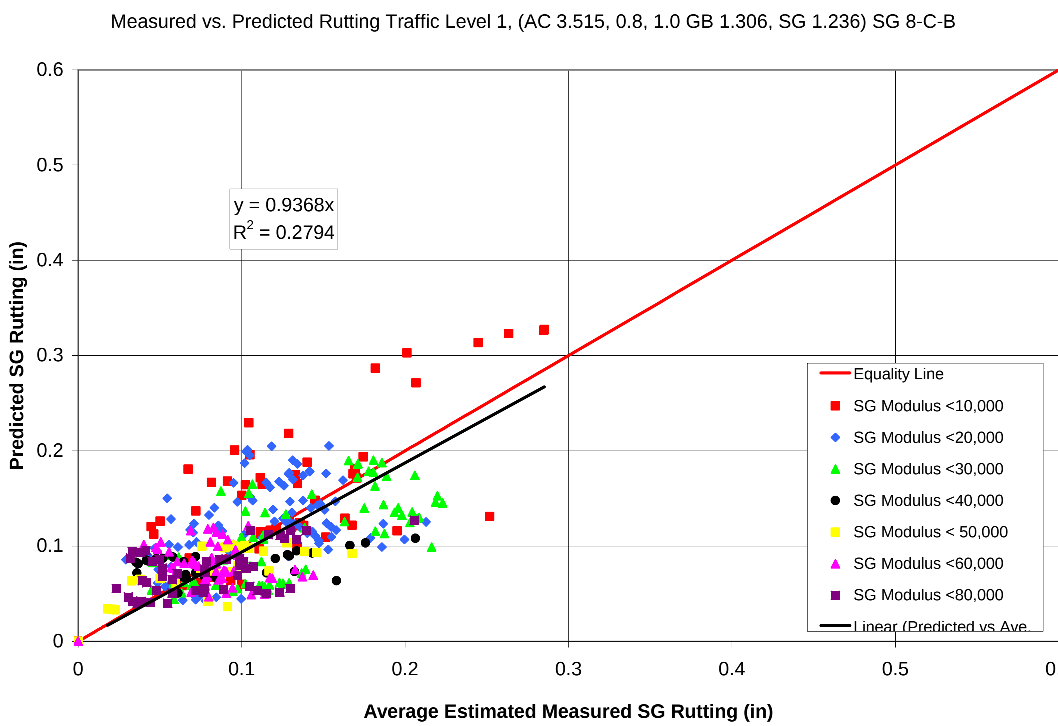


Figure C-99 Subgrade Rut Depth (β_{r2} = 0.8 and β_{r3} = 1.0) (By Subgrade Modulus)

Table C-55 Permanent Deformation Simulation (β_{r2} = 0.8 and β_{r3} = 1.2) Summary

	AC	GB	SG	Total
Average Predicted=	0.166	0.050	0.120	0.336
Sum of error =	0.738	-0.088	-0.374	0.000
Sum of error^2 =	1.974	0.220	0.984	7.355
Predicted % =	46.85%	14.97%	38.18%	100.00%
Se =	0.065	0.022	0.046	0.125
Average Measured =	0.050	0.121	0.336	0.346
Calibration Factor β_1 =	1.134	1.468	1.400	

Table C-56 Permanent Deformation Simulation (β_{r2} = 0.8 and β_{r3} = 1.2) Data

Section	Month	Time	Predicted							Measured			
			AC	GB	SG	Total	%AC	%GB	%SG	AC	GB	SG	Total
11001	4/5/1989	103	0.416	0.152	0.122	0.69	60.21%	22.04%	17.75%	0.202	0.074	0.059	0.335
11001	2/12/1991	125	0.464	0.155	0.125	0.744	62.32%	20.84%	16.84%	0.196	0.066	0.053	0.315
11001	4/2/1992	139	0.479	0.156	0.127	0.762	62.89%	20.49%	16.62%	0.186	0.061	0.049	0.295
11019	5/15/1989	32	0.14	0.022	0.141	0.303	46.16%	7.18%	46.66%	0.236	0.037	0.239	0.512
11019	4/16/1990	43	0.163	0.022	0.146	0.332	49.20%	6.76%	44.04%	0.271	0.037	0.243	0.551
11019	1/15/1991	52	0.185	0.023	0.15	0.358	51.68%	6.44%	41.88%	0.285	0.035	0.231	0.551
11019	3/31/1992	66	0.2	0.023	0.153	0.377	53.13%	6.19%	40.68%	0.293	0.034	0.224	0.551
11019	3/22/1994	90	0.231	0.027	0.159	0.417	55.47%	6.48%	38.05%	0.328	0.038	0.225	0.591
11019	1/8/1996	112	0.259	0.03	0.163	0.452	57.42%	6.57%	36.01%	0.339	0.039	0.213	0.591
11019	1/23/1998	136	0.279	0.03	0.166	0.475	58.81%	6.31%	34.88%	0.417	0.045	0.247	0.709
14126	6/5/1989	15	0.069	0.012	0.05	0.131	52.90%	8.85%	38.25%	0.094	0.016	0.068	0.177
14126	3/3/1991	36	0.105	0.013	0.058	0.176	59.84%	7.25%	32.91%	0.13	0.016	0.071	0.217
14126	4/8/1992	49	0.119	0.013	0.061	0.193	61.62%	6.75%	31.62%	0.097	0.011	0.05	0.157
14126	4/8/1994	73	0.142	0.014	0.065	0.221	64.40%	6.18%	29.41%	0.127	0.012	0.058	0.197
14126	12/11/1995	93	0.163	0.014	0.067	0.244	66.66%	5.78%	27.56%	0.144	0.013	0.06	0.217
14126	12/5/1997	117	0.18	0.014	0.069	0.264	68.32%	5.45%	26.23%	0.134	0.011	0.052	0.197
21001	8/21/1991	98	0.036	0.04	0.132	0.208	17.29%	19.21%	63.50%	0.031	0.034	0.112	0.177
21001	8/26/1993	122	0.039	0.041	0.135	0.215	18.30%	18.91%	62.80%	0.043	0.045	0.148	0.236
21001	6/15/1995	144	0.042	0.042	0.142	0.226	18.46%	18.42%	63.12%	0.051	0.051	0.174	0.276
21001	8/22/1997	170	0.046	0.043	0.144	0.232	19.71%	18.32%	61.97%	0.07	0.065	0.22	0.354
21001	8/26/1998	182	0.047	0.043	0.146	0.236	19.96%	18.18%	61.86%	0.071	0.064	0.219	0.354
21002	8/22/1991	83	0.046	0.051	0.057	0.155	29.85%	33.04%	37.11%	0.053	0.059	0.066	0.177
21002	7/30/1992	94	0.048	0.052	0.059	0.158	30.15%	32.81%	37.04%	0.071	0.077	0.087	0.236
21002	6/14/1995	129	0.059	0.054	0.061	0.173	33.80%	31.20%	35.00%	0.08	0.074	0.083	0.236
21002	8/21/1997	155	0.063	0.055	0.062	0.18	34.79%	30.67%	34.54%	0.103	0.091	0.102	0.295
21002	5/14/1998	164	0.063	0.055	0.062	0.181	34.79%	30.64%	34.57%	0.089	0.078	0.088	0.256
40114	3/30/1995	20	0.12	0.046	0.185	0.351	34.12%	13.15%	52.73%	0.134	0.052	0.208	0.394
40114	11/7/1995	28	0.152	0.049	0.195	0.396	38.44%	12.27%	49.28%	0.151	0.048	0.194	0.394
40114	2/4/1996	31	0.152	0.049	0.196	0.397	38.35%	12.24%	49.41%	0.166	0.053	0.214	0.433
40114	4/4/1996	33	0.154	0.049	0.198	0.4	38.46%	12.15%	49.39%	0.182	0.057	0.233	0.472
40114	7/9/1996	36	0.175	0.05	0.201	0.426	41.07%	11.72%	47.21%	0.178	0.051	0.204	0.433
40114	8/13/1996	37	0.183	0.05	0.202	0.436	42.00%	11.56%	46.44%	0.182	0.05	0.201	0.433
40114	1/7/1998	54	0.213	0.052	0.211	0.476	44.81%	10.92%	44.27%	0.194	0.047	0.192	0.433
40114	4/21/1998	57	0.214	0.052	0.211	0.477	44.79%	10.89%	44.31%	0.194	0.047	0.192	0.433
40114	6/12/1998	59	0.218	0.052	0.213	0.483	45.16%	10.83%	44.02%	0.213	0.051	0.208	0.472
40114	10/23/1998	63	0.236	0.053	0.215	0.504	46.81%	10.52%	42.67%	0.203	0.046	0.185	0.433
40114	2/12/1999	65	0.236	0.053	0.215	0.504	46.79%	10.51%	42.71%	0.221	0.05	0.202	0.472
40115	2/15/1995	19	0.069	0	0.081	0.15	45.84%	0.00%	54.16%	0.036	0	0.043	0.079
40115	3/30/1995	20	0.069	0	0.081	0.15	45.84%	0.00%	54.16%	0.072	0	0.085	0.157
40115	1/7/1998	54	0.122	0	0.092	0.215	57.02%	0.00%	42.98%	0.056	0	0.042	0.098
40115	2/11/1999	65	0.136	0	0.094	0.23	58.99%	0.00%	41.01%	0.058	0	0.04	0.098
40116	3/30/1995	20	0.051	0	0.112	0.163	31.21%	0.00%	68.79%	0.111	0	0.244	0.354
40116	1/8/1998	54	0.09	0	0.128	0.219	41.35%	0.00%	58.65%	0.147	0	0.208	0.354
40116	2/12/1999	65	0.1	0	0.131	0.231	43.32%	0.00%	56.68%	0.153	0	0.201	0.354

Table C-6 (Cont'd) Permanent Deformation Simulation (β_{r2} = 0.8 and β_{r3} = 1.2) Data

Section	Month	Time	Predicted							Measured			
			AC	GB	SG	Total	%AC	%GB	%SG	AC	GB	SG	Total
40117	3/30/1995	20	0.084	0.007	0.072	0.163	51.22%	4.58%	44.20%	0.222	0.02	0.191	0.433
40117	1/8/1998	54	0.149	0.009	0.081	0.239	62.32%	3.57%	34.12%	0.245	0.014	0.134	0.394
40117	2/11/1999	65	0.165	0.009	0.083	0.257	64.21%	3.38%	32.42%	0.303	0.016	0.153	0.472
40118	3/30/1995	20	0.08	0.011	0.112	0.204	39.35%	5.48%	55.17%	0.155	0.022	0.217	0.394
40118	1/8/1998	54	0.141	0.012	0.131	0.284	49.72%	4.34%	45.95%	0.176	0.015	0.163	0.354
40118	2/12/1999	65	0.157	0.012	0.134	0.303	51.68%	4.12%	44.20%	0.183	0.015	0.157	0.354
41007	11/20/1989	140	0.724	0.042	0.122	0.888	81.58%	4.70%	13.72%	0.723	0.042	0.122	0.886
41007	9/5/1991	162	0.806	0.042	0.124	0.973	82.88%	4.36%	12.75%	0.734	0.039	0.113	0.886
41007	9/20/1991	163	0.806	0.042	0.124	0.973	82.89%	4.36%	12.75%	0.685	0.036	0.105	0.827
41007	9/16/1994	198	0.915	0.043	0.127	1.085	84.34%	3.98%	11.69%	0.847	0.04	0.117	1.004
41016	11/30/1989	122	0.216	0	0.175	0.392	55.25%	0.00%	44.75%	0.207	0	0.167	0.374
41016	7/2/1990	130	0.222	0	0.176	0.398	55.75%	0.00%	44.25%	0.154	0	0.122	0.276
41016	9/25/1991	144	0.237	0	0.179	0.416	57.03%	0.00%	42.97%	0.135	0	0.102	0.236
41016	9/18/1996	204	0.296	0	0.187	0.483	61.30%	0.00%	38.70%	0.193	0	0.122	0.315
41024	11/3/1989	149	0.339	0.028	0.162	0.53	64.00%	5.35%	30.65%	0.151	0.013	0.072	0.236
41024	8/26/1990	158	0.357	0.028	0.164	0.549	64.96%	5.19%	29.85%	0.166	0.013	0.076	0.256
41024	9/4/1991	171	0.379	0.029	0.166	0.574	66.08%	5.04%	28.88%	0.143	0.011	0.063	0.217
41024	8/22/1995	218	0.453	0.03	0.171	0.654	69.25%	4.56%	26.19%	0.177	0.012	0.067	0.256
41024	11/9/1995	221	0.456	0.03	0.171	0.657	69.36%	4.54%	26.11%	0.191	0.013	0.072	0.276
41024	2/8/1996	224	0.456	0.03	0.172	0.657	69.34%	4.54%	26.12%	0.205	0.013	0.077	0.295
41024	4/4/1996	226	0.456	0.03	0.172	0.657	69.36%	4.53%	26.11%	0.177	0.012	0.067	0.256
41024	6/13/1996	228	0.46	0.03	0.172	0.661	69.50%	4.51%	25.99%	0.192	0.012	0.072	0.276
41024	7/11/1996	229	0.468	0.03	0.172	0.67	69.82%	4.47%	25.71%	0.192	0.012	0.071	0.276
41024	8/15/1996	230	0.475	0.03	0.173	0.677	70.07%	4.44%	25.49%	0.193	0.012	0.07	0.276
41024	1/15/1998	247	0.498	0.03	0.174	0.703	70.90%	4.32%	24.78%	0.195	0.012	0.068	0.276
41024	4/22/1998	250	0.499	0.03	0.174	0.703	70.90%	4.32%	24.78%	0.195	0.012	0.068	0.276
41024	6/15/1998	252	0.504	0.03	0.175	0.709	71.07%	4.29%	24.64%	0.196	0.012	0.068	0.276
41024	10/26/1998	256	0.513	0.03	0.175	0.719	71.42%	4.23%	24.36%	0.211	0.012	0.072	0.295
81029	10/20/1989	209	0.114	0.074	0.113	0.301	37.97%	24.50%	37.53%	0.09	0.058	0.089	0.236
81029	8/25/1991	231	0.121	0.075	0.115	0.31	38.99%	24.03%	36.98%	0.084	0.052	0.08	0.217
81029	10/21/1991	233	0.121	0.075	0.115	0.311	39.04%	23.99%	36.97%	0.069	0.043	0.065	0.177
81029	9/8/1995	280	0.134	0.076	0.118	0.328	40.74%	23.21%	36.05%	0.096	0.055	0.085	0.236
81047	10/20/1989	73	0.087	0.105	0.136	0.328	26.50%	32.11%	41.38%	0.099	0.12	0.155	0.374
81047	8/25/1991	95	0.099	0.107	0.142	0.348	28.33%	30.80%	40.87%	0.1	0.109	0.145	0.354
81047	10/22/1991	97	0.099	0.107	0.143	0.349	28.37%	30.75%	40.87%	0.095	0.103	0.137	0.335
81053	10/19/1989	60	0.1	0.094	0.11	0.304	32.82%	31.04%	36.14%	0.116	0.11	0.128	0.354
81053	7/7/1990	69	0.108	0.095	0.113	0.315	34.16%	30.07%	35.77%	0.148	0.13	0.155	0.433
81053	12/6/1993	110	0.15	0.109	0.127	0.386	38.88%	28.21%	32.91%	0.153	0.111	0.13	0.394
81053	3/14/1994	113	0.15	0.109	0.128	0.387	38.80%	28.16%	33.03%	0.153	0.111	0.13	0.394
81053	8/8/1994	118	0.159	0.113	0.13	0.402	39.58%	28.03%	32.39%	0.156	0.11	0.128	0.394
81053	10/21/1994	120	0.16	0.113	0.131	0.404	39.57%	28.01%	32.42%	0.164	0.116	0.134	0.413
81053	2/13/1995	124	0.16	0.113	0.132	0.405	39.50%	27.96%	32.54%	0.163	0.116	0.135	0.413
81053	5/8/1995	127	0.161	0.113	0.132	0.406	39.57%	27.90%	32.53%	0.164	0.115	0.134	0.413
81053	5/10/1996	139	0.172	0.114	0.134	0.42	40.99%	27.10%	31.91%	0.177	0.117	0.138	0.433
81053	10/21/1996	144	0.181	0.114	0.135	0.43	42.08%	26.55%	31.37%	0.199	0.125	0.148	0.472
81053	11/14/1996	145	0.181	0.114	0.135	0.43	42.06%	26.54%	31.40%	0.199	0.125	0.148	0.472
81053	3/20/1997	149	0.181	0.114	0.136	0.431	41.98%	26.51%	31.51%	0.198	0.125	0.149	0.472

Table C-6 (Cont'd) Permanent Deformation Simulation (β_{r2} = 0.8 and β_{r3} = 1.2) Data

			Predicted							Measured			
Section	Month	Time	AC	GB	SG	Total	%AC	%GB	%SG	AC	GB	SG	Total
81053	8/5/1997	154	0.193	0.117	0.138	0.448	43.14%	26.17%	30.70%	0.212	0.129	0.151	0.492
81053	9/26/1997	155	0.194	0.118	0.138	0.45	43.20%	26.15%	30.66%	0.221	0.134	0.157	0.512
81053	8/25/1998	166	0.206	0.122	0.141	0.468	43.94%	25.96%	30.10%	0.225	0.133	0.154	0.512
91803	9/5/1990	63	0.041	0.03	0.078	0.149	27.83%	19.94%	52.23%	0.049	0.035	0.093	0.177
91803	8/22/1991	74	0.047	0.031	0.08	0.159	29.77%	19.45%	50.78%	0.041	0.027	0.07	0.138
91803	9/30/1992	87	0.05	0.032	0.083	0.166	30.43%	19.16%	50.41%	0.06	0.038	0.099	0.197
91803	5/12/1994	107	0.056	0.033	0.087	0.176	31.79%	18.62%	49.59%	0.044	0.026	0.068	0.138
91803	9/25/1994	111	0.06	0.033	0.088	0.182	32.89%	18.42%	48.69%	0.045	0.025	0.067	0.138
91803	5/25/1995	119	0.06	0.034	0.089	0.183	32.86%	18.34%	48.80%	0.058	0.032	0.086	0.177
91803	10/30/1995	124	0.064	0.034	0.091	0.189	33.85%	18.15%	48.00%	0.067	0.036	0.094	0.197
91803	10/8/1996	136	0.071	0.035	0.093	0.199	35.47%	17.72%	46.81%	0.063	0.031	0.083	0.177
91803	5/8/1997	143	0.071	0.035	0.094	0.2	35.40%	17.62%	46.98%	0.063	0.031	0.083	0.177
91803	10/16/1997	148	0.074	0.036	0.095	0.205	36.01%	17.50%	46.49%	0.064	0.031	0.082	0.177
91803	6/17/1998	156	0.076	0.036	0.096	0.208	36.37%	17.32%	46.31%	0.064	0.031	0.082	0.177
123995	4/18/1989	161	0.92	0.107	0.096	1.122	81.96%	9.50%	8.54%	0.323	0.037	0.034	0.394
123995	2/5/1991	183	0.972	0.108	0.097	1.176	82.60%	9.16%	8.24%	0.325	0.036	0.032	0.394
123995	4/15/1992	197	0.995	0.108	0.098	1.201	82.86%	9.02%	8.12%	0.359	0.039	0.035	0.433
123995	3/9/1994	220	1.05	0.11	0.099	1.258	83.45%	8.71%	7.84%	0.329	0.034	0.031	0.394
123995	1/21/1996	242	1.094	0.11	0.1	1.304	83.90%	8.47%	7.63%	0.33	0.033	0.03	0.394
123997	12/14/1989	187	0.318	0.115	0.072	0.505	63.02%	22.81%	14.16%	0.397	0.144	0.089	0.63
123997	2/9/1991	201	0.332	0.116	0.073	0.521	63.71%	22.36%	13.93%	0.401	0.141	0.088	0.63
123997	4/13/1992	215	0.344	0.118	0.073	0.535	64.31%	21.98%	13.71%	0.456	0.156	0.097	0.709
123997	3/8/1994	238	0.372	0.12	0.075	0.567	65.64%	21.14%	13.22%	0.491	0.158	0.099	0.748
124105	4/12/1989	53	0.189	0.133	0.113	0.435	43.47%	30.50%	26.02%	0.163	0.114	0.097	0.374
124105	2/9/1991	75	0.227	0.138	0.118	0.484	46.96%	28.54%	24.49%	0.176	0.107	0.092	0.374
124105	4/13/1992	89	0.245	0.141	0.121	0.506	48.37%	27.74%	23.88%	0.209	0.12	0.103	0.433
124106	4/18/1989	21	0.188	0.052	0.089	0.329	57.00%	15.92%	27.08%	0.135	0.038	0.064	0.236
124106	2/5/1991	43	0.252	0.057	0.099	0.407	61.84%	13.92%	24.24%	0.17	0.038	0.067	0.276
124106	4/15/1992	57	0.278	0.058	0.102	0.439	63.41%	13.26%	23.33%	0.125	0.026	0.046	0.197
124106	3/9/1994	80	0.326	0.06	0.107	0.494	66.08%	12.22%	21.69%	0.156	0.029	0.051	0.236
124106	1/21/1996	102	0.36	0.062	0.111	0.532	67.63%	11.59%	20.78%	0.16	0.027	0.049	0.236
124106	1/17/1997	114	0.381	0.063	0.112	0.555	68.52%	11.26%	20.22%	0.216	0.035	0.064	0.315
124107	12/6/1989	75	0.11	0.083	0.107	0.3	36.58%	27.84%	35.57%	0.065	0.049	0.063	0.177
124107	2/5/1991	89	0.119	0.085	0.109	0.314	38.02%	27.16%	34.82%	0.06	0.043	0.055	0.157
124107	4/15/1992	103	0.129	0.087	0.112	0.328	39.45%	26.47%	34.08%	0.062	0.042	0.054	0.157
124107	3/9/1994	126	0.147	0.089	0.115	0.351	41.79%	25.41%	32.80%	0.058	0.035	0.045	0.138
124107	1/22/1996	148	0.161	0.091	0.118	0.37	43.45%	24.63%	31.92%	0.077	0.044	0.057	0.177
124108	4/27/1989	35	0.107	0.029	0.053	0.189	56.52%	15.32%	28.17%	0.2	0.054	0.1	0.354
124108	1/16/1991	56	0.14	0.031	0.057	0.228	61.45%	13.58%	24.97%	0.278	0.061	0.113	0.453
124108	4/1/1992	71	0.153	0.032	0.059	0.243	62.76%	13.09%	24.15%	0.247	0.052	0.095	0.394
124108	3/21/1994	94	0.181	0.033	0.062	0.276	65.64%	12.03%	22.33%	0.323	0.059	0.11	0.492
124108	1/16/1996	116	0.198	0.034	0.064	0.296	67.00%	11.50%	21.50%	0.356	0.061	0.114	0.531
124135	12/10/1989	227	0.464	0.246	0.157	0.868	53.46%	28.40%	18.14%	0.263	0.14	0.089	0.492
124135	1/29/1991	240	0.473	0.247	0.158	0.878	53.84%	28.14%	18.02%	0.318	0.166	0.106	0.591

Table C-6 (Cont'd) Permanent Deformation Simulation (β_{r2} = 0.8 and β_{r3} = 1.2) Data

Section	Month	Time	Predicted							Measured			
			AC	GB	SG	Total	%AC	%GB	%SG	AC	GB	SG	Total
131031	1/9/1990	104	0.08	0.023	0.057	0.16	49.86%	14.60%	35.54%	0.196	0.057	0.14	0.394
131031	3/4/1991	118	0.087	0.024	0.059	0.17	51.36%	14.18%	34.46%	0.222	0.061	0.149	0.433
131031	4/28/1992	131	0.095	0.025	0.06	0.18	52.86%	13.70%	33.44%	0.208	0.054	0.132	0.394
131031	4/4/1994	155	0.111	0.026	0.063	0.2	55.61%	12.91%	31.48%	0.274	0.064	0.155	0.492
131031	1/13/1996	176	0.126	0.027	0.066	0.218	57.69%	12.26%	30.05%	0.238	0.051	0.124	0.413
134111	3/20/1989	101	0.112	0.039	0.157	0.308	36.28%	12.74%	50.97%	0.1	0.035	0.14	0.276
134111	3/4/1991	125	0.134	0.042	0.167	0.343	39.00%	12.13%	48.87%	0.1	0.031	0.125	0.256
134111	4/27/1992	138	0.144	0.042	0.172	0.358	40.12%	11.85%	48.03%	0.103	0.03	0.123	0.256
134112	5/4/1989	144	0.191	0	0.128	0.319	59.99%	0.00%	40.01%	0.142	0	0.095	0.236
134112	2/10/1991	165	0.213	0	0.13	0.343	62.08%	0.00%	37.92%	0.147	0	0.09	0.236
134112	4/13/1992	179	0.226	0	0.132	0.357	63.18%	0.00%	36.82%	0.124	0	0.072	0.197
134112	2/24/1994	201	0.248	0	0.134	0.381	64.94%	0.00%	35.06%	0.153	0	0.083	0.236
134112	1/25/1996	224	0.27	0	0.136	0.406	66.58%	0.00%	33.42%	0.17	0	0.086	0.256
134112	4/23/1998	251	0.295	0	0.138	0.433	68.19%	0.00%	31.81%	0.228	0	0.106	0.335
134113	5/4/1989	144	0.226	0	0.172	0.398	56.76%	0.00%	43.24%	0.089	0	0.068	0.157
134113	2/10/1991	165	0.247	0	0.175	0.422	58.50%	0.00%	41.50%	0.081	0	0.057	0.138
134113	4/13/1992	179	0.26	0	0.177	0.436	59.50%	0.00%	40.50%	0.105	0	0.072	0.177
134113	2/24/1994	201	0.281	0	0.179	0.46	61.04%	0.00%	38.96%	0.108	0	0.069	0.177
134113	1/25/1996	224	0.303	0	0.181	0.484	62.54%	0.00%	37.46%	0.111	0	0.066	0.177
134113	4/23/1998	251	0.327	0	0.184	0.511	64.02%	0.00%	35.98%	0.113	0	0.064	0.177
134119	1/8/1990	140	0.398	0.012	0.038	0.447	88.95%	2.63%	8.42%	0.245	0.007	0.023	0.276
134119	3/4/1991	154	0.418	0.012	0.038	0.468	89.32%	2.54%	8.14%	0.246	0.007	0.022	0.276
134119	4/28/1992	167	0.427	0.012	0.038	0.477	89.50%	2.49%	8.01%	0.229	0.006	0.02	0.256
134119	4/7/1994	191	0.454	0.012	0.039	0.504	89.95%	2.39%	7.66%	0.212	0.006	0.018	0.236
161001	7/17/1989	192	0.177	0.111	0.095	0.383	46.23%	29.08%	24.69%	0.137	0.086	0.073	0.295
161001	8/2/1990	205	0.188	0.114	0.096	0.398	47.23%	28.65%	24.11%	0.093	0.056	0.047	0.197
161001	7/4/1991	216	0.193	0.115	0.097	0.404	47.65%	28.44%	23.90%	0.094	0.056	0.047	0.197
161001	8/25/1994	253	0.219	0.117	0.098	0.435	50.38%	26.98%	22.64%	0.119	0.064	0.053	0.236
161001	5/17/1995	262	0.22	0.117	0.099	0.437	50.49%	26.91%	22.61%	0.129	0.069	0.058	0.256
161001	7/9/1997	288	0.24	0.12	0.1	0.461	52.09%	26.13%	21.78%	0.154	0.077	0.064	0.295
161001	9/23/1998	302	0.252	0.12	0.101	0.473	53.26%	25.44%	21.30%	0.199	0.095	0.08	0.374
161009	9/20/1989	180	0.23	0.021	0.083	0.334	68.99%	6.16%	24.85%	0.299	0.027	0.108	0.433
161009	7/19/1990	190	0.236	0.021	0.083	0.34	69.42%	6.09%	24.50%	0.273	0.024	0.096	0.394
161009	7/26/1991	202	0.247	0.021	0.084	0.352	70.24%	5.93%	23.83%	0.277	0.023	0.094	0.394
161021	9/21/1989	48	0.155	0.021	0.095	0.27	57.20%	7.60%	35.20%	0.09	0.012	0.055	0.157
161021	7/21/1990	58	0.167	0.021	0.097	0.285	58.53%	7.37%	34.10%	0.104	0.013	0.06	0.177
161021	7/28/1991	70	0.181	0.021	0.099	0.302	60.06%	7.09%	32.85%	0.071	0.008	0.039	0.118
161021	9/12/1995	120	0.241	0.023	0.106	0.37	65.23%	6.15%	28.63%	0.103	0.01	0.045	0.157
161021	6/5/1996	129	0.244	0.023	0.107	0.374	65.35%	6.12%	28.52%	0.09	0.008	0.039	0.138
161021	7/29/1997	142	0.259	0.023	0.108	0.391	66.42%	5.94%	27.64%	0.118	0.011	0.049	0.177
169034	7/17/1989	10	0.037	0.024	0.053	0.114	32.23%	21.37%	46.40%	0.025	0.017	0.037	0.079
169034	8/2/1990	23	0.074	0.029	0.06	0.163	45.19%	17.85%	36.96%	0.071	0.028	0.058	0.157
169034	7/4/1991	34	0.083	0.03	0.063	0.176	47.15%	17.03%	35.82%	0.037	0.013	0.028	0.079
169034	5/17/1995	80	0.119	0.033	0.07	0.222	53.76%	14.78%	31.47%	0.085	0.023	0.05	0.157
169034	7/9/1997	106	0.14	0.034	0.072	0.246	56.84%	13.83%	29.33%	0.09	0.022	0.046	0.157
169034	9/24/1998	120	0.149	0.035	0.073	0.257	57.98%	13.48%	28.54%	0.137	0.032	0.067	0.236

Table C-6 (Cont'd) Permanent Deformation Simulation (β_{r2} = 0.8 and β_{r3} = 1.2) Data

			Predicted							Measured			
Section	Month	Time	AC	GB	SG	Total	%AC	%GB	%SG	AC	GB	SG	Total
201009	5/2/1989	53	0.046	0	0.081	0.128	36.26%	0.00%	63.74%	0.093	0	0.163	0.256
201009	12/10/1990	72	0.056	0	0.086	0.142	39.69%	0.00%	60.31%	0.109	0	0.166	0.276
201009	4/8/1993	100	0.065	0	0.089	0.155	42.12%	0.00%	57.88%	0.091	0	0.125	0.217
201009	4/23/1996	136	0.077	0	0.094	0.171	45.16%	0.00%	54.84%	0.044	0	0.054	0.098
251003	8/4/1989	180	0.07	0.047	0.045	0.161	43.15%	29.02%	27.84%	0.068	0.046	0.044	0.157
251003	9/6/1990	193	0.071	0.047	0.045	0.164	43.55%	28.81%	27.64%	0.103	0.068	0.065	0.236
251003	8/23/1991	204	0.074	0.048	0.046	0.167	44.20%	28.52%	27.28%	0.07	0.045	0.043	0.157
251003	9/30/1992	217	0.078	0.048	0.046	0.173	45.33%	27.98%	26.68%	0.089	0.055	0.053	0.197
251003	10/27/1995	254	0.085	0.049	0.047	0.181	46.71%	27.28%	26.01%	0.083	0.048	0.046	0.177
251003	10/23/1996	266	0.087	0.05	0.048	0.185	47.28%	26.99%	25.73%	0.084	0.048	0.046	0.177
251003	6/16/1998	286	0.092	0.051	0.048	0.191	48.35%	26.48%	25.17%	0.076	0.042	0.04	0.157
251004	8/4/1989	178	0.08	0.064	0.048	0.192	41.79%	33.08%	25.13%	0.148	0.117	0.089	0.354
251004	9/5/1990	191	0.085	0.065	0.049	0.198	42.69%	32.59%	24.72%	0.126	0.096	0.073	0.295
251004	8/22/1991	202	0.088	0.065	0.05	0.203	43.38%	32.19%	24.43%	0.145	0.108	0.082	0.335
251004	9/30/1992	215	0.093	0.067	0.051	0.211	44.37%	31.64%	23.99%	0.21	0.149	0.113	0.472
251004	10/29/1995	252	0.105	0.069	0.052	0.227	46.39%	30.51%	23.10%	0.192	0.126	0.095	0.413
251004	6/5/1997	272	0.111	0.07	0.053	0.235	47.34%	29.95%	22.71%	0.168	0.106	0.08	0.354
251004	6/15/1998	284	0.116	0.071	0.054	0.241	48.09%	29.54%	22.36%	0.18	0.11	0.084	0.374
261001	9/7/1989	217	0.078	0.073	0.092	0.243	32.10%	30.06%	37.83%	0.07	0.065	0.082	0.217
261001	7/21/1990	227	0.079	0.073	0.092	0.244	32.21%	29.98%	37.81%	0.082	0.077	0.097	0.256
261001	7/16/1991	239	0.081	0.074	0.093	0.248	32.57%	29.83%	37.60%	0.064	0.059	0.074	0.197
261001	6/9/1993	262	0.084	0.075	0.094	0.253	33.17%	29.59%	37.24%	0.085	0.076	0.095	0.256
261001	7/5/1996	299	0.09	0.076	0.096	0.262	34.22%	29.10%	36.68%	0.074	0.063	0.079	0.217
261004	10/21/1990	64	0.073	0.026	0.069	0.167	43.42%	15.46%	41.12%	0.077	0.027	0.073	0.177
261004	5/13/1993	95	0.08	0.027	0.072	0.178	44.69%	15.06%	40.25%	0.044	0.015	0.04	0.098
261004	7/7/1994	109	0.089	0.028	0.074	0.19	46.69%	14.59%	38.72%	0.055	0.017	0.046	0.118
261004	6/15/1995	120	0.092	0.028	0.075	0.194	47.17%	14.43%	38.40%	0.074	0.023	0.06	0.157
271018	6/22/1989	126	0.174	0.029	0.107	0.31	56.12%	9.32%	34.56%	0.221	0.037	0.136	0.394
271018	10/30/1990	142	0.191	0.029	0.109	0.329	57.99%	8.93%	33.08%	0.205	0.032	0.117	0.354
271018	6/2/1993	174	0.213	0.03	0.112	0.355	60.10%	8.48%	31.43%	0.166	0.023	0.087	0.276
271018	3/8/1994	183	0.223	0.03	0.112	0.365	61.03%	8.28%	30.69%	0.168	0.023	0.085	0.276
271087	6/9/1989	126	0.036	0	0.056	0.092	39.15%	0.00%	60.85%	0.077	0	0.12	0.197
271087	11/13/1990	143	0.038	0	0.056	0.095	40.53%	0.00%	59.47%	0.088	0	0.129	0.217
271087	5/11/1993	173	0.041	0	0.057	0.099	41.84%	0.00%	58.16%	0.049	0	0.069	0.118
271087	6/25/1996	210	0.045	0	0.059	0.104	43.67%	0.00%	56.33%	0.06	0	0.078	0.138
271087	8/3/1999	240	0.049	0	0.059	0.108	45.11%	0.00%	54.89%	0.071	0	0.086	0.157
291008	3/13/1989	35	0.049	0.009	0.101	0.159	31.10%	5.37%	63.53%	0.073	0.013	0.15	0.236
291008	11/7/1990	55	0.062	0.009	0.109	0.181	34.51%	5.11%	60.38%	0.102	0.015	0.178	0.295
291008	3/5/1993	85	0.075	0.01	0.116	0.201	37.21%	4.89%	57.90%	0.11	0.014	0.171	0.295
291008	4/17/1996	120	0.09	0.01	0.123	0.224	40.27%	4.65%	55.08%	0.095	0.011	0.13	0.236
307088	9/27/1989	100	0.193	0.12	0.151	0.464	41.64%	25.75%	32.61%	0.18	0.112	0.141	0.433
307088	7/29/1990	110	0.201	0.121	0.153	0.475	42.26%	25.48%	32.26%	0.166	0.1	0.127	0.394
307088	5/20/1991	120	0.207	0.122	0.155	0.484	42.73%	25.26%	32.01%	0.151	0.09	0.113	0.354
308129	10/3/1989	17	0.07	0.086	0.141	0.297	23.53%	29.13%	47.34%	0.083	0.103	0.168	0.354
308129	7/29/1990	26	0.079	0.105	0.153	0.337	23.48%	31.05%	45.47%	0.074	0.098	0.143	0.315
308129	7/30/1991	38	0.092	0.111	0.166	0.369	24.98%	30.07%	44.94%	0.059	0.071	0.106	0.236
308129	12/14/1993	67	0.123	0.117	0.183	0.423	29.15%	27.57%	43.28%	0.086	0.081	0.128	0.295

Table C-6 (Cont'd) Permanent Deformation Simulation (β_{r2} = 0.8 and β_{r3} = 1.2) Data

			Predicted							Measured			
Section	Month	Time	AC	GB	SG	Total	%AC	%GB	%SG	AC	GB	SG	Total
308129	3/17/1994	70	0.124	0.117	0.185	0.426	29.01%	27.52%	43.47%	0.091	0.087	0.137	0.315
308129	8/22/1994	75	0.134	0.124	0.189	0.446	29.93%	27.76%	42.31%	0.088	0.082	0.125	0.295
308129	10/31/1994	77	0.134	0.125	0.19	0.449	29.93%	27.73%	42.34%	0.094	0.087	0.133	0.315
308129	2/17/1995	81	0.135	0.125	0.192	0.451	29.84%	27.65%	42.51%	0.123	0.114	0.176	0.413
308129	5/18/1995	84	0.135	0.125	0.192	0.452	29.84%	27.59%	42.56%	0.1	0.092	0.142	0.335
308129	6/10/1996	97	0.146	0.126	0.197	0.47	31.12%	26.90%	41.98%	0.11	0.095	0.149	0.354
308129	10/28/1996	101	0.153	0.127	0.199	0.479	31.92%	26.52%	41.56%	0.107	0.089	0.139	0.335
308129	1/23/1997	104	0.153	0.127	0.2	0.48	31.87%	26.52%	41.61%	0.125	0.104	0.164	0.394
308129	3/25/1997	106	0.153	0.127	0.2	0.481	31.85%	26.48%	41.67%	0.107	0.089	0.139	0.335
308129	8/11/1997	111	0.163	0.128	0.202	0.492	33.12%	25.91%	40.97%	0.124	0.097	0.153	0.374
308129	10/1/1997	113	0.165	0.128	0.202	0.495	33.35%	25.81%	40.85%	0.125	0.097	0.153	0.374
321020	8/29/1989	63	0.11	0.021	0.087	0.218	50.59%	9.42%	39.98%	0.159	0.03	0.126	0.315
321020	8/22/1990	75	0.119	0.021	0.089	0.229	51.99%	9.11%	38.90%	0.174	0.03	0.13	0.335
321020	7/23/1991	86	0.126	0.021	0.09	0.238	53.08%	8.89%	38.03%	0.167	0.028	0.12	0.315
321020	9/14/1994	124	0.16	0.022	0.095	0.277	57.76%	8.06%	34.18%	0.159	0.022	0.094	0.276
321020	4/25/1995	131	0.16	0.022	0.095	0.277	57.72%	8.05%	34.23%	0.205	0.029	0.121	0.354
321020	6/5/1997	157	0.179	0.023	0.097	0.299	59.79%	7.66%	32.54%	0.188	0.024	0.103	0.315
321020	6/9/1998	169	0.186	0.023	0.098	0.307	60.51%	7.51%	31.98%	0.202	0.025	0.107	0.335
321020	4/13/1999	175	0.194	0.023	0.099	0.316	61.41%	7.38%	31.21%	0.23	0.028	0.117	0.374
341003	9/11/1990	195	0.13	0.024	0.056	0.21	61.67%	11.51%	26.81%	0.498	0.093	0.216	0.807
341003	8/15/1991	206	0.134	0.025	0.057	0.216	62.25%	11.36%	26.39%	0.441	0.08	0.187	0.709
341003	9/28/1992	219	0.139	0.025	0.058	0.222	62.77%	11.20%	26.03%	0.519	0.093	0.215	0.827
341011	4/17/1999	214	0.327	0.026	0.129	0.482	67.85%	5.30%	26.85%	0.2	0.016	0.079	0.295
341011	4/18/1999	227	0.338	0.026	0.131	0.495	68.31%	5.22%	26.46%	0.256	0.02	0.099	0.374
341011	4/19/1999	244	0.354	0.026	0.133	0.513	69.07%	5.07%	25.87%	0.204	0.015	0.076	0.295
341011	4/20/1999	254	0.37	0.026	0.134	0.53	69.77%	4.96%	25.27%	0.261	0.019	0.095	0.374
341011	4/21/1999	287	0.41	0.027	0.138	0.575	71.32%	4.70%	23.98%	0.281	0.018	0.094	0.394
341011	4/22/1999	307	0.437	0.027	0.14	0.604	72.32%	4.54%	23.14%	0.242	0.015	0.077	0.335
341031	10/5/1989	194	0.2	0.061	0.121	0.383	52.37%	15.96%	31.68%	0.258	0.079	0.156	0.492
341031	9/12/1990	205	0.212	0.062	0.123	0.397	53.35%	15.65%	31.00%	0.252	0.074	0.146	0.472
341031	4/6/1992	224	0.226	0.063	0.126	0.416	54.48%	15.23%	30.29%	0.257	0.072	0.143	0.472
341031	2/24/1993	234	0.237	0.064	0.127	0.428	55.37%	14.98%	29.65%	0.251	0.068	0.134	0.453
341031	10/26/1995	266	0.273	0.067	0.132	0.472	57.97%	14.13%	27.90%	0.331	0.081	0.159	0.571
341031	11/4/1995	267	0.273	0.067	0.132	0.472	57.97%	14.13%	27.90%	0.308	0.075	0.148	0.531
341033	10/5/1989	181	0.145	0.045	0.075	0.265	54.80%	16.91%	28.29%	0.151	0.047	0.078	0.276
341033	9/12/1990	192	0.148	0.045	0.075	0.269	55.14%	16.78%	28.09%	0.195	0.059	0.1	0.354
341033	4/5/1992	211	0.157	0.046	0.077	0.279	56.19%	16.40%	27.41%	0.155	0.045	0.076	0.276
341033	2/24/1993	221	0.162	0.046	0.077	0.285	56.79%	16.16%	27.05%	0.19	0.054	0.091	0.335
341033	11/3/1995	254	0.175	0.047	0.079	0.301	58.16%	15.67%	26.16%	0.206	0.056	0.093	0.354
341033	7/23/1997	274	0.179	0.047	0.079	0.306	58.55%	15.50%	25.95%	0.173	0.046	0.077	0.295
341034	10/5/1989	48	0.1	0	0.077	0.178	56.55%	0.00%	43.45%	0.078	0	0.06	0.138
341034	9/12/1990	59	0.114	0	0.079	0.193	59.08%	0.00%	40.92%	0.163	0	0.113	0.276
341034	4/6/1992	78	0.125	0	0.081	0.206	60.75%	0.00%	39.25%	0.108	0	0.07	0.177
341034	2/24/1993	88	0.137	0	0.082	0.219	62.41%	0.00%	37.59%	0.147	0	0.089	0.236
341034	11/4/1995	121	0.168	0	0.086	0.254	66.17%	0.00%	33.83%	0.169	0	0.087	0.256
341034	7/30/1997	141	0.183	0	0.087	0.271	67.71%	0.00%	32.29%	0.12	0	0.057	0.177

Table C-6 (Cont'd) Permanent Deformation Simulation (β_{r2} = 0.8 and β_{r3} = 1.2) Data

			Predicted							Measured			
Section	Month	Time	AC	GB	SG	Total	%AC	%GB	%SG	AC	GB	SG	Total
350101	5/1/1997	19	0.114	0.044	0.189	0.346	32.92%	12.63%	54.45%	0.065	0.025	0.107	0.197
350101	3/19/1999	38	0.18	0.049	0.212	0.441	40.74%	11.19%	48.06%	0.096	0.026	0.114	0.236
350102	5/1/1997	19	0.123	0.074	0.227	0.424	28.99%	17.36%	53.65%	0.057	0.034	0.106	0.197
350102	3/19/1999	38	0.195	0.082	0.26	0.537	36.32%	15.30%	48.38%	0.086	0.036	0.114	0.236
350103	5/1/1997	19	0.063	0	0.188	0.25	25.09%	0.00%	74.91%	0.049	0	0.147	0.197
350103	3/19/1999	38	0.098	0	0.22	0.318	30.96%	0.00%	69.04%	0.085	0	0.19	0.276
350104	5/1/1997	19	0.05	0	0.124	0.174	28.95%	0.00%	71.05%	0.068	0	0.168	0.236
350104	3/19/1999	38	0.079	0	0.146	0.225	34.98%	0.00%	65.02%	0.096	0	0.179	0.276
350105	5/2/1997	19	0.093	0.016	0.213	0.322	28.81%	4.98%	66.21%	0.068	0.012	0.156	0.236
350105	3/22/1999	38	0.145	0.018	0.247	0.41	35.36%	4.40%	60.23%	0.084	0.01	0.142	0.236
350106	5/2/1996	19	0.049	0.006	0.143	0.199	24.87%	3.18%	71.95%	0.049	0.006	0.142	0.197
350106	3/22/1999	38	0.077	0.007	0.168	0.251	30.45%	2.86%	66.69%	0.072	0.007	0.158	0.236
351005	10/31/1989	73	0.121	0.025	0.148	0.293	41.34%	8.36%	50.30%	0.195	0.039	0.238	0.472
351005	8/21/1991	95	0.136	0.025	0.154	0.315	43.18%	7.93%	48.89%	0.204	0.037	0.231	0.472
351005	10/24/1992	109	0.149	0.025	0.158	0.333	44.77%	7.63%	47.60%	0.185	0.032	0.197	0.413
351005	3/18/1995	138	0.185	0.027	0.165	0.377	49.22%	7.06%	43.72%	0.281	0.04	0.25	0.571
351005	3/16/1999	183	0.236	0.028	0.173	0.436	54.02%	6.33%	39.66%	0.33	0.039	0.242	0.61
351022	10/31/1989	37	0.081	0.035	0.134	0.25	32.42%	14.11%	53.47%	0.057	0.025	0.095	0.177
351022	8/22/1991	59	0.125	0.039	0.145	0.309	40.36%	12.51%	47.13%	0.056	0.017	0.065	0.138
351022	10/24/1992	73	0.135	0.039	0.15	0.325	41.64%	12.14%	46.22%	0.082	0.024	0.091	0.197
351022	3/18/1995	102	0.166	0.041	0.159	0.366	45.33%	11.23%	43.44%	0.098	0.024	0.094	0.217
351022	3/17/1999	147	0.229	0.044	0.17	0.443	51.64%	9.91%	38.44%	0.081	0.016	0.061	0.157
351112	12/5/1989	67	0.206	0.033	0.092	0.331	62.38%	9.85%	27.77%	0.098	0.016	0.044	0.157
351112	1/22/1991	80	0.216	0.033	0.093	0.342	63.09%	9.66%	27.25%	0.112	0.017	0.048	0.177
351112	9/27/1991	88	0.227	0.033	0.094	0.355	64.01%	9.39%	26.60%	0.088	0.013	0.037	0.138
351112	1/27/1993	104	0.239	0.034	0.096	0.368	64.88%	9.17%	25.96%	0.077	0.011	0.031	0.118
351112	3/15/1995	130	0.266	0.035	0.098	0.399	66.83%	8.65%	24.51%	0.132	0.017	0.048	0.197
351112	9/9/1997	160	0.291	0.035	0.1	0.426	68.32%	8.27%	23.41%	0.094	0.011	0.032	0.138
351112	3/15/1999	175	0.303	0.036	0.101	0.439	69.00%	8.10%	22.90%	0.109	0.013	0.036	0.157
371006	10/13/1989	88	0.357	0.033	0.158	0.547	65.15%	5.98%	28.87%	0.051	0.005	0.023	0.079
371006	3/19/1991	105	0.382	0.033	0.161	0.576	66.29%	5.76%	27.95%	0.052	0.005	0.022	0.079
371006	10/11/1992	124	0.437	0.034	0.165	0.637	68.65%	5.37%	25.97%	0.122	0.01	0.046	0.177
371006	4/18/1994	142	0.459	0.035	0.168	0.661	69.37%	5.24%	25.39%	0.068	0.005	0.025	0.098
371006	9/20/1994	147	0.476	0.035	0.169	0.68	70.01%	5.14%	24.85%	0.083	0.006	0.029	0.118
371024	11/3/1989	109	0.079	0.051	0.12	0.25	31.54%	20.47%	47.99%	0.112	0.073	0.17	0.354
371024	3/9/1991	125	0.083	0.052	0.123	0.258	32.25%	20.08%	47.67%	0.14	0.087	0.206	0.433
371024	4/10/1992	138	0.088	0.053	0.125	0.266	33.03%	19.78%	47.19%	0.117	0.07	0.167	0.354
371802	10/13/1989	49	0.094	0.083	0.307	0.484	19.34%	17.22%	63.44%	0.069	0.061	0.225	0.354
371802	3/18/1991	66	0.106	0.086	0.325	0.517	20.50%	16.72%	62.78%	0.065	0.053	0.198	0.315
371802	10/10/1992	85	0.123	0.09	0.343	0.556	22.10%	16.26%	61.65%	0.078	0.058	0.218	0.354
371802	4/15/1994	103	0.132	0.092	0.355	0.579	22.76%	15.92%	61.32%	0.099	0.069	0.266	0.433
371802	7/18/1995	118	0.145	0.095	0.366	0.605	23.88%	15.65%	60.47%	0.113	0.074	0.286	0.472
371802	2/9/1996	125	0.148	0.095	0.37	0.613	24.10%	15.55%	60.34%	0.123	0.08	0.309	0.512
371802	4/2/1996	127	0.148	0.095	0.371	0.614	24.08%	15.52%	60.40%	0.123	0.079	0.309	0.512
371817	10/15/1989	71	0.1	0.051	0.084	0.234	42.60%	21.62%	35.79%	0.168	0.085	0.141	0.394
371817	3/18/1991	88	0.107	0.052	0.087	0.246	43.68%	21.10%	35.22%	0.112	0.054	0.09	0.256
371817	10/18/1992	107	0.127	0.054	0.09	0.271	46.84%	20.01%	33.15%	0.166	0.071	0.117	0.354

Table C-6 (Cont'd) Permanent Deformation Simulation (β_{r2} = 0.8 and β_{r3} = 1.2) Data

Section	Month	Time	Predicted							Measured			
			AC	GB	SG	Total	%AC	%GB	%SG	AC	GB	SG	Total
371992	10/15/1992	33	0.14	0.132	0.086	0.358	39.21%	36.90%	23.89%	0.093	0.087	0.056	0.236
371992	4/20/1994	51	0.174	0.139	0.091	0.404	43.00%	34.39%	22.61%	0.017	0.014	0.009	0.039
371992	2/6/1996	73	0.217	0.146	0.097	0.46	47.16%	31.73%	21.11%	0.074	0.05	0.033	0.157
371992	4/22/1998	99	0.265	0.153	0.103	0.521	50.95%	29.32%	19.73%	0.12	0.069	0.047	0.236
404087	1/17/1990	43	0.07	0.03	0.118	0.218	32.04%	13.69%	54.27%	0.196	0.084	0.331	0.61
404087	10/13/1991	64	0.087	0.032	0.131	0.251	34.75%	12.87%	52.38%	0.151	0.056	0.227	0.433
404087	2/8/1993	80	0.095	0.033	0.138	0.266	35.63%	12.51%	51.86%	0.133	0.047	0.194	0.374
404087	2/9/1995	104	0.109	0.035	0.148	0.292	37.31%	11.95%	50.74%	0.213	0.068	0.29	0.571
404163	1/23/1990	34	0.064	0	0.116	0.179	35.43%	0.00%	64.57%	0.16	0	0.292	0.453
404163	3/17/1991	48	0.073	0	0.121	0.194	37.49%	0.00%	62.51%	0.14	0	0.234	0.374
404163	10/28/1991	55	0.079	0	0.124	0.203	38.71%	0.00%	61.29%	0.114	0	0.181	0.295
404163	3/10/1993	72	0.088	0	0.129	0.217	40.60%	0.00%	59.40%	0.112	0	0.164	0.276
404163	4/22/1996	109	0.103	0	0.136	0.239	43.13%	0.00%	56.87%	0.136	0	0.179	0.315
404163	8/20/1997	125	0.115	0	0.14	0.255	45.15%	0.00%	54.85%	0.178	0	0.216	0.394
404163	1/11/1999	141	0.12	0	0.142	0.262	45.79%	0.00%	54.21%	0.207	0	0.245	0.453
421599	7/18/1989	24	0.051	0.023	0.115	0.189	26.77%	12.33%	60.91%	0.047	0.022	0.108	0.177
421599	9/27/1990	38	0.061	0.024	0.123	0.207	29.36%	11.39%	59.25%	0.064	0.025	0.128	0.217
421599	8/7/1991	49	0.068	0.024	0.127	0.219	31.09%	10.82%	58.10%	0.061	0.021	0.114	0.197
421599	3/1/1993	68	0.078	0.024	0.132	0.235	33.39%	10.19%	56.42%	0.105	0.032	0.178	0.315
421599	6/21/1995	95	0.096	0.024	0.139	0.259	36.88%	9.34%	53.78%	0.102	0.026	0.148	0.276
421599	7/19/1996	108	0.104	0.024	0.142	0.271	38.52%	8.99%	52.50%	0.106	0.025	0.145	0.276
421599	3/26/1998	128	0.116	0.025	0.146	0.287	40.54%	8.59%	50.87%	0.112	0.024	0.14	0.276
451011	4/11/1989	34	0.3	0.065	0.095	0.459	65.24%	14.06%	20.69%	0.218	0.047	0.069	0.335
451011	3/5/1991	57	0.372	0.068	0.1	0.539	68.94%	12.55%	18.51%	0.339	0.062	0.091	0.492
451011	10/24/1992	76	0.432	0.07	0.103	0.605	71.46%	11.55%	16.99%	0.45	0.073	0.107	0.63
451011	1/27/1996	115	0.513	0.072	0.107	0.692	74.13%	10.46%	15.40%	0.496	0.07	0.103	0.669
451011	2/11/1999	150	0.573	0.074	0.109	0.756	75.80%	9.78%	14.42%	0.537	0.069	0.102	0.709
473104	11/1/1989	42	0.005	0.052	0.097	0.154	2.94%	33.89%	63.17%	0.008	0.093	0.174	0.276
473104	5/6/1991	60	0.005	0.055	0.107	0.167	3.05%	33.15%	63.80%	0.01	0.104	0.201	0.315
473104	10/26/1992	77	0.006	0.058	0.115	0.179	3.36%	32.49%	64.15%	0.012	0.115	0.227	0.354
473104	11/30/1995	114	0.007	0.064	0.131	0.202	3.65%	31.74%	64.61%	0.023	0.2	0.407	0.63
480001	4/10/1989	1	0.017	0.074	0.092	0.183	9.06%	40.63%	50.31%	0.021	0.096	0.119	0.236
480001	10/11/1990	19	0.116	0.129	0.174	0.419	27.75%	30.81%	41.44%	0.076	0.085	0.114	0.276
480001	3/11/1992	36	0.15	0.139	0.195	0.483	31.09%	28.67%	40.25%	0.098	0.09	0.127	0.315
480001	2/17/1993	47	0.178	0.144	0.205	0.527	33.73%	27.38%	38.89%	0.066	0.054	0.077	0.197
480001	2/20/1995	71	0.216	0.152	0.222	0.59	36.56%	25.80%	37.64%	0.115	0.081	0.119	0.315
480001	3/19/1998	108	0.281	0.162	0.242	0.685	41.00%	23.64%	35.36%	0.065	0.037	0.056	0.157
481060	6/18/1990	52	0.152	0.054	0.095	0.301	50.37%	18.08%	31.55%	0.208	0.075	0.13	0.413
481060	2/14/1991	60	0.163	0.055	0.097	0.315	51.65%	17.56%	30.79%	0.173	0.059	0.103	0.335
481060	3/18/1992	73	0.177	0.057	0.1	0.334	53.08%	16.93%	29.99%	0.125	0.04	0.071	0.236
481060	2/23/1993	84	0.192	0.058	0.103	0.352	54.49%	16.35%	29.15%	0.118	0.035	0.063	0.217
481060	2/23/1995	108	0.217	0.059	0.107	0.383	56.61%	15.45%	27.93%	0.212	0.058	0.104	0.374
481060	1/5/1999	154	0.268	0.062	0.113	0.443	60.43%	13.99%	25.58%	0.238	0.055	0.101	0.394
481077	4/25/1989	88	0.237	0.036	0.099	0.372	63.71%	9.79%	26.50%	0.339	0.052	0.141	0.531
481077	10/13/1991	118	0.278	0.038	0.102	0.418	66.62%	9.03%	24.35%	0.407	0.055	0.149	0.61
481077	10/12/1992	130	0.288	0.038	0.103	0.429	67.07%	8.90%	24.03%	0.409	0.054	0.147	0.61

Table C-6 (Cont'd) Permanent Deformation Simulation (β_{r2} = 0.8 and β_{r3} = 1.2) Data

			Predicted							Measured			
Section	Month	Time	AC	GB	SG	Total	%AC	%GB	%SG	AC	GB	SG	Total
481077	3/10/1995	159	0.315	0.039	0.105	0.459	68.60%	8.48%	22.92%	0.486	0.06	0.162	0.709
481077	3/26/1998	195	0.347	0.04	0.108	0.495	70.20%	8.04%	21.76%	0.484	0.055	0.15	0.689
481109	1/4/1990	68	0.203	0	0.211	0.414	49.06%	0.00%	50.94%	0.155	0	0.16	0.315
481109	9/21/1990	76	0.218	0	0.215	0.434	50.32%	0.00%	49.68%	0.158	0	0.156	0.315
481109	3/10/1992	94	0.234	0	0.221	0.456	51.42%	0.00%	48.58%	0.132	0	0.124	0.256
481109	2/12/1993	105	0.25	0	0.226	0.476	52.57%	0.00%	47.43%	0.135	0	0.121	0.256
481109	2/16/1995	129	0.277	0	0.233	0.509	54.33%	0.00%	45.67%	0.214	0	0.18	0.394
481130	4/11/1989	201	0.329	0.158	0.198	0.685	47.95%	23.12%	28.93%	0.255	0.123	0.154	0.531
481130	10/12/1990	219	0.349	0.161	0.202	0.713	49.02%	22.60%	28.38%	0.338	0.156	0.196	0.689
481130	3/12/1992	236	0.359	0.163	0.205	0.727	49.38%	22.36%	28.26%	0.34	0.154	0.195	0.689
481169	3/4/1990	212	0.078	0.107	0.083	0.268	29.06%	40.08%	30.86%	0.092	0.126	0.097	0.315
481169	9/18/1990	218	0.08	0.108	0.083	0.271	29.47%	39.83%	30.69%	0.093	0.125	0.097	0.315
481169	3/7/1991	224	0.08	0.108	0.083	0.271	29.47%	39.83%	30.70%	0.093	0.125	0.097	0.315
481169	1/30/1992	234	0.082	0.109	0.084	0.275	29.94%	39.56%	30.49%	0.1	0.132	0.102	0.335
481169	2/27/1993	247	0.085	0.11	0.084	0.279	30.38%	39.32%	30.30%	0.096	0.124	0.095	0.315
481169	3/3/1995	272	0.088	0.111	0.085	0.284	31.06%	38.92%	30.02%	0.147	0.184	0.142	0.472
481174	10/17/1990	186	0.374	0.07	0.186	0.63	59.39%	11.07%	29.54%	0.234	0.044	0.116	0.394
481174	2/14/1991	190	0.375	0.07	0.187	0.631	59.37%	11.05%	29.58%	0.257	0.048	0.128	0.433
481174	3/16/1992	203	0.385	0.07	0.189	0.644	59.75%	10.91%	29.35%	0.188	0.034	0.092	0.315
481174	2/18/1993	214	0.392	0.071	0.191	0.654	60.04%	10.81%	29.16%	0.213	0.038	0.103	0.354
481174	2/21/1995	238	0.412	0.072	0.194	0.678	60.78%	10.55%	28.67%	0.407	0.071	0.192	0.669
481174	3/20/1998	275	0.436	0.073	0.199	0.707	61.59%	10.25%	28.16%	0.412	0.069	0.188	0.669
481178	4/10/1989	10	0.079	0.028	0.099	0.206	38.43%	13.66%	47.91%	0.068	0.024	0.085	0.177
481178	2/22/1991	32	0.149	0.034	0.128	0.311	47.84%	11.06%	41.10%	0.066	0.015	0.057	0.138
481178	3/10/1992	45	0.175	0.036	0.136	0.347	50.32%	10.33%	39.35%	0.069	0.014	0.054	0.138
481178	2/16/1993	56	0.193	0.037	0.143	0.373	51.74%	9.89%	38.37%	0.081	0.016	0.06	0.157
481178	2/17/1995	80	0.234	0.039	0.155	0.428	54.71%	9.06%	36.23%	0.129	0.021	0.086	0.236
481183	12/6/1989	179	0.195	0.075	0.228	0.498	39.14%	15.12%	45.75%	0.1	0.039	0.117	0.256
481183	9/15/1990	188	0.205	0.077	0.232	0.514	39.88%	14.92%	45.19%	0.118	0.044	0.133	0.295
483749	10/17/1990	116	0.266	0.218	0.201	0.685	38.86%	31.84%	29.30%	0.099	0.081	0.075	0.256
483749	2/14/1991	120	0.267	0.219	0.202	0.688	38.78%	31.84%	29.38%	0.084	0.069	0.064	0.217
483749	3/16/1992	133	0.276	0.223	0.206	0.705	39.19%	31.58%	29.22%	0.077	0.062	0.058	0.197
483749	2/21/1993	144	0.285	0.226	0.209	0.72	39.65%	31.32%	29.03%	0.086	0.068	0.063	0.217
483749	2/21/1995	168	0.304	0.231	0.215	0.75	40.47%	30.84%	28.68%	0.135	0.103	0.096	0.335
483749	3/28/1997	193	0.319	0.237	0.221	0.776	41.11%	30.48%	28.41%	0.186	0.138	0.129	0.453
489005	10/14/1990	50	0.04	0.181	0.274	0.496	8.13%	36.59%	55.28%	0.027	0.122	0.185	0.335
489005	3/12/1992	67	0.045	0.188	0.29	0.523	8.64%	35.95%	55.41%	0.012	0.05	0.076	0.138
489005	2/17/1993	78	0.048	0.192	0.298	0.538	8.94%	35.66%	55.41%	0.012	0.049	0.076	0.138
489005	2/20/1995	102	0.054	0.198	0.313	0.565	9.47%	35.07%	55.46%	0.022	0.083	0.131	0.236
489005	7/10/1998	143	0.062	0.208	0.334	0.604	10.24%	34.43%	55.33%	0.016	0.054	0.087	0.157
501002	8/9/1989	58	0.059	0.037	0.059	0.156	38.11%	23.91%	37.97%	0.113	0.071	0.112	0.295
501002	8/8/1990	70	0.066	0.038	0.061	0.166	39.97%	23.17%	36.85%	0.15	0.087	0.138	0.374
501002	9/4/1991	83	0.07	0.039	0.063	0.172	40.72%	22.77%	36.51%	0.128	0.072	0.115	0.315
501002	4/27/1993	102	0.075	0.04	0.065	0.18	41.79%	22.24%	35.97%	0.156	0.083	0.135	0.374
501002	5/25/1994	115	0.08	0.041	0.066	0.188	42.87%	21.84%	35.30%	0.16	0.082	0.132	0.374
501002	8/17/1994	118	0.084	0.041	0.067	0.192	43.66%	21.59%	34.75%	0.163	0.081	0.13	0.374

Table C-6 (Cont'd) Permanent Deformation Simulation (β_{r2} = 0.8 and β_{r3} = 1.2) Data

Section	Month	Time	Predicted AC	Predicted GB	Predicted SG	Predicted Total	Predicted %AC	Predicted %GB	Predicted %SG	Measured AC	Measured GB	Measured SG	Measured Total
501002	4/27/1995	126	0.084	0.042	0.067	0.193	43.59%	21.55%	34.85%	0.172	0.085	0.137	0.394
501002	10/12/1995	132	0.09	0.042	0.068	0.2	44.91%	21.14%	33.95%	0.195	0.092	0.147	0.433
501002	10/17/1996	144	0.092	0.043	0.069	0.204	45.34%	20.91%	33.75%	0.161	0.074	0.12	0.354
501002	5/15/1997	151	0.093	0.043	0.069	0.205	45.30%	20.89%	33.81%	0.196	0.09	0.146	0.433
501002	10/23/1997	156	0.097	0.043	0.07	0.21	46.15%	20.59%	33.26%	0.209	0.093	0.151	0.453
501002	6/6/1998	164	0.098	0.043	0.07	0.212	46.40%	20.46%	33.13%	0.201	0.089	0.143	0.433
501004	8/9/1989	58	0.036	0.039	0.066	0.142	25.38%	27.88%	46.74%	0.04	0.044	0.074	0.157
501004	8/7/1990	70	0.042	0.04	0.068	0.15	28.02%	26.78%	45.20%	0.072	0.069	0.116	0.256
501004	9/20/1991	83	0.049	0.041	0.07	0.16	30.67%	25.71%	43.62%	0.06	0.051	0.086	0.197
501004	4/27/1993	102	0.056	0.042	0.072	0.171	32.99%	24.66%	42.35%	0.084	0.063	0.108	0.256
501004	10/12/1995	132	0.072	0.044	0.077	0.192	37.41%	22.76%	39.83%	0.088	0.054	0.094	0.236
501004	11/4/1997	157	0.085	0.045	0.08	0.209	40.36%	21.53%	38.11%	0.103	0.055	0.098	0.256
511002	10/15/1989	121	0.143	0.055	0.117	0.315	45.27%	17.51%	37.22%	0.178	0.069	0.147	0.394
511023	10/12/1989	107	0.335	0.055	0.156	0.547	61.34%	10.05%	28.61%	0.35	0.057	0.163	0.571
511023	3/20/1991	124	0.356	0.055	0.159	0.57	62.45%	9.73%	27.81%	0.344	0.054	0.153	0.551
511023	10/10/1992	143	0.393	0.057	0.162	0.612	64.27%	9.27%	26.46%	0.38	0.055	0.156	0.591
511023	12/7/1993	157	0.413	0.057	0.164	0.634	65.16%	9.04%	25.81%	0.398	0.055	0.157	0.61
511023	9/18/1995	178	0.447	0.058	0.166	0.672	66.58%	8.66%	24.76%	0.367	0.048	0.136	0.551
511023	2/9/1996	183	0.447	0.058	0.166	0.672	66.58%	8.65%	24.77%	0.446	0.058	0.166	0.669
511023	3/24/1997	196	0.46	0.058	0.168	0.686	67.07%	8.50%	24.43%	0.396	0.05	0.144	0.591
512021	10/15/1989	54	0.099	0.015	0.114	0.228	43.38%	6.69%	49.93%	0.171	0.026	0.197	0.394
512021	3/11/1991	71	0.111	0.016	0.117	0.244	45.62%	6.49%	47.89%	0.198	0.028	0.207	0.433
512021	10/20/1992	90	0.13	0.016	0.123	0.269	48.38%	6.10%	45.52%	0.257	0.032	0.242	0.531
531008	7/17/1989	129	0.147	0.066	0.1	0.313	46.98%	21.16%	31.86%	0.361	0.162	0.245	0.768
531008	7/17/1989	142	0.159	0.067	0.101	0.327	48.50%	20.60%	30.90%	0.363	0.154	0.231	0.748
531008	8/2/1990	151	0.16	0.068	0.102	0.329	48.57%	20.56%	30.87%	0.373	0.158	0.237	0.768
531008	8/2/1990	153	0.163	0.068	0.102	0.332	48.92%	20.41%	30.67%	0.404	0.169	0.254	0.827
531008	5/28/1991	188	0.177	0.069	0.104	0.351	50.48%	19.78%	29.74%	0.547	0.214	0.322	1.083
531801	7/17/1989	190	0.065	0.008	0.066	0.14	46.83%	6.00%	47.17%	0.092	0.012	0.093	0.197
531801	8/9/1990	203	0.069	0.009	0.067	0.144	47.73%	5.92%	46.35%	0.085	0.01	0.082	0.177
531801	6/5/1991	213	0.07	0.009	0.067	0.145	48.00%	5.87%	46.13%	0.104	0.013	0.1	0.217
531801	6/22/1994	249	0.079	0.009	0.069	0.156	50.33%	5.63%	44.04%	0.079	0.009	0.069	0.157
531801	5/8/1995	260	0.08	0.009	0.069	0.159	50.68%	5.55%	43.76%	0.08	0.009	0.069	0.157
531801	10/31/1995	265	0.083	0.009	0.07	0.162	51.39%	5.51%	43.09%	0.091	0.01	0.076	0.177
531801	3/27/1997	282	0.086	0.009	0.071	0.166	52.01%	5.48%	42.51%	0.102	0.011	0.084	0.197
561007	9/26/1989	111	0.093	0.034	0.104	0.231	40.17%	14.62%	45.21%	0.182	0.066	0.205	0.453
561007	7/22/1990	121	0.094	0.034	0.106	0.234	40.31%	14.55%	45.14%	0.159	0.057	0.178	0.394
561007	5/13/1991	131	0.096	0.034	0.107	0.237	40.47%	14.49%	45.05%	0.151	0.054	0.168	0.374
561007	8/3/1991	134	0.102	0.035	0.107	0.244	41.76%	14.27%	43.97%	0.132	0.045	0.138	0.315
561007	12/9/1993	162	0.111	0.036	0.11	0.257	43.13%	13.88%	42.99%	0.119	0.038	0.118	0.276
561007	3/16/1994	165	0.111	0.036	0.111	0.257	43.08%	13.87%	43.05%	0.119	0.038	0.119	0.276
561007	4/19/1994	166	0.111	0.036	0.111	0.257	43.06%	13.86%	43.08%	0.127	0.041	0.127	0.295
561007	8/19/1994	170	0.113	0.036	0.111	0.26	43.39%	13.83%	42.79%	0.111	0.035	0.109	0.256
561007	2/16/1995	176	0.113	0.036	0.112	0.261	43.37%	13.78%	42.85%	0.12	0.038	0.118	0.276
561007	5/17/1995	179	0.113	0.036	0.112	0.262	43.35%	13.80%	42.85%	0.111	0.035	0.11	0.256
561007	9/8/1995	183	0.116	0.036	0.112	0.264	43.76%	13.72%	42.52%	0.121	0.038	0.117	0.276
561007	6/11/1996	192	0.117	0.036	0.113	0.266	43.81%	13.68%	42.50%	0.095	0.03	0.092	0.217

Table C-6 (Cont'd) Permanent Deformation Simulation (β_{r2} = 0.8 and β_{r3} = 1.2) Data

Section	Month	Time	Predicted							Measured			
			AC	GB	SG	Total	%AC	%GB	%SG	AC	GB	SG	Total
561007	10/24/1996	196	0.121	0.037	0.114	0.271	44.59%	13.54%	41.87%	0.123	0.037	0.115	0.276
561007	11/19/1996	197	0.121	0.037	0.114	0.271	44.57%	13.53%	41.90%	0.123	0.037	0.115	0.276
561007	3/10/1997	201	0.121	0.037	0.114	0.272	44.52%	13.52%	41.96%	0.131	0.04	0.124	0.295
561007	3/24/1997	202	0.121	0.037	0.114	0.272	44.52%	13.50%	41.97%	0.123	0.037	0.116	0.276
561007	8/7/1997	206	0.126	0.037	0.115	0.278	45.47%	13.32%	41.21%	0.125	0.037	0.114	0.276
561007	9/30/1997	207	0.127	0.037	0.115	0.278	45.52%	13.34%	41.14%	0.125	0.037	0.113	0.276
841684	8/29/1990	144	0.146	0.077	0.075	0.298	49.10%	25.75%	25.16%	0.271	0.142	0.139	0.551
841684	8/28/1991	156	0.152	0.078	0.076	0.306	49.87%	25.36%	24.77%	0.275	0.14	0.137	0.551
841684	5/3/1993	177	0.158	0.079	0.077	0.314	50.46%	25.02%	24.52%	0.328	0.163	0.159	0.65
841684	10/24/1995	206	0.176	0.08	0.079	0.336	52.56%	23.96%	23.47%	0.372	0.17	0.166	0.709

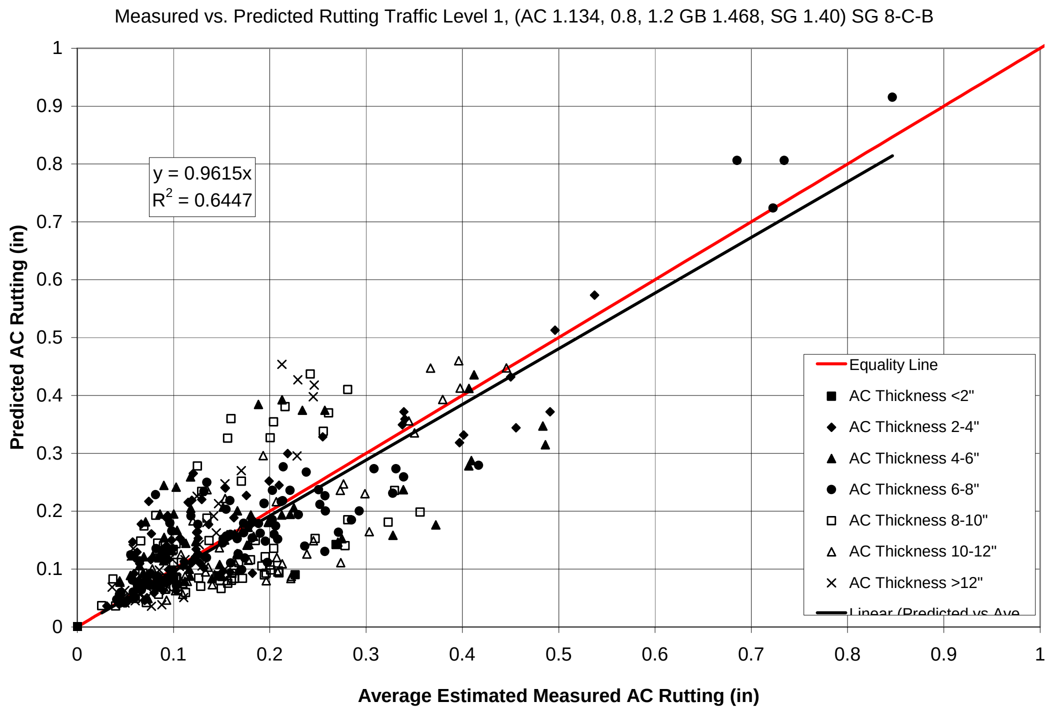


Figure C-100 Asphalt Concrete Layers Rut Depth (β_{r2} = 0.8 and β_{r3} = 1.2)

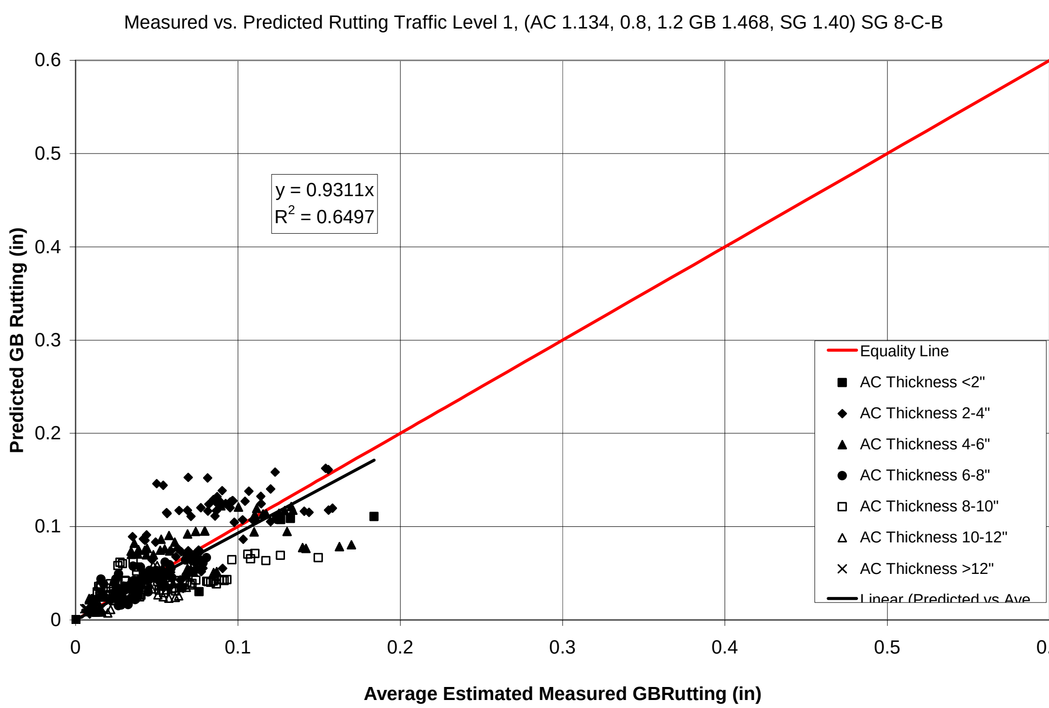


Figure C-101 Granular Base Layers Rut Depth (β_{r2} = 0.8 and β_{r3} = 1.2)

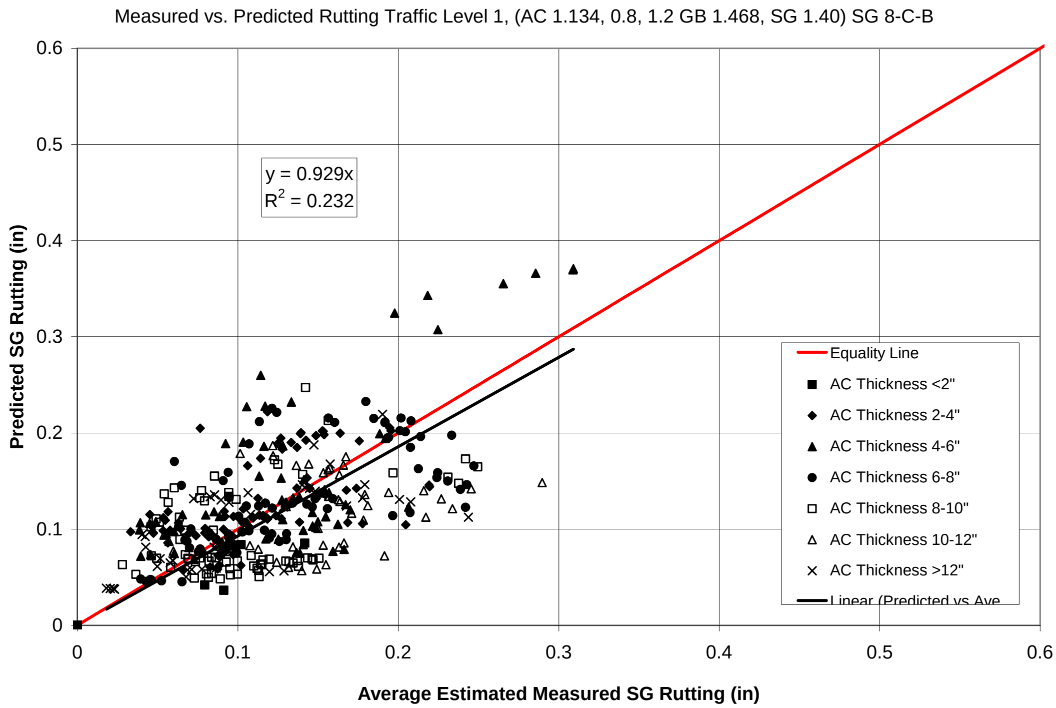


Figure C-102 Granular Subgrade Rut Depth (β_{r2} = 0.8 and β_{r3} = 1.2)

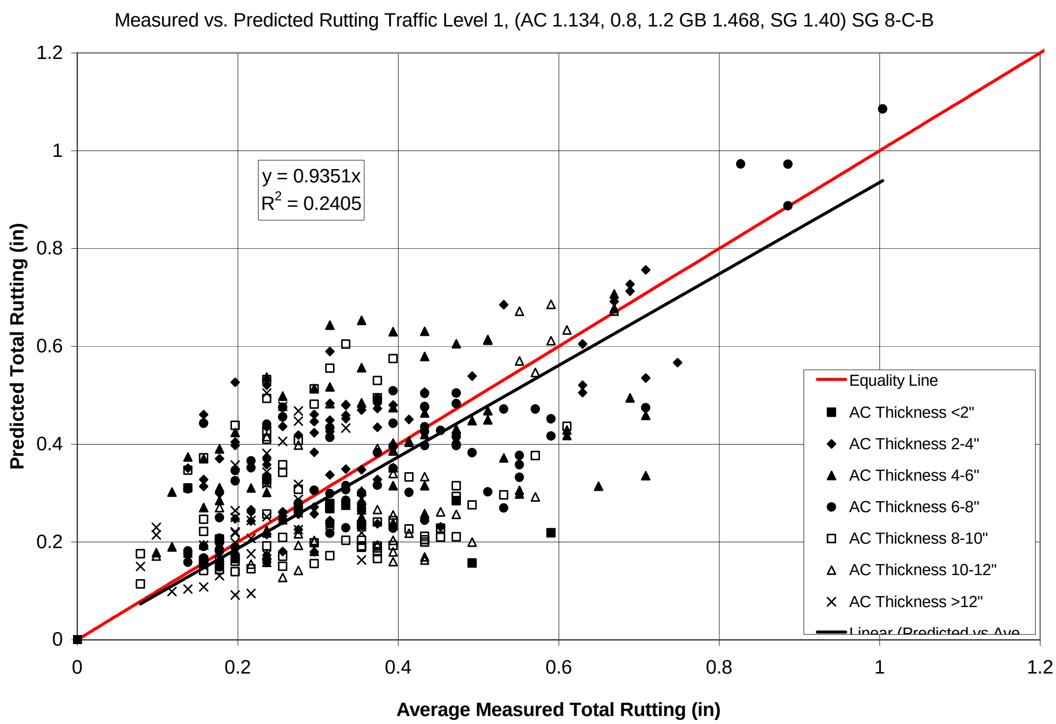


Figure C-103 Total Asphalt Pavement Rut Depth (β_{r2} = 0.8 and β_{r3} = 1.2)

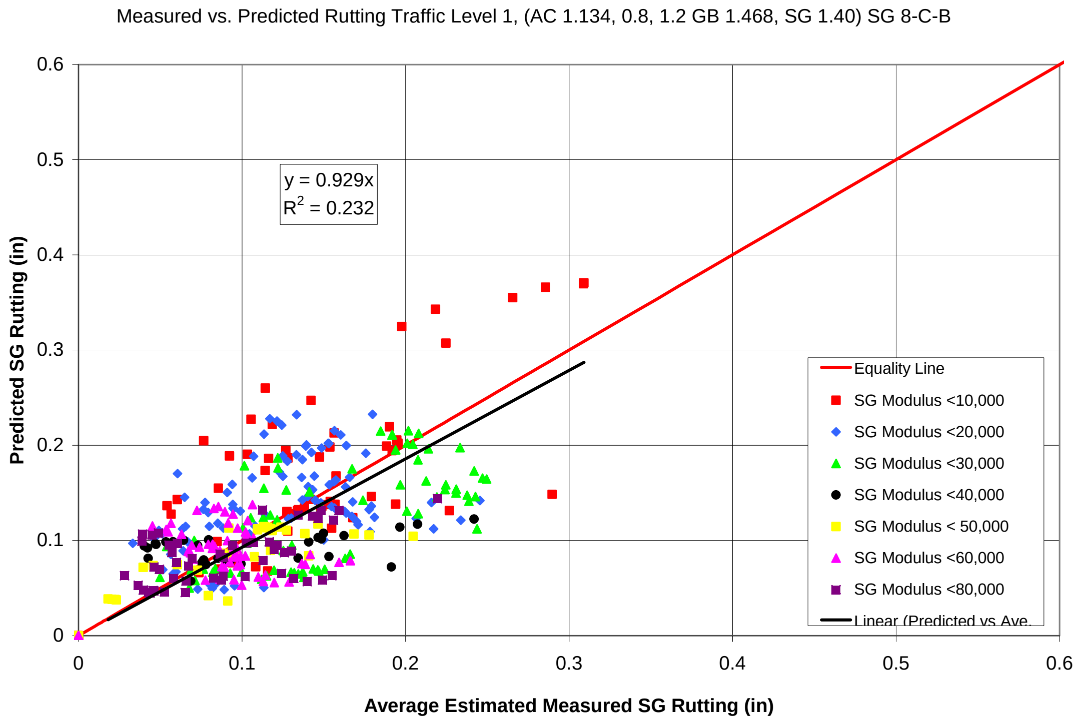


Figure C-104 Subgrade Rut Depth (β_{r2} = 0.8 and β_{r3} = 1.2) (By Subgrade Modulus)

Table C-57 Permanent Deformation Simulation (β_{r2} = 0.9 and β_{r3} = 1.2) Summary

	AC	GB	SG	Total
Average Predicted=	0.162	0.055	0.113	0.330
Sum of error =	15.584	-40.508	22.246	0.000
Sum of error^2 =	2.434	9.580	2.997	6.915
Predicted % =	46.60%	16.73%	36.67%	100.00%
Se =	0.072	0.143	0.080	0.121
Average Measured =	0.160	0.056	0.330	0.346
Calibration Factor β_1 =	0.509	1.673	1.350	

Table C-58 Permanent Deformation Simulation (β_{r2} = 0.9 and β_{r3} = 1.2) Data

Section	Month	Time	Predicted							Measured			
			AC	GB	SG	Total	%AC	%GB	%SG	AC	GB	SG	Total
11001	4/5/1989	103	0.434	0.176	0.12	0.73	59.47%	24.13%	16.40%	0.199	0.081	0.055	0.335
11001	2/12/1991	125	0.485	0.18	0.122	0.787	61.62%	22.82%	15.56%	0.194	0.072	0.049	0.315
11001	4/2/1992	139	0.501	0.181	0.124	0.806	62.18%	22.46%	15.36%	0.184	0.066	0.045	0.295
11019	5/15/1989	32	0.14	0.025	0.135	0.3	46.73%	8.26%	45.00%	0.239	0.042	0.23	0.512
11019	4/16/1990	43	0.164	0.026	0.14	0.329	49.79%	7.78%	42.43%	0.274	0.043	0.234	0.551
11019	1/15/1991	52	0.186	0.026	0.143	0.355	52.29%	7.40%	40.31%	0.288	0.041	0.222	0.551
11019	3/31/1992	66	0.201	0.027	0.146	0.374	53.72%	7.11%	39.17%	0.296	0.039	0.216	0.551
11019	3/22/1994	90	0.232	0.031	0.151	0.414	56.00%	7.43%	36.57%	0.331	0.044	0.216	0.591
11019	1/8/1996	112	0.26	0.034	0.155	0.449	57.89%	7.52%	34.58%	0.342	0.044	0.204	0.591
11019	1/23/1998	136	0.28	0.034	0.158	0.472	59.28%	7.23%	33.50%	0.42	0.051	0.237	0.709
14126	6/5/1989	15	0.141	0.023	0.072	0.236	59.91%	9.57%	30.53%	0.106	0.017	0.054	0.177
14126	3/3/1991	36	0.215	0.025	0.083	0.324	66.51%	7.80%	25.69%	0.144	0.017	0.056	0.217
14126	4/8/1992	49	0.242	0.026	0.087	0.356	68.15%	7.29%	24.56%	0.107	0.011	0.039	0.157
14126	4/8/1994	73	0.289	0.027	0.093	0.409	70.68%	6.62%	22.70%	0.139	0.013	0.045	0.197
14126	12/11/1995	93	0.332	0.028	0.097	0.457	72.63%	6.12%	21.25%	0.157	0.013	0.046	0.217
14126	12/5/1997	117	0.368	0.029	0.1	0.497	74.10%	5.76%	20.14%	0.146	0.011	0.04	0.197
21001	8/21/1991	98	0.035	0.041	0.115	0.191	18.21%	21.50%	60.29%	0.032	0.038	0.107	0.177
21001	8/26/1993	122	0.038	0.042	0.119	0.199	19.21%	21.16%	59.63%	0.045	0.05	0.141	0.236
21001	6/15/1995	144	0.041	0.043	0.122	0.205	19.80%	20.89%	59.31%	0.055	0.058	0.163	0.276
21001	8/22/1997	170	0.045	0.044	0.124	0.212	21.01%	20.69%	58.30%	0.074	0.073	0.207	0.354
21001	8/26/1998	182	0.046	0.044	0.125	0.215	21.35%	20.52%	58.13%	0.076	0.073	0.206	0.354
21002	8/22/1991	83	0.044	0.058	0.055	0.157	28.07%	36.81%	35.12%	0.05	0.065	0.062	0.177
21002	7/30/1992	94	0.045	0.058	0.056	0.16	28.38%	36.55%	35.07%	0.067	0.086	0.083	0.236
21002	6/14/1995	129	0.056	0.061	0.058	0.175	31.94%	34.85%	33.20%	0.075	0.082	0.078	0.236
21002	8/21/1997	155	0.06	0.062	0.06	0.182	32.87%	34.28%	32.86%	0.097	0.101	0.097	0.295
21002	5/14/1998	164	0.06	0.063	0.06	0.182	32.83%	34.31%	32.86%	0.084	0.088	0.084	0.256
40114	3/30/1995	20	0.121	0.053	0.099	0.273	44.46%	19.28%	36.26%	0.175	0.076	0.143	0.394
40114	11/7/1995	28	0.154	0.055	0.104	0.314	49.10%	17.66%	33.23%	0.193	0.07	0.131	0.394
40114	2/4/1996	31	0.154	0.055	0.105	0.314	49.04%	17.63%	33.34%	0.212	0.076	0.144	0.433
40114	4/4/1996	33	0.155	0.055	0.105	0.316	49.15%	17.51%	33.34%	0.232	0.083	0.157	0.472
40114	7/9/1996	36	0.177	0.057	0.107	0.341	51.89%	16.67%	31.45%	0.225	0.072	0.136	0.433
40114	8/13/1996	37	0.185	0.057	0.108	0.351	52.85%	16.36%	30.79%	0.229	0.071	0.133	0.433
40114	1/7/1998	54	0.216	0.059	0.112	0.387	55.69%	15.29%	29.02%	0.241	0.066	0.126	0.433
40114	4/21/1998	57	0.216	0.059	0.113	0.388	55.70%	15.26%	29.04%	0.241	0.066	0.126	0.433
40114	6/12/1998	59	0.221	0.06	0.113	0.394	56.04%	15.14%	28.82%	0.265	0.072	0.136	0.472
40114	10/23/1998	63	0.239	0.06	0.115	0.414	57.70%	14.59%	27.71%	0.25	0.063	0.12	0.433
40114	2/12/1999	65	0.239	0.06	0.115	0.414	57.69%	14.58%	27.73%	0.273	0.069	0.131	0.472
40115	2/15/1995	19	0.07	0	0.077	0.146	47.46%	0.00%	52.54%	0.037	0	0.041	0.079
40115	3/30/1995	20	0.07	0	0.077	0.147	47.47%	0.00%	52.53%	0.075	0	0.083	0.157
40115	1/7/1998	54	0.124	0	0.087	0.211	58.60%	0.00%	41.40%	0.058	0	0.041	0.098
40115	2/11/1999	65	0.137	0	0.089	0.227	60.54%	0.00%	39.46%	0.06	0	0.039	0.098
40116	3/30/1995	20	0.052	0	0.118	0.169	30.43%	0.00%	69.57%	0.108	0	0.247	0.354
40116	1/8/1998	54	0.091	0	0.135	0.226	40.43%	0.00%	59.57%	0.143	0	0.211	0.354
40116	2/12/1999	65	0.101	0	0.138	0.239	42.40%	0.00%	57.60%	0.15	0	0.204	0.354

Table C-8 (Cont'd) Permanent Deformation Simulation (β_{r2} = 0.9 and β_{r3} = 1.2) Data

			Predicted							Measured			
Section	Month	Time	AC	GB	SG	Total	%AC	%GB	%SG	AC	GB	SG	Total
40117	3/30/1995	20	0.085	0.009	0.069	0.163	52.06%	5.25%	42.69%	0.225	0.023	0.185	0.433
40117	1/8/1998	54	0.15	0.01	0.078	0.238	63.09%	4.07%	32.84%	0.248	0.016	0.129	0.394
40117	2/11/1999	65	0.167	0.01	0.08	0.256	64.96%	3.85%	31.18%	0.307	0.018	0.147	0.472
40118	3/30/1995	20	0.081	0.013	0.107	0.2	40.52%	6.34%	53.14%	0.16	0.025	0.209	0.394
40118	1/8/1998	54	0.143	0.014	0.124	0.281	50.92%	5.00%	44.08%	0.18	0.018	0.156	0.354
40118	2/12/1999	65	0.159	0.014	0.127	0.3	52.90%	4.74%	42.36%	0.187	0.017	0.15	0.354
41007	11/20/1989	140	0.742	0.048	0.115	0.905	81.99%	5.25%	12.76%	0.726	0.047	0.113	0.886
41007	9/5/1991	162	0.826	0.048	0.118	0.992	83.27%	4.88%	11.86%	0.738	0.043	0.105	0.886
41007	9/20/1991	163	0.826	0.048	0.118	0.992	83.28%	4.87%	11.85%	0.689	0.04	0.098	0.827
41007	9/16/1994	198	0.938	0.049	0.12	1.107	84.69%	4.44%	10.86%	0.85	0.045	0.109	1.004
41016	11/30/1989	122	0.223	0	0.131	0.354	62.95%	0.00%	37.05%	0.235	0	0.139	0.374
41016	7/2/1990	130	0.229	0	0.132	0.361	63.42%	0.00%	36.58%	0.175	0	0.101	0.276
41016	9/25/1991	144	0.244	0	0.134	0.377	64.62%	0.00%	35.38%	0.153	0	0.084	0.236
41016	9/18/1996	204	0.305	0	0.139	0.444	68.64%	0.00%	31.36%	0.216	0	0.099	0.315
41024	11/3/1989	149	0.342	0.032	0.153	0.528	64.84%	6.12%	29.04%	0.153	0.014	0.069	0.236
41024	8/26/1990	158	0.36	0.032	0.155	0.547	65.80%	5.93%	28.27%	0.168	0.015	0.072	0.256
41024	9/4/1991	171	0.383	0.033	0.156	0.572	66.90%	5.76%	27.34%	0.145	0.012	0.059	0.217
41024	8/22/1995	218	0.457	0.034	0.162	0.653	70.04%	5.20%	24.76%	0.179	0.013	0.063	0.256
41024	11/9/1995	221	0.46	0.034	0.162	0.656	70.13%	5.18%	24.69%	0.193	0.014	0.068	0.276
41024	2/8/1996	224	0.46	0.034	0.162	0.656	70.13%	5.18%	24.69%	0.207	0.015	0.073	0.295
41024	4/4/1996	226	0.461	0.034	0.162	0.657	70.13%	5.17%	24.69%	0.179	0.013	0.063	0.256
41024	6/13/1996	228	0.464	0.034	0.162	0.661	70.29%	5.14%	24.57%	0.194	0.014	0.068	0.276
41024	7/11/1996	229	0.473	0.034	0.163	0.67	70.61%	5.10%	24.30%	0.195	0.014	0.067	0.276
41024	8/15/1996	230	0.48	0.034	0.163	0.677	70.86%	5.07%	24.07%	0.195	0.014	0.066	0.276
41024	1/15/1998	247	0.504	0.035	0.164	0.703	71.67%	4.93%	23.40%	0.198	0.014	0.064	0.276
41024	4/22/1998	250	0.504	0.035	0.165	0.703	71.67%	4.93%	23.41%	0.198	0.014	0.065	0.276
41024	6/15/1998	252	0.509	0.035	0.165	0.708	71.84%	4.89%	23.27%	0.198	0.013	0.064	0.276
41024	10/26/1998	256	0.519	0.035	0.166	0.719	72.15%	4.82%	23.03%	0.213	0.014	0.068	0.295
81029	10/20/1989	209	0.112	0.093	0.114	0.319	35.05%	29.18%	35.78%	0.083	0.069	0.085	0.236
81029	8/25/1991	231	0.118	0.094	0.116	0.328	36.01%	28.67%	35.32%	0.078	0.062	0.076	0.217
81029	10/21/1991	233	0.118	0.094	0.116	0.329	36.05%	28.67%	35.29%	0.064	0.051	0.063	0.177
81029	9/8/1995	280	0.13	0.096	0.119	0.346	37.71%	27.84%	34.45%	0.089	0.066	0.081	0.236
81047	10/20/1989	73	0.083	0.104	0.133	0.32	25.93%	32.59%	41.48%	0.097	0.122	0.155	0.374
81047	8/25/1991	95	0.095	0.108	0.139	0.343	27.73%	31.61%	40.66%	0.098	0.112	0.144	0.354
81047	10/22/1991	97	0.096	0.109	0.14	0.344	27.76%	31.56%	40.68%	0.093	0.106	0.136	0.335
81053	10/19/1989	60	0.097	0.128	0.112	0.337	28.85%	37.85%	33.30%	0.102	0.134	0.118	0.354
81053	7/7/1990	69	0.105	0.131	0.116	0.351	29.89%	37.21%	32.90%	0.129	0.161	0.142	0.433
81053	12/6/1993	110	0.147	0.145	0.128	0.42	34.95%	34.51%	30.54%	0.138	0.136	0.12	0.394
81053	3/14/1994	113	0.147	0.145	0.129	0.421	34.90%	34.45%	30.65%	0.137	0.136	0.121	0.394
81053	8/8/1994	118	0.156	0.148	0.131	0.434	35.89%	34.04%	30.07%	0.141	0.134	0.118	0.394
81053	10/21/1994	120	0.157	0.148	0.131	0.436	35.93%	33.99%	30.09%	0.149	0.141	0.124	0.413
81053	2/13/1995	124	0.157	0.148	0.132	0.437	35.86%	33.96%	30.18%	0.148	0.14	0.125	0.413
81053	5/8/1995	127	0.157	0.149	0.133	0.438	35.87%	33.89%	30.24%	0.148	0.14	0.125	0.413
81053	5/10/1996	139	0.168	0.152	0.135	0.455	36.96%	33.31%	29.73%	0.16	0.144	0.129	0.433
81053	10/21/1996	144	0.177	0.154	0.137	0.467	37.81%	32.95%	29.24%	0.179	0.156	0.138	0.472
81053	11/14/1996	145	0.177	0.154	0.137	0.467	37.80%	32.94%	29.26%	0.179	0.156	0.138	0.472
81053	3/20/1997	149	0.177	0.154	0.137	0.468	37.75%	32.89%	29.36%	0.178	0.155	0.139	0.472

Table C-8 (Cont'd) Permanent Deformation Simulation (β_{r2} = 0.9 and β_{r3} = 1.2) Data

			Predicted							Measured			
Section	Month	Time	AC	GB	SG	Total	%AC	%GB	%SG	AC	GB	SG	Total
81053	8/5/1997	154	0.189	0.157	0.139	0.485	39.03%	32.34%	28.63%	0.192	0.159	0.141	0.492
81053	9/26/1997	155	0.19	0.157	0.139	0.486	39.10%	32.31%	28.59%	0.2	0.165	0.146	0.512
81053	8/25/1998	166	0.202	0.16	0.141	0.503	40.11%	31.79%	28.09%	0.205	0.163	0.144	0.512
91803	9/5/1990	63	0.041	0.034	0.076	0.151	27.29%	22.35%	50.35%	0.048	0.04	0.089	0.177
91803	8/22/1991	74	0.047	0.035	0.079	0.161	29.23%	21.79%	48.98%	0.04	0.03	0.067	0.138
91803	9/30/1992	87	0.05	0.036	0.082	0.168	29.84%	21.50%	48.66%	0.059	0.042	0.096	0.197
91803	5/12/1994	107	0.056	0.037	0.085	0.179	31.26%	20.89%	47.85%	0.043	0.029	0.066	0.138
91803	9/25/1994	111	0.06	0.038	0.087	0.184	32.31%	20.69%	47.00%	0.045	0.029	0.065	0.138
91803	5/25/1995	119	0.06	0.038	0.088	0.186	32.24%	20.59%	47.16%	0.057	0.036	0.084	0.177
91803	10/30/1995	124	0.064	0.039	0.089	0.192	33.28%	20.39%	46.33%	0.066	0.04	0.091	0.197
91803	10/8/1996	136	0.07	0.04	0.091	0.202	34.91%	19.89%	45.20%	0.062	0.035	0.08	0.177
91803	5/8/1997	143	0.071	0.04	0.092	0.203	34.80%	19.80%	45.40%	0.062	0.035	0.08	0.177
91803	10/16/1997	148	0.073	0.041	0.093	0.207	35.42%	19.68%	44.90%	0.063	0.035	0.08	0.177
91803	6/17/1998	156	0.075	0.041	0.094	0.211	35.79%	19.47%	44.75%	0.063	0.034	0.079	0.177
123995	4/18/1989	161	0.913	0.121	0.092	1.127	81.02%	10.78%	8.20%	0.319	0.042	0.032	0.394
123995	2/5/1991	183	0.964	0.123	0.093	1.181	81.68%	10.40%	7.91%	0.322	0.041	0.031	0.394
123995	4/15/1992	197	0.988	0.123	0.094	1.205	81.95%	10.25%	7.81%	0.355	0.044	0.034	0.433
123995	3/9/1994	220	1.042	0.125	0.095	1.262	82.57%	9.89%	7.53%	0.325	0.039	0.03	0.394
123995	1/21/1996	242	1.085	0.126	0.096	1.307	83.03%	9.63%	7.34%	0.327	0.038	0.029	0.394
123997	12/14/1989	187	0.32	0.131	0.07	0.521	61.44%	25.20%	13.36%	0.387	0.159	0.084	0.63
123997	2/9/1991	201	0.334	0.133	0.07	0.537	62.16%	24.72%	13.13%	0.392	0.156	0.083	0.63
123997	4/13/1992	215	0.346	0.134	0.071	0.551	62.75%	24.31%	12.93%	0.445	0.172	0.092	0.709
123997	3/8/1994	238	0.374	0.137	0.073	0.583	64.11%	23.41%	12.48%	0.48	0.175	0.093	0.748
124105	4/12/1989	53	0.191	0.151	0.104	0.446	42.79%	33.91%	23.30%	0.16	0.127	0.087	0.374
124105	2/9/1991	75	0.229	0.157	0.109	0.495	46.28%	31.78%	21.94%	0.173	0.119	0.082	0.374
124105	4/13/1992	89	0.247	0.16	0.111	0.519	47.69%	30.91%	21.40%	0.207	0.134	0.093	0.433
124106	4/18/1989	21	0.186	0.06	0.085	0.331	56.38%	18.06%	25.56%	0.133	0.043	0.06	0.236
124106	2/5/1991	43	0.25	0.065	0.093	0.408	61.26%	15.83%	22.90%	0.169	0.044	0.063	0.276
124106	4/15/1992	57	0.276	0.066	0.097	0.439	62.83%	15.09%	22.08%	0.124	0.03	0.043	0.197
124106	3/9/1994	80	0.324	0.069	0.102	0.494	65.53%	13.92%	20.55%	0.155	0.033	0.049	0.236
124106	1/21/1996	102	0.357	0.07	0.105	0.532	67.10%	13.21%	19.69%	0.159	0.031	0.047	0.236
124106	1/17/1997	114	0.378	0.071	0.106	0.555	68.03%	12.84%	19.13%	0.214	0.04	0.06	0.315
124107	12/6/1989	75	0.106	0.087	0.091	0.285	37.37%	30.57%	32.06%	0.066	0.054	0.057	0.177
124107	2/5/1991	89	0.116	0.089	0.094	0.298	38.82%	29.80%	31.38%	0.061	0.047	0.049	0.157
124107	4/15/1992	103	0.125	0.091	0.096	0.312	40.26%	29.06%	30.68%	0.063	0.046	0.048	0.157
124107	3/9/1994	126	0.143	0.093	0.099	0.334	42.67%	27.84%	29.49%	0.059	0.038	0.041	0.138
124107	1/22/1996	148	0.156	0.095	0.101	0.352	44.33%	26.99%	28.68%	0.079	0.048	0.051	0.177
124108	4/27/1989	35	0.109	0.033	0.052	0.193	56.25%	17.06%	26.69%	0.199	0.06	0.095	0.354
124108	1/16/1991	56	0.143	0.035	0.055	0.234	61.31%	15.09%	23.60%	0.278	0.068	0.107	0.453
124108	4/1/1992	71	0.156	0.036	0.057	0.25	62.56%	14.55%	22.88%	0.246	0.057	0.09	0.394
124108	3/21/1994	94	0.185	0.038	0.06	0.283	65.50%	13.36%	21.14%	0.322	0.066	0.104	0.492
124108	1/16/1996	116	0.203	0.039	0.062	0.304	66.85%	12.79%	20.37%	0.355	0.068	0.108	0.531
124135	12/10/1989	227	0.447	0.254	0.134	0.834	53.54%	30.44%	16.02%	0.263	0.15	0.079	0.492
124135	1/29/1991	240	0.455	0.255	0.134	0.844	53.91%	30.18%	15.91%	0.318	0.178	0.094	0.591

Table C-8 (Cont'd) Permanent Deformation Simulation (β_{r2} = 0.9 and β_{r3} = 1.2) Data

Section	Month	Time	Predicted AC	Predicted GB	Predicted SG	Predicted Total	Predicted %AC	Predicted %GB	Predicted %SG	Measured AC	Measured GB	Measured SG	Measured Total
131031	1/9/1990	104	0.078	0.024	0.075	0.177	43.74%	13.78%	42.48%	0.172	0.054	0.167	0.394
131031	3/4/1991	118	0.085	0.024	0.077	0.187	45.58%	13.06%	41.36%	0.197	0.057	0.179	0.433
131031	4/28/1992	131	0.093	0.025	0.08	0.198	46.89%	12.86%	40.26%	0.185	0.051	0.158	0.394
131031	4/4/1994	155	0.108	0.027	0.084	0.219	49.62%	12.17%	38.22%	0.244	0.06	0.188	0.492
131031	1/13/1996	176	0.123	0.027	0.087	0.237	52.10%	11.32%	36.58%	0.215	0.047	0.151	0.413
134111	3/20/1989	101	0.113	0.045	0.148	0.306	37.01%	14.58%	48.41%	0.102	0.04	0.133	0.276
134111	3/4/1991	125	0.136	0.047	0.158	0.342	39.77%	13.87%	46.37%	0.102	0.035	0.119	0.256
134111	4/27/1992	138	0.146	0.048	0.163	0.357	40.87%	13.55%	45.58%	0.105	0.035	0.117	0.256
134112	5/4/1989	144	0.193	0	0.122	0.315	61.15%	0.00%	38.85%	0.144	0	0.092	0.236
134112	2/10/1991	165	0.214	0	0.125	0.339	63.17%	0.00%	36.83%	0.149	0	0.087	0.236
134112	4/13/1992	179	0.227	0	0.126	0.353	64.26%	0.00%	35.74%	0.126	0	0.07	0.197
134112	2/24/1994	201	0.249	0	0.128	0.377	65.98%	0.00%	34.02%	0.156	0	0.08	0.236
134112	1/25/1996	224	0.272	0	0.13	0.402	67.60%	0.00%	32.40%	0.173	0	0.083	0.256
134112	4/23/1998	251	0.297	0	0.132	0.429	69.21%	0.00%	30.79%	0.232	0	0.103	0.335
134113	5/4/1989	144	0.227	0	0.18	0.407	55.76%	0.00%	44.24%	0.088	0	0.07	0.157
134113	2/10/1991	165	0.248	0	0.183	0.431	57.53%	0.00%	42.47%	0.079	0	0.059	0.138
134113	4/13/1992	179	0.261	0	0.185	0.445	58.56%	0.00%	41.44%	0.104	0	0.073	0.177
134113	2/24/1994	201	0.282	0	0.187	0.469	60.14%	0.00%	39.86%	0.107	0	0.071	0.177
134113	1/25/1996	224	0.305	0	0.19	0.494	61.63%	0.00%	38.37%	0.109	0	0.068	0.177
134113	4/23/1998	251	0.329	0	0.192	0.521	63.14%	0.00%	36.86%	0.112	0	0.065	0.177
134119	1/8/1990	140	0.403	0.013	0.036	0.452	89.10%	2.96%	7.94%	0.246	0.008	0.022	0.276
134119	3/4/1991	154	0.424	0.014	0.036	0.474	89.50%	2.86%	7.64%	0.247	0.008	0.021	0.276
134119	4/28/1992	167	0.433	0.014	0.036	0.483	89.67%	2.81%	7.52%	0.229	0.007	0.019	0.256
134119	4/7/1994	191	0.46	0.014	0.037	0.51	90.11%	2.69%	7.20%	0.213	0.006	0.017	0.236
161001	7/17/1989	192	0.17	0.061	0.06	0.291	58.56%	20.99%	20.46%	0.173	0.062	0.06	0.295
161001	8/2/1990	205	0.18	0.062	0.06	0.302	59.64%	20.46%	19.91%	0.117	0.04	0.039	0.197
161001	7/4/1991	216	0.184	0.062	0.06	0.306	60.04%	20.26%	19.70%	0.118	0.04	0.039	0.197
161001	8/25/1994	253	0.21	0.064	0.062	0.336	62.66%	18.98%	18.37%	0.148	0.045	0.043	0.236
161001	5/17/1995	262	0.212	0.064	0.062	0.337	62.69%	18.94%	18.36%	0.16	0.048	0.047	0.256
161001	7/9/1997	288	0.23	0.065	0.063	0.357	64.27%	18.17%	17.57%	0.19	0.054	0.052	0.295
161001	9/23/1998	302	0.242	0.066	0.063	0.371	65.30%	17.67%	17.02%	0.244	0.066	0.064	0.374
161009	9/20/1989	180	0.233	0.024	0.118	0.375	62.09%	6.30%	31.61%	0.269	0.027	0.137	0.433
161009	7/19/1990	190	0.239	0.024	0.119	0.381	62.58%	6.19%	31.23%	0.246	0.024	0.123	0.394
161009	7/26/1991	202	0.25	0.024	0.12	0.394	63.46%	6.04%	30.50%	0.25	0.024	0.12	0.394
161021	9/21/1989	48	0.154	0.023	0.089	0.266	57.93%	8.80%	33.27%	0.091	0.014	0.052	0.157
161021	7/21/1990	58	0.166	0.024	0.09	0.281	59.23%	8.53%	32.24%	0.105	0.015	0.057	0.177
161021	7/28/1991	70	0.181	0.024	0.092	0.297	60.76%	8.16%	31.09%	0.072	0.01	0.037	0.118
161021	9/12/1995	120	0.241	0.026	0.099	0.365	65.89%	7.10%	27.01%	0.104	0.011	0.043	0.157
161021	6/5/1996	129	0.244	0.026	0.099	0.369	66.03%	7.03%	26.94%	0.091	0.01	0.037	0.138
161021	7/29/1997	142	0.258	0.026	0.101	0.385	67.08%	6.82%	26.10%	0.119	0.012	0.046	0.177
169034	7/17/1989	10	0.036	0.028	0.055	0.119	30.62%	23.41%	45.97%	0.024	0.018	0.036	0.079
169034	8/2/1990	23	0.073	0.033	0.062	0.168	43.53%	19.58%	36.89%	0.069	0.031	0.058	0.157
169034	7/4/1991	34	0.082	0.034	0.065	0.182	45.43%	18.80%	35.77%	0.036	0.015	0.028	0.079
169034	5/17/1995	80	0.118	0.037	0.072	0.227	52.03%	16.40%	31.57%	0.082	0.026	0.05	0.157
169034	7/9/1997	106	0.139	0.039	0.074	0.252	55.14%	15.38%	29.47%	0.087	0.024	0.046	0.157
169034	9/24/1998	120	0.148	0.039	0.075	0.263	56.36%	14.95%	28.69%	0.133	0.035	0.068	0.236

Table C-8 (Cont'd) Permanent Deformation Simulation (β_{r2} = 0.9 and β_{r3} = 1.2) Data

			Predicted							Measured			
Section	Month	Time	AC	GB	SG	Total	%AC	%GB	%SG	AC	GB	SG	Total
201009	5/2/1989	53	0.046	0	0.08	0.126	36.33%	0.00%	63.67%	0.093	0	0.163	0.256
201009	12/10/1990	72	0.056	0	0.084	0.14	39.75%	0.00%	60.25%	0.11	0	0.166	0.276
201009	4/8/1993	100	0.064	0	0.088	0.153	42.22%	0.00%	57.78%	0.091	0	0.125	0.217
201009	4/23/1996	136	0.077	0	0.092	0.169	45.32%	0.00%	54.68%	0.045	0	0.054	0.098
251003	8/4/1989	180	0.073	0.054	0.039	0.165	44.05%	32.51%	23.44%	0.069	0.051	0.037	0.157
251003	9/6/1990	193	0.074	0.054	0.039	0.167	44.43%	32.27%	23.30%	0.105	0.076	0.055	0.236
251003	8/23/1991	204	0.077	0.055	0.039	0.171	45.07%	31.89%	23.04%	0.071	0.05	0.036	0.157
251003	9/30/1992	217	0.082	0.055	0.04	0.177	46.22%	31.28%	22.50%	0.091	0.062	0.044	0.197
251003	10/27/1995	254	0.088	0.057	0.041	0.185	47.60%	30.49%	21.91%	0.084	0.054	0.039	0.177
251003	10/23/1996	266	0.091	0.057	0.041	0.189	48.15%	30.16%	21.69%	0.085	0.053	0.038	0.177
251003	6/16/1998	286	0.096	0.058	0.041	0.195	49.21%	29.57%	21.23%	0.077	0.047	0.033	0.157
251004	8/4/1989	178	0.089	0.073	0.041	0.202	43.80%	36.05%	20.15%	0.155	0.128	0.071	0.354
251004	9/5/1990	191	0.093	0.074	0.041	0.209	44.68%	35.48%	19.84%	0.132	0.105	0.059	0.295
251004	8/22/1991	202	0.097	0.075	0.042	0.214	45.37%	35.05%	19.59%	0.152	0.117	0.066	0.335
251004	9/30/1992	215	0.103	0.076	0.043	0.222	46.39%	34.41%	19.20%	0.219	0.163	0.091	0.472
251004	10/29/1995	252	0.116	0.079	0.044	0.24	48.33%	33.15%	18.52%	0.2	0.137	0.077	0.413
251004	6/5/1997	272	0.122	0.081	0.045	0.248	49.26%	32.53%	18.20%	0.175	0.115	0.065	0.354
251004	6/15/1998	284	0.128	0.082	0.046	0.255	50.01%	32.06%	17.93%	0.187	0.12	0.067	0.374
261001	9/7/1989	217	0.076	0.083	0.088	0.247	30.85%	33.67%	35.48%	0.067	0.073	0.077	0.217
261001	7/21/1990	227	0.077	0.083	0.088	0.249	30.96%	33.58%	35.45%	0.079	0.086	0.091	0.256
261001	7/16/1991	239	0.079	0.084	0.089	0.252	31.32%	33.44%	35.24%	0.062	0.066	0.069	0.197
261001	6/9/1993	262	0.082	0.085	0.09	0.257	31.87%	33.18%	34.95%	0.082	0.085	0.089	0.256
261001	7/5/1996	299	0.088	0.087	0.092	0.266	32.94%	32.65%	34.41%	0.071	0.071	0.075	0.217
261004	10/21/1990	64	0.072	0.029	0.062	0.163	43.88%	18.02%	38.09%	0.078	0.032	0.067	0.177
261004	5/13/1993	95	0.078	0.031	0.065	0.174	45.06%	17.58%	37.36%	0.044	0.017	0.037	0.098
261004	7/7/1994	109	0.088	0.032	0.067	0.186	47.10%	17.02%	35.89%	0.056	0.02	0.042	0.118
261004	6/15/1995	120	0.09	0.032	0.068	0.19	47.55%	16.83%	35.62%	0.075	0.027	0.056	0.157
271018	6/22/1989	126	0.172	0.033	0.094	0.298	57.57%	11.04%	31.39%	0.227	0.043	0.124	0.394
271018	10/30/1990	142	0.188	0.033	0.095	0.317	59.39%	10.56%	30.05%	0.21	0.037	0.106	0.354
271018	6/2/1993	174	0.21	0.034	0.097	0.342	61.49%	10.02%	28.48%	0.169	0.028	0.079	0.276
271018	3/8/1994	183	0.22	0.034	0.098	0.352	62.45%	9.78%	27.77%	0.172	0.027	0.077	0.276
271087	6/9/1989	126	0.035	0	0.048	0.083	42.42%	0.00%	57.58%	0.084	0	0.113	0.197
271087	11/13/1990	143	0.038	0	0.048	0.086	43.82%	0.00%	56.18%	0.095	0	0.122	0.217
271087	5/11/1993	173	0.041	0	0.049	0.09	45.18%	0.00%	54.82%	0.053	0	0.065	0.118
271087	6/25/1996	210	0.045	0	0.05	0.095	47.08%	0.00%	52.92%	0.065	0	0.073	0.138
271087	8/3/1999	240	0.048	0	0.051	0.099	48.50%	0.00%	51.50%	0.076	0	0.081	0.157
291008	3/13/1989	35	0.05	0.01	0.096	0.156	32.02%	6.23%	61.75%	0.076	0.015	0.146	0.236
291008	11/7/1990	55	0.063	0.01	0.104	0.178	35.62%	5.65%	58.73%	0.105	0.017	0.173	0.295
291008	3/5/1993	85	0.076	0.01	0.111	0.197	38.54%	5.27%	56.19%	0.114	0.016	0.166	0.295
291008	4/17/1996	120	0.092	0.011	0.117	0.219	41.83%	4.81%	53.36%	0.099	0.011	0.126	0.236
307088	9/27/1989	100	0.192	0.113	0.145	0.449	42.70%	25.08%	32.23%	0.185	0.109	0.14	0.433
307088	7/29/1990	110	0.199	0.114	0.146	0.459	43.37%	24.74%	31.89%	0.171	0.097	0.126	0.394
307088	5/20/1991	120	0.205	0.114	0.148	0.468	43.90%	24.46%	31.65%	0.156	0.087	0.112	0.354
308129	10/3/1989	17	0.068	0.115	0.148	0.331	20.51%	34.68%	44.82%	0.073	0.123	0.159	0.354
308129	7/29/1990	26	0.078	0.12	0.159	0.356	21.80%	33.57%	44.62%	0.069	0.106	0.141	0.315
308129	7/30/1991	38	0.09	0.126	0.171	0.387	23.25%	32.53%	44.22%	0.055	0.077	0.104	0.236
308129	12/14/1993	67	0.12	0.134	0.189	0.443	27.16%	30.15%	42.69%	0.08	0.089	0.126	0.295

Table C-8 (Cont'd) Permanent Deformation Simulation (β_{r2} = 0.9 and β_{r3} = 1.2) Data

Section	Month	Time	Predicted							Measured			
			AC	GB	SG	Total	%AC	%GB	%SG	AC	GB	SG	Total
308129	3/17/1994	70	0.12	0.134	0.191	0.445	27.06%	30.11%	42.83%	0.085	0.095	0.135	0.315
308129	8/22/1994	75	0.13	0.135	0.193	0.459	28.37%	29.50%	42.13%	0.084	0.087	0.124	0.295
308129	10/31/1994	77	0.131	0.136	0.194	0.461	28.38%	29.45%	42.16%	0.089	0.093	0.133	0.315
308129	2/17/1995	81	0.131	0.136	0.196	0.462	28.30%	29.39%	42.31%	0.117	0.121	0.175	0.413
308129	5/18/1995	84	0.131	0.136	0.197	0.464	28.29%	29.32%	42.39%	0.095	0.098	0.142	0.335
308129	6/10/1996	97	0.142	0.138	0.202	0.482	29.48%	28.66%	41.86%	0.104	0.102	0.148	0.354
308129	10/28/1996	101	0.149	0.139	0.204	0.492	30.29%	28.29%	41.42%	0.101	0.095	0.139	0.335
308129	1/23/1997	104	0.149	0.139	0.204	0.492	30.24%	28.27%	41.48%	0.119	0.111	0.163	0.394
308129	3/25/1997	106	0.149	0.139	0.205	0.493	30.20%	28.23%	41.58%	0.101	0.094	0.139	0.335
308129	8/11/1997	111	0.159	0.14	0.207	0.506	31.36%	27.74%	40.90%	0.117	0.104	0.153	0.374
308129	10/1/1997	113	0.161	0.141	0.208	0.509	31.55%	27.64%	40.81%	0.118	0.103	0.153	0.374
321020	8/29/1989	63	0.113	0.022	0.074	0.209	54.21%	10.34%	35.45%	0.171	0.033	0.112	0.315
321020	8/22/1990	75	0.122	0.022	0.075	0.22	55.56%	10.06%	34.38%	0.186	0.034	0.115	0.335
321020	7/23/1991	86	0.129	0.022	0.077	0.228	56.66%	9.82%	33.52%	0.178	0.031	0.106	0.315
321020	9/14/1994	124	0.164	0.024	0.08	0.268	61.27%	8.80%	29.92%	0.169	0.024	0.082	0.276
321020	4/25/1995	131	0.164	0.024	0.08	0.268	61.23%	8.79%	29.98%	0.217	0.031	0.106	0.354
321020	6/5/1997	157	0.183	0.024	0.082	0.29	63.27%	8.31%	28.42%	0.199	0.026	0.09	0.315
321020	6/9/1998	169	0.19	0.024	0.083	0.298	63.95%	8.15%	27.90%	0.214	0.027	0.093	0.335
321020	4/13/1999	175	0.199	0.025	0.084	0.307	64.82%	8.00%	27.18%	0.242	0.03	0.102	0.374
341003	9/11/1990	195	0.127	0.028	0.057	0.212	60.23%	13.04%	26.73%	0.486	0.105	0.216	0.807
341003	8/15/1991	206	0.132	0.028	0.057	0.217	60.82%	12.87%	26.31%	0.431	0.091	0.186	0.709
341003	9/28/1992	219	0.137	0.028	0.058	0.223	61.35%	12.70%	25.95%	0.507	0.105	0.215	0.827
341011	4/17/1999	214	0.328	0.029	0.122	0.479	68.36%	6.08%	25.56%	0.202	0.018	0.075	0.295
341011	4/18/1999	227	0.338	0.029	0.124	0.492	68.83%	5.96%	25.21%	0.257	0.022	0.094	0.374
341011	4/19/1999	244	0.355	0.03	0.126	0.51	69.56%	5.81%	24.64%	0.205	0.017	0.073	0.295
341011	4/20/1999	254	0.371	0.03	0.127	0.527	70.26%	5.68%	24.06%	0.263	0.021	0.09	0.374
341011	4/21/1999	287	0.411	0.031	0.131	0.572	71.80%	5.38%	22.82%	0.283	0.021	0.09	0.394
341011	4/22/1999	307	0.438	0.031	0.132	0.602	72.79%	5.20%	22.01%	0.244	0.017	0.074	0.335
341031	10/5/1989	194	0.201	0.07	0.116	0.387	51.99%	17.97%	30.04%	0.256	0.088	0.148	0.492
341031	9/12/1990	205	0.213	0.071	0.118	0.402	52.98%	17.62%	29.41%	0.25	0.083	0.139	0.472
341031	4/6/1992	224	0.228	0.072	0.121	0.421	54.13%	17.15%	28.73%	0.256	0.081	0.136	0.472
341031	2/24/1993	234	0.238	0.073	0.122	0.433	55.01%	16.87%	28.12%	0.249	0.076	0.127	0.453
341031	10/26/1995	266	0.275	0.076	0.126	0.477	57.62%	15.92%	26.46%	0.329	0.091	0.151	0.571
341031	11/4/1995	267	0.275	0.076	0.126	0.477	57.60%	15.92%	26.48%	0.306	0.085	0.141	0.531
341033	10/5/1989	181	0.085	0.049	0.09	0.223	38.06%	21.77%	40.16%	0.105	0.06	0.111	0.276
341033	9/12/1990	192	0.087	0.049	0.09	0.226	38.40%	21.63%	39.97%	0.136	0.077	0.142	0.354
341033	4/5/1992	211	0.093	0.05	0.092	0.235	39.73%	21.21%	39.06%	0.109	0.058	0.108	0.276
341033	2/24/1993	221	0.096	0.05	0.093	0.238	40.10%	21.05%	38.84%	0.134	0.07	0.13	0.335
341033	11/3/1995	254	0.104	0.052	0.095	0.25	41.48%	20.61%	37.91%	0.147	0.073	0.134	0.354
341033	7/23/1997	274	0.107	0.052	0.096	0.255	41.91%	20.44%	37.65%	0.124	0.06	0.111	0.295
341034	10/5/1989	48	0.1	0	0.073	0.173	57.73%	0.00%	42.27%	0.08	0	0.058	0.138
341034	9/12/1990	59	0.114	0	0.075	0.189	60.26%	0.00%	39.74%	0.166	0	0.11	0.276
341034	4/6/1992	78	0.125	0	0.077	0.201	61.89%	0.00%	38.11%	0.11	0	0.068	0.177
341034	2/24/1993	88	0.136	0	0.078	0.214	63.53%	0.00%	36.47%	0.15	0	0.086	0.236
341034	11/4/1995	121	0.167	0	0.081	0.248	67.28%	0.00%	32.72%	0.172	0	0.084	0.256
341034	7/30/1997	141	0.182	0	0.083	0.265	68.80%	0.00%	31.20%	0.122	0	0.055	0.177

Table C-8 (Cont'd) Permanent Deformation Simulation (β_{r2} = 0.9 and β_{r3} = 1.2) Data

			Predicted							Measured			
Section	Month	Time	AC	GB	SG	Total	%AC	%GB	%SG	AC	GB	SG	Total
350101	5/1/1997	19	0.115	0.05	0.178	0.343	33.48%	14.54%	51.99%	0.066	0.029	0.102	0.197
350101	3/19/1999	38	0.181	0.056	0.2	0.437	41.39%	12.85%	45.76%	0.098	0.03	0.108	0.236
350102	5/1/1997	19	0.123	0.084	0.216	0.423	29.12%	19.87%	51.01%	0.057	0.039	0.1	0.197
350102	3/19/1999	38	0.196	0.094	0.247	0.536	36.52%	17.50%	45.98%	0.086	0.041	0.109	0.236
350103	5/1/1997	19	0.063	0	0.178	0.242	26.23%	0.00%	73.77%	0.052	0	0.145	0.197
350103	3/19/1999	38	0.099	0	0.209	0.308	32.27%	0.00%	67.73%	0.089	0	0.187	0.276
350104	5/1/1997	19	0.051	0	0.121	0.172	29.54%	0.00%	70.46%	0.07	0	0.166	0.236
350104	3/19/1999	38	0.079	0	0.143	0.223	35.69%	0.00%	64.31%	0.098	0	0.177	0.276
350105	5/2/1997	19	0.094	0.018	0.202	0.314	29.80%	5.80%	64.40%	0.07	0.014	0.152	0.236
350105	3/22/1999	38	0.147	0.021	0.235	0.402	36.47%	5.12%	58.41%	0.086	0.012	0.138	0.236
350106	5/2/1996	19	0.05	0.007	0.14	0.197	25.31%	3.64%	71.05%	0.05	0.007	0.14	0.197
350106	3/22/1999	38	0.077	0.008	0.164	0.25	30.93%	3.28%	65.79%	0.073	0.008	0.155	0.236
351005	10/31/1989	73	0.122	0.028	0.138	0.288	42.22%	9.71%	48.07%	0.199	0.046	0.227	0.472
351005	8/21/1991	95	0.136	0.028	0.144	0.309	44.01%	9.21%	46.78%	0.208	0.044	0.221	0.472
351005	10/24/1992	109	0.149	0.029	0.149	0.327	45.54%	8.85%	45.61%	0.188	0.037	0.189	0.413
351005	3/18/1995	138	0.186	0.03	0.155	0.371	50.06%	8.17%	41.77%	0.286	0.047	0.238	0.571
351005	3/16/1999	183	0.236	0.031	0.163	0.43	54.82%	7.32%	37.86%	0.335	0.045	0.231	0.61
351022	10/31/1989	37	0.085	0.037	0.175	0.297	28.68%	12.44%	58.88%	0.051	0.022	0.104	0.177
351022	8/22/1991	59	0.131	0.04	0.189	0.361	36.37%	11.21%	52.43%	0.05	0.015	0.072	0.138
351022	10/24/1992	73	0.142	0.041	0.195	0.379	37.57%	10.86%	51.57%	0.074	0.021	0.102	0.197
351022	3/18/1995	102	0.175	0.043	0.206	0.424	41.22%	10.15%	48.63%	0.089	0.022	0.105	0.217
351022	3/17/1999	147	0.241	0.046	0.219	0.506	47.59%	9.06%	43.35%	0.075	0.014	0.068	0.157
351112	12/5/1989	67	0.209	0.037	0.088	0.334	62.59%	11.11%	26.30%	0.099	0.018	0.041	0.157
351112	1/22/1991	80	0.219	0.038	0.089	0.345	63.27%	10.90%	25.83%	0.112	0.019	0.046	0.177
351112	9/27/1991	88	0.23	0.038	0.09	0.358	64.17%	10.61%	25.22%	0.088	0.015	0.035	0.138
351112	1/27/1993	104	0.242	0.038	0.092	0.372	65.04%	10.35%	24.61%	0.077	0.012	0.029	0.118
351112	3/15/1995	130	0.27	0.039	0.094	0.403	67.00%	9.77%	23.24%	0.132	0.019	0.046	0.197
351112	9/9/1997	160	0.295	0.04	0.096	0.43	68.47%	9.33%	22.20%	0.094	0.013	0.031	0.138
351112	3/15/1999	175	0.306	0.04	0.096	0.443	69.12%	9.13%	21.74%	0.109	0.014	0.034	0.157
371006	10/13/1989	88	0.355	0.037	0.166	0.558	63.67%	6.68%	29.64%	0.05	0.005	0.023	0.079
371006	3/19/1991	105	0.381	0.038	0.169	0.587	64.85%	6.44%	28.71%	0.051	0.005	0.023	0.079
371006	10/11/1992	124	0.436	0.039	0.173	0.648	67.26%	6.02%	26.72%	0.119	0.011	0.047	0.177
371006	4/18/1994	142	0.457	0.039	0.176	0.672	68.01%	5.87%	26.12%	0.067	0.006	0.026	0.098
371006	9/20/1994	147	0.474	0.04	0.177	0.691	68.63%	5.76%	25.61%	0.081	0.007	0.03	0.118
371024	11/3/1989	109	0.077	0.074	0.119	0.27	28.37%	27.48%	44.15%	0.101	0.097	0.156	0.354
371024	3/9/1991	125	0.081	0.075	0.122	0.279	28.99%	27.08%	43.93%	0.126	0.117	0.19	0.433
371024	4/10/1992	138	0.085	0.077	0.125	0.287	29.70%	26.77%	43.53%	0.105	0.095	0.154	0.354
371802	10/13/1989	49	0.093	0.095	0.291	0.479	19.42%	19.86%	60.72%	0.069	0.07	0.215	0.354
371802	3/18/1991	66	0.105	0.098	0.307	0.511	20.61%	19.26%	60.13%	0.065	0.061	0.189	0.315
371802	10/10/1992	85	0.122	0.103	0.324	0.549	22.22%	18.71%	59.07%	0.079	0.066	0.209	0.354
371802	4/15/1994	103	0.131	0.105	0.336	0.571	22.88%	18.31%	58.81%	0.099	0.079	0.255	0.433
371802	7/18/1995	118	0.143	0.107	0.346	0.597	24.03%	18.00%	57.96%	0.114	0.085	0.274	0.472
371802	2/9/1996	125	0.147	0.108	0.349	0.604	24.26%	17.87%	57.86%	0.124	0.091	0.296	0.512
371802	4/2/1996	127	0.147	0.108	0.35	0.605	24.24%	17.87%	57.89%	0.124	0.091	0.296	0.512
371817	10/15/1989	71	0.1	0.058	0.08	0.237	42.09%	24.36%	33.55%	0.166	0.096	0.132	0.394
371817	3/18/1991	88	0.107	0.059	0.082	0.248	43.18%	23.80%	33.02%	0.111	0.061	0.084	0.256
371817	10/18/1992	107	0.127	0.062	0.085	0.274	46.35%	22.57%	31.09%	0.164	0.08	0.11	0.354

Table C-8 (Cont'd) Permanent Deformation Simulation (β_{r2} = 0.9 and β_{r3} = 1.2) Data

Section	Month	Time	Predicted							Measured			
			AC	GB	SG	Total	%AC	%GB	%SG	AC	GB	SG	Total
371992	10/15/1992	33	0.14	0.15	0.081	0.372	37.75%	40.46%	21.79%	0.089	0.096	0.051	0.236
371992	4/20/1994	51	0.174	0.159	0.087	0.419	41.44%	37.86%	20.70%	0.016	0.015	0.008	0.039
371992	2/6/1996	73	0.217	0.167	0.092	0.477	45.52%	35.11%	19.37%	0.072	0.055	0.031	0.157
371992	4/22/1998	99	0.265	0.175	0.098	0.538	49.26%	32.60%	18.14%	0.116	0.077	0.043	0.236
404087	1/17/1990	43	0.071	0.02	0.128	0.219	32.30%	9.24%	58.46%	0.197	0.056	0.357	0.61
404087	10/13/1991	64	0.089	0.022	0.142	0.253	34.99%	8.73%	56.28%	0.152	0.038	0.244	0.433
404087	2/8/1993	80	0.096	0.023	0.15	0.269	35.87%	8.47%	55.66%	0.134	0.032	0.208	0.374
404087	2/9/1995	104	0.111	0.024	0.16	0.295	37.51%	8.11%	54.38%	0.214	0.046	0.31	0.571
404163	1/23/1990	34	0.064	0	0.109	0.174	37.03%	0.00%	62.97%	0.168	0	0.285	0.453
404163	3/17/1991	48	0.074	0	0.115	0.188	39.11%	0.00%	60.89%	0.146	0	0.228	0.374
404163	10/28/1991	55	0.08	0	0.118	0.197	40.34%	0.00%	59.66%	0.119	0	0.176	0.295
404163	3/10/1993	72	0.089	0	0.122	0.211	42.31%	0.00%	57.69%	0.117	0	0.159	0.276
404163	4/22/1996	109	0.104	0	0.129	0.233	44.84%	0.00%	55.16%	0.141	0	0.174	0.315
404163	8/20/1997	125	0.117	0	0.132	0.249	46.89%	0.00%	53.11%	0.185	0	0.209	0.394
404163	1/11/1999	141	0.122	0	0.134	0.256	47.53%	0.00%	52.47%	0.215	0	0.238	0.453
421599	7/18/1989	24	0.051	0.027	0.104	0.182	28.24%	14.79%	56.98%	0.05	0.026	0.101	0.177
421599	9/27/1990	38	0.062	0.028	0.112	0.202	30.43%	14.07%	55.50%	0.066	0.03	0.12	0.217
421599	8/7/1991	49	0.068	0.029	0.117	0.214	31.93%	13.67%	54.40%	0.063	0.027	0.107	0.197
421599	3/1/1993	68	0.079	0.03	0.122	0.232	34.19%	13.14%	52.67%	0.108	0.041	0.166	0.315
421599	6/21/1995	95	0.096	0.032	0.129	0.258	37.38%	12.46%	50.16%	0.103	0.034	0.138	0.276
421599	7/19/1996	108	0.105	0.033	0.132	0.27	38.92%	12.13%	48.95%	0.107	0.033	0.135	0.276
421599	3/26/1998	128	0.117	0.034	0.136	0.287	40.86%	11.72%	47.42%	0.113	0.032	0.131	0.276
451011	4/11/1989	34	0.3	0.074	0.091	0.465	64.58%	15.84%	19.58%	0.216	0.053	0.066	0.335
451011	3/5/1991	57	0.372	0.077	0.096	0.545	68.29%	14.16%	17.55%	0.336	0.07	0.086	0.492
451011	10/24/1992	76	0.432	0.079	0.098	0.61	70.87%	13.03%	16.11%	0.446	0.082	0.101	0.63
451011	1/27/1996	115	0.512	0.082	0.102	0.696	73.53%	11.83%	14.64%	0.492	0.079	0.098	0.669
451011	2/11/1999	150	0.572	0.084	0.104	0.761	75.23%	11.06%	13.71%	0.533	0.078	0.097	0.709
473104	11/1/1989	42	0.006	0.088	0.109	0.203	2.86%	43.51%	53.63%	0.008	0.12	0.148	0.276
473104	5/6/1991	60	0.006	0.096	0.121	0.224	2.89%	43.06%	54.05%	0.009	0.136	0.17	0.315
473104	10/26/1992	77	0.008	0.105	0.131	0.244	3.21%	42.90%	53.88%	0.011	0.152	0.191	0.354
473104	11/30/1995	114	0.01	0.119	0.151	0.28	3.48%	42.55%	53.97%	0.022	0.268	0.34	0.63
480001	4/10/1989	1	0.016	0.084	0.082	0.183	8.95%	46.07%	44.98%	0.021	0.109	0.106	0.236
480001	10/11/1990	19	0.12	0.146	0.152	0.418	28.62%	35.02%	36.36%	0.079	0.097	0.1	0.276
480001	3/11/1992	36	0.154	0.157	0.17	0.481	32.10%	32.68%	35.23%	0.101	0.103	0.111	0.315
480001	2/17/1993	47	0.183	0.164	0.178	0.525	34.86%	31.19%	33.94%	0.069	0.061	0.067	0.197
480001	2/20/1995	71	0.221	0.173	0.192	0.586	37.77%	29.44%	32.79%	0.119	0.093	0.103	0.315
480001	3/19/1998	108	0.288	0.184	0.209	0.681	42.36%	26.98%	30.67%	0.067	0.042	0.048	0.157
481060	6/18/1990	52	0.154	0.062	0.094	0.309	49.69%	20.07%	30.24%	0.205	0.083	0.125	0.413
481060	2/14/1991	60	0.165	0.063	0.096	0.324	50.97%	19.49%	29.54%	0.171	0.065	0.099	0.335
481060	3/18/1992	73	0.179	0.064	0.098	0.342	52.44%	18.79%	28.77%	0.124	0.044	0.068	0.236
481060	2/23/1993	84	0.194	0.066	0.101	0.361	53.87%	18.19%	27.93%	0.117	0.039	0.06	0.217
481060	2/23/1995	108	0.219	0.067	0.105	0.392	56.06%	17.22%	26.72%	0.21	0.064	0.1	0.374
481060	1/5/1999	154	0.271	0.071	0.111	0.452	59.91%	15.61%	24.48%	0.236	0.061	0.096	0.394
481077	4/25/1989	88	0.23	0.049	0.104	0.383	60.06%	12.87%	27.07%	0.319	0.068	0.144	0.531
481077	10/13/1991	118	0.271	0.051	0.108	0.429	63.00%	11.85%	25.15%	0.384	0.072	0.153	0.61
481077	10/12/1992	130	0.279	0.051	0.109	0.44	63.52%	11.65%	24.84%	0.388	0.071	0.152	0.61

Table C-8 (Cont'd) Permanent Deformation Simulation (β_{r2} = 0.9 and β_{r3} = 1.2) Data

Section	Month	Time	Predicted							Measured			
			AC	GB	SG	Total	%AC	%GB	%SG	AC	GB	SG	Total
481077	3/10/1995	159	0.306	0.052	0.112	0.47	65.08%	11.12%	23.81%	0.461	0.079	0.169	0.709
481077	3/26/1998	195	0.337	0.053	0.115	0.505	66.76%	10.54%	22.70%	0.46	0.073	0.156	0.689
481109	1/4/1990	68	0.207	0	0.2	0.406	50.85%	0.00%	49.15%	0.16	0	0.155	0.315
481109	9/21/1990	76	0.222	0	0.204	0.426	52.09%	0.00%	47.91%	0.164	0	0.151	0.315
481109	3/10/1992	94	0.238	0	0.21	0.448	53.17%	0.00%	46.83%	0.136	0	0.12	0.256
481109	2/12/1993	105	0.254	0	0.213	0.468	54.35%	0.00%	45.65%	0.139	0	0.117	0.256
481109	2/16/1995	129	0.281	0	0.22	0.501	56.07%	0.00%	43.93%	0.221	0	0.173	0.394
481130	4/11/1989	201	0.334	0.185	0.195	0.714	46.77%	25.87%	27.36%	0.249	0.138	0.145	0.531
481130	10/12/1990	219	0.355	0.188	0.199	0.742	47.82%	25.31%	26.86%	0.329	0.174	0.185	0.689
481130	3/12/1992	236	0.365	0.19	0.203	0.757	48.19%	25.05%	26.76%	0.332	0.173	0.184	0.689
481169	3/4/1990	212	0.079	0.122	0.078	0.28	28.30%	43.80%	27.90%	0.089	0.138	0.088	0.315
481169	9/18/1990	218	0.081	0.123	0.078	0.282	28.68%	43.55%	27.77%	0.09	0.137	0.087	0.315
481169	3/7/1991	224	0.081	0.123	0.079	0.283	28.69%	43.53%	27.77%	0.09	0.137	0.087	0.315
481169	1/30/1992	234	0.084	0.124	0.079	0.287	29.15%	43.25%	27.60%	0.098	0.145	0.092	0.335
481169	2/27/1993	247	0.086	0.125	0.08	0.29	29.57%	43.00%	27.44%	0.093	0.135	0.086	0.315
481169	3/3/1995	272	0.09	0.126	0.081	0.296	30.25%	42.56%	27.19%	0.143	0.201	0.128	0.472
481174	10/17/1990	186	0.376	0.079	0.176	0.632	59.48%	12.58%	27.94%	0.234	0.05	0.11	0.394
481174	2/14/1991	190	0.376	0.079	0.177	0.632	59.45%	12.57%	27.97%	0.257	0.054	0.121	0.433
481174	3/16/1992	203	0.386	0.08	0.179	0.645	59.83%	12.40%	27.76%	0.188	0.039	0.087	0.315
481174	2/18/1993	214	0.394	0.08	0.181	0.655	60.11%	12.29%	27.60%	0.213	0.044	0.098	0.354
481174	2/21/1995	238	0.414	0.081	0.184	0.679	60.89%	12.00%	27.11%	0.408	0.08	0.181	0.669
481174	3/20/1998	275	0.437	0.083	0.189	0.708	61.69%	11.67%	26.64%	0.413	0.078	0.178	0.669
481178	4/10/1989	10	0.081	0.032	0.097	0.21	38.49%	15.31%	46.20%	0.068	0.027	0.082	0.177
481178	2/22/1991	32	0.151	0.039	0.125	0.316	47.95%	12.40%	39.65%	0.066	0.017	0.055	0.138
481178	3/10/1992	45	0.178	0.041	0.134	0.353	50.47%	11.58%	37.95%	0.07	0.016	0.052	0.138
481178	2/16/1993	56	0.196	0.042	0.14	0.378	51.87%	11.10%	37.03%	0.082	0.017	0.058	0.157
481178	2/17/1995	80	0.238	0.044	0.152	0.434	54.86%	10.17%	34.97%	0.13	0.024	0.083	0.236
481183	12/6/1989	179	0.194	0.092	0.223	0.509	38.19%	18.07%	43.74%	0.098	0.046	0.112	0.256
481183	9/15/1990	188	0.204	0.094	0.227	0.525	38.91%	17.86%	43.23%	0.115	0.053	0.128	0.295
483749	10/17/1990	116	0.269	0.156	0.27	0.695	38.73%	22.46%	38.82%	0.099	0.057	0.099	0.256
483749	2/14/1991	120	0.27	0.156	0.271	0.697	38.66%	22.43%	38.91%	0.084	0.049	0.084	0.217
483749	3/16/1992	133	0.279	0.159	0.276	0.715	39.07%	22.24%	38.69%	0.077	0.044	0.076	0.197
483749	2/21/1993	144	0.289	0.161	0.281	0.73	39.51%	22.06%	38.43%	0.086	0.048	0.083	0.217
483749	2/21/1995	168	0.307	0.165	0.288	0.76	40.36%	21.70%	37.94%	0.135	0.073	0.127	0.335
483749	3/28/1997	193	0.323	0.169	0.296	0.787	40.98%	21.43%	37.60%	0.186	0.097	0.17	0.453
489005	10/14/1990	50	0.04	0.207	0.26	0.507	7.97%	40.78%	51.25%	0.027	0.136	0.172	0.335
489005	3/12/1992	67	0.045	0.214	0.274	0.534	8.49%	40.11%	51.40%	0.012	0.055	0.071	0.138
489005	2/17/1993	78	0.048	0.219	0.283	0.55	8.79%	39.79%	51.43%	0.012	0.055	0.071	0.138
489005	2/20/1995	102	0.054	0.226	0.297	0.577	9.31%	39.17%	51.52%	0.022	0.093	0.122	0.236
489005	7/10/1998	143	0.062	0.237	0.317	0.615	10.06%	38.50%	51.44%	0.016	0.061	0.081	0.157
501002	8/9/1989	58	0.059	0.043	0.056	0.157	37.48%	27.08%	35.44%	0.111	0.08	0.105	0.295
501002	8/8/1990	70	0.066	0.044	0.058	0.167	39.36%	26.23%	34.41%	0.147	0.098	0.129	0.374
501002	9/4/1991	83	0.069	0.045	0.059	0.173	40.08%	25.82%	34.10%	0.126	0.081	0.107	0.315
501002	4/27/1993	102	0.075	0.046	0.061	0.181	41.16%	25.22%	33.62%	0.154	0.094	0.126	0.374
501002	5/25/1994	115	0.08	0.047	0.062	0.188	42.25%	24.78%	32.97%	0.158	0.093	0.123	0.374
501002	8/17/1994	118	0.083	0.047	0.063	0.193	43.04%	24.50%	32.46%	0.161	0.092	0.121	0.374

Table C-8 (Cont'd) Permanent Deformation Simulation (β_{r2} = 0.9 and β_{r3} = 1.2) Data

			Predicted							Measured			
Section	Month	Time	AC	GB	SG	Total	%AC	%GB	%SG	AC	GB	SG	Total
501002	4/27/1995	126	0.083	0.047	0.063	0.194	42.98%	24.46%	32.56%	0.169	0.096	0.128	0.394
501002	10/12/1995	132	0.089	0.048	0.064	0.201	44.28%	23.99%	31.72%	0.192	0.104	0.137	0.433
501002	10/17/1996	144	0.091	0.049	0.065	0.204	44.69%	23.74%	31.57%	0.158	0.084	0.112	0.354
501002	5/15/1997	151	0.092	0.049	0.065	0.205	44.65%	23.72%	31.63%	0.193	0.103	0.137	0.433
501002	10/23/1997	156	0.096	0.049	0.065	0.21	45.53%	23.40%	31.08%	0.206	0.106	0.141	0.453
501002	6/6/1998	164	0.097	0.049	0.066	0.212	45.74%	23.24%	31.02%	0.198	0.101	0.134	0.433
501004	8/9/1989	58	0.034	0.048	0.074	0.156	21.74%	30.87%	47.39%	0.034	0.049	0.075	0.157
501004	8/7/1990	70	0.039	0.051	0.079	0.169	23.33%	29.98%	46.69%	0.06	0.077	0.119	0.256
501004	9/20/1991	83	0.046	0.053	0.083	0.182	25.04%	29.19%	45.77%	0.049	0.057	0.09	0.197
501004	4/27/1993	102	0.052	0.055	0.089	0.196	26.58%	28.25%	45.17%	0.068	0.072	0.116	0.256
501004	10/12/1995	132	0.066	0.059	0.097	0.222	29.74%	26.74%	43.52%	0.07	0.063	0.103	0.236
501004	11/4/1997	157	0.077	0.062	0.102	0.242	31.97%	25.73%	42.30%	0.082	0.066	0.108	0.256
511002	10/15/1989	121	0.141	0.063	0.122	0.326	43.33%	19.27%	37.40%	0.171	0.076	0.147	0.394
511023	10/12/1989	107	0.337	0.063	0.153	0.554	60.96%	11.31%	27.73%	0.348	0.065	0.158	0.571
511023	3/20/1991	124	0.358	0.063	0.156	0.577	62.08%	10.96%	26.97%	0.342	0.06	0.149	0.551
511023	10/10/1992	143	0.395	0.065	0.159	0.619	63.91%	10.44%	25.65%	0.377	0.062	0.152	0.591
511023	12/7/1993	157	0.416	0.065	0.16	0.641	64.81%	10.18%	25.01%	0.395	0.062	0.153	0.61
511023	9/18/1995	178	0.45	0.066	0.163	0.68	66.23%	9.75%	24.02%	0.365	0.054	0.132	0.551
511023	2/9/1996	183	0.45	0.066	0.163	0.68	66.23%	9.75%	24.03%	0.443	0.065	0.161	0.669
511023	3/24/1997	196	0.463	0.066	0.164	0.694	66.72%	9.58%	23.71%	0.394	0.057	0.14	0.591
512021	10/15/1989	54	0.098	0.017	0.112	0.227	43.22%	7.66%	49.13%	0.17	0.03	0.193	0.394
512021	3/11/1991	71	0.111	0.018	0.117	0.246	44.97%	7.35%	47.69%	0.195	0.032	0.207	0.433
512021	10/20/1992	90	0.129	0.019	0.121	0.269	48.06%	6.97%	44.97%	0.255	0.037	0.239	0.531
531008	7/17/1989	129	0.146	0.075	0.094	0.315	46.28%	23.93%	29.79%	0.355	0.184	0.229	0.768
531008	7/17/1989	142	0.158	0.077	0.095	0.33	47.81%	23.29%	28.90%	0.358	0.174	0.216	0.748
531008	8/2/1990	151	0.159	0.077	0.096	0.332	47.87%	23.24%	28.88%	0.368	0.178	0.222	0.768
531008	8/2/1990	153	0.161	0.077	0.096	0.335	48.21%	23.09%	28.71%	0.399	0.191	0.237	0.827
531008	5/28/1991	188	0.176	0.079	0.098	0.354	49.77%	22.39%	27.84%	0.539	0.242	0.301	1.083
531801	7/17/1989	190	0.065	0.01	0.063	0.137	47.30%	6.96%	45.74%	0.093	0.014	0.09	0.197
531801	8/9/1990	203	0.068	0.01	0.063	0.141	48.21%	6.87%	44.92%	0.085	0.012	0.08	0.177
531801	6/5/1991	213	0.069	0.01	0.064	0.143	48.48%	6.81%	44.71%	0.105	0.015	0.097	0.217
531801	6/22/1994	249	0.078	0.01	0.066	0.154	50.77%	6.53%	42.70%	0.08	0.01	0.067	0.157
531801	5/8/1995	260	0.08	0.01	0.066	0.156	51.20%	6.44%	42.36%	0.081	0.01	0.067	0.157
531801	10/31/1995	265	0.083	0.01	0.067	0.16	51.91%	6.40%	41.70%	0.092	0.011	0.074	0.177
531801	3/27/1997	282	0.086	0.01	0.067	0.163	52.52%	6.36%	41.12%	0.103	0.013	0.081	0.197
561007	9/26/1989	111	0.093	0.038	0.099	0.23	40.32%	16.71%	42.97%	0.183	0.076	0.195	0.453
561007	7/22/1990	121	0.094	0.039	0.1	0.233	40.47%	16.63%	42.90%	0.159	0.065	0.169	0.394
561007	5/13/1991	131	0.096	0.039	0.101	0.236	40.60%	16.56%	42.83%	0.152	0.062	0.16	0.374
561007	8/3/1991	134	0.102	0.039	0.102	0.243	41.92%	16.23%	41.84%	0.132	0.051	0.132	0.315
561007	12/9/1993	162	0.111	0.041	0.105	0.256	43.32%	15.86%	40.82%	0.119	0.044	0.112	0.276
561007	3/16/1994	165	0.111	0.041	0.105	0.257	43.27%	15.85%	40.88%	0.119	0.044	0.113	0.276
561007	4/19/1994	166	0.111	0.041	0.105	0.257	43.25%	15.84%	40.91%	0.128	0.047	0.121	0.295
561007	8/19/1994	170	0.113	0.041	0.105	0.259	43.57%	15.80%	40.63%	0.112	0.04	0.104	0.256
561007	2/16/1995	176	0.113	0.041	0.106	0.26	43.58%	15.75%	40.67%	0.12	0.043	0.112	0.276
561007	5/17/1995	179	0.114	0.041	0.106	0.261	43.54%	15.78%	40.68%	0.111	0.04	0.104	0.256
561007	9/8/1995	183	0.116	0.041	0.107	0.264	43.92%	15.68%	40.41%	0.121	0.043	0.111	0.276
561007	6/11/1996	192	0.117	0.041	0.107	0.265	43.96%	15.64%	40.40%	0.095	0.034	0.087	0.217

Table C-8 (Cont'd) Permanent Deformation Simulation (β_{r2} = 0.9 and β_{r3} = 1.2) Data

			Predicted							Measured			
Section	Month	Time	AC	GB	SG	Total	%AC	%GB	%SG	AC	GB	SG	Total
561007	10/24/1996	196	0.121	0.042	0.108	0.271	44.77%	15.46%	39.77%	0.123	0.043	0.11	0.276
561007	11/19/1996	197	0.121	0.042	0.108	0.271	44.74%	15.45%	39.80%	0.123	0.043	0.11	0.276
561007	3/10/1997	201	0.121	0.042	0.108	0.271	44.73%	15.44%	39.82%	0.132	0.046	0.118	0.295
561007	3/24/1997	202	0.121	0.042	0.108	0.271	44.72%	15.43%	39.85%	0.123	0.043	0.11	0.276
561007	8/7/1997	206	0.127	0.042	0.108	0.277	45.70%	15.21%	39.10%	0.126	0.042	0.108	0.276
561007	9/30/1997	207	0.127	0.042	0.109	0.278	45.73%	15.18%	39.08%	0.126	0.042	0.108	0.276
841684	8/29/1990	144	0.142	0.088	0.083	0.313	45.39%	28.22%	26.39%	0.25	0.156	0.145	0.551
841684	8/28/1991	156	0.148	0.089	0.084	0.321	46.09%	27.86%	26.05%	0.254	0.154	0.144	0.551
841684	5/3/1993	177	0.154	0.091	0.085	0.329	46.67%	27.50%	25.84%	0.303	0.179	0.168	0.65
841684	10/24/1995	206	0.171	0.093	0.087	0.351	48.80%	26.36%	24.84%	0.346	0.187	0.176	0.709

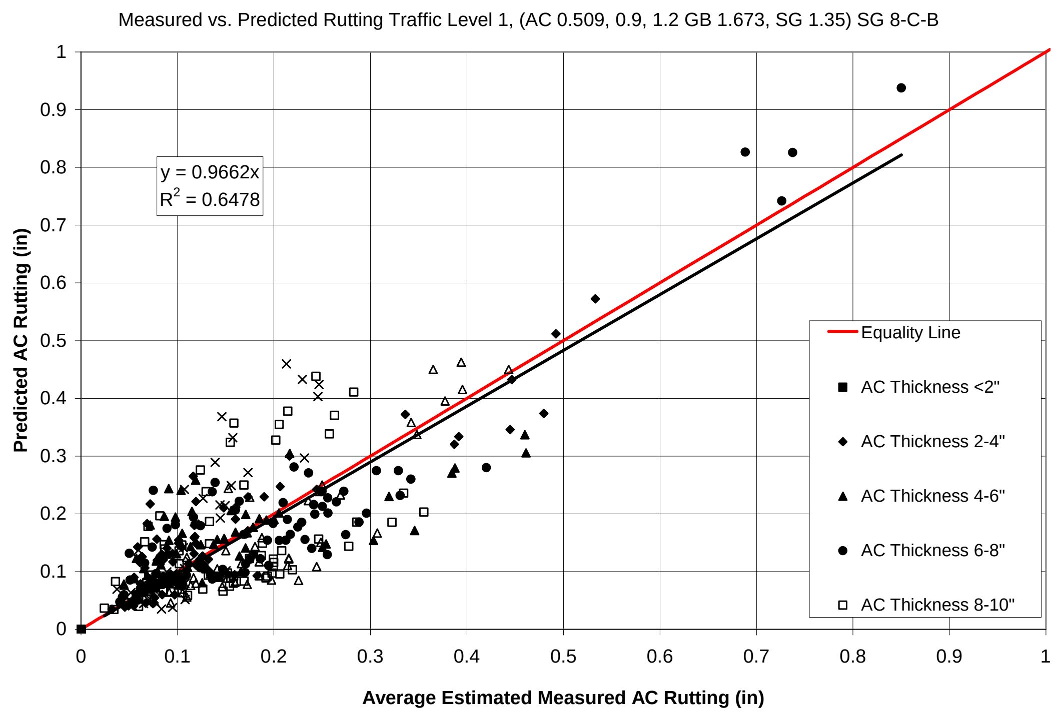


Figure C-105 Asphalt Concrete Layers Rut Depth (β_{r2} = 0.9 and β_{r3} = 1.2)

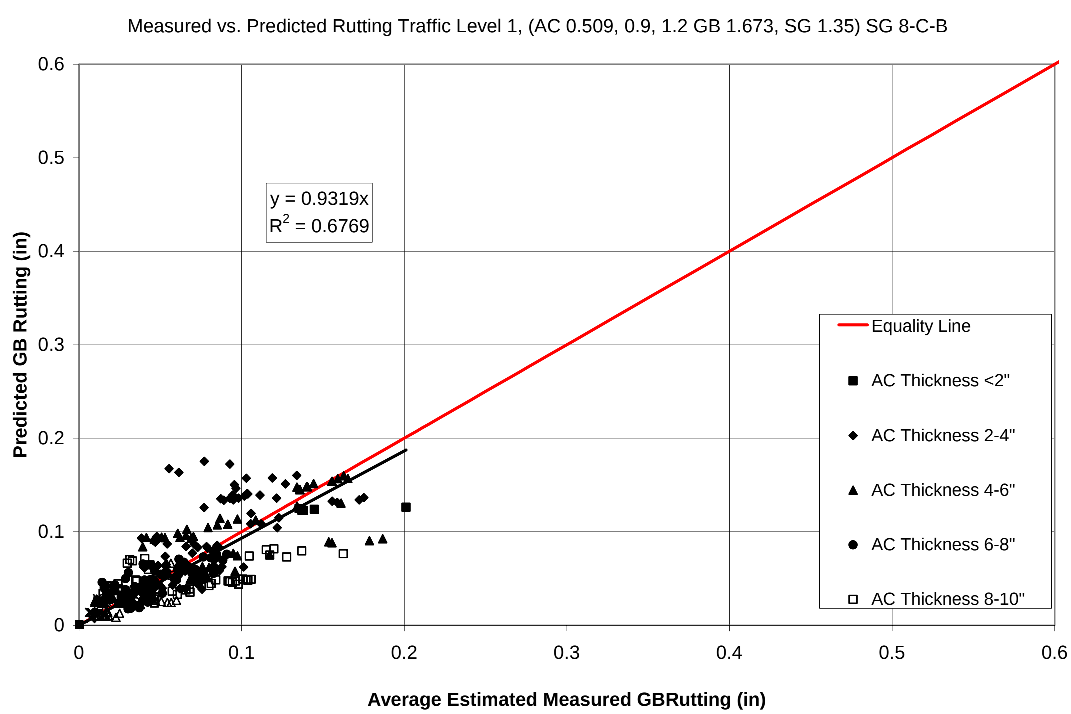


Figure C-106 Granular Base Layers Rut Depth (β_{r2} = 0.9 and β_{r3} = 1.2)

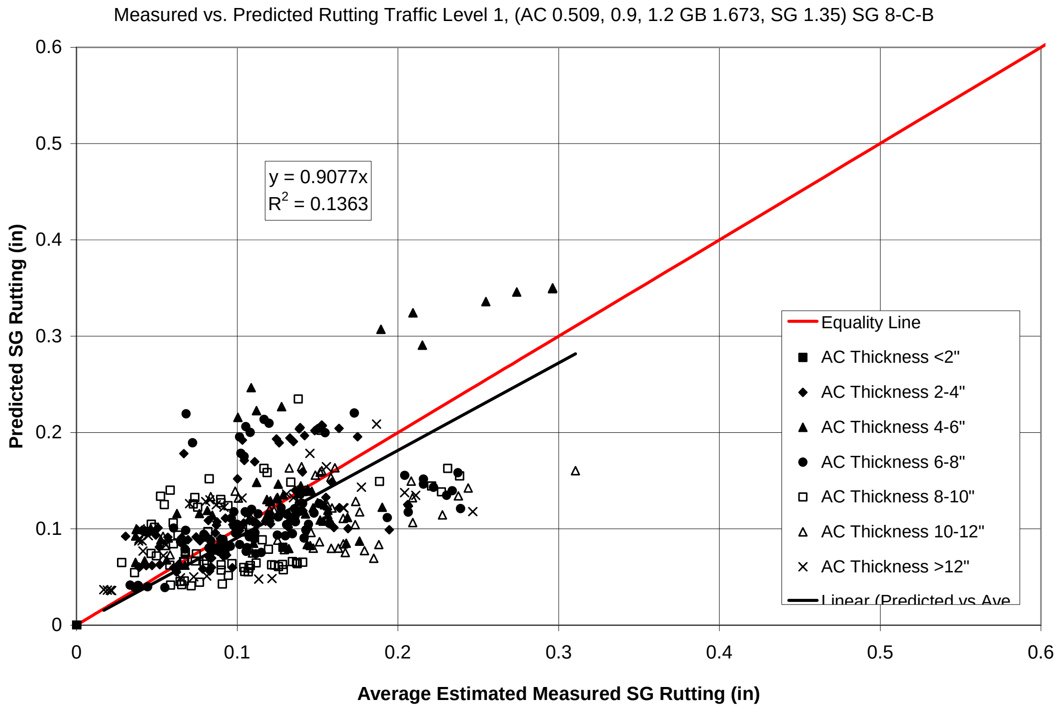


Figure C-107 Granular Subgrade Rut Depth (β_{r2} = 0.9 and β_{r3} = 1.2)

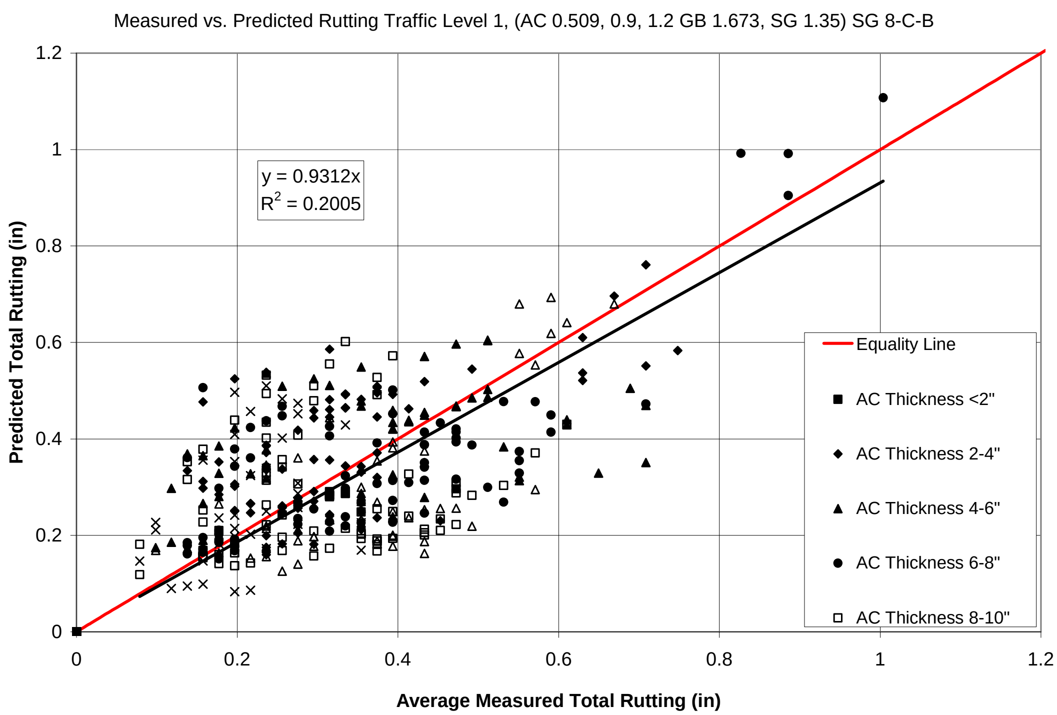


Figure C-108 Total Asphalt Pavement Rut Depth (β_{r2} = 0.9 and β_{r3} = 1.2)

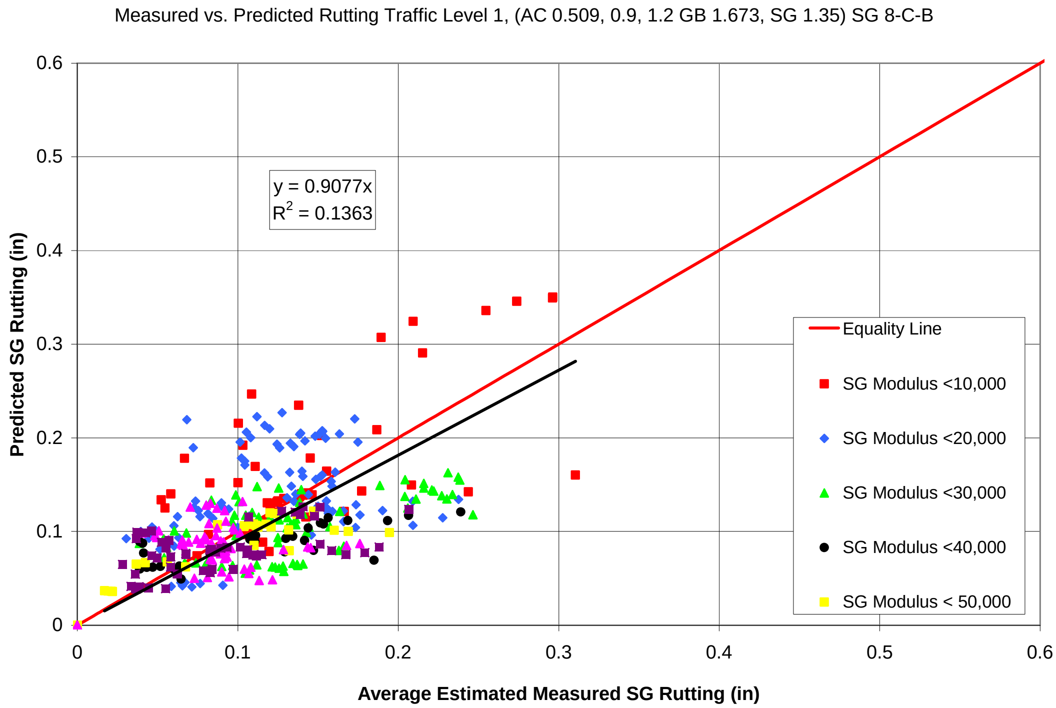


Figure C-109 Subgrade Rut Depth (β_{r2} = 0.9 and β_{r3} = 1.2) (By Subgrade Modulus)

Table C-59 Permanent Deformation Simulation (β_{r2} = 1.0 and β_{r3} = 0.8) Summary

	AC	GB	SG	Total
Average Predicted=	0.220	0.038	0.073	0.330
Sum of error =	0.321	-0.050	-0.271	0.000
Sum of error^2 =	2.810	0.113	0.319	6.061
Predicted % =	65.21%	11.41%	23.38%	100.00%
Se =	0.077	0.016	0.026	0.114
Average Measured =	0.038	0.074	0.330	0.346
Calibration Factor β_1 =	2.206	1.133	0.859	

Table C-60 Permanent Deformation Simulation (β_{r2} = 1.0 and β_{r3} = 0.8) Data

Section	Month	Time	Predicted							Measured			
			AC	GB	SG	Total	%AC	%GB	%SG	AC	GB	SG	Total
11001	4/5/1989	103	0.532	0.117	0.075	0.725	73.45%	16.19%	10.37%	0.246	0.054	0.035	0.335
11001	2/12/1991	125	0.575	0.12	0.077	0.772	74.55%	15.49%	9.96%	0.235	0.049	0.031	0.315
11001	4/2/1992	139	0.585	0.121	0.078	0.783	74.69%	15.39%	9.92%	0.221	0.045	0.029	0.295
11019	5/15/1989	32	0.222	0.017	0.087	0.325	68.19%	5.16%	26.66%	0.349	0.026	0.136	0.512
11019	4/16/1990	43	0.247	0.017	0.09	0.354	69.74%	4.90%	25.36%	0.384	0.027	0.14	0.551
11019	1/15/1991	52	0.268	0.018	0.092	0.378	70.98%	4.70%	24.32%	0.391	0.026	0.134	0.551
11019	3/31/1992	66	0.28	0.018	0.094	0.392	71.41%	4.59%	24.00%	0.394	0.025	0.132	0.551
11019	3/22/1994	90	0.308	0.021	0.097	0.426	72.26%	4.89%	22.85%	0.427	0.029	0.135	0.591
11019	1/8/1996	112	0.332	0.023	0.1	0.455	73.02%	5.03%	21.95%	0.431	0.03	0.13	0.591
11019	1/23/1998	136	0.346	0.023	0.102	0.471	73.54%	4.90%	21.56%	0.521	0.035	0.153	0.709
14126	6/5/1989	15	0.099	0.009	0.031	0.139	71.43%	6.44%	22.13%	0.127	0.011	0.039	0.177
14126	3/3/1991	36	0.133	0.01	0.036	0.178	74.52%	5.53%	19.95%	0.161	0.012	0.043	0.217
14126	4/8/1992	49	0.142	0.01	0.038	0.19	74.95%	5.30%	19.74%	0.118	0.008	0.031	0.157
14126	4/8/1994	73	0.158	0.011	0.04	0.209	75.84%	5.05%	19.11%	0.149	0.01	0.038	0.197
14126	12/11/1995	93	0.173	0.011	0.041	0.225	76.83%	4.84%	18.34%	0.166	0.01	0.04	0.217
14126	12/5/1997	117	0.184	0.011	0.043	0.237	77.41%	4.68%	17.91%	0.152	0.009	0.035	0.197
21001	8/21/1991	98	0.052	0.031	0.081	0.164	31.77%	18.80%	49.43%	0.056	0.033	0.088	0.177
21001	8/26/1993	122	0.055	0.031	0.083	0.169	32.46%	18.55%	48.99%	0.077	0.044	0.116	0.236
21001	6/15/1995	144	0.057	0.032	0.087	0.176	32.19%	18.20%	49.60%	0.089	0.05	0.137	0.276
21001	8/22/1997	170	0.061	0.033	0.088	0.182	33.35%	18.06%	48.59%	0.118	0.064	0.172	0.354
21001	8/26/1998	182	0.062	0.033	0.089	0.184	33.43%	17.96%	48.61%	0.118	0.064	0.172	0.354
21002	8/22/1991	83	0.08	0.039	0.035	0.155	51.83%	25.44%	22.73%	0.092	0.045	0.04	0.177
21002	7/30/1992	94	0.081	0.04	0.036	0.157	51.62%	25.49%	22.89%	0.122	0.06	0.054	0.236
21002	6/14/1995	129	0.096	0.042	0.037	0.175	54.94%	23.81%	21.25%	0.13	0.056	0.05	0.236
21002	8/21/1997	155	0.099	0.043	0.038	0.179	54.98%	23.75%	21.27%	0.162	0.07	0.063	0.295
21002	5/14/1998	164	0.099	0.043	0.038	0.18	54.95%	23.75%	21.30%	0.141	0.061	0.055	0.256
40114	3/30/1995	20	0.204	0.036	0.113	0.353	57.74%	10.09%	32.18%	0.227	0.04	0.127	0.394
40114	11/7/1995	28	0.234	0.037	0.12	0.391	59.82%	9.58%	30.60%	0.235	0.038	0.12	0.394
40114	2/4/1996	31	0.234	0.037	0.12	0.392	59.71%	9.57%	30.72%	0.259	0.041	0.133	0.433
40114	4/4/1996	33	0.235	0.037	0.121	0.393	59.66%	9.53%	30.81%	0.282	0.045	0.146	0.472
40114	7/9/1996	36	0.257	0.039	0.123	0.419	61.38%	9.19%	29.43%	0.266	0.04	0.127	0.433
40114	8/13/1996	37	0.266	0.039	0.124	0.429	61.99%	9.06%	28.95%	0.268	0.039	0.125	0.433
40114	1/7/1998	54	0.29	0.04	0.129	0.459	63.12%	8.73%	28.15%	0.273	0.038	0.122	0.433
40114	4/21/1998	57	0.29	0.04	0.13	0.46	63.06%	8.72%	28.22%	0.273	0.038	0.122	0.433
40114	6/12/1998	59	0.293	0.04	0.13	0.463	63.16%	8.70%	28.13%	0.298	0.041	0.133	0.472
40114	10/23/1998	63	0.31	0.041	0.132	0.483	64.23%	8.46%	27.30%	0.278	0.037	0.118	0.433
40114	2/12/1999	65	0.31	0.041	0.132	0.483	64.20%	8.46%	27.34%	0.303	0.04	0.129	0.472
40115	2/15/1995	19	0.116	0	0.05	0.165	69.88%	0.00%	30.12%	0.055	0	0.024	0.079
40115	3/30/1995	20	0.116	0	0.05	0.166	69.89%	0.00%	30.11%	0.11	0	0.047	0.157
40115	1/7/1998	54	0.165	0	0.057	0.221	74.41%	0.00%	25.59%	0.073	0	0.025	0.098
40115	2/11/1999	65	0.176	0	0.058	0.234	75.28%	0.00%	24.72%	0.074	0	0.024	0.098
40116	3/30/1995	20	0.086	0	0.069	0.155	55.47%	0.00%	44.53%	0.197	0	0.158	0.354
40116	1/8/1998	54	0.122	0	0.079	0.201	60.79%	0.00%	39.21%	0.215	0	0.139	0.354
40116	2/12/1999	65	0.131	0	0.08	0.211	61.92%	0.00%	38.08%	0.219	0	0.135	0.354

Table C-10 (Cont'd) Permanent Deformation Simulation (β_{r2} = 1.0 and β_{r3} = 0.8) Data

Section	Month	Time	Predicted							Measured			
			AC	GB	SG	Total	%AC	%GB	%SG	AC	GB	SG	Total
40117	3/30/1995	20	0.142	0.006	0.044	0.192	73.87%	3.01%	23.12%	0.32	0.013	0.1	0.433
40117	1/8/1998	54	0.202	0.007	0.05	0.258	78.09%	2.54%	19.36%	0.307	0.01	0.076	0.394
40117	2/11/1999	65	0.216	0.007	0.051	0.274	78.91%	2.44%	18.64%	0.373	0.012	0.088	0.472
40118	3/30/1995	20	0.139	0.009	0.069	0.216	64.13%	3.99%	31.89%	0.252	0.016	0.126	0.394
40118	1/8/1998	54	0.194	0.01	0.08	0.284	68.41%	3.35%	28.24%	0.242	0.012	0.1	0.354
40118	2/12/1999	65	0.208	0.01	0.082	0.3	69.38%	3.21%	27.41%	0.246	0.011	0.097	0.354
41007	11/20/1989	140	0.742	0.032	0.075	0.849	87.41%	3.79%	8.80%	0.774	0.034	0.078	0.886
41007	9/5/1991	162	0.794	0.033	0.076	0.903	87.95%	3.62%	8.42%	0.779	0.032	0.075	0.886
41007	9/20/1991	163	0.794	0.033	0.076	0.903	87.95%	3.62%	8.42%	0.727	0.03	0.07	0.827
41007	9/16/1994	198	0.86	0.033	0.078	0.971	88.55%	3.43%	8.02%	0.889	0.034	0.08	1.004
41016	11/30/1989	122	0.318	0	0.108	0.426	74.75%	0.00%	25.25%	0.28	0	0.094	0.374
41016	7/2/1990	130	0.322	0	0.108	0.431	74.89%	0.00%	25.11%	0.206	0	0.069	0.276
41016	9/25/1991	144	0.335	0	0.11	0.445	75.37%	0.00%	24.63%	0.178	0	0.058	0.236
41016	9/18/1996	204	0.386	0	0.115	0.5	77.08%	0.00%	22.92%	0.243	0	0.072	0.315
41024	11/3/1989	149	0.372	0.022	0.1	0.493	75.38%	4.43%	20.19%	0.178	0.01	0.048	0.236
41024	8/26/1990	158	0.385	0.022	0.1	0.507	75.85%	4.33%	19.81%	0.194	0.011	0.051	0.256
41024	9/4/1991	171	0.401	0.022	0.102	0.525	76.41%	4.25%	19.34%	0.165	0.009	0.042	0.217
41024	8/22/1995	218	0.45	0.023	0.105	0.578	77.85%	3.98%	18.17%	0.199	0.01	0.047	0.256
41024	11/9/1995	221	0.451	0.023	0.105	0.579	77.87%	3.97%	18.16%	0.215	0.011	0.05	0.276
41024	2/8/1996	224	0.451	0.023	0.105	0.579	77.86%	3.97%	18.17%	0.23	0.012	0.054	0.295
41024	4/4/1996	226	0.451	0.023	0.105	0.58	77.87%	3.97%	18.17%	0.199	0.01	0.046	0.256
41024	6/13/1996	228	0.453	0.023	0.105	0.581	77.91%	3.95%	18.14%	0.215	0.011	0.05	0.276
41024	7/11/1996	229	0.46	0.023	0.106	0.589	78.13%	3.92%	17.94%	0.215	0.011	0.049	0.276
41024	8/15/1996	230	0.466	0.023	0.106	0.595	78.29%	3.90%	17.81%	0.216	0.011	0.049	0.276
41024	1/15/1998	247	0.481	0.023	0.107	0.612	78.70%	3.83%	17.46%	0.217	0.011	0.048	0.276
41024	4/22/1998	250	0.481	0.023	0.107	0.612	78.69%	3.83%	17.47%	0.217	0.011	0.048	0.276
41024	6/15/1998	252	0.484	0.023	0.107	0.615	78.76%	3.81%	17.43%	0.217	0.011	0.048	0.276
41024	10/26/1998	256	0.489	0.023	0.107	0.62	78.88%	3.78%	17.34%	0.233	0.011	0.051	0.295
81029	10/20/1989	209	0.204	0.057	0.069	0.331	61.78%	17.23%	20.99%	0.146	0.041	0.05	0.236
81029	8/25/1991	231	0.212	0.058	0.07	0.34	62.38%	16.92%	20.70%	0.135	0.037	0.045	0.217
81029	10/21/1991	233	0.212	0.058	0.071	0.34	62.39%	16.90%	20.71%	0.111	0.03	0.037	0.177
81029	9/8/1995	280	0.226	0.059	0.072	0.357	63.29%	16.42%	20.29%	0.149	0.039	0.048	0.236
81047	10/20/1989	73	0.169	0.081	0.083	0.334	50.71%	24.34%	24.95%	0.19	0.091	0.093	0.374
81047	8/25/1991	95	0.184	0.083	0.087	0.354	51.95%	23.38%	24.67%	0.184	0.083	0.087	0.354
81047	10/22/1991	97	0.184	0.083	0.088	0.354	51.93%	23.37%	24.70%	0.174	0.078	0.083	0.335
81053	10/19/1989	60	0.18	0.073	0.067	0.321	56.26%	22.71%	21.02%	0.199	0.08	0.074	0.354
81053	7/7/1990	69	0.191	0.073	0.069	0.333	57.29%	21.95%	20.76%	0.248	0.095	0.09	0.433
81053	12/6/1993	110	0.237	0.084	0.078	0.399	59.43%	21.04%	19.53%	0.234	0.083	0.077	0.394
81053	3/14/1994	113	0.237	0.084	0.078	0.4	59.34%	21.04%	19.62%	0.234	0.083	0.077	0.394
81053	8/8/1994	118	0.246	0.087	0.08	0.413	59.54%	21.08%	19.38%	0.234	0.083	0.076	0.394
81053	10/21/1994	120	0.246	0.087	0.08	0.414	59.48%	21.10%	19.42%	0.246	0.087	0.08	0.413
81053	2/13/1995	124	0.246	0.087	0.081	0.414	59.42%	21.08%	19.51%	0.246	0.087	0.081	0.413
81053	5/8/1995	127	0.246	0.087	0.081	0.415	59.38%	21.08%	19.54%	0.245	0.087	0.081	0.413
81053	5/10/1996	139	0.258	0.088	0.082	0.428	60.33%	20.49%	19.18%	0.261	0.089	0.083	0.433
81053	10/21/1996	144	0.267	0.088	0.083	0.438	61.01%	20.10%	18.89%	0.288	0.095	0.089	0.472
81053	11/14/1996	145	0.267	0.088	0.083	0.438	61.00%	20.10%	18.91%	0.288	0.095	0.089	0.472
81053	3/20/1997	149	0.267	0.088	0.083	0.439	60.91%	20.09%	19.00%	0.288	0.095	0.09	0.472

Table C-10 (Cont'd) Permanent Deformation Simulation (β_{r2} = 1.0 and β_{r3} = 0.8) Data

Section	Month	Time	Predicted							Measured			
			AC	GB	SG	Total	%AC	%GB	%SG	AC	GB	SG	Total
81053	8/5/1997	154	0.28	0.09	0.084	0.455	61.58%	19.88%	18.54%	0.303	0.098	0.091	0.492
81053	9/26/1997	155	0.281	0.091	0.085	0.456	61.56%	19.89%	18.55%	0.315	0.102	0.095	0.512
81053	8/25/1998	166	0.292	0.094	0.086	0.472	61.83%	19.86%	18.31%	0.316	0.102	0.094	0.512
91803	9/5/1990	63	0.091	0.023	0.048	0.161	56.30%	14.17%	29.53%	0.1	0.025	0.052	0.177
91803	8/22/1991	74	0.102	0.024	0.049	0.175	58.15%	13.60%	28.24%	0.08	0.019	0.039	0.138
91803	9/30/1992	87	0.105	0.024	0.051	0.18	58.02%	13.58%	28.40%	0.114	0.027	0.056	0.197
91803	5/12/1994	107	0.112	0.025	0.054	0.191	58.82%	13.21%	27.98%	0.081	0.018	0.039	0.138
91803	9/25/1994	111	0.117	0.026	0.054	0.197	59.39%	13.09%	27.52%	0.082	0.018	0.038	0.138
91803	5/25/1995	119	0.117	0.026	0.055	0.198	59.22%	13.09%	27.69%	0.105	0.023	0.049	0.177
91803	10/30/1995	124	0.122	0.027	0.056	0.204	59.73%	12.98%	27.29%	0.118	0.026	0.054	0.197
91803	10/8/1996	136	0.132	0.027	0.057	0.216	61.05%	12.56%	26.39%	0.108	0.022	0.047	0.177
91803	5/8/1997	143	0.132	0.027	0.058	0.217	60.90%	12.53%	26.56%	0.108	0.022	0.047	0.177
91803	10/16/1997	148	0.135	0.028	0.058	0.221	61.04%	12.52%	26.45%	0.108	0.022	0.047	0.177
91803	6/17/1998	156	0.137	0.028	0.059	0.224	61.30%	12.38%	26.32%	0.109	0.022	0.047	0.177
123995	4/18/1989	161	0.684	0.082	0.059	0.825	82.91%	9.97%	7.12%	0.326	0.039	0.028	0.394
123995	2/5/1991	183	0.708	0.083	0.059	0.851	83.24%	9.77%	6.99%	0.328	0.038	0.028	0.394
123995	4/15/1992	197	0.718	0.084	0.06	0.861	83.34%	9.71%	6.95%	0.361	0.042	0.03	0.433
123995	3/9/1994	220	0.744	0.084	0.06	0.889	83.70%	9.50%	6.80%	0.33	0.037	0.027	0.394
123995	1/21/1996	242	0.764	0.085	0.061	0.91	83.94%	9.35%	6.71%	0.33	0.037	0.026	0.394
123997	12/14/1989	187	0.396	0.089	0.044	0.529	74.90%	16.80%	8.29%	0.472	0.106	0.052	0.63
123997	2/9/1991	201	0.407	0.09	0.044	0.541	75.20%	16.59%	8.22%	0.474	0.104	0.052	0.63
123997	4/13/1992	215	0.416	0.091	0.045	0.551	75.38%	16.46%	8.16%	0.534	0.117	0.058	0.709
123997	3/8/1994	238	0.438	0.092	0.046	0.576	75.98%	16.05%	7.98%	0.568	0.12	0.06	0.748
124105	4/12/1989	53	0.279	0.102	0.069	0.45	61.87%	22.72%	15.41%	0.231	0.085	0.058	0.374
124105	2/9/1991	75	0.316	0.106	0.073	0.495	63.83%	21.50%	14.67%	0.239	0.08	0.055	0.374
124105	4/13/1992	89	0.332	0.108	0.074	0.515	64.54%	21.05%	14.41%	0.28	0.091	0.062	0.433
124106	4/18/1989	21	0.227	0.04	0.055	0.323	70.50%	12.54%	16.96%	0.167	0.03	0.04	0.236
124106	2/5/1991	43	0.269	0.044	0.061	0.374	72.09%	11.70%	16.21%	0.199	0.032	0.045	0.276
124106	4/15/1992	57	0.285	0.045	0.063	0.392	72.55%	11.44%	16.01%	0.143	0.023	0.032	0.197
124106	3/9/1994	80	0.316	0.047	0.066	0.429	73.82%	10.86%	15.32%	0.174	0.026	0.036	0.236
124106	1/21/1996	102	0.335	0.048	0.068	0.451	74.40%	10.55%	15.05%	0.176	0.025	0.036	0.236
124106	1/17/1997	114	0.35	0.048	0.069	0.467	74.90%	10.34%	14.76%	0.236	0.033	0.046	0.315
124107	12/6/1989	75	0.166	0.064	0.065	0.296	56.15%	21.75%	22.10%	0.099	0.039	0.039	0.177
124107	2/5/1991	89	0.175	0.066	0.067	0.308	56.93%	21.33%	21.75%	0.09	0.034	0.034	0.157
124107	4/15/1992	103	0.185	0.067	0.069	0.32	57.71%	20.90%	21.40%	0.091	0.033	0.034	0.157
124107	3/9/1994	126	0.202	0.069	0.071	0.342	59.15%	20.16%	20.69%	0.082	0.028	0.029	0.138
124107	1/22/1996	148	0.213	0.07	0.072	0.356	59.89%	19.75%	20.35%	0.106	0.035	0.036	0.177
124108	4/27/1989	35	0.191	0.022	0.033	0.246	77.64%	9.08%	13.28%	0.275	0.032	0.047	0.354
124108	1/16/1991	56	0.244	0.024	0.035	0.303	80.58%	7.89%	11.54%	0.365	0.036	0.052	0.453
124108	4/1/1992	71	0.254	0.025	0.036	0.315	80.74%	7.80%	11.45%	0.318	0.031	0.045	0.394
124108	3/21/1994	94	0.29	0.026	0.038	0.353	82.05%	7.25%	10.70%	0.404	0.036	0.053	0.492
124108	1/16/1996	116	0.303	0.026	0.039	0.368	82.26%	7.13%	10.61%	0.437	0.038	0.056	0.531
124135	12/10/1989	227	0.418	0.19	0.097	0.705	59.32%	26.98%	13.70%	0.292	0.133	0.067	0.492
124135	1/29/1991	240	0.422	0.191	0.097	0.71	59.47%	26.85%	13.67%	0.351	0.159	0.081	0.591

Table C-10 (Cont'd) Permanent Deformation Simulation (β_{r2} = 1.0 and β_{r3} = 0.8) Data

Section	Month	Time	Predicted							Measured			
			AC	GB	SG	Total	%AC	%GB	%SG	AC	GB	SG	Total
131031	1/9/1990	104	0.137	0.018	0.035	0.19	72.21%	9.46%	18.32%	0.284	0.037	0.072	0.394
131031	3/4/1991	118	0.145	0.019	0.036	0.2	72.71%	9.31%	17.98%	0.315	0.04	0.078	0.433
131031	4/28/1992	131	0.153	0.019	0.037	0.209	73.23%	9.10%	17.67%	0.288	0.036	0.07	0.394
131031	4/4/1994	155	0.17	0.02	0.039	0.229	74.38%	8.72%	16.90%	0.366	0.043	0.083	0.492
131031	1/13/1996	176	0.183	0.021	0.04	0.244	75.09%	8.44%	16.47%	0.31	0.035	0.068	0.413
134111	3/20/1989	101	0.217	0.03	0.096	0.343	63.19%	8.80%	28.00%	0.174	0.024	0.077	0.276
134111	3/4/1991	125	0.242	0.032	0.103	0.377	64.23%	8.51%	27.26%	0.164	0.022	0.07	0.256
134111	4/27/1992	138	0.253	0.033	0.105	0.391	64.67%	8.37%	26.96%	0.166	0.021	0.069	0.256
134112	5/4/1989	144	0.203	0	0.078	0.281	72.15%	0.00%	27.85%	0.17	0	0.066	0.236
134112	2/10/1991	165	0.218	0	0.08	0.298	73.20%	0.00%	26.80%	0.173	0	0.063	0.236
134112	4/13/1992	179	0.226	0	0.081	0.307	73.71%	0.00%	26.29%	0.145	0	0.052	0.197
134112	2/24/1994	201	0.24	0	0.082	0.322	74.56%	0.00%	25.44%	0.176	0	0.06	0.236
134112	1/25/1996	224	0.254	0	0.083	0.338	75.34%	0.00%	24.66%	0.193	0	0.063	0.256
134112	4/23/1998	251	0.27	0	0.085	0.354	76.13%	0.00%	23.87%	0.255	0	0.08	0.335
134113	5/4/1989	144	0.236	0	0.106	0.342	69.10%	0.00%	30.90%	0.109	0	0.049	0.157
134113	2/10/1991	165	0.25	0	0.107	0.357	69.95%	0.00%	30.05%	0.096	0	0.041	0.138
134113	4/13/1992	179	0.258	0	0.108	0.367	70.44%	0.00%	29.56%	0.125	0	0.052	0.177
134113	2/24/1994	201	0.272	0	0.11	0.382	71.20%	0.00%	28.80%	0.126	0	0.051	0.177
134113	1/25/1996	224	0.285	0	0.111	0.397	71.94%	0.00%	28.06%	0.127	0	0.05	0.177
134113	4/23/1998	251	0.3	0	0.113	0.413	72.69%	0.00%	27.31%	0.129	0	0.048	0.177
134119	1/8/1990	140	0.358	0.009	0.023	0.39	91.75%	2.33%	5.93%	0.253	0.006	0.016	0.276
134119	3/4/1991	154	0.371	0.009	0.023	0.404	91.94%	2.27%	5.79%	0.253	0.006	0.016	0.276
134119	4/28/1992	167	0.375	0.009	0.023	0.408	92.00%	2.25%	5.75%	0.235	0.006	0.015	0.256
134119	4/7/1994	191	0.388	0.009	0.024	0.421	92.17%	2.20%	5.62%	0.218	0.005	0.013	0.236
161001	7/17/1989	192	0.238	0.086	0.058	0.382	62.34%	22.48%	15.18%	0.184	0.066	0.045	0.295
161001	8/2/1990	205	0.247	0.088	0.059	0.394	62.76%	22.31%	14.93%	0.124	0.044	0.029	0.197
161001	7/4/1991	216	0.251	0.089	0.059	0.398	62.88%	22.25%	14.87%	0.124	0.044	0.029	0.197
161001	8/25/1994	253	0.273	0.09	0.06	0.424	64.41%	21.35%	14.24%	0.152	0.05	0.034	0.236
161001	5/17/1995	262	0.273	0.091	0.061	0.425	64.41%	21.34%	14.26%	0.165	0.055	0.036	0.256
161001	7/9/1997	288	0.289	0.093	0.062	0.444	65.20%	20.93%	13.87%	0.193	0.062	0.041	0.295
161001	9/23/1998	302	0.299	0.093	0.062	0.454	65.92%	20.46%	13.62%	0.247	0.077	0.051	0.374
161009	9/20/1989	180	0.287	0.016	0.051	0.354	81.15%	4.48%	14.37%	0.351	0.019	0.062	0.433
161009	7/19/1990	190	0.291	0.016	0.051	0.358	81.28%	4.46%	14.26%	0.32	0.018	0.056	0.394
161009	7/26/1991	202	0.301	0.016	0.051	0.368	81.66%	4.37%	13.97%	0.321	0.017	0.055	0.394
161021	9/21/1989	48	0.249	0.016	0.058	0.323	77.00%	4.91%	18.09%	0.121	0.008	0.028	0.157
161021	7/21/1990	58	0.261	0.016	0.06	0.336	77.48%	4.81%	17.71%	0.137	0.009	0.031	0.177
161021	7/28/1991	70	0.274	0.017	0.061	0.352	77.99%	4.70%	17.31%	0.092	0.006	0.02	0.118
161021	9/12/1995	120	0.333	0.018	0.065	0.415	80.12%	4.23%	15.65%	0.126	0.007	0.025	0.157
161021	6/5/1996	129	0.334	0.018	0.065	0.417	80.09%	4.23%	15.67%	0.11	0.006	0.022	0.138
161021	7/29/1997	142	0.349	0.018	0.066	0.433	80.58%	4.13%	15.29%	0.143	0.007	0.027	0.177
169034	7/17/1989	10	0.077	0.019	0.032	0.128	59.96%	14.69%	25.36%	0.047	0.012	0.02	0.079
169034	8/2/1990	23	0.134	0.022	0.037	0.193	69.32%	11.59%	19.09%	0.109	0.018	0.03	0.157
169034	7/4/1991	34	0.143	0.023	0.039	0.205	69.86%	11.28%	18.86%	0.055	0.009	0.015	0.079
169034	5/17/1995	80	0.179	0.025	0.043	0.247	72.45%	10.23%	17.32%	0.114	0.016	0.027	0.157
169034	7/9/1997	106	0.199	0.026	0.044	0.27	73.85%	9.73%	16.41%	0.116	0.015	0.026	0.157
169034	9/24/1998	120	0.208	0.027	0.045	0.279	74.32%	9.57%	16.11%	0.176	0.023	0.038	0.236

Table C-10 (Cont'd) Permanent Deformation Simulation (β_{r2} = 1.0 and β_{r3} = 0.8) Data

Section	Month	Time	Predicted							Measured			
			AC	GB	SG	Total	%AC	%GB	%SG	AC	GB	SG	Total
201009	5/2/1989	53	0.091	0	0.05	0.141	64.55%	0.00%	35.45%	0.165	0	0.091	0.256
201009	12/10/1990	72	0.105	0	0.053	0.158	66.69%	0.00%	33.31%	0.184	0	0.092	0.276
201009	4/8/1993	100	0.116	0	0.055	0.17	67.80%	0.00%	32.20%	0.147	0	0.07	0.217
201009	4/23/1996	136	0.13	0	0.058	0.188	69.34%	0.00%	30.66%	0.068	0	0.03	0.098
251003	8/4/1989	180	0.12	0.036	0.028	0.183	65.28%	19.69%	15.03%	0.103	0.031	0.024	0.157
251003	9/6/1990	193	0.121	0.036	0.028	0.186	65.36%	19.65%	14.99%	0.154	0.046	0.035	0.236
251003	8/23/1991	204	0.124	0.037	0.028	0.189	65.67%	19.50%	14.83%	0.103	0.031	0.023	0.157
251003	9/30/1992	217	0.13	0.037	0.028	0.196	66.45%	19.08%	14.47%	0.131	0.038	0.028	0.197
251003	10/27/1995	254	0.136	0.038	0.029	0.203	66.97%	18.78%	14.24%	0.119	0.033	0.025	0.177
251003	10/23/1996	266	0.139	0.039	0.029	0.206	67.20%	18.65%	14.14%	0.119	0.033	0.025	0.177
251003	6/16/1998	286	0.145	0.039	0.029	0.213	67.89%	18.28%	13.82%	0.107	0.029	0.022	0.157
251004	8/4/1989	178	0.119	0.049	0.03	0.198	60.22%	24.80%	14.98%	0.213	0.088	0.053	0.354
251004	9/5/1990	191	0.124	0.05	0.03	0.203	60.72%	24.50%	14.78%	0.179	0.072	0.044	0.295
251004	8/22/1991	202	0.127	0.051	0.03	0.208	61.02%	24.31%	14.67%	0.204	0.081	0.049	0.335
251004	9/30/1992	215	0.132	0.051	0.031	0.215	61.62%	23.94%	14.44%	0.291	0.113	0.068	0.472
251004	10/29/1995	252	0.142	0.053	0.032	0.228	62.51%	23.40%	14.09%	0.258	0.097	0.058	0.413
251004	6/5/1997	272	0.148	0.054	0.033	0.235	62.92%	23.13%	13.95%	0.223	0.082	0.049	0.354
251004	6/15/1998	284	0.152	0.055	0.033	0.24	63.36%	22.87%	13.77%	0.237	0.086	0.051	0.374
261001	9/7/1989	217	0.131	0.056	0.056	0.243	53.69%	23.15%	23.16%	0.116	0.05	0.05	0.217
261001	7/21/1990	227	0.131	0.057	0.057	0.244	53.69%	23.12%	23.19%	0.137	0.059	0.059	0.256
261001	7/16/1991	239	0.133	0.057	0.057	0.248	53.91%	23.02%	23.07%	0.106	0.045	0.045	0.197
261001	6/9/1993	262	0.137	0.058	0.058	0.253	54.24%	22.87%	22.89%	0.139	0.059	0.059	0.256
261001	7/5/1996	299	0.143	0.059	0.059	0.261	54.88%	22.54%	22.59%	0.119	0.049	0.049	0.217
261004	10/21/1990	64	0.139	0.02	0.042	0.201	69.15%	9.90%	20.95%	0.123	0.018	0.037	0.177
261004	5/13/1993	95	0.145	0.021	0.044	0.209	69.07%	9.89%	21.03%	0.068	0.01	0.021	0.098
261004	7/7/1994	109	0.156	0.021	0.045	0.223	70.08%	9.62%	20.30%	0.083	0.011	0.024	0.118
261004	6/15/1995	120	0.158	0.022	0.046	0.225	70.09%	9.60%	20.31%	0.11	0.015	0.032	0.157
271018	6/22/1989	126	0.249	0.022	0.066	0.337	73.88%	6.61%	19.50%	0.291	0.026	0.077	0.394
271018	10/30/1990	142	0.263	0.023	0.067	0.353	74.66%	6.42%	18.92%	0.265	0.023	0.067	0.354
271018	6/2/1993	174	0.283	0.023	0.068	0.375	75.55%	6.19%	18.26%	0.208	0.017	0.05	0.276
271018	3/8/1994	183	0.294	0.023	0.069	0.386	76.14%	6.04%	17.82%	0.21	0.017	0.049	0.276
271087	6/9/1989	126	0.051	0	0.034	0.085	59.95%	0.00%	40.05%	0.118	0	0.079	0.197
271087	11/13/1990	143	0.054	0	0.035	0.088	60.76%	0.00%	39.24%	0.132	0	0.085	0.217
271087	5/11/1993	173	0.056	0	0.035	0.091	61.50%	0.00%	38.50%	0.073	0	0.045	0.118
271087	6/25/1996	210	0.06	0	0.036	0.096	62.48%	0.00%	37.52%	0.086	0	0.052	0.138
271087	8/3/1999	240	0.063	0	0.036	0.099	63.32%	0.00%	36.68%	0.1	0	0.058	0.157
291008	3/13/1989	35	0.101	0.007	0.062	0.169	59.57%	3.88%	36.54%	0.141	0.009	0.086	0.236
291008	11/7/1990	55	0.117	0.007	0.067	0.192	61.26%	3.73%	35.02%	0.181	0.011	0.103	0.295
291008	3/5/1993	85	0.131	0.008	0.071	0.21	62.41%	3.61%	33.98%	0.184	0.011	0.1	0.295
291008	4/17/1996	120	0.148	0.008	0.076	0.232	63.89%	3.47%	32.65%	0.151	0.008	0.077	0.236
307088	9/27/1989	100	0.253	0.092	0.093	0.438	57.80%	21.03%	21.17%	0.25	0.091	0.092	0.433
307088	7/29/1990	110	0.261	0.093	0.094	0.448	58.20%	20.83%	20.97%	0.229	0.082	0.083	0.394
307088	5/20/1991	120	0.265	0.094	0.095	0.455	58.33%	20.76%	20.92%	0.207	0.074	0.074	0.354
308129	10/3/1989	17	0.118	0.067	0.086	0.271	43.60%	24.60%	31.80%	0.154	0.087	0.113	0.354
308129	7/29/1990	26	0.127	0.081	0.094	0.302	42.17%	26.72%	31.11%	0.133	0.084	0.098	0.315
308129	7/30/1991	38	0.14	0.086	0.102	0.327	42.69%	26.18%	31.12%	0.101	0.062	0.074	0.236
308129	12/14/1993	67	0.171	0.09	0.112	0.373	45.75%	24.13%	30.12%	0.135	0.071	0.089	0.295

Table C-10 (Cont'd) Permanent Deformation Simulation (β_{r2} = 1.0 and β_{r3} = 0.8) Data

Section	Month	Time	Predicted							Measured			
			AC	GB	SG	Total	%AC	%GB	%SG	AC	GB	SG	Total
308129	3/17/1994	70	0.171	0.09	0.114	0.375	45.57%	24.13%	30.31%	0.144	0.076	0.095	0.315
308129	8/22/1994	75	0.18	0.096	0.116	0.391	45.98%	24.42%	29.60%	0.136	0.072	0.087	0.295
308129	10/31/1994	77	0.18	0.096	0.117	0.393	45.90%	24.43%	29.67%	0.145	0.077	0.093	0.315
308129	2/17/1995	81	0.18	0.096	0.118	0.394	45.77%	24.40%	29.83%	0.189	0.101	0.123	0.413
308129	5/18/1995	84	0.18	0.096	0.118	0.395	45.70%	24.39%	29.91%	0.153	0.082	0.1	0.335
308129	6/10/1996	97	0.189	0.098	0.121	0.408	46.44%	23.90%	29.66%	0.165	0.085	0.105	0.354
308129	10/28/1996	101	0.195	0.098	0.122	0.416	47.01%	23.59%	29.40%	0.157	0.079	0.098	0.335
308129	1/23/1997	104	0.195	0.098	0.123	0.416	46.96%	23.60%	29.45%	0.185	0.093	0.116	0.394
308129	3/25/1997	106	0.195	0.098	0.123	0.416	46.92%	23.58%	29.51%	0.157	0.079	0.099	0.335
308129	8/11/1997	111	0.206	0.098	0.124	0.428	48.06%	23.01%	28.93%	0.18	0.086	0.108	0.374
308129	10/1/1997	113	0.207	0.099	0.124	0.429	48.18%	22.95%	28.88%	0.18	0.086	0.108	0.374
321020	8/29/1989	63	0.194	0.016	0.054	0.263	73.67%	6.02%	20.31%	0.232	0.019	0.064	0.315
321020	8/22/1990	75	0.202	0.016	0.055	0.273	74.08%	5.90%	20.03%	0.248	0.02	0.067	0.335
321020	7/23/1991	86	0.208	0.016	0.055	0.28	74.38%	5.82%	19.80%	0.234	0.018	0.062	0.315
321020	9/14/1994	124	0.245	0.017	0.058	0.32	76.50%	5.37%	18.12%	0.211	0.015	0.05	0.276
321020	4/25/1995	131	0.245	0.017	0.058	0.32	76.46%	5.37%	18.17%	0.271	0.019	0.064	0.354
321020	6/5/1997	157	0.26	0.018	0.06	0.338	77.09%	5.23%	17.68%	0.243	0.016	0.056	0.315
321020	6/9/1998	169	0.266	0.018	0.06	0.344	77.31%	5.17%	17.51%	0.259	0.017	0.059	0.335
321020	4/13/1999	175	0.276	0.018	0.061	0.354	77.84%	5.08%	17.08%	0.291	0.019	0.064	0.374
341003	9/11/1990	195	0.18	0.019	0.035	0.233	77.17%	8.00%	14.82%	0.623	0.065	0.12	0.807
341003	8/15/1991	206	0.184	0.019	0.035	0.238	77.37%	7.95%	14.68%	0.548	0.056	0.104	0.709
341003	9/28/1992	219	0.188	0.019	0.035	0.242	77.49%	7.90%	14.61%	0.641	0.065	0.121	0.827
341011	4/17/1999	214	0.386	0.02	0.079	0.485	79.56%	4.07%	16.37%	0.235	0.012	0.048	0.295
341011	4/18/1999	227	0.392	0.02	0.08	0.492	79.63%	4.05%	16.31%	0.298	0.015	0.061	0.374
341011	4/19/1999	244	0.404	0.02	0.081	0.506	79.95%	3.96%	16.09%	0.236	0.012	0.048	0.295
341011	4/20/1999	254	0.418	0.02	0.082	0.52	80.30%	3.90%	15.80%	0.3	0.015	0.059	0.374
341011	4/21/1999	287	0.445	0.021	0.085	0.551	80.86%	3.78%	15.36%	0.318	0.015	0.06	0.394
341011	4/22/1999	307	0.467	0.021	0.086	0.574	81.35%	3.69%	14.95%	0.272	0.012	0.05	0.335
341031	10/5/1989	194	0.291	0.047	0.074	0.413	70.56%	11.42%	18.02%	0.347	0.056	0.089	0.492
341031	9/12/1990	205	0.301	0.048	0.075	0.424	70.91%	11.29%	17.79%	0.335	0.053	0.084	0.472
341031	4/6/1992	224	0.317	0.049	0.077	0.443	71.55%	11.02%	17.43%	0.338	0.052	0.082	0.472
341031	2/24/1993	234	0.326	0.049	0.078	0.453	71.89%	10.92%	17.19%	0.325	0.049	0.078	0.453
341031	10/26/1995	266	0.356	0.051	0.081	0.488	72.93%	10.53%	16.54%	0.416	0.06	0.094	0.571
341031	11/4/1995	267	0.356	0.051	0.081	0.488	72.93%	10.53%	16.54%	0.388	0.056	0.088	0.531
341033	10/5/1989	181	0.212	0.035	0.046	0.292	72.48%	11.81%	15.71%	0.2	0.033	0.043	0.276
341033	9/12/1990	192	0.214	0.035	0.046	0.295	72.56%	11.77%	15.67%	0.257	0.042	0.056	0.354
341033	4/5/1992	211	0.223	0.035	0.047	0.306	73.08%	11.56%	15.36%	0.201	0.032	0.042	0.276
341033	2/24/1993	221	0.228	0.036	0.047	0.311	73.36%	11.43%	15.21%	0.246	0.038	0.051	0.335
341033	11/3/1995	254	0.24	0.036	0.048	0.325	73.95%	11.19%	14.86%	0.262	0.04	0.053	0.354
341033	7/23/1997	274	0.243	0.037	0.049	0.328	74.03%	11.14%	14.83%	0.219	0.033	0.044	0.295
341034	10/5/1989	48	0.139	0	0.047	0.186	74.54%	0.00%	25.46%	0.103	0	0.035	0.138
341034	9/12/1990	59	0.151	0	0.049	0.2	75.72%	0.00%	24.28%	0.209	0	0.067	0.276
341034	4/6/1992	78	0.161	0	0.05	0.21	76.39%	0.00%	23.61%	0.135	0	0.042	0.177
341034	2/24/1993	88	0.17	0	0.05	0.22	77.06%	0.00%	22.94%	0.182	0	0.054	0.236
341034	11/4/1995	121	0.195	0	0.053	0.247	78.72%	0.00%	21.28%	0.201	0	0.054	0.256
341034	7/30/1997	141	0.206	0	0.054	0.26	79.37%	0.00%	20.63%	0.141	0	0.037	0.177

Table C-10 (Cont'd) Permanent Deformation Simulation (β_{r2} = 1.0 and β_{r3} = 0.8) Data

Section	Month	Time	Predicted							Measured			
			AC	GB	SG	Total	%AC	%GB	%SG	AC	GB	SG	Total
350101	5/1/1997	19	0.185	0.034	0.116	0.334	55.30%	10.10%	34.61%	0.109	0.02	0.068	0.197
350101	3/19/1999	38	0.249	0.038	0.13	0.417	59.76%	9.12%	31.13%	0.141	0.022	0.074	0.236
350102	5/1/1997	19	0.189	0.057	0.139	0.385	49.10%	14.72%	36.18%	0.097	0.029	0.071	0.197
350102	3/19/1999	38	0.259	0.063	0.159	0.482	53.72%	13.17%	33.11%	0.127	0.031	0.078	0.236
350103	5/1/1997	19	0.104	0	0.115	0.219	47.44%	0.00%	52.56%	0.093	0	0.103	0.197
350103	3/19/1999	38	0.139	0	0.135	0.274	50.82%	0.00%	49.18%	0.14	0	0.136	0.276
350104	5/1/1997	19	0.081	0	0.076	0.157	51.57%	0.00%	48.43%	0.122	0	0.114	0.236
350104	3/19/1999	38	0.109	0	0.09	0.198	54.73%	0.00%	45.27%	0.151	0	0.125	0.276
350105	5/2/1997	19	0.155	0.012	0.131	0.298	51.99%	4.15%	43.86%	0.123	0.01	0.104	0.236
350105	3/22/1999	38	0.206	0.014	0.152	0.372	55.45%	3.75%	40.80%	0.131	0.009	0.096	0.236
350106	5/2/1996	19	0.081	0.005	0.088	0.174	46.70%	2.80%	50.50%	0.092	0.006	0.099	0.197
350106	3/22/1999	38	0.107	0.006	0.103	0.215	49.61%	2.58%	47.81%	0.117	0.006	0.113	0.236
351005	10/31/1989	73	0.182	0.019	0.091	0.291	62.42%	6.50%	31.09%	0.295	0.031	0.147	0.472
351005	8/21/1991	95	0.192	0.019	0.094	0.306	62.83%	6.30%	30.87%	0.297	0.03	0.146	0.472
351005	10/24/1992	109	0.203	0.02	0.097	0.319	63.44%	6.13%	30.43%	0.262	0.025	0.126	0.413
351005	3/18/1995	138	0.238	0.02	0.101	0.36	66.24%	5.70%	28.06%	0.378	0.033	0.16	0.571
351005	3/16/1999	183	0.275	0.021	0.106	0.403	68.37%	5.28%	26.34%	0.417	0.032	0.161	0.61
351022	10/31/1989	37	0.137	0.027	0.082	0.246	55.70%	11.04%	33.26%	0.099	0.02	0.059	0.177
351022	8/22/1991	59	0.192	0.03	0.089	0.311	61.69%	9.59%	28.72%	0.085	0.013	0.04	0.138
351022	10/24/1992	73	0.2	0.03	0.092	0.323	61.98%	9.44%	28.58%	0.122	0.019	0.056	0.197
351022	3/18/1995	102	0.228	0.032	0.098	0.357	63.80%	8.88%	27.32%	0.138	0.019	0.059	0.217
351022	3/17/1999	147	0.283	0.034	0.104	0.422	67.21%	8.03%	24.76%	0.106	0.013	0.039	0.157
351112	12/5/1989	67	0.335	0.025	0.056	0.417	80.46%	6.03%	13.51%	0.127	0.009	0.021	0.157
351112	1/22/1991	80	0.342	0.025	0.057	0.425	80.53%	6.00%	13.47%	0.143	0.011	0.024	0.177
351112	9/27/1991	88	0.35	0.026	0.058	0.434	80.74%	5.92%	13.33%	0.111	0.008	0.018	0.138
351112	1/27/1993	104	0.361	0.026	0.059	0.446	81.00%	5.84%	13.16%	0.096	0.007	0.016	0.118
351112	3/15/1995	130	0.388	0.027	0.06	0.474	81.75%	5.61%	12.64%	0.161	0.011	0.025	0.197
351112	9/9/1997	160	0.406	0.027	0.061	0.495	82.13%	5.49%	12.38%	0.113	0.008	0.017	0.138
351112	3/15/1999	175	0.417	0.027	0.062	0.506	82.39%	5.42%	12.19%	0.13	0.009	0.019	0.157
371006	10/13/1989	88	0.386	0.025	0.097	0.509	75.97%	4.97%	19.06%	0.06	0.004	0.015	0.079
371006	3/19/1991	105	0.404	0.026	0.099	0.528	76.46%	4.85%	18.70%	0.06	0.004	0.015	0.079
371006	10/11/1992	124	0.441	0.026	0.101	0.569	77.54%	4.64%	17.82%	0.137	0.008	0.032	0.177
371006	4/18/1994	142	0.455	0.027	0.103	0.584	77.81%	4.57%	17.62%	0.077	0.005	0.017	0.098
371006	9/20/1994	147	0.464	0.027	0.104	0.594	78.03%	4.53%	17.44%	0.092	0.005	0.021	0.118
371024	11/3/1989	109	0.146	0.04	0.074	0.26	56.40%	15.22%	28.38%	0.2	0.054	0.101	0.354
371024	3/9/1991	125	0.151	0.04	0.075	0.266	56.61%	15.02%	28.37%	0.245	0.065	0.123	0.433
371024	4/10/1992	138	0.156	0.041	0.077	0.273	57.03%	14.83%	28.14%	0.202	0.053	0.1	0.354
371802	10/13/1989	49	0.162	0.064	0.188	0.414	39.00%	15.52%	45.48%	0.138	0.055	0.161	0.354
371802	3/18/1991	66	0.177	0.067	0.199	0.443	39.97%	15.06%	44.97%	0.126	0.047	0.142	0.315
371802	10/10/1992	85	0.195	0.07	0.21	0.475	41.01%	14.69%	44.30%	0.145	0.052	0.157	0.354
371802	4/15/1994	103	0.205	0.071	0.218	0.494	41.49%	14.40%	44.11%	0.18	0.062	0.191	0.433
371802	7/18/1995	118	0.218	0.073	0.224	0.516	42.33%	14.16%	43.51%	0.2	0.067	0.206	0.472
371802	2/9/1996	125	0.222	0.074	0.227	0.522	42.49%	14.08%	43.43%	0.217	0.072	0.222	0.512
371802	4/2/1996	127	0.222	0.074	0.227	0.523	42.47%	14.05%	43.48%	0.217	0.072	0.223	0.512
371817	10/15/1989	71	0.183	0.039	0.051	0.274	66.94%	14.27%	18.79%	0.264	0.056	0.074	0.394
371817	3/18/1991	88	0.191	0.04	0.053	0.284	67.19%	14.10%	18.71%	0.172	0.036	0.048	0.256
371817	10/18/1992	107	0.216	0.042	0.055	0.313	69.04%	13.36%	17.60%	0.245	0.047	0.062	0.354

Table C-10 (Cont'd) Permanent Deformation Simulation (β_{r2} = 1.0 and β_{r3} = 0.8) Data

Section	Month	Time	Predicted							Measured			
			AC	GB	SG	Total	%AC	%GB	%SG	AC	GB	SG	Total
371992	10/15/1992	33	0.225	0.102	0.052	0.379	59.30%	26.87%	13.83%	0.14	0.063	0.033	0.236
371992	4/20/1994	51	0.261	0.107	0.056	0.424	61.52%	25.27%	13.21%	0.024	0.01	0.005	0.039
371992	2/6/1996	73	0.304	0.113	0.06	0.476	63.80%	23.67%	12.52%	0.1	0.037	0.02	0.157
371992	4/22/1998	99	0.348	0.118	0.063	0.528	65.78%	22.29%	11.93%	0.155	0.053	0.028	0.236
404087	1/17/1990	43	0.14	0.023	0.072	0.236	59.54%	9.74%	30.72%	0.363	0.059	0.187	0.61
404087	10/13/1991	64	0.162	0.025	0.081	0.267	60.50%	9.32%	30.18%	0.262	0.04	0.131	0.433
404087	2/8/1993	80	0.17	0.026	0.085	0.281	60.68%	9.15%	30.17%	0.227	0.034	0.113	0.374
404087	2/9/1995	104	0.185	0.027	0.091	0.303	61.09%	8.89%	30.02%	0.349	0.051	0.171	0.571
404163	1/23/1990	34	0.121	0	0.071	0.192	63.03%	0.00%	36.97%	0.285	0	0.167	0.453
404163	3/17/1991	48	0.132	0	0.074	0.206	63.98%	0.00%	36.02%	0.239	0	0.135	0.374
404163	10/28/1991	55	0.138	0	0.076	0.214	64.39%	0.00%	35.61%	0.19	0	0.105	0.295
404163	3/10/1993	72	0.15	0	0.079	0.229	65.50%	0.00%	34.50%	0.181	0	0.095	0.276
404163	4/22/1996	109	0.165	0	0.083	0.249	66.43%	0.00%	33.57%	0.209	0	0.106	0.315
404163	8/20/1997	125	0.179	0	0.086	0.265	67.59%	0.00%	32.41%	0.266	0	0.128	0.394
404163	1/11/1999	141	0.183	0	0.087	0.27	67.79%	0.00%	32.21%	0.307	0	0.146	0.453
421599	7/18/1989	24	0.093	0.018	0.071	0.182	51.12%	9.91%	38.96%	0.091	0.018	0.069	0.177
421599	9/27/1990	38	0.102	0.018	0.075	0.195	52.06%	9.34%	38.61%	0.113	0.02	0.084	0.217
421599	8/7/1991	49	0.109	0.018	0.078	0.205	53.08%	8.90%	38.02%	0.104	0.018	0.075	0.197
421599	3/1/1993	68	0.12	0.018	0.081	0.219	54.57%	8.41%	37.02%	0.172	0.026	0.117	0.315
421599	6/21/1995	95	0.136	0.019	0.086	0.24	56.63%	7.78%	35.59%	0.156	0.021	0.098	0.276
421599	7/19/1996	108	0.145	0.019	0.087	0.251	57.68%	7.50%	34.82%	0.159	0.021	0.096	0.276
421599	3/26/1998	128	0.157	0.019	0.09	0.265	59.06%	7.17%	33.77%	0.163	0.02	0.093	0.276
451011	4/11/1989	34	0.373	0.05	0.058	0.481	77.53%	10.35%	12.11%	0.259	0.035	0.041	0.335
451011	3/5/1991	57	0.424	0.052	0.061	0.538	78.91%	9.71%	11.39%	0.388	0.048	0.056	0.492
451011	10/24/1992	76	0.468	0.054	0.063	0.585	80.01%	9.22%	10.78%	0.504	0.058	0.068	0.63
451011	1/27/1996	115	0.521	0.056	0.065	0.642	81.13%	8.69%	10.17%	0.543	0.058	0.068	0.669
451011	2/11/1999	150	0.56	0.057	0.067	0.684	81.88%	8.34%	9.78%	0.58	0.059	0.069	0.709
473104	11/1/1989	42	0.017	0.04	0.06	0.117	14.67%	34.38%	50.96%	0.04	0.095	0.14	0.276
473104	5/6/1991	60	0.018	0.043	0.066	0.126	14.31%	33.86%	51.83%	0.045	0.107	0.163	0.315
473104	10/26/1992	77	0.02	0.045	0.07	0.136	14.97%	33.08%	51.95%	0.053	0.117	0.184	0.354
473104	11/30/1995	114	0.023	0.049	0.08	0.153	15.04%	32.44%	52.52%	0.095	0.204	0.331	0.63
480001	4/10/1989	1	0.044	0.057	0.056	0.157	27.74%	36.41%	35.85%	0.066	0.086	0.085	0.236
480001	10/11/1990	19	0.219	0.1	0.106	0.425	51.50%	23.43%	25.07%	0.142	0.065	0.069	0.276
480001	3/11/1992	36	0.262	0.107	0.119	0.489	53.70%	21.88%	24.42%	0.169	0.069	0.077	0.315
480001	2/17/1993	47	0.297	0.111	0.126	0.534	55.66%	20.82%	23.52%	0.11	0.041	0.046	0.197
480001	2/20/1995	71	0.331	0.117	0.136	0.584	56.61%	20.09%	23.30%	0.178	0.063	0.073	0.315
480001	3/19/1998	108	0.395	0.125	0.149	0.669	59.09%	18.69%	22.22%	0.093	0.029	0.035	0.157
481060	6/18/1990	52	0.226	0.042	0.058	0.327	69.28%	12.86%	17.85%	0.286	0.053	0.074	0.413
481060	2/14/1991	60	0.237	0.043	0.06	0.339	69.84%	12.60%	17.56%	0.234	0.042	0.059	0.335
481060	3/18/1992	73	0.248	0.044	0.061	0.353	70.28%	12.34%	17.38%	0.166	0.029	0.041	0.236
481060	2/23/1993	84	0.261	0.044	0.063	0.368	70.83%	12.06%	17.10%	0.153	0.026	0.037	0.217
481060	2/23/1995	108	0.28	0.046	0.066	0.391	71.56%	11.67%	16.77%	0.268	0.044	0.063	0.374
481060	1/5/1999	154	0.317	0.048	0.069	0.435	73.02%	11.00%	15.98%	0.287	0.043	0.063	0.394
481077	4/25/1989	88	0.321	0.028	0.06	0.41	78.40%	6.85%	14.75%	0.417	0.036	0.078	0.531
481077	10/13/1991	118	0.355	0.029	0.062	0.446	79.49%	6.52%	13.99%	0.485	0.04	0.085	0.61
481077	10/12/1992	130	0.361	0.029	0.063	0.453	79.57%	6.49%	13.94%	0.486	0.04	0.085	0.61

Table C-10 (Cont'd) Permanent Deformation Simulation (β_{r2} = 1.0 and β_{r3} = 0.8) Data

Section	Month	Time	Predicted							Measured			
			AC	GB	SG	Total	%AC	%GB	%SG	AC	GB	SG	Total
481077	3/10/1995	159	0.382	0.03	0.064	0.477	80.19%	6.29%	13.52%	0.568	0.045	0.096	0.709
481077	3/26/1998	195	0.406	0.031	0.066	0.503	80.75%	6.11%	13.14%	0.556	0.042	0.091	0.689
481109	1/4/1990	68	0.343	0	0.129	0.473	72.62%	0.00%	27.38%	0.229	0	0.086	0.315
481109	9/21/1990	76	0.358	0	0.132	0.49	73.03%	0.00%	26.97%	0.23	0	0.085	0.315
481109	3/10/1992	94	0.373	0	0.136	0.509	73.31%	0.00%	26.69%	0.188	0	0.068	0.256
481109	2/12/1993	105	0.389	0	0.138	0.528	73.78%	0.00%	26.22%	0.189	0	0.067	0.256
481109	2/16/1995	129	0.413	0	0.143	0.555	74.31%	0.00%	25.69%	0.293	0	0.101	0.394
481130	4/11/1989	201	0.493	0.122	0.122	0.737	66.93%	16.58%	16.50%	0.356	0.088	0.088	0.531
481130	10/12/1990	219	0.513	0.124	0.124	0.762	67.39%	16.31%	16.29%	0.464	0.112	0.112	0.689
481130	3/12/1992	236	0.521	0.125	0.126	0.773	67.47%	16.22%	16.30%	0.465	0.112	0.112	0.689
481169	3/4/1990	212	0.104	0.083	0.051	0.238	43.73%	34.90%	21.37%	0.138	0.11	0.067	0.315
481169	9/18/1990	218	0.105	0.083	0.051	0.24	43.99%	34.73%	21.28%	0.139	0.109	0.067	0.315
481169	3/7/1991	224	0.105	0.083	0.051	0.24	43.95%	34.75%	21.30%	0.138	0.109	0.067	0.315
481169	1/30/1992	234	0.108	0.084	0.051	0.243	44.29%	34.54%	21.17%	0.148	0.116	0.071	0.335
481169	2/27/1993	247	0.109	0.084	0.052	0.246	44.53%	34.39%	21.08%	0.14	0.108	0.066	0.315
481169	3/3/1995	272	0.112	0.085	0.052	0.25	44.95%	34.12%	20.93%	0.212	0.161	0.099	0.472
481174	10/17/1990	186	0.475	0.054	0.114	0.643	73.88%	8.36%	17.75%	0.291	0.033	0.07	0.394
481174	2/14/1991	190	0.475	0.054	0.114	0.644	73.85%	8.36%	17.79%	0.32	0.036	0.077	0.433
481174	3/16/1992	203	0.483	0.054	0.116	0.653	73.96%	8.29%	17.75%	0.233	0.026	0.056	0.315
481174	2/18/1993	214	0.488	0.054	0.117	0.66	74.02%	8.26%	17.72%	0.262	0.029	0.063	0.354
481174	2/21/1995	238	0.505	0.055	0.119	0.679	74.33%	8.12%	17.55%	0.497	0.054	0.117	0.669
481174	3/20/1998	275	0.522	0.056	0.122	0.7	74.54%	8.00%	17.46%	0.499	0.054	0.117	0.669
481178	4/10/1989	10	0.184	0.022	0.061	0.267	69.09%	8.16%	22.75%	0.122	0.014	0.04	0.177
481178	2/22/1991	32	0.274	0.027	0.078	0.379	72.34%	6.99%	20.67%	0.1	0.01	0.028	0.138
481178	3/10/1992	45	0.305	0.028	0.084	0.417	73.28%	6.63%	20.09%	0.101	0.009	0.028	0.138
481178	2/16/1993	56	0.322	0.028	0.088	0.439	73.53%	6.48%	19.99%	0.116	0.01	0.031	0.157
481178	2/17/1995	80	0.364	0.03	0.095	0.489	74.43%	6.12%	19.45%	0.176	0.014	0.046	0.236
481183	12/6/1989	179	0.29	0.058	0.14	0.488	59.46%	11.90%	28.64%	0.152	0.03	0.073	0.256
481183	9/15/1990	188	0.299	0.059	0.142	0.5	59.73%	11.82%	28.46%	0.176	0.035	0.084	0.295
483749	10/17/1990	116	0.369	0.168	0.123	0.661	55.89%	25.47%	18.64%	0.143	0.065	0.048	0.256
483749	2/14/1991	120	0.369	0.169	0.124	0.662	55.77%	25.51%	18.72%	0.121	0.055	0.041	0.217
483749	3/16/1992	133	0.376	0.172	0.126	0.674	55.76%	25.49%	18.75%	0.11	0.05	0.037	0.197
483749	2/21/1993	144	0.383	0.174	0.128	0.685	55.88%	25.40%	18.72%	0.121	0.055	0.041	0.217
483749	2/21/1995	168	0.397	0.178	0.132	0.707	56.11%	25.23%	18.66%	0.188	0.084	0.062	0.335
483749	3/28/1997	193	0.407	0.183	0.135	0.725	56.17%	25.17%	18.66%	0.254	0.114	0.084	0.453
489005	10/14/1990	50	0.074	0.14	0.168	0.382	19.40%	36.61%	43.99%	0.065	0.123	0.147	0.335
489005	3/12/1992	67	0.08	0.145	0.178	0.402	19.79%	36.04%	44.17%	0.027	0.05	0.061	0.138
489005	2/17/1993	78	0.082	0.148	0.183	0.413	19.95%	35.80%	44.24%	0.027	0.049	0.061	0.138
489005	2/20/1995	102	0.088	0.153	0.192	0.433	20.32%	35.30%	44.39%	0.048	0.083	0.105	0.236
489005	7/10/1998	143	0.096	0.16	0.205	0.461	20.84%	34.75%	44.41%	0.033	0.055	0.07	0.157
501002	8/9/1989	58	0.107	0.029	0.036	0.172	62.07%	16.76%	21.17%	0.183	0.049	0.062	0.295
501002	8/8/1990	70	0.116	0.03	0.038	0.183	63.32%	16.20%	20.48%	0.237	0.061	0.077	0.374
501002	9/4/1991	83	0.119	0.03	0.039	0.188	63.34%	16.11%	20.55%	0.2	0.051	0.065	0.315
501002	4/27/1993	102	0.124	0.031	0.04	0.195	63.77%	15.85%	20.38%	0.239	0.059	0.076	0.374
501002	5/25/1994	115	0.129	0.032	0.041	0.202	64.19%	15.67%	20.14%	0.24	0.059	0.075	0.374
501002	8/17/1994	118	0.133	0.032	0.041	0.206	64.62%	15.52%	19.86%	0.242	0.058	0.074	0.374

Table C-10 (Cont'd) Permanent Deformation Simulation (β_{r2} = 1.0 and β_{r3} = 0.8) Data

Section	Month	Time	Predicted							Measured			
			AC	GB	SG	Total	%AC	%GB	%SG	AC	GB	SG	Total
501002	4/27/1995	126	0.133	0.032	0.041	0.206	64.51%	15.52%	19.96%	0.254	0.061	0.079	0.394
501002	10/12/1995	132	0.14	0.033	0.042	0.214	65.35%	15.22%	19.43%	0.283	0.066	0.084	0.433
501002	10/17/1996	144	0.142	0.033	0.042	0.217	65.41%	15.15%	19.45%	0.232	0.054	0.069	0.354
501002	5/15/1997	151	0.142	0.033	0.042	0.217	65.33%	15.16%	19.51%	0.283	0.066	0.085	0.433
501002	10/23/1997	156	0.146	0.033	0.043	0.223	65.82%	14.96%	19.22%	0.298	0.068	0.087	0.453
501002	6/6/1998	164	0.148	0.033	0.043	0.224	65.91%	14.90%	19.19%	0.285	0.065	0.083	0.433
501004	8/9/1989	58	0.075	0.03	0.041	0.146	51.19%	20.92%	27.89%	0.081	0.033	0.044	0.157
501004	8/7/1990	70	0.083	0.031	0.042	0.156	53.42%	19.89%	26.69%	0.137	0.051	0.068	0.256
501004	9/20/1991	83	0.092	0.032	0.043	0.167	55.16%	19.09%	25.75%	0.109	0.038	0.051	0.197
501004	4/27/1993	102	0.102	0.033	0.044	0.179	56.99%	18.18%	24.83%	0.146	0.047	0.064	0.256
501004	10/12/1995	132	0.119	0.034	0.047	0.2	59.65%	16.87%	23.48%	0.141	0.04	0.055	0.236
501004	11/4/1997	157	0.133	0.035	0.049	0.217	61.45%	16.01%	22.54%	0.157	0.041	0.058	0.256
511002	10/15/1989	121	0.211	0.043	0.072	0.325	64.77%	13.10%	22.13%	0.255	0.052	0.087	0.394
511023	10/12/1989	107	0.361	0.042	0.096	0.5	72.32%	8.48%	19.20%	0.413	0.048	0.11	0.571
511023	3/20/1991	124	0.376	0.043	0.097	0.516	72.84%	8.30%	18.86%	0.402	0.046	0.104	0.551
511023	10/10/1992	143	0.4	0.044	0.099	0.543	73.68%	8.05%	18.27%	0.435	0.048	0.108	0.591
511023	12/7/1993	157	0.415	0.044	0.1	0.56	74.19%	7.89%	17.92%	0.453	0.048	0.109	0.61
511023	9/18/1995	178	0.436	0.045	0.102	0.583	74.81%	7.69%	17.50%	0.412	0.042	0.096	0.551
511023	2/9/1996	183	0.436	0.045	0.102	0.583	74.80%	7.69%	17.51%	0.501	0.051	0.117	0.669
511023	3/24/1997	196	0.443	0.045	0.103	0.59	74.97%	7.62%	17.41%	0.443	0.045	0.103	0.591
512021	10/15/1989	54	0.163	0.012	0.07	0.245	66.65%	4.81%	28.54%	0.262	0.019	0.112	0.394
512021	3/11/1991	71	0.177	0.012	0.072	0.261	67.80%	4.69%	27.52%	0.294	0.02	0.119	0.433
512021	10/20/1992	90	0.196	0.013	0.075	0.284	69.04%	4.47%	26.49%	0.367	0.024	0.141	0.531
531008	7/17/1989	129	0.228	0.051	0.061	0.341	67.06%	14.99%	17.95%	0.515	0.115	0.138	0.768
531008	7/17/1989	142	0.242	0.052	0.062	0.356	68.00%	14.60%	17.41%	0.509	0.109	0.13	0.748
531008	8/2/1990	151	0.243	0.052	0.062	0.357	67.95%	14.61%	17.44%	0.522	0.112	0.134	0.768
531008	8/2/1990	153	0.245	0.052	0.063	0.36	68.11%	14.53%	17.36%	0.563	0.12	0.144	0.827
531008	5/28/1991	188	0.258	0.054	0.064	0.375	68.67%	14.27%	17.06%	0.743	0.154	0.185	1.083
531801	7/17/1989	190	0.106	0.006	0.04	0.153	69.43%	4.22%	26.36%	0.137	0.008	0.052	0.197
531801	8/9/1990	203	0.11	0.007	0.041	0.157	69.83%	4.18%	25.99%	0.124	0.007	0.046	0.177
531801	6/5/1991	213	0.111	0.007	0.041	0.158	69.93%	4.15%	25.93%	0.151	0.009	0.056	0.217
531801	6/22/1994	249	0.12	0.007	0.042	0.169	71.02%	4.02%	24.96%	0.112	0.006	0.039	0.157
531801	5/8/1995	260	0.122	0.007	0.043	0.171	71.14%	3.97%	24.89%	0.112	0.006	0.039	0.157
531801	10/31/1995	265	0.125	0.007	0.043	0.175	71.54%	3.95%	24.52%	0.127	0.007	0.043	0.177
531801	3/27/1997	282	0.128	0.007	0.043	0.178	71.78%	3.94%	24.28%	0.141	0.008	0.048	0.197
561007	9/26/1989	111	0.189	0.026	0.064	0.28	67.77%	9.32%	22.92%	0.307	0.042	0.104	0.453
561007	7/22/1990	121	0.191	0.026	0.065	0.282	67.70%	9.31%	22.98%	0.267	0.037	0.09	0.394
561007	5/13/1991	131	0.192	0.027	0.066	0.284	67.61%	9.33%	23.06%	0.253	0.035	0.086	0.374
561007	8/3/1991	134	0.202	0.027	0.066	0.295	68.59%	9.10%	22.31%	0.216	0.029	0.07	0.315
561007	12/9/1993	162	0.215	0.028	0.068	0.31	69.27%	8.88%	21.85%	0.191	0.024	0.06	0.276
561007	3/16/1994	165	0.215	0.028	0.068	0.31	69.24%	8.87%	21.89%	0.191	0.024	0.06	0.276
561007	4/19/1994	166	0.215	0.028	0.068	0.31	69.22%	8.87%	21.91%	0.204	0.026	0.065	0.295
561007	8/19/1994	170	0.217	0.028	0.068	0.313	69.33%	8.86%	21.81%	0.177	0.023	0.056	0.256
561007	2/16/1995	176	0.217	0.028	0.069	0.313	69.25%	8.85%	21.89%	0.191	0.024	0.06	0.276
561007	5/17/1995	179	0.217	0.028	0.069	0.314	69.21%	8.88%	21.91%	0.177	0.023	0.056	0.256
561007	9/8/1995	183	0.219	0.028	0.069	0.316	69.34%	8.85%	21.81%	0.191	0.024	0.06	0.276
561007	6/11/1996	192	0.22	0.028	0.069	0.317	69.29%	8.85%	21.86%	0.15	0.019	0.047	0.217

Table C-10 (Cont'd) Permanent Deformation Simulation (β_{r2} = 1.0 and β_{r3} = 0.8) Data

Section	Month	Time	Predicted							Measured			
			AC	GB	SG	Total	%AC	%GB	%SG	AC	GB	SG	Total
561007	10/24/1996	196	0.227	0.028	0.07	0.325	69.87%	8.71%	21.42%	0.193	0.024	0.059	0.276
561007	11/19/1996	197	0.227	0.028	0.07	0.325	69.85%	8.71%	21.44%	0.193	0.024	0.059	0.276
561007	3/10/1997	201	0.227	0.028	0.07	0.325	69.82%	8.70%	21.48%	0.206	0.026	0.063	0.295
561007	3/24/1997	202	0.227	0.028	0.07	0.325	69.80%	8.70%	21.50%	0.192	0.024	0.059	0.276
561007	8/7/1997	206	0.236	0.029	0.07	0.335	70.49%	8.53%	20.98%	0.194	0.023	0.058	0.276
561007	9/30/1997	207	0.236	0.029	0.07	0.335	70.49%	8.55%	20.96%	0.194	0.024	0.058	0.276
841684	8/29/1990	144	0.21	0.059	0.046	0.315	66.63%	18.78%	14.59%	0.367	0.103	0.08	0.551
841684	8/28/1991	156	0.216	0.06	0.046	0.322	67.02%	18.56%	14.42%	0.369	0.102	0.079	0.551
841684	5/3/1993	177	0.221	0.061	0.047	0.329	67.19%	18.44%	14.37%	0.436	0.12	0.093	0.65
841684	10/24/1995	206	0.238	0.062	0.048	0.348	68.31%	17.81%	13.88%	0.484	0.126	0.098	0.709

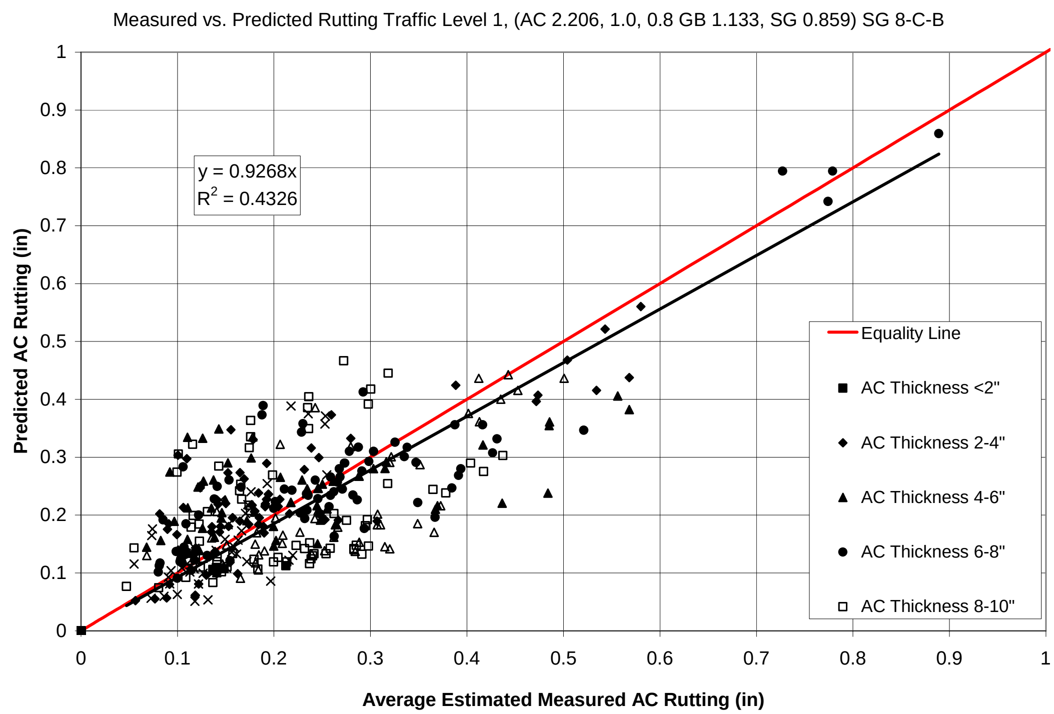


Figure C-110 Asphalt Concrete Layers Rut Depth (β_{r2} = 1.0 and β_{r3} = 0.8)

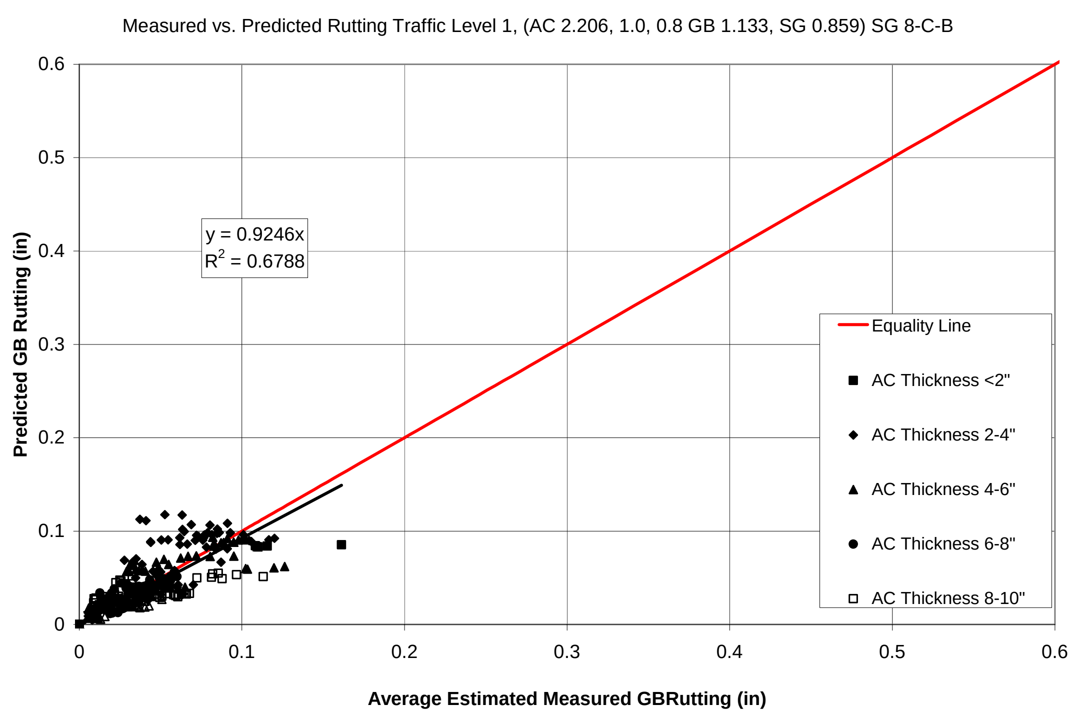


Figure C-111 Granular Base Layers Rut Depth (β_{r2} = 1.0 and β_{r3} = 0.8)

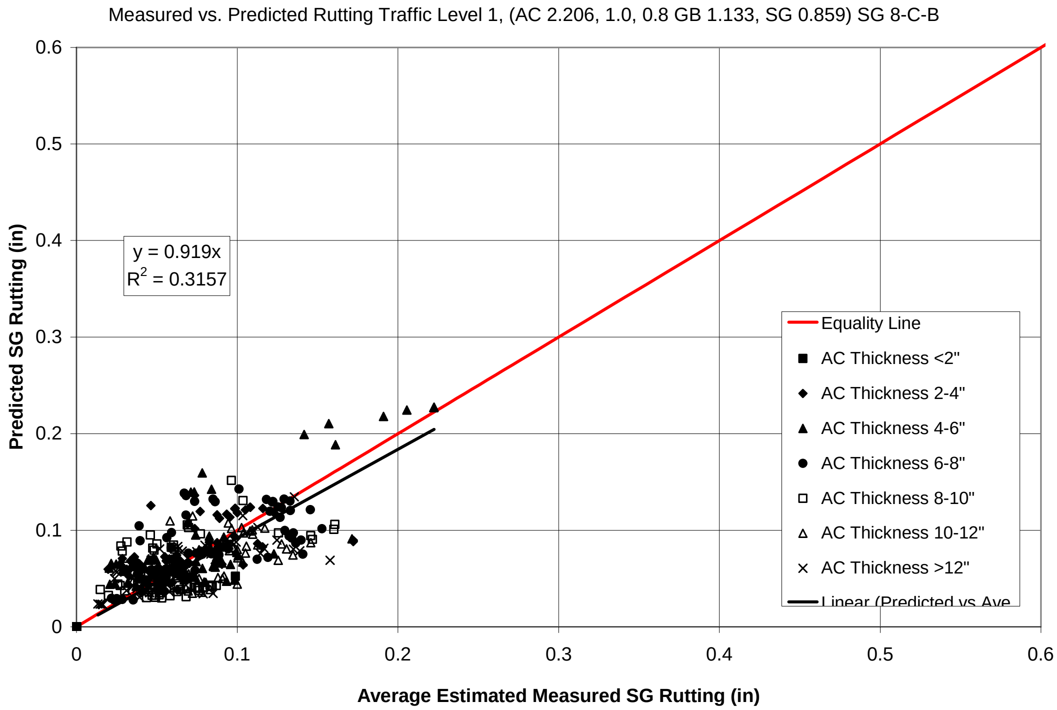


Figure C-112 Granular Subgrade Rut Depth (β_{r2} = 1.0 and β_{r3} = 0.8)

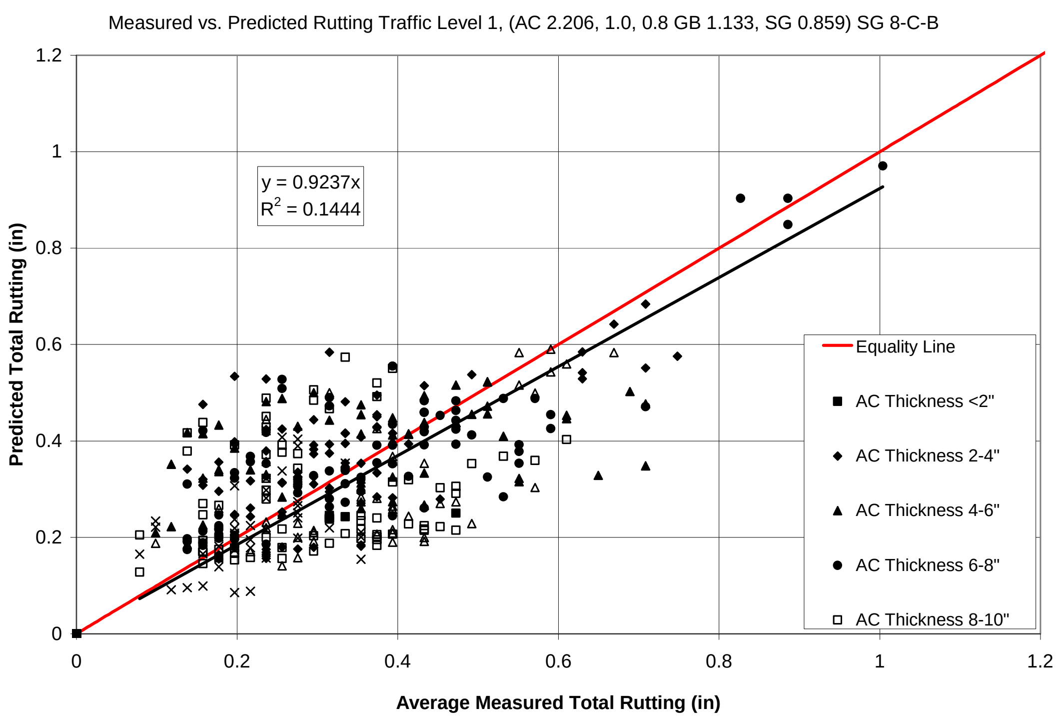


Figure C-113 Total Asphalt Pavement Rut Depth (β_{r2} = 1.0 and β_{r3} = 0.8)

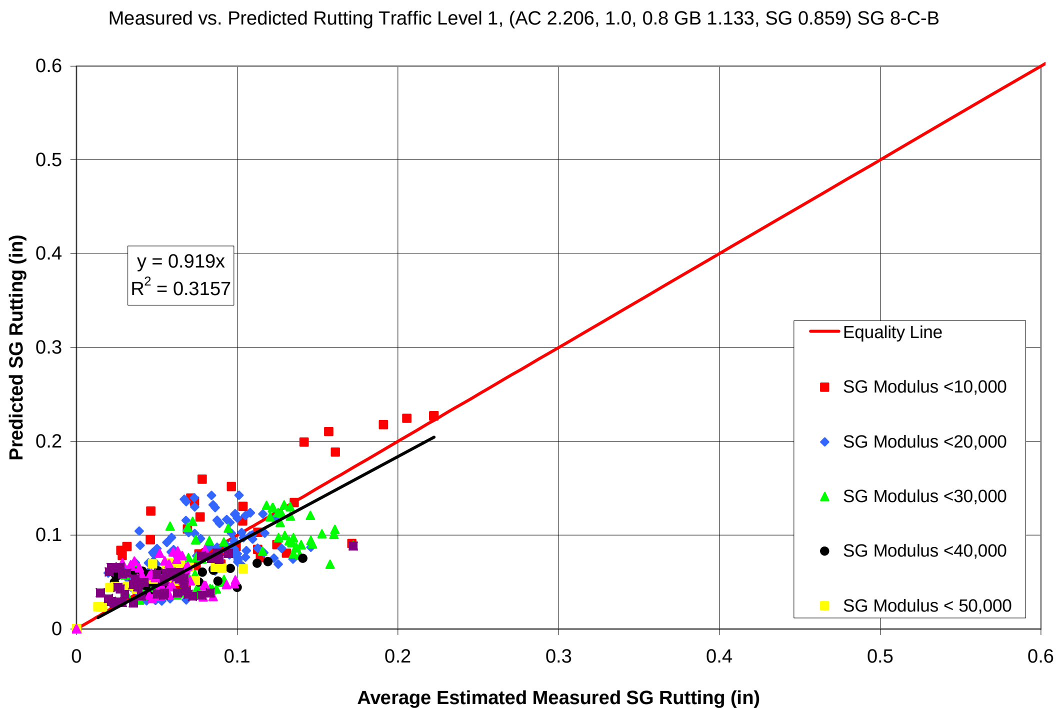


Figure C-114 Subgrade Rut Depth (β_{r2} = 1.0 and β_{r3} = 0.8) (By Subgrade Modulus)

Table C-61 Permanent Deformation Simulation (β_{r2} = 1.0 and β_{r3} = 1.0) Summary

	AC	GB	SG	Total
Average Predicted=	0.193	0.044	0.093	0.330
Sum of error =	0.529	-0.099	-0.430	0.000
Sum of error^2 =	2.351	0.161	0.547	6.387
Predicted % =	56.47%	13.43%	30.10%	100.00%
Se =	0.071	0.019	0.034	0.117
Average Measured =	0.044	0.095	0.330	0.346
Calibration Factor β_1 =	0.746	1.324	1.098	

Table C-62 Permanent Deformation Simulation (β_{r2} = 1.0 and β_{r3} = 1.0) Data

Section	Month	Time	Predicted							Measured			
			AC	GB	SG	Total	%AC	%GB	%SG	AC	GB	SG	Total
11001	4/5/1989	103	0.49	0.137	0.096	0.723	67.74%	18.97%	13.29%	0.227	0.063	0.044	0.335
11001	2/12/1991	125	0.538	0.14	0.098	0.776	69.33%	18.01%	12.66%	0.218	0.057	0.04	0.315
11001	4/2/1992	139	0.551	0.141	0.099	0.791	69.65%	17.80%	12.56%	0.206	0.053	0.037	0.295
11019	5/15/1989	32	0.182	0.02	0.111	0.313	58.28%	6.27%	35.45%	0.298	0.032	0.181	0.512
11019	4/16/1990	43	0.208	0.02	0.115	0.343	60.63%	5.91%	33.46%	0.334	0.033	0.184	0.551
11019	1/15/1991	52	0.231	0.021	0.118	0.369	62.54%	5.63%	31.83%	0.345	0.031	0.175	0.551
11019	3/31/1992	66	0.245	0.021	0.12	0.387	63.45%	5.44%	31.11%	0.35	0.03	0.171	0.551
11019	3/22/1994	90	0.276	0.024	0.124	0.425	65.00%	5.73%	29.27%	0.384	0.034	0.173	0.591
11019	1/8/1996	112	0.304	0.027	0.128	0.458	66.34%	5.83%	27.83%	0.392	0.034	0.164	0.591
11019	1/23/1998	136	0.322	0.027	0.13	0.479	67.26%	5.64%	27.11%	0.477	0.04	0.192	0.709
14126	6/5/1989	15	0.087	0.01	0.039	0.137	63.60%	7.65%	28.75%	0.113	0.014	0.051	0.177
14126	3/3/1991	36	0.124	0.012	0.045	0.181	68.53%	6.36%	25.11%	0.148	0.014	0.054	0.217
14126	4/8/1992	49	0.136	0.012	0.048	0.196	69.54%	6.00%	24.45%	0.11	0.009	0.039	0.157
14126	4/8/1994	73	0.157	0.012	0.051	0.22	71.30%	5.59%	23.12%	0.14	0.011	0.046	0.197
14126	12/11/1995	93	0.176	0.013	0.053	0.241	72.86%	5.27%	21.87%	0.158	0.011	0.047	0.217
14126	12/5/1997	117	0.191	0.013	0.054	0.258	73.91%	5.03%	21.06%	0.145	0.01	0.041	0.197
21001	8/21/1991	98	0.042	0.036	0.104	0.181	22.99%	19.87%	57.14%	0.041	0.035	0.101	0.177
21001	8/26/1993	122	0.045	0.037	0.106	0.187	23.90%	19.56%	56.54%	0.056	0.046	0.134	0.236
21001	6/15/1995	144	0.047	0.037	0.112	0.196	23.89%	19.12%	56.99%	0.066	0.053	0.157	0.276
21001	8/22/1997	170	0.051	0.038	0.113	0.202	25.14%	18.98%	55.88%	0.089	0.067	0.198	0.354
21001	8/26/1998	182	0.052	0.039	0.114	0.205	25.31%	18.86%	55.83%	0.09	0.067	0.198	0.354
21002	8/22/1991	83	0.059	0.046	0.045	0.15	39.42%	30.64%	29.94%	0.07	0.054	0.053	0.177
21002	7/30/1992	94	0.06	0.047	0.046	0.153	39.50%	30.52%	29.98%	0.093	0.072	0.071	0.236
21002	6/14/1995	129	0.073	0.049	0.048	0.17	43.28%	28.70%	28.01%	0.102	0.068	0.066	0.236
21002	8/21/1997	155	0.077	0.05	0.049	0.175	43.76%	28.41%	27.83%	0.129	0.084	0.082	0.295
21002	5/14/1998	164	0.077	0.05	0.049	0.176	43.72%	28.40%	27.87%	0.112	0.073	0.071	0.256
40114	3/30/1995	20	0.163	0.042	0.145	0.35	46.63%	11.89%	41.48%	0.184	0.047	0.163	0.394
40114	11/7/1995	28	0.197	0.044	0.153	0.394	50.02%	11.12%	38.86%	0.197	0.044	0.153	0.394
40114	2/4/1996	31	0.197	0.044	0.154	0.395	49.91%	11.10%	38.99%	0.216	0.048	0.169	0.433
40114	4/4/1996	33	0.198	0.044	0.155	0.397	49.91%	11.04%	39.05%	0.236	0.052	0.184	0.472
40114	7/9/1996	36	0.222	0.045	0.158	0.424	52.23%	10.61%	37.16%	0.226	0.046	0.161	0.433
40114	8/13/1996	37	0.231	0.045	0.159	0.435	53.06%	10.44%	36.50%	0.23	0.045	0.158	0.433
40114	1/7/1998	54	0.26	0.047	0.165	0.472	55.04%	9.93%	35.02%	0.238	0.043	0.152	0.433
40114	4/21/1998	57	0.26	0.047	0.166	0.473	55.00%	9.92%	35.08%	0.238	0.043	0.152	0.433
40114	6/12/1998	59	0.264	0.047	0.167	0.478	55.23%	9.87%	34.90%	0.261	0.047	0.165	0.472
40114	10/23/1998	63	0.283	0.048	0.169	0.499	56.65%	9.57%	33.78%	0.245	0.041	0.146	0.433
40114	2/12/1999	65	0.283	0.048	0.169	0.5	56.61%	9.56%	33.82%	0.267	0.045	0.16	0.472
40115	2/15/1995	19	0.093	0	0.064	0.157	59.40%	0.00%	40.60%	0.047	0	0.032	0.079
40115	3/30/1995	20	0.093	0	0.064	0.157	59.37%	0.00%	40.63%	0.094	0	0.064	0.157
40115	1/7/1998	54	0.148	0	0.072	0.221	67.21%	0.00%	32.79%	0.066	0	0.032	0.098
40115	2/11/1999	65	0.162	0	0.074	0.235	68.62%	0.00%	31.38%	0.068	0	0.031	0.098
40116	3/30/1995	20	0.069	0	0.088	0.157	43.95%	0.00%	56.05%	0.156	0	0.199	0.354
40116	1/8/1998	54	0.11	0	0.101	0.21	52.19%	0.00%	47.81%	0.185	0	0.169	0.354
40116	2/12/1999	65	0.12	0	0.103	0.222	53.79%	0.00%	46.21%	0.191	0	0.164	0.354

Table C-12 (Cont'd) Permanent Deformation Simulation (β_{r2} = 1.0 and β_{r3} = 1.0) Data

Section	Month	Time	Predicted							Measured			
			AC	GB	SG	Total	%AC	%GB	%SG	AC	GB	SG	Total
40117	3/30/1995	20	0.114	0.007	0.057	0.177	64.23%	3.81%	31.96%	0.278	0.016	0.138	0.433
40117	1/8/1998	54	0.181	0.008	0.064	0.253	71.69%	3.04%	25.28%	0.282	0.012	0.1	0.394
40117	2/11/1999	65	0.197	0.008	0.065	0.27	72.98%	2.89%	24.13%	0.345	0.014	0.114	0.472
40118	3/30/1995	20	0.11	0.01	0.088	0.208	52.90%	4.83%	42.28%	0.208	0.019	0.166	0.394
40118	1/8/1998	54	0.173	0.011	0.102	0.287	60.43%	3.87%	35.70%	0.214	0.014	0.126	0.354
40118	2/12/1999	65	0.189	0.011	0.105	0.305	61.90%	3.68%	34.41%	0.219	0.013	0.122	0.354
41007	11/20/1989	140	0.776	0.038	0.096	0.909	85.35%	4.14%	10.51%	0.756	0.037	0.093	0.886
41007	9/5/1991	162	0.848	0.038	0.097	0.983	86.22%	3.89%	9.89%	0.764	0.034	0.088	0.886
41007	9/20/1991	163	0.848	0.038	0.097	0.983	86.22%	3.89%	9.89%	0.713	0.032	0.082	0.827
41007	9/16/1994	198	0.939	0.039	0.099	1.077	87.16%	3.61%	9.23%	0.875	0.036	0.093	1.004
41016	11/30/1989	122	0.276	0	0.137	0.413	66.74%	0.00%	33.26%	0.25	0	0.124	0.374
41016	7/2/1990	130	0.281	0	0.138	0.419	67.05%	0.00%	32.95%	0.185	0	0.091	0.276
41016	9/25/1991	144	0.296	0	0.14	0.436	67.89%	0.00%	32.11%	0.16	0	0.076	0.236
41016	9/18/1996	204	0.355	0	0.147	0.502	70.79%	0.00%	29.21%	0.223	0	0.092	0.315
41024	11/3/1989	149	0.371	0.026	0.127	0.524	70.80%	4.88%	24.32%	0.167	0.012	0.057	0.236
41024	8/26/1990	158	0.387	0.026	0.128	0.541	71.51%	4.75%	23.74%	0.183	0.012	0.061	0.256
41024	9/4/1991	171	0.407	0.026	0.13	0.563	72.32%	4.63%	23.05%	0.157	0.01	0.05	0.217
41024	8/22/1995	218	0.472	0.027	0.134	0.633	74.53%	4.25%	21.22%	0.191	0.011	0.054	0.256
41024	11/9/1995	221	0.474	0.027	0.134	0.635	74.58%	4.23%	21.18%	0.206	0.012	0.058	0.276
41024	2/8/1996	224	0.474	0.027	0.135	0.635	74.57%	4.23%	21.20%	0.22	0.012	0.063	0.295
41024	4/4/1996	226	0.474	0.027	0.135	0.635	74.58%	4.23%	21.19%	0.191	0.011	0.054	0.256
41024	6/13/1996	228	0.477	0.027	0.135	0.638	74.67%	4.21%	21.12%	0.206	0.012	0.058	0.276
41024	7/11/1996	229	0.485	0.027	0.135	0.647	74.94%	4.17%	20.89%	0.207	0.012	0.058	0.276
41024	8/15/1996	230	0.491	0.027	0.135	0.654	75.14%	4.15%	20.71%	0.207	0.011	0.057	0.276
41024	1/15/1998	247	0.512	0.027	0.137	0.676	75.74%	4.05%	20.21%	0.209	0.011	0.056	0.276
41024	4/22/1998	250	0.512	0.027	0.137	0.676	75.73%	4.05%	20.22%	0.209	0.011	0.056	0.276
41024	6/15/1998	252	0.516	0.027	0.137	0.681	75.84%	4.03%	20.13%	0.209	0.011	0.055	0.276
41024	10/26/1998	256	0.523	0.027	0.137	0.688	76.05%	3.98%	19.96%	0.225	0.012	0.059	0.295
81029	10/20/1989	209	0.156	0.067	0.089	0.311	50.13%	21.38%	28.49%	0.118	0.051	0.067	0.236
81029	8/25/1991	231	0.164	0.067	0.09	0.321	50.98%	20.96%	28.06%	0.11	0.045	0.061	0.217
81029	10/21/1991	233	0.164	0.067	0.09	0.321	51.02%	20.93%	28.06%	0.09	0.037	0.05	0.177
81029	9/8/1995	280	0.177	0.069	0.093	0.339	52.38%	20.25%	27.37%	0.124	0.048	0.065	0.236
81047	10/20/1989	73	0.124	0.095	0.106	0.325	38.12%	29.18%	32.71%	0.143	0.109	0.122	0.374
81047	8/25/1991	95	0.138	0.097	0.112	0.346	39.82%	27.93%	32.25%	0.141	0.099	0.114	0.354
81047	10/22/1991	97	0.138	0.097	0.112	0.347	39.81%	27.91%	32.27%	0.133	0.093	0.108	0.335
81053	10/19/1989	60	0.137	0.085	0.086	0.308	44.47%	27.59%	27.94%	0.158	0.098	0.099	0.354
81053	7/7/1990	69	0.147	0.086	0.088	0.321	45.75%	26.66%	27.59%	0.198	0.115	0.119	0.433
81053	12/6/1993	110	0.193	0.098	0.1	0.391	49.42%	25.10%	25.48%	0.195	0.099	0.1	0.394
81053	3/14/1994	113	0.193	0.098	0.1	0.392	49.33%	25.08%	25.59%	0.194	0.099	0.101	0.394
81053	8/8/1994	118	0.203	0.102	0.102	0.406	49.83%	25.01%	25.15%	0.196	0.098	0.099	0.394
81053	10/21/1994	120	0.203	0.102	0.103	0.408	49.78%	25.02%	25.20%	0.206	0.103	0.104	0.413
81053	2/13/1995	124	0.203	0.102	0.103	0.408	49.71%	24.99%	25.30%	0.206	0.103	0.105	0.413
81053	5/8/1995	127	0.204	0.102	0.104	0.409	49.72%	24.96%	25.32%	0.206	0.103	0.105	0.413
81053	5/10/1996	139	0.216	0.103	0.105	0.423	50.95%	24.23%	24.82%	0.221	0.105	0.107	0.433
81053	10/21/1996	144	0.225	0.103	0.106	0.433	51.88%	23.73%	24.40%	0.245	0.112	0.115	0.472
81053	11/14/1996	145	0.225	0.103	0.106	0.434	51.86%	23.72%	24.41%	0.245	0.112	0.115	0.472
81053	3/20/1997	149	0.225	0.103	0.106	0.434	51.77%	23.71%	24.52%	0.245	0.112	0.116	0.472

Table C-12 (Cont'd) Permanent Deformation Simulation (β_{r2} = 1.0 and β_{r3} = 1.0) Data

			Predicted							Measured			
Section	Month	Time	AC	GB	SG	Total	%AC	%GB	%SG	AC	GB	SG	Total
81053	8/5/1997	154	0.238	0.106	0.108	0.452	52.74%	23.39%	23.87%	0.26	0.115	0.117	0.492
81053	9/26/1997	155	0.239	0.106	0.108	0.453	52.76%	23.39%	23.86%	0.27	0.12	0.122	0.512
81053	8/25/1998	166	0.251	0.11	0.111	0.471	53.28%	23.26%	23.46%	0.273	0.119	0.12	0.512
91803	9/5/1990	63	0.063	0.027	0.061	0.15	41.64%	17.80%	40.56%	0.074	0.032	0.072	0.177
91803	8/22/1991	74	0.071	0.028	0.063	0.162	43.76%	17.19%	39.04%	0.06	0.024	0.054	0.138
91803	9/30/1992	87	0.074	0.029	0.065	0.168	44.01%	17.03%	38.97%	0.087	0.034	0.077	0.197
91803	5/12/1994	107	0.081	0.03	0.068	0.179	45.25%	16.51%	38.25%	0.062	0.023	0.053	0.138
91803	9/25/1994	111	0.085	0.03	0.069	0.185	46.15%	16.32%	37.53%	0.064	0.022	0.052	0.138
91803	5/25/1995	119	0.086	0.03	0.07	0.186	46.03%	16.28%	37.69%	0.082	0.029	0.067	0.177
91803	10/30/1995	124	0.09	0.031	0.071	0.192	46.87%	16.10%	37.04%	0.092	0.032	0.073	0.197
91803	10/8/1996	136	0.099	0.032	0.073	0.203	48.46%	15.62%	35.91%	0.086	0.028	0.064	0.177
91803	5/8/1997	143	0.099	0.032	0.074	0.204	48.33%	15.57%	36.11%	0.086	0.028	0.064	0.177
91803	10/16/1997	148	0.102	0.032	0.075	0.209	48.71%	15.49%	35.80%	0.086	0.027	0.063	0.177
91803	6/17/1998	156	0.104	0.032	0.075	0.212	49.05%	15.32%	35.63%	0.087	0.027	0.063	0.177
123995	4/18/1989	161	0.811	0.096	0.075	0.983	82.58%	9.78%	7.64%	0.325	0.039	0.03	0.394
123995	2/5/1991	183	0.849	0.097	0.076	1.022	83.06%	9.51%	7.44%	0.327	0.037	0.029	0.394
123995	4/15/1992	197	0.864	0.098	0.077	1.039	83.23%	9.41%	7.37%	0.36	0.041	0.032	0.433
123995	3/9/1994	220	0.904	0.099	0.077	1.08	83.70%	9.14%	7.16%	0.33	0.036	0.028	0.394
123995	1/21/1996	242	0.935	0.1	0.078	1.113	84.04%	8.94%	7.01%	0.331	0.035	0.028	0.394
123997	12/14/1989	187	0.367	0.104	0.056	0.527	69.61%	19.73%	10.66%	0.438	0.124	0.067	0.63
123997	2/9/1991	201	0.379	0.105	0.057	0.541	70.09%	19.40%	10.51%	0.441	0.122	0.066	0.63
123997	4/13/1992	215	0.39	0.106	0.058	0.553	70.45%	19.16%	10.40%	0.499	0.136	0.074	0.709
123997	3/8/1994	238	0.416	0.108	0.059	0.583	71.39%	18.53%	10.08%	0.534	0.139	0.075	0.748
124105	4/12/1989	53	0.237	0.12	0.089	0.445	53.21%	26.85%	19.93%	0.199	0.1	0.075	0.374
124105	2/9/1991	75	0.277	0.124	0.093	0.494	56.05%	25.17%	18.79%	0.21	0.094	0.07	0.374
124105	4/13/1992	89	0.295	0.127	0.095	0.517	57.12%	24.52%	18.36%	0.247	0.106	0.08	0.433
124106	4/18/1989	21	0.211	0.047	0.07	0.329	64.33%	14.38%	21.29%	0.152	0.034	0.05	0.236
124106	2/5/1991	43	0.266	0.051	0.077	0.395	67.46%	12.94%	19.60%	0.186	0.036	0.054	0.276
124106	4/15/1992	57	0.288	0.052	0.08	0.42	68.43%	12.47%	19.10%	0.135	0.025	0.038	0.197
124106	3/9/1994	80	0.329	0.054	0.084	0.467	70.37%	11.65%	17.98%	0.166	0.028	0.042	0.236
124106	1/21/1996	102	0.355	0.056	0.087	0.498	71.40%	11.17%	17.43%	0.169	0.026	0.041	0.236
124106	1/17/1997	114	0.373	0.056	0.088	0.518	72.10%	10.89%	17.01%	0.227	0.034	0.054	0.315
124107	12/6/1989	75	0.138	0.075	0.084	0.297	46.52%	25.33%	28.15%	0.082	0.045	0.05	0.177
124107	2/5/1991	89	0.148	0.077	0.086	0.31	47.68%	24.73%	27.59%	0.075	0.039	0.043	0.157
124107	4/15/1992	103	0.158	0.078	0.088	0.324	48.83%	24.14%	27.03%	0.077	0.038	0.043	0.157
124107	3/9/1994	126	0.176	0.08	0.09	0.347	50.81%	23.17%	26.02%	0.07	0.032	0.036	0.138
124107	1/22/1996	148	0.19	0.082	0.093	0.365	52.03%	22.55%	25.42%	0.092	0.04	0.045	0.177
124108	4/27/1989	35	0.15	0.026	0.042	0.217	68.81%	11.99%	19.19%	0.244	0.043	0.068	0.354
124108	1/16/1991	56	0.193	0.028	0.045	0.266	72.71%	10.50%	16.79%	0.329	0.048	0.076	0.453
124108	4/1/1992	71	0.206	0.029	0.046	0.281	73.35%	10.23%	16.42%	0.289	0.04	0.065	0.394
124108	3/21/1994	94	0.24	0.03	0.048	0.318	75.41%	9.41%	15.19%	0.371	0.046	0.075	0.492
124108	1/16/1996	116	0.257	0.031	0.05	0.337	76.08%	9.10%	14.81%	0.404	0.048	0.079	0.531
124135	12/10/1989	227	0.459	0.222	0.123	0.805	57.06%	27.60%	15.34%	0.281	0.136	0.075	0.492
124135	1/29/1991	240	0.466	0.223	0.124	0.813	57.32%	27.41%	15.27%	0.338	0.162	0.09	0.591

Table C-12 (Cont'd) Permanent Deformation Simulation (β_{r2} = 1.0 and β_{r3} = 1.0) Data

Section	Month	Time	Predicted							Measured			
			AC	GB	SG	Total	%AC	%GB	%SG	AC	GB	SG	Total
131031	1/9/1990	104	0.109	0.021	0.045	0.174	62.34%	12.08%	25.58%	0.245	0.048	0.101	0.394
131031	3/4/1991	118	0.117	0.022	0.046	0.184	63.33%	11.78%	24.90%	0.274	0.051	0.108	0.433
131031	4/28/1992	131	0.125	0.022	0.047	0.195	64.32%	11.43%	24.26%	0.253	0.045	0.096	0.394
131031	4/4/1994	155	0.143	0.023	0.049	0.215	66.26%	10.81%	22.93%	0.326	0.053	0.113	0.492
131031	1/13/1996	176	0.157	0.024	0.051	0.233	67.60%	10.34%	22.06%	0.279	0.043	0.091	0.413
134111	3/20/1989	101	0.161	0.035	0.123	0.319	50.45%	11.06%	38.49%	0.139	0.03	0.106	0.276
134111	3/4/1991	125	0.186	0.037	0.131	0.355	52.44%	10.56%	37.00%	0.134	0.027	0.095	0.256
134111	4/27/1992	138	0.197	0.038	0.135	0.37	53.24%	10.33%	36.43%	0.136	0.026	0.093	0.256
134112	5/4/1989	144	0.204	0	0.1	0.304	67.09%	0.00%	32.91%	0.158	0	0.078	0.236
134112	2/10/1991	165	0.223	0	0.102	0.326	68.64%	0.00%	31.36%	0.162	0	0.074	0.236
134112	4/13/1992	179	0.234	0	0.103	0.338	69.42%	0.00%	30.58%	0.137	0	0.06	0.197
134112	2/24/1994	201	0.253	0	0.105	0.358	70.69%	0.00%	29.31%	0.167	0	0.069	0.236
134112	1/25/1996	224	0.272	0	0.106	0.378	71.87%	0.00%	28.13%	0.184	0	0.072	0.256
134112	4/23/1998	251	0.292	0	0.108	0.4	73.02%	0.00%	26.98%	0.244	0	0.09	0.335
134113	5/4/1989	144	0.24	0	0.135	0.375	63.97%	0.00%	36.03%	0.101	0	0.057	0.157
134113	2/10/1991	165	0.258	0	0.137	0.395	65.26%	0.00%	34.74%	0.09	0	0.048	0.138
134113	4/13/1992	179	0.269	0	0.139	0.407	65.98%	0.00%	34.02%	0.117	0	0.06	0.177
134113	2/24/1994	201	0.287	0	0.141	0.427	67.10%	0.00%	32.90%	0.119	0	0.058	0.177
134113	1/25/1996	224	0.305	0	0.142	0.448	68.20%	0.00%	31.80%	0.121	0	0.056	0.177
134113	4/23/1998	251	0.326	0	0.144	0.47	69.29%	0.00%	30.71%	0.123	0	0.054	0.177
134119	1/8/1990	140	0.394	0.011	0.03	0.434	90.75%	2.44%	6.81%	0.25	0.007	0.019	0.276
134119	3/4/1991	154	0.412	0.011	0.03	0.452	91.03%	2.37%	6.60%	0.251	0.007	0.018	0.276
134119	4/28/1992	167	0.418	0.011	0.03	0.459	91.13%	2.34%	6.53%	0.233	0.006	0.017	0.256
134119	4/7/1994	191	0.438	0.011	0.03	0.479	91.42%	2.26%	6.32%	0.216	0.005	0.015	0.236
161001	7/17/1989	192	0.21	0.1	0.074	0.384	54.55%	26.14%	19.31%	0.161	0.077	0.057	0.295
161001	8/2/1990	205	0.22	0.103	0.075	0.398	55.28%	25.82%	18.91%	0.109	0.051	0.037	0.197
161001	7/4/1991	216	0.224	0.104	0.076	0.403	55.54%	25.69%	18.78%	0.109	0.051	0.037	0.197
161001	8/25/1994	253	0.25	0.106	0.077	0.433	57.71%	24.45%	17.84%	0.136	0.058	0.042	0.236
161001	5/17/1995	262	0.25	0.106	0.077	0.434	57.74%	24.41%	17.85%	0.148	0.062	0.046	0.256
161001	7/9/1997	288	0.269	0.109	0.079	0.456	58.95%	23.80%	17.26%	0.174	0.07	0.051	0.295
161001	9/23/1998	302	0.28	0.109	0.079	0.468	59.91%	23.20%	16.90%	0.224	0.087	0.063	0.374
161009	9/20/1989	180	0.268	0.019	0.065	0.351	76.22%	5.28%	18.50%	0.33	0.023	0.08	0.433
161009	7/19/1990	190	0.273	0.019	0.065	0.357	76.47%	5.23%	18.30%	0.301	0.021	0.072	0.394
161009	7/26/1991	202	0.284	0.019	0.066	0.368	77.03%	5.10%	17.86%	0.303	0.02	0.07	0.394
161021	9/21/1989	48	0.201	0.019	0.075	0.294	68.35%	6.29%	25.36%	0.108	0.01	0.04	0.157
161021	7/21/1990	58	0.214	0.019	0.076	0.309	69.23%	6.12%	24.65%	0.123	0.011	0.044	0.177
161021	7/28/1991	70	0.229	0.019	0.078	0.326	70.20%	5.93%	23.87%	0.083	0.007	0.028	0.118
161021	9/12/1995	120	0.291	0.021	0.083	0.395	73.74%	5.20%	21.06%	0.116	0.008	0.033	0.157
161021	6/5/1996	129	0.293	0.021	0.084	0.398	73.77%	5.19%	21.04%	0.102	0.007	0.029	0.138
161021	7/29/1997	142	0.309	0.021	0.085	0.414	74.52%	5.05%	20.43%	0.132	0.009	0.036	0.177
169034	7/17/1989	10	0.054	0.022	0.042	0.118	46.06%	18.67%	35.27%	0.036	0.015	0.028	0.079
169034	8/2/1990	23	0.102	0.026	0.047	0.176	58.19%	14.92%	26.88%	0.092	0.024	0.042	0.157
169034	7/4/1991	34	0.112	0.027	0.049	0.188	59.44%	14.33%	26.23%	0.047	0.011	0.021	0.079
169034	5/17/1995	80	0.15	0.03	0.055	0.234	64.02%	12.61%	23.37%	0.101	0.02	0.037	0.157
169034	7/9/1997	106	0.172	0.031	0.057	0.259	66.28%	11.85%	21.87%	0.104	0.019	0.034	0.157
169034	9/24/1998	120	0.181	0.031	0.058	0.27	67.07%	11.59%	21.34%	0.158	0.027	0.05	0.236

Table C-12 (Cont'd) Permanent Deformation Simulation (β_{r2} = 1.0 and β_{r3} = 1.0) Data

			Predicted							Measured			
Section	Month	Time	AC	GB	SG	Total	%AC	%GB	%SG	AC	GB	SG	Total
201009	5/2/1989	53	0.067	0	0.064	0.131	51.27%	0.00%	48.73%	0.131	0	0.125	0.256
201009	12/10/1990	72	0.08	0	0.067	0.147	54.26%	0.00%	45.74%	0.15	0	0.126	0.276
201009	4/8/1993	100	0.09	0	0.07	0.16	56.14%	0.00%	43.86%	0.122	0	0.095	0.217
201009	4/23/1996	136	0.104	0	0.074	0.177	58.51%	0.00%	41.49%	0.058	0	0.041	0.098
251003	8/4/1989	180	0.092	0.042	0.035	0.169	54.28%	24.92%	20.80%	0.085	0.039	0.033	0.157
251003	9/6/1990	193	0.094	0.043	0.036	0.172	54.50%	24.80%	20.70%	0.129	0.059	0.049	0.236
251003	8/23/1991	204	0.096	0.043	0.036	0.175	55.01%	24.56%	20.43%	0.087	0.039	0.032	0.157
251003	9/30/1992	217	0.102	0.044	0.036	0.182	56.01%	24.05%	19.95%	0.11	0.047	0.039	0.197
251003	10/27/1995	254	0.108	0.045	0.037	0.19	56.96%	23.52%	19.51%	0.101	0.042	0.035	0.177
251003	10/23/1996	266	0.111	0.045	0.037	0.193	57.38%	23.30%	19.32%	0.102	0.041	0.034	0.177
251003	6/16/1998	286	0.116	0.046	0.038	0.2	58.31%	22.82%	18.87%	0.092	0.036	0.03	0.157
251004	8/4/1989	178	0.099	0.057	0.038	0.195	51.07%	29.46%	19.47%	0.181	0.104	0.069	0.354
251004	9/5/1990	191	0.104	0.058	0.038	0.2	51.79%	29.05%	19.17%	0.153	0.086	0.057	0.295
251004	8/22/1991	202	0.107	0.059	0.039	0.205	52.29%	28.74%	18.97%	0.175	0.096	0.063	0.335
251004	9/30/1992	215	0.113	0.06	0.04	0.213	53.11%	28.26%	18.64%	0.251	0.133	0.088	0.472
251004	10/29/1995	252	0.124	0.062	0.041	0.228	54.58%	27.38%	18.03%	0.226	0.113	0.075	0.413
251004	6/5/1997	272	0.13	0.063	0.042	0.235	55.28%	26.94%	17.78%	0.196	0.095	0.063	0.354
251004	6/15/1998	284	0.135	0.064	0.042	0.241	55.89%	26.60%	17.51%	0.209	0.099	0.066	0.374
261001	9/7/1989	217	0.101	0.066	0.072	0.239	42.40%	27.50%	30.10%	0.092	0.06	0.065	0.217
261001	7/21/1990	227	0.102	0.066	0.072	0.241	42.47%	27.43%	30.10%	0.109	0.07	0.077	0.256
261001	7/16/1991	239	0.104	0.067	0.073	0.244	42.78%	27.29%	29.93%	0.084	0.054	0.059	0.197
261001	6/9/1993	262	0.108	0.068	0.074	0.249	43.27%	27.08%	29.64%	0.111	0.069	0.076	0.256
261001	7/5/1996	299	0.114	0.069	0.075	0.258	44.18%	26.63%	29.19%	0.096	0.058	0.063	0.217
261004	10/21/1990	64	0.102	0.023	0.054	0.179	56.80%	13.03%	30.16%	0.101	0.023	0.053	0.177
261004	5/13/1993	95	0.108	0.024	0.056	0.189	57.32%	12.84%	29.85%	0.056	0.013	0.029	0.098
261004	7/7/1994	109	0.119	0.025	0.058	0.202	58.93%	12.41%	28.66%	0.07	0.015	0.034	0.118
261004	6/15/1995	120	0.121	0.025	0.059	0.205	59.14%	12.33%	28.53%	0.093	0.019	0.045	0.157
271018	6/22/1989	126	0.212	0.026	0.084	0.322	65.79%	8.10%	26.11%	0.259	0.032	0.103	0.394
271018	10/30/1990	142	0.228	0.026	0.085	0.34	67.08%	7.80%	25.12%	0.238	0.028	0.089	0.354
271018	6/2/1993	174	0.25	0.027	0.088	0.364	68.54%	7.45%	24.01%	0.189	0.021	0.066	0.276
271018	3/8/1994	183	0.26	0.027	0.088	0.376	69.33%	7.26%	23.41%	0.191	0.02	0.065	0.276
271087	6/9/1989	126	0.043	0	0.044	0.087	49.77%	0.00%	50.23%	0.098	0	0.099	0.197
271087	11/13/1990	143	0.046	0	0.044	0.09	50.88%	0.00%	49.12%	0.11	0	0.106	0.217
271087	5/11/1993	173	0.049	0	0.045	0.094	51.91%	0.00%	48.09%	0.061	0	0.057	0.118
271087	6/25/1996	210	0.053	0	0.046	0.099	53.42%	0.00%	46.58%	0.074	0	0.064	0.138
271087	8/3/1999	240	0.056	0	0.047	0.103	54.60%	0.00%	45.40%	0.086	0	0.071	0.157
291008	3/13/1989	35	0.074	0.008	0.079	0.16	45.91%	4.79%	49.31%	0.108	0.011	0.116	0.236
291008	11/7/1990	55	0.089	0.008	0.086	0.184	48.73%	4.54%	46.73%	0.144	0.013	0.138	0.295
291008	3/5/1993	85	0.103	0.009	0.091	0.204	50.78%	4.36%	44.87%	0.15	0.013	0.132	0.295
291008	4/17/1996	120	0.121	0.009	0.097	0.227	53.20%	4.14%	42.66%	0.126	0.01	0.101	0.236
307088	9/27/1989	100	0.225	0.108	0.119	0.452	49.87%	23.85%	26.28%	0.216	0.103	0.114	0.433
307088	7/29/1990	110	0.233	0.109	0.12	0.462	50.40%	23.60%	25.99%	0.198	0.093	0.102	0.394
307088	5/20/1991	120	0.238	0.11	0.122	0.47	50.70%	23.45%	25.85%	0.18	0.083	0.092	0.354
308129	10/3/1989	17	0.093	0.078	0.11	0.281	32.97%	27.77%	39.26%	0.117	0.098	0.139	0.354
308129	7/29/1990	26	0.102	0.094	0.12	0.317	32.24%	29.80%	37.96%	0.102	0.094	0.12	0.315
308129	7/30/1991	38	0.115	0.1	0.13	0.345	33.32%	28.99%	37.69%	0.079	0.068	0.089	0.236
308129	12/14/1993	67	0.147	0.105	0.144	0.396	37.17%	26.56%	36.27%	0.11	0.078	0.107	0.295

Table C-12 (Cont'd) Permanent Deformation Simulation (β_{r2} = 1.0 and β_{r3} = 1.0) Data

			Predicted							Measured			
Section	Month	Time	AC	GB	SG	Total	%AC	%GB	%SG	AC	GB	SG	Total
308129	3/17/1994	70	0.147	0.106	0.145	0.398	37.01%	26.53%	36.46%	0.117	0.084	0.115	0.315
308129	8/22/1994	75	0.157	0.112	0.148	0.417	37.74%	26.77%	35.49%	0.111	0.079	0.105	0.295
308129	10/31/1994	77	0.158	0.112	0.149	0.419	37.67%	26.77%	35.56%	0.119	0.084	0.112	0.315
308129	2/17/1995	81	0.158	0.112	0.15	0.421	37.56%	26.71%	35.73%	0.155	0.11	0.148	0.413
308129	5/18/1995	84	0.158	0.113	0.151	0.422	37.51%	26.68%	35.80%	0.126	0.089	0.12	0.335
308129	6/10/1996	97	0.169	0.114	0.155	0.437	38.58%	26.05%	35.37%	0.137	0.092	0.125	0.354
308129	10/28/1996	101	0.175	0.115	0.156	0.446	39.30%	25.69%	35.01%	0.132	0.086	0.117	0.335
308129	1/23/1997	104	0.175	0.115	0.157	0.447	39.25%	25.69%	35.07%	0.155	0.101	0.138	0.394
308129	3/25/1997	106	0.175	0.115	0.157	0.447	39.21%	25.66%	35.13%	0.131	0.086	0.118	0.335
308129	8/11/1997	111	0.186	0.115	0.158	0.459	40.48%	25.05%	34.46%	0.151	0.094	0.129	0.374
308129	10/1/1997	113	0.188	0.115	0.159	0.461	40.68%	24.96%	34.36%	0.152	0.093	0.129	0.374
321020	8/29/1989	63	0.153	0.019	0.068	0.24	63.74%	7.73%	28.53%	0.201	0.024	0.09	0.315
321020	8/22/1990	75	0.162	0.019	0.07	0.25	64.59%	7.51%	27.90%	0.216	0.025	0.093	0.335
321020	7/23/1991	86	0.169	0.019	0.071	0.259	65.26%	7.36%	27.38%	0.206	0.023	0.086	0.315
321020	9/14/1994	124	0.207	0.02	0.074	0.301	68.65%	6.69%	24.67%	0.189	0.018	0.068	0.276
321020	4/25/1995	131	0.207	0.02	0.074	0.301	68.60%	6.68%	24.72%	0.243	0.024	0.088	0.354
321020	6/5/1997	157	0.225	0.021	0.076	0.322	69.86%	6.42%	23.72%	0.22	0.02	0.075	0.315
321020	6/9/1998	169	0.232	0.021	0.077	0.329	70.32%	6.31%	23.37%	0.235	0.021	0.078	0.335
321020	4/13/1999	175	0.241	0.021	0.077	0.34	71.03%	6.19%	22.78%	0.266	0.023	0.085	0.374
341003	9/11/1990	195	0.155	0.022	0.044	0.221	70.07%	9.89%	20.04%	0.566	0.08	0.162	0.807
341003	8/15/1991	206	0.159	0.022	0.045	0.226	70.45%	9.78%	19.77%	0.499	0.069	0.14	0.709
341003	9/28/1992	219	0.163	0.022	0.045	0.231	70.73%	9.68%	19.58%	0.585	0.08	0.162	0.827
341011	4/17/1999	214	0.366	0.023	0.101	0.49	74.61%	4.70%	20.69%	0.22	0.014	0.061	0.295
341011	4/18/1999	227	0.375	0.023	0.103	0.501	74.84%	4.65%	20.50%	0.28	0.017	0.077	0.374
341011	4/19/1999	244	0.39	0.023	0.104	0.517	75.35%	4.53%	20.12%	0.223	0.013	0.059	0.295
341011	4/20/1999	254	0.405	0.024	0.105	0.534	75.87%	4.44%	19.69%	0.284	0.017	0.074	0.374
341011	4/21/1999	287	0.44	0.024	0.108	0.573	76.86%	4.25%	18.88%	0.303	0.017	0.074	0.394
341011	4/22/1999	307	0.465	0.025	0.11	0.6	77.59%	4.13%	18.28%	0.26	0.014	0.061	0.335
341031	10/5/1989	194	0.249	0.055	0.095	0.399	62.36%	13.80%	23.83%	0.307	0.068	0.117	0.492
341031	9/12/1990	205	0.26	0.056	0.097	0.412	63.03%	13.57%	23.40%	0.298	0.064	0.111	0.472
341031	4/6/1992	224	0.276	0.057	0.099	0.432	63.92%	13.21%	22.86%	0.302	0.062	0.108	0.472
341031	2/24/1993	234	0.286	0.058	0.1	0.444	64.52%	13.04%	22.44%	0.292	0.059	0.102	0.453
341031	10/26/1995	266	0.321	0.06	0.103	0.485	66.31%	12.40%	21.30%	0.379	0.071	0.122	0.571
341031	11/4/1995	267	0.321	0.06	0.103	0.485	66.31%	12.40%	21.30%	0.352	0.066	0.113	0.531
341033	10/5/1989	181	0.179	0.04	0.059	0.278	64.41%	14.50%	21.09%	0.178	0.04	0.058	0.276
341033	9/12/1990	192	0.182	0.041	0.059	0.282	64.62%	14.40%	20.98%	0.229	0.051	0.074	0.354
341033	4/5/1992	211	0.192	0.041	0.06	0.293	65.40%	14.10%	20.50%	0.18	0.039	0.057	0.276
341033	2/24/1993	221	0.197	0.042	0.06	0.299	65.85%	13.91%	20.25%	0.22	0.047	0.068	0.335
341033	11/3/1995	254	0.21	0.042	0.062	0.314	66.81%	13.53%	19.65%	0.237	0.048	0.07	0.354
341033	7/23/1997	274	0.213	0.043	0.062	0.318	67.01%	13.43%	19.56%	0.198	0.04	0.058	0.295
341034	10/5/1989	48	0.12	0	0.06	0.181	66.56%	0.00%	33.44%	0.092	0	0.046	0.138
341034	9/12/1990	59	0.135	0	0.062	0.197	68.44%	0.00%	31.56%	0.189	0	0.087	0.276
341034	4/6/1992	78	0.145	0	0.063	0.208	69.55%	0.00%	30.45%	0.123	0	0.054	0.177
341034	2/24/1993	88	0.156	0	0.065	0.22	70.70%	0.00%	29.30%	0.167	0	0.069	0.236
341034	11/4/1995	121	0.185	0	0.067	0.252	73.33%	0.00%	26.67%	0.188	0	0.068	0.256
341034	7/30/1997	141	0.199	0	0.069	0.267	74.38%	0.00%	25.62%	0.132	0	0.045	0.177

Table C-12 (Cont'd) Permanent Deformation Simulation (β_{r2} = 1.0 and β_{r3} = 1.0) Data

			Predicted							Measured			
Section	Month	Time	AC	GB	SG	Total	%AC	%GB	%SG	AC	GB	SG	Total
350101	5/1/1997	19	0.15	0.039	0.148	0.338	44.52%	11.68%	43.80%	0.088	0.023	0.086	0.197
350101	3/19/1999	38	0.22	0.044	0.166	0.43	51.06%	10.33%	38.60%	0.121	0.024	0.091	0.236
350102	5/1/1997	19	0.157	0.066	0.178	0.401	39.07%	16.52%	44.42%	0.077	0.033	0.087	0.197
350102	3/19/1999	38	0.232	0.074	0.204	0.51	45.50%	14.53%	39.97%	0.107	0.034	0.094	0.236
350103	5/1/1997	19	0.084	0	0.147	0.231	36.30%	0.00%	63.70%	0.071	0	0.125	0.197
350103	3/19/1999	38	0.122	0	0.172	0.294	41.44%	0.00%	58.56%	0.114	0	0.161	0.276
350104	5/1/1997	19	0.066	0	0.097	0.163	40.55%	0.00%	59.45%	0.096	0	0.14	0.236
350104	3/19/1999	38	0.096	0	0.115	0.211	45.59%	0.00%	54.41%	0.126	0	0.15	0.276
350105	5/2/1997	19	0.124	0.014	0.167	0.306	40.65%	4.72%	54.63%	0.096	0.011	0.129	0.236
350105	3/22/1999	38	0.18	0.016	0.194	0.39	46.12%	4.18%	49.70%	0.109	0.01	0.117	0.236
350106	5/2/1996	19	0.066	0.006	0.112	0.184	35.81%	3.10%	61.10%	0.07	0.006	0.12	0.197
350106	3/22/1999	38	0.094	0.006	0.132	0.232	40.51%	2.80%	56.70%	0.096	0.007	0.134	0.236
351005	10/31/1989	73	0.153	0.022	0.116	0.29	52.54%	7.61%	39.85%	0.248	0.036	0.188	0.472
351005	8/21/1991	95	0.166	0.023	0.121	0.309	53.66%	7.28%	39.06%	0.254	0.034	0.185	0.472
351005	10/24/1992	109	0.178	0.023	0.124	0.326	54.78%	7.03%	38.18%	0.226	0.029	0.158	0.413
351005	3/18/1995	138	0.216	0.024	0.129	0.369	58.55%	6.49%	34.96%	0.334	0.037	0.2	0.571
351005	3/16/1999	183	0.262	0.025	0.136	0.422	61.99%	5.89%	32.12%	0.378	0.036	0.196	0.61
351022	10/31/1989	37	0.108	0.032	0.105	0.245	44.24%	12.98%	42.78%	0.078	0.023	0.076	0.177
351022	8/22/1991	59	0.16	0.035	0.114	0.308	51.73%	11.28%	36.98%	0.071	0.016	0.051	0.138
351022	10/24/1992	73	0.17	0.036	0.118	0.323	52.50%	11.02%	36.49%	0.103	0.022	0.072	0.197
351022	3/18/1995	102	0.2	0.037	0.125	0.362	55.33%	10.23%	34.43%	0.12	0.022	0.075	0.217
351022	3/17/1999	147	0.263	0.04	0.134	0.436	60.27%	9.08%	30.64%	0.095	0.014	0.048	0.157
351112	12/5/1989	67	0.275	0.029	0.072	0.377	73.08%	7.80%	19.12%	0.115	0.012	0.03	0.157
351112	1/22/1991	80	0.284	0.03	0.073	0.387	73.40%	7.70%	18.90%	0.13	0.014	0.033	0.177
351112	9/27/1991	88	0.295	0.03	0.074	0.399	73.91%	7.54%	18.56%	0.102	0.01	0.026	0.138
351112	1/27/1993	104	0.307	0.03	0.075	0.412	74.43%	7.38%	18.18%	0.088	0.009	0.021	0.118
351112	3/15/1995	130	0.336	0.031	0.077	0.444	75.73%	7.01%	17.27%	0.149	0.014	0.034	0.197
351112	9/9/1997	160	0.359	0.032	0.078	0.47	76.56%	6.77%	16.67%	0.105	0.009	0.023	0.138
351112	3/15/1999	175	0.371	0.032	0.079	0.482	77.01%	6.64%	16.35%	0.121	0.01	0.026	0.157
371006	10/13/1989	88	0.381	0.03	0.124	0.534	71.28%	5.52%	23.20%	0.056	0.004	0.018	0.079
371006	3/19/1991	105	0.403	0.03	0.126	0.559	72.07%	5.35%	22.58%	0.057	0.004	0.018	0.079
371006	10/11/1992	124	0.451	0.031	0.13	0.612	73.76%	5.04%	21.20%	0.131	0.009	0.038	0.177
371006	4/18/1994	142	0.469	0.031	0.132	0.632	74.22%	4.94%	20.84%	0.073	0.005	0.021	0.098
371006	9/20/1994	147	0.482	0.032	0.133	0.646	74.63%	4.87%	20.50%	0.088	0.006	0.024	0.118
371024	11/3/1989	109	0.11	0.046	0.094	0.25	43.95%	18.44%	37.61%	0.156	0.065	0.133	0.354
371024	3/9/1991	125	0.115	0.047	0.097	0.258	44.46%	18.12%	37.42%	0.193	0.078	0.162	0.433
371024	4/10/1992	138	0.12	0.047	0.098	0.265	45.10%	17.85%	37.05%	0.16	0.063	0.131	0.354
371802	10/13/1989	49	0.125	0.075	0.241	0.442	28.39%	17.03%	54.59%	0.101	0.06	0.193	0.354
371802	3/18/1991	66	0.14	0.078	0.255	0.472	29.57%	16.51%	53.93%	0.093	0.052	0.17	0.315
371802	10/10/1992	85	0.158	0.082	0.269	0.508	31.03%	16.04%	52.93%	0.11	0.057	0.188	0.354
371802	4/15/1994	103	0.167	0.083	0.279	0.529	31.64%	15.71%	52.65%	0.137	0.068	0.228	0.433
371802	7/18/1995	118	0.181	0.085	0.287	0.554	32.73%	15.42%	51.85%	0.155	0.073	0.245	0.472
371802	2/9/1996	125	0.185	0.086	0.29	0.56	32.93%	15.33%	51.74%	0.169	0.078	0.265	0.512
371802	4/2/1996	127	0.185	0.086	0.291	0.561	32.89%	15.31%	51.80%	0.168	0.078	0.265	0.512
371817	10/15/1989	71	0.139	0.046	0.066	0.25	55.45%	18.26%	26.29%	0.218	0.072	0.104	0.394
371817	3/18/1991	88	0.147	0.047	0.068	0.261	56.12%	17.89%	25.99%	0.144	0.046	0.067	0.256
371817	10/18/1992	107	0.17	0.049	0.07	0.289	58.75%	16.90%	24.35%	0.208	0.06	0.086	0.354

Table C-12 (Cont'd) Permanent Deformation Simulation (β_{r2} = 1.0 and β_{r3} = 1.0) Data

Section	Month	Time	Predicted							Measured			
			AC	GB	SG	Total	%AC	%GB	%SG	AC	GB	SG	Total
371992	10/15/1992	33	0.183	0.119	0.067	0.369	49.50%	32.31%	18.19%	0.117	0.076	0.043	0.236
371992	4/20/1994	51	0.219	0.125	0.072	0.416	52.65%	30.12%	17.23%	0.021	0.012	0.007	0.039
371992	2/6/1996	73	0.264	0.132	0.076	0.472	55.95%	27.90%	16.14%	0.088	0.044	0.025	0.157
371992	4/22/1998	99	0.312	0.138	0.081	0.531	58.88%	25.94%	15.19%	0.139	0.061	0.036	0.236
404087	1/17/1990	43	0.103	0.027	0.093	0.222	46.25%	12.08%	41.67%	0.282	0.074	0.254	0.61
404087	10/13/1991	64	0.123	0.029	0.103	0.256	48.26%	11.40%	40.35%	0.209	0.049	0.175	0.433
404087	2/8/1993	80	0.132	0.03	0.108	0.271	48.84%	11.11%	40.06%	0.183	0.042	0.15	0.374
404087	2/9/1995	104	0.147	0.032	0.116	0.295	49.92%	10.67%	39.41%	0.285	0.061	0.225	0.571
404163	1/23/1990	34	0.091	0	0.091	0.182	50.13%	0.00%	49.87%	0.227	0	0.226	0.453
404163	3/17/1991	48	0.102	0	0.095	0.197	51.78%	0.00%	48.22%	0.194	0	0.18	0.374
404163	10/28/1991	55	0.108	0	0.098	0.206	52.63%	0.00%	47.37%	0.155	0	0.14	0.295
404163	3/10/1993	72	0.12	0	0.101	0.221	54.24%	0.00%	45.76%	0.149	0	0.126	0.276
404163	4/22/1996	109	0.136	0	0.107	0.243	56.01%	0.00%	43.99%	0.176	0	0.139	0.315
404163	8/20/1997	125	0.15	0	0.11	0.259	57.68%	0.00%	42.32%	0.227	0	0.167	0.394
404163	1/11/1999	141	0.155	0	0.111	0.266	58.13%	0.00%	41.87%	0.263	0	0.19	0.453
421599	7/18/1989	24	0.07	0.021	0.09	0.182	38.60%	11.59%	49.82%	0.068	0.021	0.088	0.177
421599	9/27/1990	38	0.08	0.021	0.096	0.198	40.49%	10.77%	48.73%	0.088	0.023	0.106	0.217
421599	8/7/1991	49	0.087	0.021	0.1	0.208	41.96%	10.23%	47.81%	0.083	0.02	0.094	0.197
421599	3/1/1993	68	0.099	0.022	0.104	0.224	43.99%	9.63%	46.37%	0.139	0.03	0.146	0.315
421599	6/21/1995	95	0.116	0.022	0.109	0.247	46.93%	8.84%	44.24%	0.129	0.024	0.122	0.276
421599	7/19/1996	108	0.125	0.022	0.112	0.259	48.32%	8.50%	43.18%	0.133	0.023	0.119	0.276
421599	3/26/1998	128	0.138	0.022	0.115	0.274	50.13%	8.10%	41.77%	0.138	0.022	0.115	0.276
451011	4/11/1989	34	0.346	0.058	0.075	0.478	72.24%	12.18%	15.59%	0.242	0.041	0.052	0.335
451011	3/5/1991	57	0.41	0.061	0.078	0.549	74.64%	11.11%	14.25%	0.367	0.055	0.07	0.492
451011	10/24/1992	76	0.465	0.063	0.081	0.608	76.39%	10.36%	13.25%	0.481	0.065	0.083	0.63
451011	1/27/1996	115	0.534	0.065	0.084	0.682	78.19%	9.56%	12.24%	0.523	0.064	0.082	0.669
451011	2/11/1999	150	0.585	0.067	0.086	0.737	79.34%	9.05%	11.61%	0.562	0.064	0.082	0.709
473104	11/1/1989	42	0.009	0.047	0.076	0.133	6.81%	35.54%	57.64%	0.019	0.098	0.159	0.276
473104	5/6/1991	60	0.01	0.05	0.084	0.144	6.81%	34.85%	58.34%	0.021	0.11	0.184	0.315
473104	10/26/1992	77	0.011	0.052	0.09	0.154	7.38%	34.08%	58.54%	0.026	0.121	0.207	0.354
473104	11/30/1995	114	0.013	0.058	0.102	0.174	7.66%	33.33%	59.02%	0.048	0.21	0.372	0.63
480001	4/10/1989	1	0.027	0.067	0.072	0.166	16.27%	40.31%	43.42%	0.038	0.095	0.103	0.236
480001	10/11/1990	19	0.165	0.116	0.136	0.418	39.53%	27.87%	32.61%	0.109	0.077	0.09	0.276
480001	3/11/1992	36	0.205	0.125	0.153	0.483	42.51%	25.88%	31.61%	0.134	0.082	0.1	0.315
480001	2/17/1993	47	0.238	0.13	0.161	0.529	45.04%	24.58%	30.38%	0.089	0.048	0.06	0.197
480001	2/20/1995	71	0.276	0.137	0.174	0.587	47.01%	23.35%	29.64%	0.148	0.074	0.093	0.315
480001	3/19/1998	108	0.345	0.146	0.19	0.681	50.66%	21.44%	27.90%	0.08	0.034	0.044	0.157
481060	6/18/1990	52	0.193	0.049	0.075	0.317	60.95%	15.51%	23.54%	0.252	0.064	0.097	0.413
481060	2/14/1991	60	0.205	0.05	0.076	0.331	61.90%	15.09%	23.01%	0.207	0.051	0.077	0.335
481060	3/18/1992	73	0.218	0.051	0.079	0.348	62.79%	14.65%	22.56%	0.148	0.035	0.053	0.236
481060	2/23/1993	84	0.233	0.052	0.08	0.365	63.78%	14.20%	22.02%	0.138	0.031	0.048	0.217
481060	2/23/1995	108	0.257	0.053	0.084	0.394	65.17%	13.54%	21.29%	0.244	0.051	0.08	0.374
481060	1/5/1999	154	0.304	0.056	0.089	0.448	67.72%	12.46%	19.82%	0.267	0.049	0.078	0.394
481077	4/25/1989	88	0.29	0.033	0.077	0.4	72.45%	8.21%	19.34%	0.385	0.044	0.103	0.531
481077	10/13/1991	118	0.33	0.034	0.08	0.444	74.34%	7.67%	17.99%	0.454	0.047	0.11	0.61
481077	10/12/1992	130	0.338	0.034	0.081	0.453	74.57%	7.60%	17.84%	0.455	0.046	0.109	0.61

Table C-12 (Cont'd) Permanent Deformation Simulation (β_{r2} = 1.0 and β_{r3} = 1.0) Data

			Predicted							Measured			
Section	Month	Time	AC	GB	SG	Total	%AC	%GB	%SG	AC	GB	SG	Total
481077	3/10/1995	159	0.364	0.035	0.082	0.481	75.59%	7.29%	17.13%	0.536	0.052	0.121	0.709
481077	3/26/1998	195	0.394	0.036	0.084	0.514	76.59%	6.98%	16.43%	0.528	0.048	0.113	0.689
481109	1/4/1990	68	0.276	0	0.165	0.441	62.52%	0.00%	37.48%	0.197	0	0.118	0.315
481109	9/21/1990	76	0.292	0	0.169	0.461	63.35%	0.00%	36.65%	0.2	0	0.115	0.315
481109	3/10/1992	94	0.309	0	0.174	0.482	64.00%	0.00%	36.00%	0.164	0	0.092	0.256
481109	2/12/1993	105	0.326	0	0.177	0.503	64.82%	0.00%	35.18%	0.166	0	0.09	0.256
481109	2/16/1995	129	0.353	0	0.182	0.535	65.93%	0.00%	34.07%	0.26	0	0.134	0.394
481130	4/11/1989	201	0.417	0.143	0.155	0.716	58.32%	19.95%	21.72%	0.31	0.106	0.115	0.531
481130	10/12/1990	219	0.439	0.145	0.159	0.743	59.10%	19.54%	21.36%	0.407	0.135	0.147	0.689
481130	3/12/1992	236	0.448	0.147	0.161	0.756	59.32%	19.38%	21.30%	0.409	0.134	0.147	0.689
481169	3/4/1990	212	0.094	0.097	0.065	0.256	36.76%	37.87%	25.36%	0.116	0.119	0.08	0.315
481169	9/18/1990	218	0.096	0.097	0.065	0.258	37.12%	37.65%	25.24%	0.117	0.119	0.079	0.315
481169	3/7/1991	224	0.096	0.097	0.065	0.259	37.10%	37.65%	25.25%	0.117	0.119	0.08	0.315
481169	1/30/1992	234	0.098	0.098	0.066	0.262	37.52%	37.40%	25.08%	0.126	0.125	0.084	0.335
481169	2/27/1993	247	0.101	0.099	0.066	0.265	37.87%	37.19%	24.94%	0.119	0.117	0.079	0.315
481169	3/3/1995	272	0.104	0.1	0.067	0.271	38.44%	36.84%	24.72%	0.182	0.174	0.117	0.472
481174	10/17/1990	186	0.435	0.063	0.146	0.644	67.56%	9.76%	22.68%	0.266	0.038	0.089	0.394
481174	2/14/1991	190	0.435	0.063	0.146	0.644	67.53%	9.76%	22.71%	0.292	0.042	0.098	0.433
481174	3/16/1992	203	0.444	0.063	0.148	0.656	67.76%	9.65%	22.59%	0.213	0.03	0.071	0.315
481174	2/18/1993	214	0.451	0.064	0.149	0.664	67.92%	9.58%	22.49%	0.241	0.034	0.08	0.354
481174	2/21/1995	238	0.47	0.064	0.152	0.687	68.45%	9.38%	22.17%	0.458	0.063	0.148	0.669
481174	3/20/1998	275	0.491	0.065	0.156	0.713	68.92%	9.17%	21.91%	0.461	0.061	0.147	0.669
481178	4/10/1989	10	0.127	0.025	0.078	0.23	55.19%	11.06%	33.75%	0.098	0.02	0.06	0.177
481178	2/22/1991	32	0.212	0.031	0.1	0.343	61.75%	9.04%	29.21%	0.085	0.012	0.04	0.138
481178	3/10/1992	45	0.242	0.032	0.107	0.382	63.50%	8.46%	28.04%	0.087	0.012	0.039	0.138
481178	2/16/1993	56	0.262	0.033	0.112	0.407	64.28%	8.17%	27.55%	0.101	0.013	0.043	0.157
481178	2/17/1995	80	0.306	0.035	0.122	0.462	66.16%	7.56%	26.29%	0.156	0.018	0.062	0.236
481183	12/6/1989	179	0.245	0.068	0.179	0.492	49.83%	13.81%	36.36%	0.128	0.035	0.093	0.256
481183	9/15/1990	188	0.255	0.069	0.182	0.506	50.35%	13.66%	35.99%	0.149	0.04	0.106	0.295
483749	10/17/1990	116	0.324	0.197	0.157	0.678	47.80%	28.99%	23.21%	0.122	0.074	0.059	0.256
483749	2/14/1991	120	0.324	0.197	0.158	0.68	47.70%	29.01%	23.29%	0.103	0.063	0.05	0.217
483749	3/16/1992	133	0.333	0.201	0.162	0.695	47.90%	28.87%	23.23%	0.094	0.057	0.046	0.197
483749	2/21/1993	144	0.342	0.203	0.164	0.709	48.20%	28.68%	23.12%	0.104	0.062	0.05	0.217
483749	2/21/1995	168	0.359	0.209	0.169	0.736	48.75%	28.33%	22.92%	0.163	0.095	0.077	0.335
483749	3/28/1997	193	0.373	0.213	0.173	0.759	49.10%	28.11%	22.79%	0.222	0.127	0.103	0.453
489005	10/14/1990	50	0.056	0.163	0.215	0.435	12.98%	37.60%	49.42%	0.043	0.126	0.165	0.335
489005	3/12/1992	67	0.062	0.169	0.227	0.458	13.50%	36.95%	49.55%	0.019	0.051	0.068	0.138
489005	2/17/1993	78	0.065	0.173	0.234	0.472	13.78%	36.66%	49.56%	0.019	0.051	0.068	0.138
489005	2/20/1995	102	0.071	0.179	0.246	0.495	14.30%	36.07%	49.63%	0.034	0.085	0.117	0.236
489005	7/10/1998	143	0.079	0.187	0.262	0.529	15.02%	35.44%	49.54%	0.024	0.056	0.078	0.157
501002	8/9/1989	58	0.081	0.034	0.046	0.161	50.24%	20.89%	28.86%	0.148	0.062	0.085	0.295
501002	8/8/1990	70	0.089	0.035	0.048	0.172	51.90%	20.18%	27.92%	0.194	0.075	0.104	0.374
501002	9/4/1991	83	0.093	0.035	0.049	0.177	52.28%	19.93%	27.80%	0.165	0.063	0.088	0.315
501002	4/27/1993	102	0.098	0.036	0.051	0.185	53.04%	19.51%	27.45%	0.198	0.073	0.103	0.374
501002	5/25/1994	115	0.104	0.037	0.052	0.192	53.81%	19.19%	26.99%	0.201	0.072	0.101	0.374
501002	8/17/1994	118	0.107	0.037	0.052	0.197	54.47%	18.97%	26.56%	0.204	0.071	0.099	0.374

Table C-12 (Cont'd) Permanent Deformation Simulation (β_{r2} = 1.0 and β_{r3} = 1.0) Data

			Predicted							Measured			
Section	Month	Time	AC	GB	SG	Total	%AC	%GB	%SG	AC	GB	SG	Total
501002	4/27/1995	126	0.107	0.037	0.053	0.198	54.38%	18.95%	26.66%	0.214	0.075	0.105	0.394
501002	10/12/1995	132	0.114	0.038	0.053	0.205	55.51%	18.56%	25.93%	0.24	0.08	0.112	0.433
501002	10/17/1996	144	0.116	0.038	0.054	0.208	55.72%	18.42%	25.86%	0.197	0.065	0.092	0.354
501002	5/15/1997	151	0.116	0.039	0.054	0.209	55.66%	18.41%	25.93%	0.241	0.08	0.112	0.433
501002	10/23/1997	156	0.121	0.039	0.055	0.214	56.34%	18.15%	25.51%	0.255	0.082	0.115	0.453
501002	6/6/1998	164	0.122	0.039	0.055	0.216	56.51%	18.06%	25.44%	0.245	0.078	0.11	0.433
501004	8/9/1989	58	0.053	0.036	0.052	0.14	37.61%	25.38%	37.01%	0.059	0.04	0.058	0.157
501004	8/7/1990	70	0.06	0.036	0.053	0.15	40.28%	24.19%	35.52%	0.103	0.062	0.091	0.256
501004	9/20/1991	83	0.069	0.037	0.055	0.161	42.69%	23.15%	34.16%	0.084	0.046	0.067	0.197
501004	4/27/1993	102	0.077	0.038	0.057	0.172	44.91%	22.08%	33.00%	0.115	0.057	0.084	0.256
501004	10/12/1995	132	0.094	0.039	0.06	0.194	48.69%	20.34%	30.97%	0.115	0.048	0.073	0.236
501004	11/4/1997	157	0.108	0.041	0.063	0.211	51.19%	19.22%	29.60%	0.131	0.049	0.076	0.256
511002	10/15/1989	121	0.178	0.05	0.092	0.32	55.64%	15.57%	28.79%	0.219	0.061	0.113	0.394
511023	10/12/1989	107	0.361	0.05	0.123	0.533	67.72%	9.28%	23.00%	0.387	0.053	0.131	0.571
511023	3/20/1991	124	0.38	0.05	0.124	0.554	68.52%	9.03%	22.45%	0.378	0.05	0.124	0.551
511023	10/10/1992	143	0.412	0.051	0.127	0.59	69.81%	8.66%	21.52%	0.412	0.051	0.127	0.591
511023	12/7/1993	157	0.43	0.052	0.128	0.61	70.49%	8.47%	21.04%	0.43	0.052	0.128	0.61
511023	9/18/1995	178	0.458	0.052	0.13	0.641	71.49%	8.17%	20.34%	0.394	0.045	0.112	0.551
511023	2/9/1996	183	0.459	0.052	0.131	0.641	71.48%	8.17%	20.35%	0.478	0.055	0.136	0.669
511023	3/24/1997	196	0.468	0.053	0.131	0.652	71.79%	8.06%	20.15%	0.424	0.048	0.119	0.591
512021	10/15/1989	54	0.13	0.014	0.089	0.233	55.72%	5.91%	38.37%	0.219	0.023	0.151	0.394
512021	3/11/1991	71	0.144	0.014	0.092	0.25	57.50%	5.73%	36.77%	0.249	0.025	0.159	0.433
512021	10/20/1992	90	0.163	0.015	0.096	0.274	59.54%	5.40%	35.06%	0.316	0.029	0.186	0.531
531008	7/17/1989	129	0.186	0.06	0.078	0.324	57.48%	18.41%	24.11%	0.441	0.141	0.185	0.768
531008	7/17/1989	142	0.2	0.061	0.079	0.34	58.76%	17.89%	23.35%	0.44	0.134	0.175	0.748
531008	8/2/1990	151	0.201	0.061	0.08	0.341	58.77%	17.88%	23.35%	0.451	0.137	0.179	0.768
531008	8/2/1990	153	0.203	0.061	0.08	0.344	59.03%	17.76%	23.21%	0.488	0.147	0.192	0.827
531008	5/28/1991	188	0.217	0.063	0.082	0.362	60.07%	17.30%	22.63%	0.65	0.187	0.245	1.083
531801	7/17/1989	190	0.085	0.008	0.052	0.144	58.95%	5.24%	35.81%	0.116	0.01	0.07	0.197
531801	8/9/1990	203	0.089	0.008	0.052	0.149	59.65%	5.17%	35.18%	0.106	0.009	0.062	0.177
531801	6/5/1991	213	0.089	0.008	0.052	0.15	59.80%	5.13%	35.07%	0.129	0.011	0.076	0.217
531801	6/22/1994	249	0.099	0.008	0.054	0.161	61.54%	4.93%	33.53%	0.097	0.008	0.053	0.157
531801	5/8/1995	260	0.101	0.008	0.054	0.163	61.79%	4.86%	33.34%	0.097	0.008	0.053	0.157
531801	10/31/1995	265	0.104	0.008	0.055	0.167	62.35%	4.83%	32.82%	0.11	0.009	0.058	0.177
531801	3/27/1997	282	0.107	0.008	0.055	0.171	62.78%	4.81%	32.41%	0.124	0.009	0.064	0.197
561007	9/26/1989	111	0.136	0.03	0.082	0.248	54.79%	12.25%	32.96%	0.248	0.055	0.149	0.453
561007	7/22/1990	121	0.138	0.031	0.083	0.251	54.82%	12.21%	32.96%	0.216	0.048	0.13	0.394
561007	5/13/1991	131	0.139	0.031	0.084	0.254	54.83%	12.19%	32.98%	0.205	0.046	0.123	0.374
561007	8/3/1991	134	0.147	0.031	0.084	0.263	56.09%	11.93%	31.98%	0.177	0.038	0.101	0.315
561007	12/9/1993	162	0.159	0.032	0.087	0.277	57.18%	11.59%	31.23%	0.158	0.032	0.086	0.276
561007	3/16/1994	165	0.159	0.032	0.087	0.278	57.13%	11.59%	31.28%	0.157	0.032	0.086	0.276
561007	4/19/1994	166	0.159	0.032	0.087	0.278	57.11%	11.58%	31.31%	0.169	0.034	0.092	0.295
561007	8/19/1994	170	0.161	0.032	0.087	0.28	57.32%	11.56%	31.12%	0.147	0.03	0.08	0.256
561007	2/16/1995	176	0.161	0.032	0.088	0.281	57.28%	11.53%	31.19%	0.158	0.032	0.086	0.276
561007	5/17/1995	179	0.161	0.033	0.088	0.282	57.22%	11.56%	31.22%	0.146	0.03	0.08	0.256
561007	9/8/1995	183	0.164	0.033	0.088	0.284	57.50%	11.50%	31.00%	0.158	0.032	0.085	0.276
561007	6/11/1996	192	0.164	0.033	0.089	0.286	57.48%	11.48%	31.04%	0.124	0.025	0.067	0.217

Table C-12 (Cont'd) Permanent Deformation Simulation (β_{r2} = 1.0 and β_{r3} = 1.0) Data

			Predicted							Measured			
Section	Month	Time	AC	GB	SG	Total	%AC	%GB	%SG	AC	GB	SG	Total
561007	10/24/1996	196	0.17	0.033	0.089	0.292	58.24%	11.31%	30.44%	0.161	0.031	0.084	0.276
561007	11/19/1996	197	0.17	0.033	0.089	0.293	58.22%	11.31%	30.47%	0.16	0.031	0.084	0.276
561007	3/10/1997	201	0.17	0.033	0.089	0.293	58.18%	11.30%	30.52%	0.172	0.033	0.09	0.295
561007	3/24/1997	202	0.17	0.033	0.089	0.293	58.15%	11.30%	30.55%	0.16	0.031	0.084	0.276
561007	8/7/1997	206	0.178	0.033	0.09	0.301	59.06%	11.09%	29.86%	0.163	0.031	0.082	0.276
561007	9/30/1997	207	0.178	0.033	0.09	0.301	59.07%	11.12%	29.81%	0.163	0.031	0.082	0.276
841684	8/29/1990	144	0.178	0.069	0.059	0.306	58.18%	22.60%	19.22%	0.321	0.125	0.106	0.551
841684	8/28/1991	156	0.184	0.07	0.059	0.314	58.78%	22.28%	18.94%	0.324	0.123	0.104	0.551
841684	5/3/1993	177	0.19	0.071	0.06	0.321	59.15%	22.05%	18.80%	0.384	0.143	0.122	0.65
841684	10/24/1995	206	0.208	0.073	0.062	0.343	60.79%	21.17%	18.04%	0.431	0.15	0.128	0.709

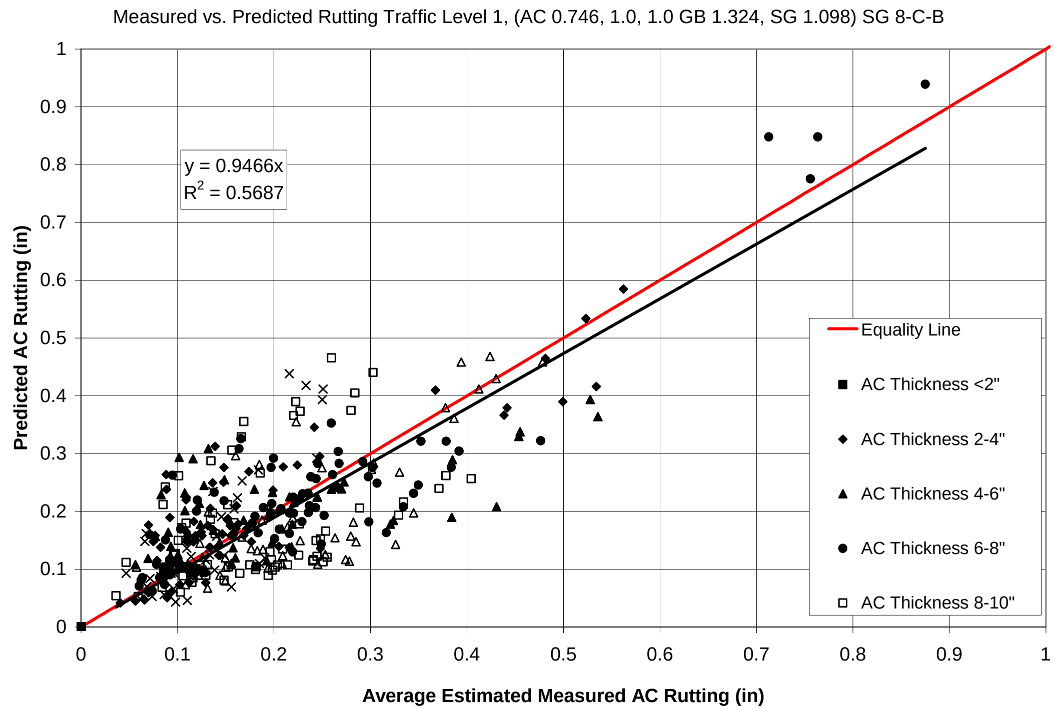


Figure C-115 Asphalt Concrete Layers Rut Depth (β_{r2} = 1.0 and β_{r3} = 1.0)

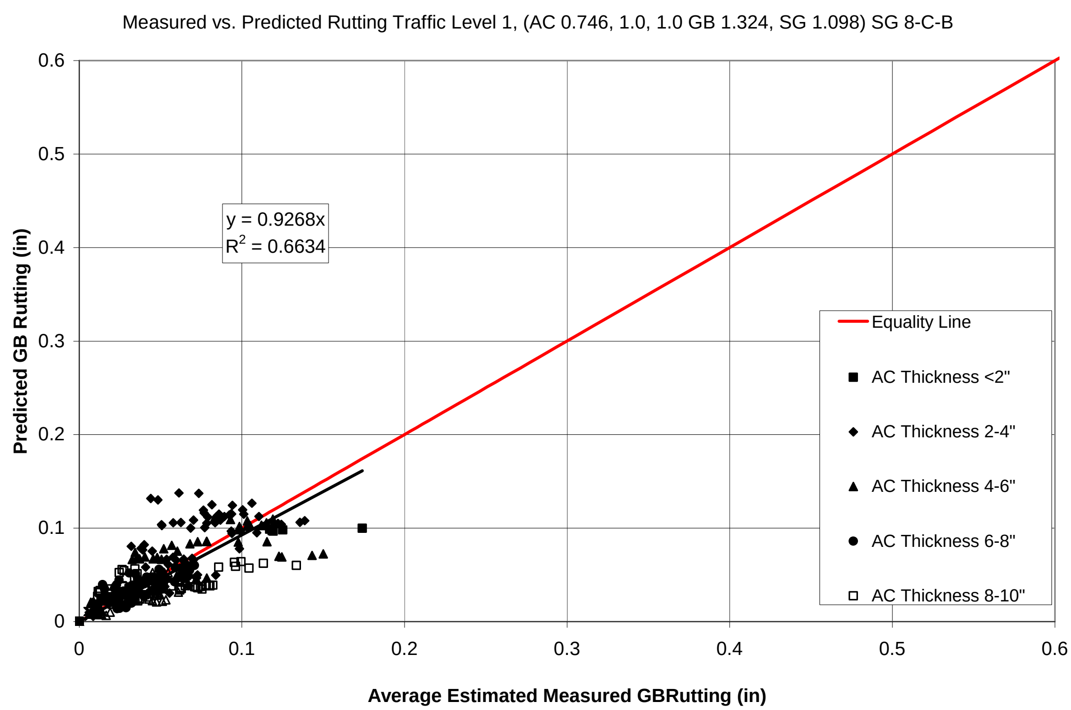


Figure C-116 Granular Base Layers Rut Depth (β_{r2} = 1.0 and β_{r3} = 1.0)

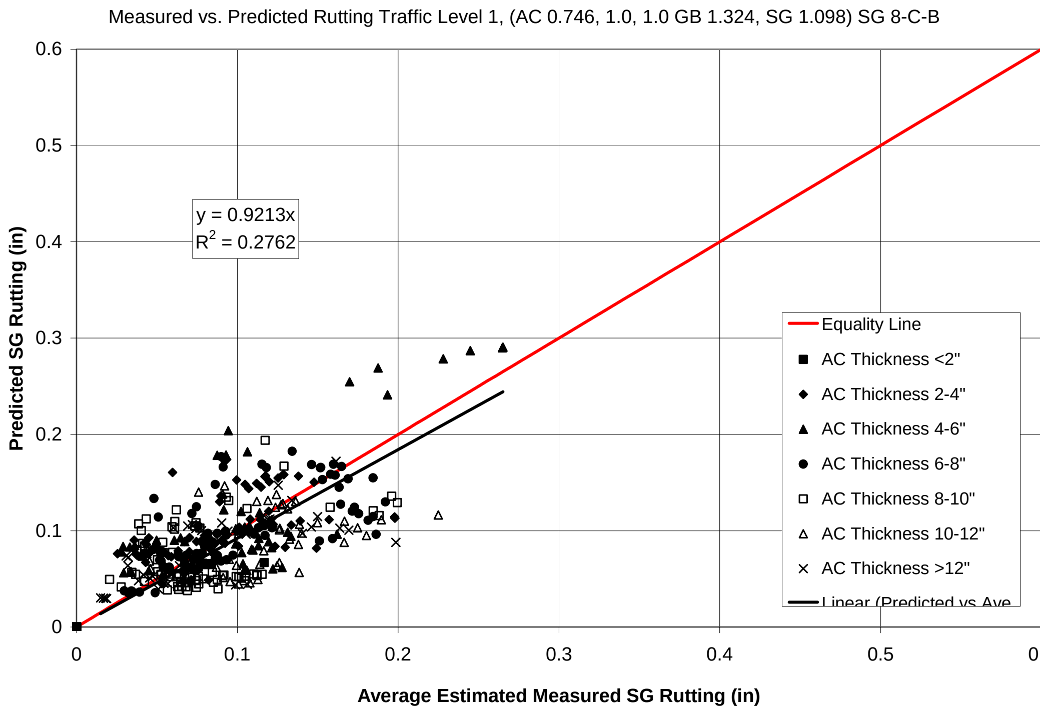


Figure C-117 Granular Subgrade Rut Depth (β_{r2} = 1.0 and β_{r3} = 1.0)

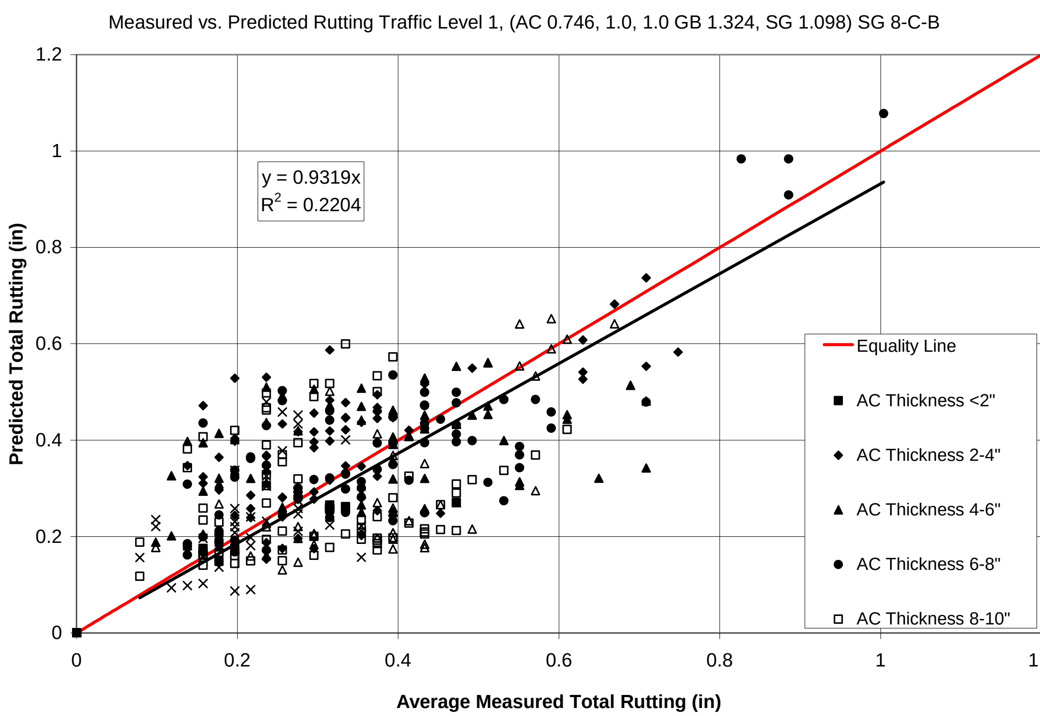


Figure C-118 Total Asphalt Pavement Rut Depth (β_{r2} = 1.0 and β_{r3} = 1.0)

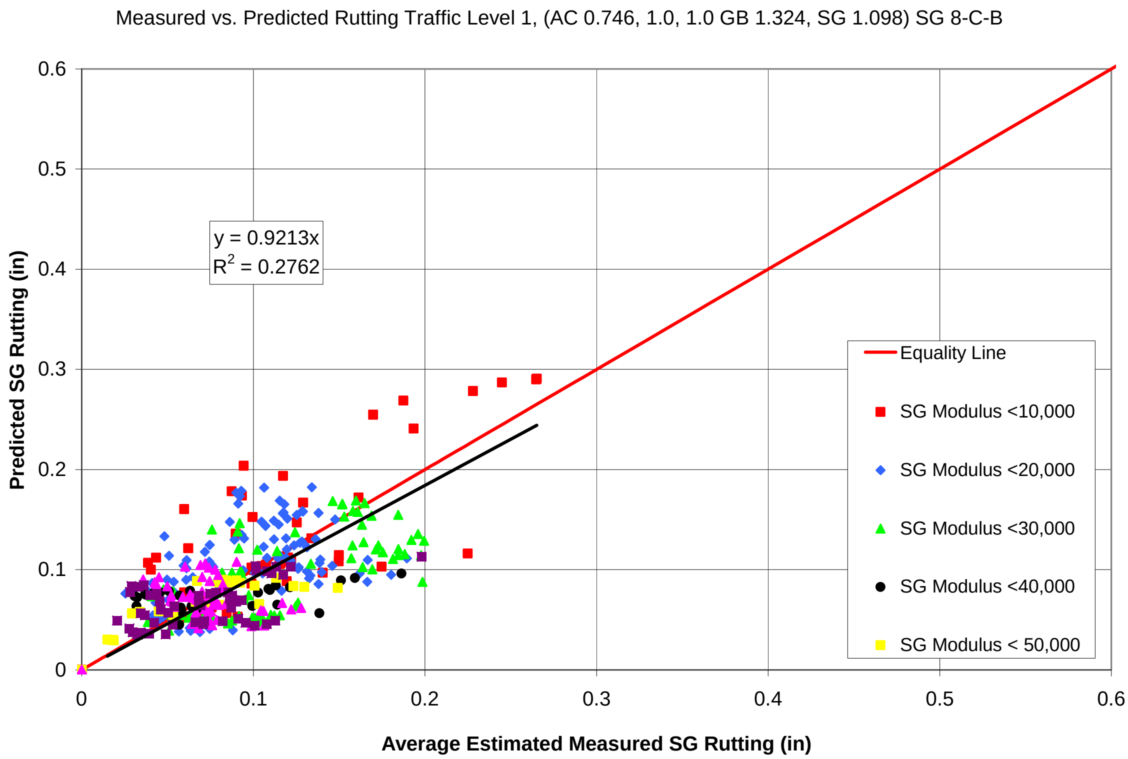


Figure C-119 Subgrade Rut Depth (β_{r2} = 1.0 and β_{r3} = 1.0) (By Subgrade Modulus)

Table C-63 Permanent Deformation Simulation (β_{r2} = 1.0 and β_{r3} = 1.2) Summary

	AC	GB	SG	Total
Average Predicted=	0.174	0.048	0.109	0.330
Sum of error =	0.864	-0.187	-0.678	0.000
Sum of error^2 =	2.148	0.203	0.791	6.860
Predicted % =	49.96%	14.79%	35.26%	100.00%
Se =	0.068	0.021	0.041	0.121
Average Measured =	0.049	0.110	0.330	0.346
Calibration Factor β_1 =	0.247	1.447	1.278	

Table C-64 Permanent Deformation Simulation (β_{r2} = 1.0 and β_{r3} = 1.2) Data

Section	Month	Time	Predicted							Measured			
			AC	GB	SG	Total	%AC	%GB	%SG	AC	GB	SG	Total
11001	04/05/89	103	0.461	0.150	0.112	0.722	63.78%	20.74%	15.47%	0.213	0.069	0.052	0.335
11001	02/12/91	125	0.515	0.153	0.114	0.782	65.84%	19.54%	14.62%	0.207	0.062	0.046	0.315
11001	04/02/92	139	0.532	0.154	0.116	0.801	66.37%	19.21%	14.43%	0.196	0.057	0.043	0.295
11019	05/15/89	32	0.152	0.021	0.129	0.302	50.28%	7.08%	42.64%	0.257	0.036	0.218	0.512
11019	04/16/90	43	0.178	0.022	0.134	0.334	53.35%	6.63%	40.02%	0.294	0.037	0.221	0.551
11019	01/15/91	52	0.202	0.023	0.137	0.361	55.84%	6.29%	37.87%	0.308	0.035	0.209	0.551
11019	03/31/92	66	0.218	0.023	0.140	0.381	57.24%	6.03%	36.73%	0.315	0.033	0.202	0.551
11019	03/22/94	90	0.252	0.027	0.145	0.423	59.53%	6.29%	34.19%	0.352	0.037	0.202	0.591
11019	01/08/96	112	0.283	0.029	0.148	0.460	61.41%	6.35%	32.24%	0.363	0.037	0.190	0.591
11019	01/23/98	136	0.304	0.030	0.151	0.485	62.74%	6.09%	31.18%	0.445	0.043	0.221	0.709
14126	06/05/89	15	0.078	0.011	0.046	0.135	57.55%	8.49%	33.96%	0.102	0.015	0.060	0.177
14126	03/03/91	36	0.118	0.013	0.053	0.184	64.35%	6.85%	28.79%	0.139	0.015	0.062	0.217
14126	04/08/92	49	0.133	0.013	0.056	0.202	66.00%	6.37%	27.63%	0.104	0.010	0.044	0.157
14126	04/08/94	73	0.159	0.013	0.059	0.232	68.62%	5.80%	25.58%	0.135	0.011	0.050	0.197
14126	12/11/95	93	0.182	0.014	0.061	0.257	70.76%	5.40%	23.84%	0.153	0.012	0.052	0.217
14126	12/05/97	117	0.202	0.014	0.063	0.279	72.27%	5.08%	22.65%	0.142	0.010	0.045	0.197
21001	08/21/91	98	0.034	0.039	0.120	0.194	17.67%	20.27%	62.06%	0.031	0.036	0.110	0.177
21001	08/26/93	122	0.037	0.040	0.123	0.201	18.66%	19.95%	61.39%	0.044	0.047	0.145	0.236
21001	06/15/95	144	0.040	0.041	0.130	0.210	18.81%	19.45%	61.74%	0.052	0.054	0.170	0.276
21001	08/22/97	170	0.044	0.042	0.131	0.217	20.11%	19.33%	60.57%	0.071	0.068	0.215	0.354
21001	08/26/98	182	0.045	0.042	0.133	0.220	20.37%	19.18%	60.45%	0.072	0.068	0.214	0.354
21002	08/22/91	83	0.046	0.050	0.052	0.148	30.78%	33.92%	35.30%	0.055	0.060	0.063	0.177
21002	07/30/92	94	0.047	0.051	0.053	0.151	31.03%	33.71%	35.26%	0.073	0.080	0.083	0.236
21002	06/14/95	129	0.058	0.053	0.055	0.167	34.90%	31.92%	33.17%	0.082	0.075	0.078	0.236
21002	08/21/97	155	0.062	0.054	0.057	0.173	35.81%	31.42%	32.77%	0.106	0.093	0.097	0.295
21002	05/14/98	164	0.062	0.055	0.057	0.174	35.81%	31.39%	32.80%	0.092	0.080	0.084	0.256
40114	03/30/95	20	0.133	0.045	0.169	0.347	38.23%	13.10%	48.67%	0.151	0.052	0.192	0.394
40114	11/07/95	28	0.168	0.048	0.178	0.394	42.68%	12.15%	45.18%	0.168	0.048	0.178	0.394
40114	02/04/96	31	0.168	0.048	0.179	0.395	42.58%	12.11%	45.31%	0.184	0.052	0.196	0.433
40114	04/04/96	33	0.170	0.048	0.180	0.398	42.67%	12.03%	45.30%	0.202	0.057	0.214	0.472
40114	07/09/96	36	0.194	0.049	0.183	0.426	45.42%	11.54%	43.04%	0.197	0.050	0.186	0.433
40114	08/13/96	37	0.203	0.050	0.185	0.437	46.40%	11.35%	42.24%	0.201	0.049	0.183	0.433
40114	01/07/98	54	0.236	0.051	0.192	0.479	49.21%	10.68%	40.11%	0.213	0.046	0.174	0.433
40114	04/21/98	57	0.236	0.051	0.193	0.480	49.18%	10.66%	40.16%	0.213	0.046	0.174	0.433
40114	06/12/98	59	0.241	0.051	0.194	0.486	49.54%	10.59%	39.88%	0.234	0.050	0.188	0.472
40114	10/23/98	63	0.261	0.052	0.196	0.510	51.25%	10.25%	38.51%	0.222	0.044	0.167	0.433
40114	02/12/99	65	0.261	0.052	0.197	0.510	51.21%	10.24%	38.55%	0.242	0.048	0.182	0.472
40115	02/15/95	19	0.076	0.000	0.074	0.150	50.69%	0.00%	49.31%	0.040	0.000	0.039	0.079
40115	03/30/95	20	0.076	0.000	0.074	0.151	50.70%	0.00%	49.30%	0.080	0.000	0.078	0.157
40115	01/07/98	54	0.136	0.000	0.084	0.220	61.68%	0.00%	38.32%	0.061	0.000	0.038	0.098
40115	02/11/99	65	0.150	0.000	0.086	0.236	63.60%	0.00%	36.40%	0.063	0.000	0.036	0.098
40116	03/30/95	20	0.056	0.000	0.102	0.159	35.53%	0.00%	64.47%	0.126	0.000	0.228	0.354
40116	01/08/98	54	0.100	0.000	0.117	0.217	46.11%	0.00%	53.89%	0.163	0.000	0.191	0.354
40116	02/12/99	65	0.111	0.000	0.119	0.230	48.15%	0.00%	51.85%	0.171	0.000	0.184	0.354

Table C-14 (Cont'd) Permanent Deformation Simulation (β_{r2} = 1.0 and β_{r3} = 1.2) Data

Section	Month	Time	Predicted							Measured			
			AC	GB	SG	Total	%AC	%GB	%SG	AC	GB	SG	Total
40117	03/30/95	20	0.093	0.007	0.066	0.166	55.89%	4.44%	39.67%	0.242	0.019	0.172	0.433
40117	01/08/98	54	0.165	0.008	0.074	0.248	66.60%	3.39%	30.01%	0.262	0.013	0.118	0.394
40117	02/11/99	65	0.183	0.009	0.076	0.267	68.40%	3.19%	28.41%	0.323	0.015	0.134	0.472
40118	03/30/95	20	0.089	0.011	0.102	0.203	44.00%	5.43%	50.58%	0.173	0.021	0.199	0.394
40118	01/08/98	54	0.157	0.012	0.119	0.288	54.43%	4.22%	41.35%	0.193	0.015	0.147	0.354
40118	02/12/99	65	0.174	0.012	0.122	0.309	56.39%	3.98%	39.62%	0.200	0.014	0.140	0.354
41007	11/20/89	140	0.721	0.041	0.111	0.874	82.57%	4.70%	12.72%	0.731	0.042	0.113	0.886
41007	09/05/91	162	0.772	0.042	0.113	0.927	83.28%	4.51%	12.21%	0.738	0.040	0.108	0.886
41007	09/20/91	163	0.772	0.042	0.113	0.927	83.28%	4.51%	12.21%	0.689	0.037	0.101	0.827
41007	09/16/94	198	0.809	0.043	0.116	0.967	83.64%	4.40%	11.97%	0.840	0.044	0.120	1.004
41016	11/30/89	122	0.243	0.000	0.160	0.403	60.30%	0.00%	39.70%	0.226	0.000	0.148	0.374
41016	07/02/90	130	0.249	0.000	0.161	0.410	60.76%	0.00%	39.24%	0.167	0.000	0.108	0.276
41016	09/25/91	144	0.266	0.000	0.163	0.429	61.99%	0.00%	38.01%	0.146	0.000	0.090	0.236
41016	09/18/96	204	0.332	0.000	0.171	0.503	66.06%	0.00%	33.94%	0.208	0.000	0.107	0.315
41024	11/03/89	149	0.374	0.028	0.148	0.550	67.98%	5.08%	26.94%	0.161	0.012	0.064	0.236
41024	08/26/90	158	0.393	0.028	0.149	0.571	68.91%	4.91%	26.18%	0.176	0.013	0.067	0.256
41024	09/04/91	171	0.418	0.028	0.151	0.598	69.96%	4.76%	25.27%	0.151	0.010	0.055	0.217
41024	08/22/95	218	0.500	0.029	0.156	0.685	72.92%	4.28%	22.79%	0.187	0.011	0.058	0.256
41024	11/09/95	221	0.503	0.029	0.157	0.689	73.01%	4.26%	22.73%	0.201	0.012	0.063	0.276
41024	02/08/96	224	0.503	0.029	0.157	0.689	73.00%	4.26%	22.74%	0.216	0.013	0.067	0.295
41024	04/04/96	226	0.503	0.029	0.157	0.689	73.01%	4.26%	22.73%	0.187	0.011	0.058	0.256
41024	06/13/96	228	0.507	0.029	0.157	0.694	73.14%	4.23%	22.62%	0.202	0.012	0.062	0.276
41024	07/11/96	229	0.517	0.030	0.157	0.703	73.45%	4.20%	22.36%	0.202	0.012	0.062	0.276
41024	08/15/96	230	0.524	0.030	0.158	0.712	73.69%	4.17%	22.14%	0.203	0.011	0.061	0.276
41024	01/15/98	247	0.550	0.030	0.159	0.739	74.45%	4.05%	21.50%	0.205	0.011	0.059	0.276
41024	04/22/98	250	0.551	0.030	0.159	0.740	74.45%	4.05%	21.50%	0.205	0.011	0.059	0.276
41024	06/15/98	252	0.556	0.030	0.159	0.746	74.61%	4.02%	21.38%	0.206	0.011	0.059	0.276
41024	10/26/98	256	0.567	0.030	0.160	0.757	74.92%	3.96%	21.13%	0.221	0.012	0.062	0.295
81029	10/20/89	209	0.123	0.073	0.103	0.299	41.05%	24.37%	34.58%	0.097	0.058	0.082	0.236
81029	08/25/91	231	0.130	0.073	0.105	0.308	42.09%	23.87%	34.03%	0.091	0.052	0.074	0.217
81029	10/21/91	233	0.130	0.073	0.105	0.308	42.14%	23.84%	34.02%	0.075	0.042	0.060	0.177
81029	09/08/95	280	0.143	0.075	0.108	0.326	43.88%	23.01%	33.11%	0.104	0.054	0.078	0.236
81047	10/20/89	73	0.094	0.104	0.124	0.321	29.21%	32.27%	38.52%	0.109	0.121	0.144	0.374
81047	08/25/91	95	0.107	0.106	0.130	0.342	31.17%	30.88%	37.96%	0.110	0.109	0.134	0.354
81047	10/22/91	97	0.107	0.106	0.130	0.343	31.20%	30.84%	37.97%	0.104	0.103	0.127	0.335
81053	10/19/89	60	0.108	0.093	0.100	0.301	35.76%	30.91%	33.33%	0.127	0.110	0.118	0.354
81053	07/07/90	69	0.116	0.093	0.103	0.313	37.19%	29.88%	32.93%	0.161	0.129	0.143	0.433
81053	12/06/93	110	0.162	0.107	0.116	0.385	42.06%	27.85%	30.10%	0.166	0.110	0.118	0.394
81053	03/14/94	113	0.162	0.107	0.117	0.386	41.97%	27.81%	30.22%	0.165	0.109	0.119	0.394
81053	08/08/94	118	0.172	0.111	0.119	0.402	42.74%	27.65%	29.61%	0.168	0.109	0.117	0.394
81053	10/21/94	120	0.172	0.112	0.120	0.404	42.73%	27.64%	29.63%	0.177	0.114	0.122	0.413
81053	02/13/95	124	0.172	0.112	0.120	0.404	42.66%	27.59%	29.74%	0.176	0.114	0.123	0.413
81053	05/08/95	127	0.173	0.112	0.121	0.405	42.71%	27.54%	29.75%	0.177	0.114	0.123	0.413
81053	05/10/96	139	0.185	0.112	0.122	0.420	44.17%	26.71%	29.13%	0.191	0.116	0.126	0.433
81053	10/21/96	144	0.195	0.112	0.123	0.430	45.28%	26.12%	28.60%	0.214	0.123	0.135	0.472
81053	11/14/96	145	0.195	0.112	0.123	0.430	45.27%	26.11%	28.61%	0.214	0.123	0.135	0.472
81053	03/20/97	149	0.195	0.113	0.124	0.431	45.18%	26.09%	28.73%	0.213	0.123	0.136	0.472

Table C-14 (Cont'd) Permanent Deformation Simulation (β_{r2} = 1.0 and β_{r3} = 1.2) Data

Section	Month	Time	Predicted							Measured			
			AC	GB	SG	Total	%AC	%GB	%SG	AC	GB	SG	Total
81053	08/05/97	154	0.209	0.116	0.126	0.450	46.37%	25.70%	27.93%	0.228	0.126	0.137	0.492
81053	09/26/97	155	0.210	0.116	0.126	0.451	46.43%	25.68%	27.89%	0.238	0.131	0.143	0.512
81053	08/25/98	166	0.222	0.120	0.129	0.470	47.20%	25.46%	27.35%	0.242	0.130	0.140	0.512
91803	09/05/90	63	0.044	0.029	0.071	0.145	30.76%	20.21%	49.03%	0.054	0.036	0.087	0.177
91803	08/22/91	74	0.051	0.030	0.073	0.155	32.89%	19.63%	47.48%	0.045	0.027	0.065	0.138
91803	09/30/92	87	0.054	0.031	0.076	0.162	33.50%	19.35%	47.15%	0.066	0.038	0.093	0.197
91803	05/12/94	107	0.060	0.032	0.080	0.172	34.99%	18.75%	46.26%	0.048	0.026	0.064	0.138
91803	09/25/94	111	0.064	0.033	0.081	0.178	36.10%	18.53%	45.37%	0.050	0.026	0.063	0.138
91803	05/25/95	119	0.065	0.033	0.082	0.179	36.04%	18.46%	45.50%	0.064	0.033	0.081	0.177
91803	10/30/95	124	0.069	0.034	0.083	0.186	37.09%	18.24%	44.67%	0.073	0.036	0.088	0.197
91803	10/08/96	136	0.076	0.035	0.085	0.196	38.83%	17.74%	43.42%	0.069	0.031	0.077	0.177
91803	05/08/97	143	0.076	0.035	0.086	0.197	38.73%	17.66%	43.61%	0.069	0.031	0.077	0.177
91803	10/16/97	148	0.079	0.035	0.087	0.201	39.33%	17.53%	43.14%	0.070	0.031	0.076	0.177
91803	06/17/98	156	0.081	0.035	0.088	0.204	39.73%	17.33%	42.93%	0.070	0.031	0.076	0.177
123995	04/18/89	161	0.801	0.105	0.087	0.993	80.62%	10.58%	8.80%	0.317	0.042	0.035	0.394
123995	02/05/91	183	0.818	0.106	0.088	1.012	80.77%	10.49%	8.74%	0.318	0.041	0.034	0.394
123995	04/15/92	197	0.825	0.107	0.089	1.021	80.83%	10.45%	8.72%	0.350	0.045	0.038	0.433
123995	03/09/94	220	0.843	0.108	0.090	1.041	81.00%	10.37%	8.64%	0.319	0.041	0.034	0.394
123995	01/21/96	242	0.858	0.109	0.091	1.057	81.12%	10.29%	8.59%	0.319	0.041	0.034	0.394
123997	12/14/89	187	0.347	0.114	0.065	0.525	65.96%	21.61%	12.43%	0.416	0.136	0.078	0.630
123997	02/09/91	201	0.361	0.115	0.066	0.542	66.63%	21.16%	12.21%	0.420	0.133	0.077	0.630
123997	04/13/92	215	0.374	0.116	0.067	0.557	67.18%	20.80%	12.02%	0.476	0.147	0.085	0.709
123997	03/08/94	238	0.405	0.118	0.068	0.591	68.46%	19.97%	11.57%	0.512	0.149	0.087	0.748
124105	04/12/89	53	0.207	0.131	0.103	0.440	46.90%	29.66%	23.44%	0.175	0.111	0.088	0.374
124105	02/09/91	75	0.249	0.136	0.108	0.493	50.48%	27.59%	21.93%	0.189	0.103	0.082	0.374
124105	04/13/92	89	0.268	0.138	0.110	0.517	51.89%	26.77%	21.35%	0.225	0.116	0.092	0.433
124106	04/18/89	21	0.200	0.052	0.081	0.333	60.07%	15.50%	24.43%	0.142	0.037	0.058	0.236
124106	02/05/91	43	0.268	0.056	0.090	0.414	64.73%	13.50%	21.77%	0.178	0.037	0.060	0.276
124106	04/15/92	57	0.295	0.057	0.093	0.446	66.23%	12.84%	20.93%	0.130	0.025	0.041	0.197
124106	03/09/94	80	0.347	0.059	0.098	0.504	68.83%	11.79%	19.38%	0.163	0.028	0.046	0.236
124106	01/21/96	102	0.383	0.061	0.101	0.545	70.31%	11.16%	18.54%	0.166	0.026	0.044	0.236
124106	01/17/97	114	0.405	0.062	0.102	0.569	71.17%	10.83%	18.00%	0.224	0.034	0.057	0.315
124107	12/06/89	75	0.117	0.082	0.097	0.297	39.53%	27.70%	32.78%	0.070	0.049	0.058	0.177
124107	02/05/91	89	0.128	0.084	0.100	0.311	41.01%	26.96%	32.03%	0.065	0.042	0.050	0.157
124107	04/15/92	103	0.138	0.085	0.102	0.326	42.47%	26.24%	31.29%	0.067	0.041	0.049	0.157
124107	03/09/94	126	0.157	0.088	0.105	0.350	44.91%	25.09%	30.00%	0.062	0.035	0.041	0.138
124107	01/22/96	148	0.172	0.090	0.108	0.370	46.57%	24.28%	29.15%	0.083	0.043	0.052	0.177
124108	04/27/89	35	0.120	0.028	0.049	0.197	60.84%	14.48%	24.67%	0.216	0.051	0.087	0.354
124108	01/16/91	56	0.159	0.031	0.052	0.241	65.78%	12.66%	21.56%	0.298	0.057	0.098	0.453
124108	04/01/92	71	0.172	0.031	0.054	0.258	66.98%	12.19%	20.84%	0.264	0.048	0.082	0.394
124108	03/21/94	94	0.205	0.033	0.056	0.294	69.77%	11.12%	19.12%	0.343	0.055	0.094	0.492
124108	01/16/96	116	0.224	0.034	0.058	0.316	71.00%	10.62%	18.39%	0.377	0.056	0.098	0.531
124135	12/10/89	227	0.222	0.243	0.144	0.609	36.51%	39.89%	23.60%	0.180	0.196	0.116	0.492
124135	01/29/91	240	0.222	0.243	0.144	0.610	36.42%	39.91%	23.67%	0.215	0.236	0.140	0.591

Table C-14 (Cont'd) Permanent Deformation Simulation (β_{r2} = 1.0 and β_{r3} = 1.2) Data

Section	Month	Time	Predicted							Measured			
			AC	GB	SG	Total	%AC	%GB	%SG	AC	GB	SG	Total
131031	01/09/90	104	0.087	0.023	0.052	0.162	53.86%	14.17%	31.96%	0.212	0.056	0.126	0.394
131031	03/04/91	118	0.096	0.024	0.053	0.173	55.35%	13.73%	30.91%	0.240	0.059	0.134	0.433
131031	04/28/92	131	0.104	0.024	0.055	0.184	56.82%	13.24%	29.94%	0.224	0.052	0.118	0.394
131031	04/04/94	155	0.122	0.025	0.057	0.205	59.51%	12.43%	28.06%	0.293	0.061	0.138	0.492
131031	01/13/96	176	0.138	0.026	0.060	0.224	61.53%	11.76%	26.71%	0.254	0.049	0.110	0.413
134111	03/20/89	101	0.125	0.039	0.143	0.307	40.72%	12.60%	46.68%	0.112	0.035	0.129	0.276
134111	03/04/91	125	0.149	0.041	0.153	0.343	43.51%	11.94%	44.55%	0.111	0.031	0.114	0.256
134111	04/27/92	138	0.160	0.042	0.157	0.359	44.64%	11.65%	43.71%	0.114	0.030	0.112	0.256
134112	05/04/89	144	0.211	0.000	0.117	0.327	64.42%	0.00%	35.58%	0.152	0.000	0.084	0.236
134112	02/10/91	165	0.235	0.000	0.119	0.354	66.42%	0.00%	33.58%	0.157	0.000	0.079	0.236
134112	04/13/92	179	0.249	0.000	0.120	0.369	67.46%	0.00%	32.54%	0.133	0.000	0.064	0.197
134112	02/24/94	201	0.273	0.000	0.122	0.395	69.11%	0.00%	30.89%	0.163	0.000	0.073	0.236
134112	01/25/96	224	0.298	0.000	0.124	0.422	70.65%	0.00%	29.35%	0.181	0.000	0.075	0.256
134112	04/23/98	251	0.325	0.000	0.126	0.451	72.14%	0.00%	27.86%	0.241	0.000	0.093	0.335
134113	05/04/89	144	0.250	0.000	0.157	0.407	61.39%	0.00%	38.61%	0.097	0.000	0.061	0.157
134113	02/10/91	165	0.273	0.000	0.160	0.433	63.09%	0.00%	36.91%	0.087	0.000	0.051	0.138
134113	04/13/92	179	0.287	0.000	0.161	0.448	64.02%	0.00%	35.98%	0.113	0.000	0.064	0.177
134113	02/24/94	201	0.311	0.000	0.164	0.474	65.50%	0.00%	34.50%	0.116	0.000	0.061	0.177
134113	01/25/96	224	0.335	0.000	0.166	0.501	66.92%	0.00%	33.08%	0.119	0.000	0.059	0.177
134113	04/23/98	251	0.362	0.000	0.168	0.530	68.32%	0.00%	31.68%	0.121	0.000	0.056	0.177
134119	01/08/90	140	0.442	0.012	0.034	0.488	90.59%	2.37%	7.04%	0.250	0.007	0.019	0.276
134119	03/04/91	154	0.466	0.012	0.035	0.512	90.92%	2.29%	6.79%	0.251	0.006	0.019	0.276
134119	04/28/92	167	0.475	0.012	0.035	0.522	91.07%	2.25%	6.68%	0.233	0.006	0.017	0.256
134119	04/07/94	191	0.504	0.012	0.035	0.551	91.46%	2.15%	6.39%	0.216	0.005	0.015	0.236
161001	07/17/89	192	0.189	0.110	0.086	0.385	49.05%	28.52%	22.43%	0.145	0.084	0.066	0.295
161001	08/02/90	205	0.200	0.112	0.088	0.400	50.05%	28.07%	21.88%	0.099	0.055	0.043	0.197
161001	07/04/91	216	0.205	0.113	0.088	0.407	50.46%	27.86%	21.68%	0.099	0.055	0.043	0.197
161001	08/25/94	253	0.233	0.116	0.090	0.439	53.19%	26.34%	20.47%	0.126	0.062	0.048	0.236
161001	05/17/95	262	0.235	0.116	0.090	0.441	53.28%	26.27%	20.45%	0.136	0.067	0.052	0.256
161001	07/09/97	288	0.256	0.119	0.092	0.466	54.88%	25.46%	19.66%	0.162	0.075	0.058	0.295
161001	09/23/98	302	0.269	0.119	0.092	0.479	56.05%	24.75%	19.20%	0.210	0.093	0.072	0.374
161009	09/20/89	180	0.252	0.020	0.076	0.348	72.47%	5.81%	21.72%	0.314	0.025	0.094	0.433
161009	07/19/90	190	0.259	0.020	0.076	0.355	72.86%	5.74%	21.40%	0.287	0.023	0.084	0.394
161009	07/26/91	202	0.271	0.021	0.077	0.368	73.62%	5.58%	20.80%	0.290	0.022	0.082	0.394
161021	09/21/89	48	0.166	0.020	0.087	0.273	60.78%	7.41%	31.81%	0.096	0.012	0.050	0.157
161021	07/21/90	58	0.179	0.021	0.089	0.288	62.07%	7.18%	30.76%	0.110	0.013	0.054	0.177
161021	07/28/91	70	0.195	0.021	0.091	0.306	63.52%	6.90%	29.58%	0.075	0.008	0.035	0.118
161021	09/12/95	120	0.259	0.022	0.097	0.378	68.51%	5.93%	25.56%	0.108	0.009	0.040	0.157
161021	06/05/96	129	0.262	0.023	0.097	0.382	68.61%	5.91%	25.48%	0.095	0.008	0.035	0.138
161021	07/29/97	142	0.278	0.023	0.099	0.400	69.63%	5.72%	24.65%	0.123	0.010	0.044	0.177
169034	07/17/89	10	0.039	0.024	0.048	0.111	35.13%	21.54%	43.33%	0.028	0.017	0.034	0.079
169034	08/02/90	23	0.080	0.029	0.055	0.163	48.79%	17.55%	33.66%	0.077	0.028	0.053	0.157
169034	07/04/91	34	0.090	0.030	0.057	0.177	50.71%	16.72%	32.57%	0.040	0.013	0.026	0.079
169034	05/17/95	80	0.128	0.032	0.064	0.224	57.22%	14.39%	28.39%	0.090	0.023	0.045	0.157
169034	07/09/97	106	0.151	0.034	0.066	0.250	60.28%	13.40%	26.32%	0.095	0.021	0.041	0.157
169034	09/24/98	120	0.161	0.034	0.067	0.262	61.39%	13.04%	25.57%	0.145	0.031	0.060	0.236

Table C-14 (Cont'd) Permanent Deformation Simulation (β_{r2} = 1.0 and β_{r3} = 1.2) Data

Section	Month	Time	Predicted							Measured			
			AC	GB	SG	Total	%AC	%GB	%SG	AC	GB	SG	Total
201009	05/02/89	53	0.051	0.000	0.074	0.125	40.50%	0.00%	59.50%	0.104	0.000	0.152	0.256
201009	12/10/90	72	0.062	0.000	0.078	0.140	44.09%	0.00%	55.91%	0.122	0.000	0.154	0.276
201009	04/08/93	100	0.071	0.000	0.082	0.153	46.58%	0.00%	53.42%	0.101	0.000	0.116	0.217
201009	04/23/96	136	0.084	0.000	0.086	0.170	49.68%	0.00%	50.32%	0.049	0.000	0.050	0.098
251003	08/04/89	180	0.073	0.046	0.041	0.160	45.60%	28.80%	25.60%	0.072	0.045	0.040	0.157
251003	09/06/90	193	0.075	0.047	0.041	0.163	45.98%	28.60%	25.42%	0.109	0.068	0.060	0.236
251003	08/23/91	204	0.077	0.047	0.042	0.166	46.64%	28.30%	25.07%	0.073	0.045	0.039	0.157
251003	09/30/92	217	0.082	0.048	0.042	0.172	47.82%	27.71%	24.47%	0.094	0.055	0.048	0.197
251003	10/27/95	254	0.089	0.049	0.043	0.181	49.17%	26.99%	23.84%	0.087	0.048	0.042	0.177
251003	10/23/96	266	0.092	0.049	0.043	0.184	49.73%	26.69%	23.58%	0.088	0.047	0.042	0.177
251003	06/16/98	286	0.097	0.050	0.044	0.190	50.82%	26.15%	23.03%	0.080	0.041	0.036	0.157
251004	08/04/89	178	0.086	0.063	0.044	0.193	44.58%	32.53%	22.89%	0.158	0.115	0.081	0.354
251004	09/05/90	191	0.090	0.064	0.045	0.199	45.49%	32.02%	22.50%	0.134	0.095	0.066	0.295
251004	08/22/91	202	0.094	0.065	0.045	0.204	46.17%	31.61%	22.22%	0.154	0.106	0.074	0.335
251004	09/30/92	215	0.100	0.066	0.046	0.212	47.20%	31.02%	21.78%	0.223	0.147	0.103	0.472
251004	10/29/95	252	0.112	0.068	0.048	0.228	49.21%	29.85%	20.94%	0.203	0.123	0.087	0.413
251004	06/05/97	272	0.119	0.069	0.049	0.237	50.16%	29.28%	20.57%	0.178	0.104	0.073	0.354
251004	06/15/98	284	0.124	0.070	0.049	0.243	50.92%	28.85%	20.23%	0.190	0.108	0.076	0.374
261001	09/07/89	217	0.081	0.072	0.084	0.237	34.22%	30.37%	35.41%	0.074	0.066	0.077	0.217
261001	07/21/90	227	0.082	0.072	0.084	0.238	34.35%	30.28%	35.37%	0.088	0.077	0.091	0.256
261001	07/16/91	239	0.084	0.073	0.085	0.242	34.72%	30.12%	35.17%	0.068	0.059	0.069	0.197
261001	06/09/93	262	0.087	0.074	0.086	0.247	35.32%	29.87%	34.81%	0.090	0.076	0.089	0.256
261001	07/05/96	299	0.093	0.075	0.088	0.256	36.42%	29.33%	34.25%	0.079	0.064	0.074	0.217
261004	10/21/90	64	0.077	0.025	0.063	0.166	46.75%	15.37%	37.88%	0.083	0.027	0.067	0.177
261004	05/13/93	95	0.085	0.026	0.066	0.177	47.90%	14.99%	37.11%	0.047	0.015	0.037	0.098
261004	07/07/94	109	0.094	0.027	0.067	0.189	49.97%	14.47%	35.56%	0.059	0.017	0.042	0.118
261004	06/15/95	120	0.097	0.028	0.068	0.193	50.41%	14.31%	35.28%	0.079	0.023	0.056	0.157
271018	06/22/89	126	0.183	0.028	0.098	0.310	59.19%	9.20%	31.61%	0.233	0.036	0.124	0.394
271018	10/30/90	142	0.201	0.029	0.099	0.329	61.00%	8.80%	30.20%	0.216	0.031	0.107	0.354
271018	06/02/93	174	0.224	0.030	0.102	0.356	63.03%	8.34%	28.63%	0.174	0.023	0.079	0.276
271018	03/08/94	183	0.235	0.030	0.102	0.367	63.97%	8.12%	27.90%	0.176	0.022	0.077	0.276
271087	06/09/89	126	0.037	0.000	0.051	0.088	42.38%	0.00%	57.62%	0.083	0.000	0.113	0.197
271087	11/13/90	143	0.040	0.000	0.051	0.092	43.78%	0.00%	56.22%	0.095	0.000	0.122	0.217
271087	05/11/93	173	0.043	0.000	0.052	0.095	45.10%	0.00%	54.90%	0.053	0.000	0.065	0.118
271087	06/25/96	210	0.047	0.000	0.053	0.101	47.01%	0.00%	52.99%	0.065	0.000	0.073	0.138
271087	08/03/99	240	0.051	0.000	0.054	0.105	48.46%	0.00%	51.54%	0.076	0.000	0.081	0.157
291008	03/13/89	35	0.055	0.008	0.092	0.155	35.36%	5.40%	59.24%	0.084	0.013	0.140	0.236
291008	11/07/90	55	0.070	0.009	0.100	0.179	39.00%	5.10%	55.89%	0.115	0.015	0.165	0.295
291008	03/05/93	85	0.083	0.010	0.106	0.199	41.81%	4.86%	53.33%	0.123	0.014	0.157	0.295
291008	04/17/96	120	0.101	0.010	0.113	0.224	45.00%	4.59%	50.41%	0.106	0.011	0.119	0.236
307088	09/27/89	100	0.205	0.118	0.138	0.461	44.49%	25.55%	29.96%	0.193	0.111	0.130	0.433
307088	07/29/90	110	0.213	0.119	0.140	0.472	45.14%	25.25%	29.61%	0.178	0.099	0.117	0.394
307088	05/20/91	120	0.220	0.120	0.141	0.482	45.60%	25.03%	29.37%	0.162	0.089	0.104	0.354
308129	10/03/89	17	0.074	0.085	0.128	0.288	25.78%	29.62%	44.60%	0.091	0.105	0.158	0.354
308129	07/29/90	26	0.084	0.103	0.140	0.327	25.66%	31.55%	42.79%	0.081	0.099	0.135	0.315
308129	07/30/91	38	0.097	0.109	0.151	0.358	27.18%	30.54%	42.28%	0.064	0.072	0.100	0.236
308129	12/14/93	67	0.130	0.115	0.167	0.413	31.61%	27.87%	40.53%	0.093	0.082	0.120	0.295

Table C-14 (Cont'd) Permanent Deformation Simulation (β_{r2} = 1.0 and β_{r3} = 1.2) Data

Section	Month	Time	Predicted							Measured			
			AC	GB	SG	Total	%AC	%GB	%SG	AC	GB	SG	Total
308129	03/17/94	70	0.131	0.115	0.169	0.415	31.47%	27.82%	40.71%	0.099	0.088	0.128	0.315
308129	08/22/94	75	0.141	0.122	0.172	0.436	32.43%	28.02%	39.55%	0.096	0.083	0.117	0.295
308129	10/31/94	77	0.142	0.123	0.174	0.438	32.41%	27.99%	39.59%	0.102	0.088	0.125	0.315
308129	02/17/95	81	0.142	0.123	0.175	0.440	32.31%	27.92%	39.77%	0.134	0.115	0.164	0.413
308129	05/18/95	84	0.142	0.123	0.176	0.441	32.29%	27.88%	39.83%	0.108	0.093	0.133	0.335
308129	06/10/96	97	0.154	0.125	0.180	0.459	33.62%	27.15%	39.24%	0.119	0.096	0.139	0.354
308129	10/28/96	101	0.162	0.125	0.182	0.469	34.47%	26.73%	38.80%	0.115	0.089	0.130	0.335
308129	01/23/97	104	0.162	0.125	0.182	0.469	34.42%	26.73%	38.85%	0.136	0.105	0.153	0.394
308129	03/25/97	106	0.162	0.125	0.183	0.470	34.39%	26.70%	38.92%	0.115	0.089	0.130	0.335
308129	08/11/97	111	0.172	0.126	0.184	0.482	35.76%	26.07%	38.18%	0.134	0.097	0.143	0.374
308129	10/01/97	113	0.174	0.126	0.184	0.485	35.99%	25.96%	38.05%	0.135	0.097	0.142	0.374
321020	08/29/89	63	0.122	0.020	0.080	0.222	55.06%	9.11%	35.82%	0.173	0.029	0.113	0.315
321020	08/22/90	75	0.132	0.021	0.081	0.233	56.39%	8.80%	34.81%	0.189	0.029	0.116	0.335
321020	07/23/91	86	0.140	0.021	0.083	0.243	57.45%	8.57%	33.97%	0.181	0.027	0.107	0.315
321020	09/14/94	124	0.177	0.022	0.086	0.285	62.03%	7.70%	30.26%	0.171	0.021	0.083	0.276
321020	04/25/95	131	0.177	0.022	0.087	0.286	62.00%	7.69%	30.31%	0.220	0.027	0.107	0.354
321020	06/05/97	157	0.197	0.023	0.089	0.309	63.94%	7.31%	28.75%	0.201	0.023	0.091	0.315
321020	06/09/98	169	0.205	0.023	0.090	0.317	64.61%	7.16%	28.23%	0.216	0.024	0.094	0.335
321020	04/13/99	175	0.215	0.023	0.090	0.328	65.51%	7.02%	27.47%	0.245	0.026	0.103	0.374
341003	09/11/90	195	0.138	0.024	0.051	0.213	64.66%	11.19%	24.15%	0.522	0.090	0.195	0.807
341003	08/15/91	206	0.143	0.024	0.052	0.219	65.21%	11.04%	23.75%	0.462	0.078	0.168	0.709
341003	09/28/92	219	0.148	0.024	0.053	0.225	65.69%	10.88%	23.43%	0.543	0.090	0.194	0.827
341011	04/17/99	214	0.355	0.025	0.118	0.498	71.27%	5.05%	23.68%	0.210	0.015	0.070	0.295
341011	04/18/99	227	0.367	0.025	0.119	0.511	71.67%	4.98%	23.36%	0.268	0.019	0.087	0.374
341011	04/19/99	244	0.384	0.026	0.121	0.531	72.38%	4.82%	22.80%	0.214	0.014	0.067	0.295
341011	04/20/99	254	0.402	0.026	0.122	0.550	73.05%	4.71%	22.24%	0.273	0.018	0.083	0.374
341011	04/21/99	287	0.445	0.027	0.126	0.598	74.50%	4.45%	21.05%	0.293	0.018	0.083	0.394
341011	04/22/99	307	0.475	0.027	0.128	0.630	75.43%	4.30%	20.27%	0.252	0.014	0.068	0.335
341031	10/05/89	194	0.218	0.060	0.111	0.389	56.10%	15.47%	28.44%	0.276	0.076	0.140	0.492
341031	09/12/90	205	0.231	0.061	0.112	0.404	57.06%	15.14%	27.80%	0.270	0.072	0.131	0.472
341031	04/06/92	224	0.247	0.062	0.115	0.424	58.20%	14.70%	27.09%	0.275	0.069	0.128	0.472
341031	02/24/93	234	0.258	0.063	0.116	0.438	59.06%	14.45%	26.49%	0.267	0.065	0.120	0.453
341031	10/26/95	266	0.298	0.066	0.120	0.484	61.58%	13.58%	24.84%	0.352	0.078	0.142	0.571
341031	11/04/95	267	0.298	0.066	0.120	0.484	61.58%	13.58%	24.84%	0.327	0.072	0.132	0.531
341033	10/05/89	181	0.156	0.044	0.068	0.269	58.13%	16.42%	25.44%	0.160	0.045	0.070	0.276
341033	09/12/90	192	0.159	0.044	0.069	0.273	58.46%	16.29%	25.25%	0.207	0.058	0.089	0.354
341033	04/05/92	211	0.169	0.045	0.070	0.284	59.50%	15.89%	24.61%	0.164	0.044	0.068	0.276
341033	02/24/93	221	0.174	0.045	0.070	0.290	60.09%	15.65%	24.26%	0.201	0.052	0.081	0.335
341033	11/03/95	254	0.188	0.046	0.072	0.307	61.44%	15.14%	23.41%	0.218	0.054	0.083	0.354
341033	07/23/97	274	0.193	0.047	0.072	0.312	61.79%	14.98%	23.23%	0.182	0.044	0.069	0.295
341034	10/05/89	48	0.107	0.000	0.070	0.178	60.37%	0.00%	39.63%	0.083	0.000	0.055	0.138
341034	09/12/90	59	0.122	0.000	0.072	0.194	62.88%	0.00%	37.12%	0.173	0.000	0.102	0.276
341034	04/06/92	78	0.134	0.000	0.074	0.208	64.46%	0.00%	35.54%	0.114	0.000	0.063	0.177
341034	02/24/93	88	0.146	0.000	0.075	0.221	66.05%	0.00%	33.95%	0.156	0.000	0.080	0.236
341034	11/04/95	121	0.180	0.000	0.078	0.258	69.65%	0.00%	30.35%	0.178	0.000	0.078	0.256
341034	07/30/97	141	0.196	0.000	0.080	0.276	71.09%	0.00%	28.91%	0.126	0.000	0.051	0.177

Table C-14 (Cont'd) Permanent Deformation Simulation (β_{r2} = 1.0 and β_{r3} = 1.2) Data

Section	Month	Time	Predicted							Measured			
			AC	GB	SG	Total	%AC	%GB	%SG	AC	GB	SG	Total
350101	05/01/97	19	0.125	0.043	0.172	0.340	36.78%	12.66%	50.56%	0.072	0.025	0.100	0.197
350101	03/19/99	38	0.197	0.049	0.193	0.439	44.94%	11.06%	43.99%	0.106	0.026	0.104	0.236
350102	05/01/97	19	0.133	0.072	0.207	0.413	32.26%	17.53%	50.20%	0.064	0.035	0.099	0.197
350102	03/19/99	38	0.213	0.081	0.237	0.531	40.05%	15.26%	44.69%	0.095	0.036	0.106	0.236
350103	05/01/97	19	0.069	0.000	0.171	0.240	28.78%	0.00%	71.22%	0.057	0.000	0.140	0.197
350103	03/19/99	38	0.109	0.000	0.200	0.309	35.16%	0.00%	64.84%	0.097	0.000	0.179	0.276
350104	05/01/97	19	0.055	0.000	0.113	0.169	32.91%	0.00%	67.09%	0.078	0.000	0.158	0.236
350104	03/19/99	38	0.087	0.000	0.134	0.220	39.39%	0.00%	60.61%	0.109	0.000	0.167	0.276
350105	05/02/97	19	0.102	0.016	0.194	0.312	32.74%	5.05%	62.22%	0.077	0.012	0.147	0.236
350105	03/22/99	38	0.160	0.018	0.226	0.403	39.69%	4.41%	55.90%	0.094	0.010	0.132	0.236
350106	05/02/96	19	0.055	0.006	0.131	0.191	28.51%	3.25%	68.24%	0.056	0.006	0.134	0.197
350106	03/22/99	38	0.084	0.007	0.153	0.245	34.53%	2.90%	62.58%	0.082	0.007	0.148	0.236
351005	10/31/89	73	0.131	0.024	0.135	0.290	45.27%	8.32%	46.40%	0.214	0.039	0.219	0.472
351005	08/21/91	95	0.147	0.025	0.140	0.312	47.07%	7.89%	45.04%	0.222	0.037	0.213	0.472
351005	10/24/92	109	0.161	0.025	0.145	0.330	48.65%	7.57%	43.78%	0.201	0.031	0.181	0.413
351005	03/18/95	138	0.201	0.026	0.150	0.377	53.21%	6.94%	39.85%	0.304	0.040	0.227	0.571
351005	03/16/99	183	0.255	0.027	0.158	0.440	57.89%	6.19%	35.92%	0.353	0.038	0.219	0.610
351022	10/31/89	37	0.087	0.035	0.122	0.244	35.82%	14.23%	49.95%	0.063	0.025	0.088	0.177
351022	08/22/91	59	0.136	0.038	0.133	0.306	44.24%	12.42%	43.34%	0.061	0.017	0.060	0.138
351022	10/24/92	73	0.147	0.039	0.137	0.323	45.50%	12.04%	42.46%	0.090	0.024	0.084	0.197
351022	03/18/95	102	0.180	0.041	0.145	0.366	49.23%	11.08%	39.69%	0.107	0.024	0.086	0.217
351022	03/17/99	147	0.248	0.043	0.155	0.447	55.56%	9.68%	34.76%	0.087	0.015	0.055	0.157
351112	12/05/89	67	0.230	0.032	0.084	0.346	66.50%	9.28%	24.22%	0.105	0.015	0.038	0.157
351112	01/22/91	80	0.240	0.033	0.085	0.358	67.14%	9.09%	23.77%	0.119	0.016	0.042	0.177
351112	09/27/91	88	0.253	0.033	0.086	0.371	67.98%	8.84%	23.18%	0.094	0.012	0.032	0.138
351112	01/27/93	104	0.266	0.033	0.087	0.386	68.81%	8.61%	22.58%	0.081	0.010	0.027	0.118
351112	03/15/95	130	0.296	0.034	0.089	0.420	70.65%	8.10%	21.25%	0.139	0.016	0.042	0.197
351112	09/09/97	160	0.324	0.035	0.091	0.450	72.02%	7.72%	20.26%	0.099	0.011	0.028	0.138
351112	03/15/99	175	0.337	0.035	0.092	0.463	72.65%	7.55%	19.79%	0.114	0.012	0.031	0.157
371006	10/13/89	88	0.384	0.032	0.144	0.560	68.49%	5.76%	25.75%	0.054	0.005	0.020	0.079
371006	03/19/91	105	0.411	0.033	0.147	0.591	69.59%	5.53%	24.88%	0.055	0.004	0.020	0.079
371006	10/11/92	124	0.471	0.034	0.151	0.655	71.82%	5.14%	23.03%	0.127	0.009	0.041	0.177
371006	04/18/94	142	0.494	0.034	0.153	0.681	72.50%	5.01%	22.49%	0.071	0.005	0.022	0.098
371006	09/20/94	147	0.510	0.034	0.154	0.699	73.01%	4.93%	22.07%	0.086	0.006	0.026	0.118
371024	11/03/89	109	0.085	0.050	0.110	0.245	34.69%	20.59%	44.72%	0.123	0.073	0.158	0.354
371024	03/09/91	125	0.090	0.051	0.112	0.253	35.43%	20.18%	44.39%	0.153	0.087	0.192	0.433
371024	04/10/92	138	0.094	0.052	0.114	0.261	36.24%	19.86%	43.90%	0.128	0.070	0.156	0.354
371802	10/13/89	49	0.100	0.082	0.280	0.463	21.61%	17.76%	60.63%	0.077	0.063	0.215	0.354
371802	03/18/91	66	0.113	0.085	0.296	0.495	22.89%	17.22%	59.89%	0.072	0.054	0.189	0.315
371802	10/10/92	85	0.131	0.089	0.313	0.533	24.61%	16.70%	58.68%	0.087	0.059	0.208	0.354
371802	04/15/94	103	0.141	0.091	0.324	0.556	25.32%	16.35%	58.33%	0.110	0.071	0.253	0.433
371802	07/18/95	118	0.154	0.093	0.334	0.582	26.55%	16.04%	57.41%	0.125	0.076	0.271	0.472
371802	02/09/96	125	0.158	0.094	0.337	0.589	26.79%	15.94%	57.28%	0.137	0.082	0.293	0.512
371802	04/02/96	127	0.158	0.094	0.338	0.590	26.77%	15.91%	57.33%	0.137	0.081	0.293	0.512
371817	10/15/89	71	0.108	0.050	0.077	0.234	46.02%	21.31%	32.68%	0.181	0.084	0.129	0.394
371817	03/18/91	88	0.116	0.051	0.079	0.246	47.09%	20.78%	32.13%	0.120	0.053	0.082	0.256
371817	10/18/92	107	0.137	0.053	0.082	0.272	50.34%	19.60%	30.06%	0.178	0.069	0.107	0.354

Table C-14 (Cont'd) Permanent Deformation Simulation (β_{r2} = 1.0 and β_{r3} = 1.2) Data

Section	Month	Time	Predicted							Measured			
			AC	GB	SG	Total	%AC	%GB	%SG	AC	GB	SG	Total
371992	10/15/92	33	0.152	0.130	0.078	0.360	42.21%	36.13%	21.66%	0.100	0.085	0.051	0.236
371992	04/20/94	51	0.189	0.137	0.083	0.409	46.11%	33.49%	20.40%	0.018	0.013	0.008	0.039
371992	02/06/96	73	0.236	0.144	0.089	0.468	50.32%	30.74%	18.94%	0.079	0.048	0.030	0.157
371992	04/22/98	99	0.288	0.150	0.094	0.532	54.12%	28.26%	17.62%	0.128	0.067	0.042	0.236
404087	01/17/90	43	0.078	0.029	0.108	0.215	36.16%	13.66%	50.18%	0.221	0.083	0.306	0.610
404087	10/13/91	64	0.097	0.032	0.120	0.249	39.03%	12.78%	48.18%	0.169	0.055	0.209	0.433
404087	02/08/93	80	0.106	0.033	0.126	0.265	39.95%	12.41%	47.65%	0.149	0.046	0.178	0.374
404087	02/09/95	104	0.121	0.034	0.135	0.291	41.67%	11.82%	46.51%	0.238	0.067	0.266	0.571
404163	01/23/90	34	0.071	0.000	0.106	0.176	40.05%	0.00%	59.95%	0.181	0.000	0.271	0.453
404163	03/17/91	48	0.081	0.000	0.111	0.191	42.19%	0.00%	57.81%	0.158	0.000	0.216	0.374
404163	10/28/91	55	0.087	0.000	0.114	0.201	43.43%	0.00%	56.57%	0.128	0.000	0.167	0.295
404163	03/10/93	72	0.098	0.000	0.118	0.215	45.43%	0.00%	54.57%	0.125	0.000	0.150	0.276
404163	04/22/96	109	0.115	0.000	0.124	0.239	47.97%	0.00%	52.03%	0.151	0.000	0.164	0.315
404163	08/20/97	125	0.128	0.000	0.128	0.256	50.06%	0.00%	49.94%	0.197	0.000	0.197	0.394
404163	01/11/99	141	0.133	0.000	0.130	0.263	50.72%	0.00%	49.28%	0.230	0.000	0.223	0.453
421599	07/18/89	24	0.054	0.023	0.105	0.182	29.52%	12.64%	57.84%	0.052	0.022	0.102	0.177
421599	09/27/90	38	0.064	0.023	0.112	0.200	32.16%	11.66%	56.17%	0.070	0.025	0.122	0.217
421599	08/07/91	49	0.072	0.023	0.116	0.211	33.96%	11.05%	54.99%	0.067	0.022	0.108	0.197
421599	03/01/93	68	0.083	0.024	0.121	0.227	36.36%	10.39%	53.25%	0.115	0.033	0.168	0.315
421599	06/21/95	95	0.101	0.024	0.127	0.252	39.97%	9.48%	50.55%	0.110	0.026	0.139	0.276
421599	07/19/96	108	0.110	0.024	0.130	0.264	41.66%	9.10%	49.24%	0.115	0.025	0.136	0.276
421599	03/26/98	128	0.123	0.024	0.133	0.280	43.78%	8.66%	47.55%	0.121	0.024	0.131	0.276
451011	04/11/89	34	0.327	0.064	0.087	0.477	68.47%	13.34%	18.19%	0.229	0.045	0.061	0.335
451011	03/05/91	57	0.405	0.067	0.091	0.562	71.94%	11.86%	16.20%	0.354	0.058	0.080	0.492
451011	10/24/92	76	0.470	0.069	0.094	0.633	74.31%	10.88%	14.81%	0.468	0.069	0.093	0.630
451011	01/27/96	115	0.554	0.071	0.097	0.722	76.67%	9.87%	13.46%	0.513	0.066	0.090	0.669
451011	02/11/99	150	0.590	0.073	0.100	0.763	77.39%	9.56%	13.05%	0.548	0.068	0.092	0.709
473104	11/01/89	42	0.005	0.051	0.089	0.145	3.43%	35.42%	61.15%	0.009	0.098	0.169	0.276
473104	05/06/91	60	0.006	0.055	0.097	0.158	3.49%	34.68%	61.83%	0.011	0.109	0.195	0.315
473104	10/26/92	77	0.007	0.057	0.105	0.169	3.91%	33.97%	62.12%	0.014	0.120	0.220	0.354
473104	11/30/95	114	0.008	0.063	0.119	0.190	4.21%	33.19%	62.59%	0.027	0.209	0.394	0.630
480001	04/10/89	1	0.017	0.073	0.084	0.174	9.75%	42.04%	48.21%	0.023	0.099	0.114	0.236
480001	10/11/90	19	0.127	0.127	0.158	0.413	30.78%	30.82%	38.40%	0.085	0.085	0.106	0.276
480001	03/11/92	36	0.164	0.137	0.178	0.479	34.35%	28.54%	37.11%	0.108	0.090	0.117	0.315
480001	02/17/93	47	0.195	0.142	0.187	0.524	37.23%	27.11%	35.67%	0.073	0.053	0.070	0.197
480001	02/20/95	71	0.236	0.150	0.203	0.588	40.09%	25.48%	34.43%	0.126	0.080	0.108	0.315
480001	03/19/98	108	0.308	0.160	0.221	0.689	44.74%	23.17%	32.09%	0.070	0.036	0.051	0.157
481060	06/18/90	52	0.168	0.054	0.087	0.309	54.52%	17.38%	28.10%	0.225	0.072	0.116	0.413
481060	02/14/91	60	0.181	0.055	0.089	0.324	55.80%	16.85%	27.35%	0.187	0.056	0.092	0.335
481060	03/18/92	73	0.196	0.056	0.091	0.344	57.19%	16.21%	26.59%	0.135	0.038	0.063	0.236
481060	02/23/93	84	0.213	0.057	0.094	0.363	58.59%	15.62%	25.79%	0.127	0.034	0.056	0.217
481060	02/23/95	108	0.240	0.058	0.098	0.396	60.65%	14.72%	24.64%	0.227	0.055	0.092	0.374
481060	01/05/99	154	0.297	0.061	0.103	0.461	64.33%	13.24%	22.42%	0.253	0.052	0.088	0.394
481077	04/25/89	88	0.265	0.036	0.090	0.390	67.76%	9.19%	23.04%	0.360	0.049	0.122	0.531
481077	10/13/91	118	0.311	0.037	0.093	0.441	70.49%	8.43%	21.07%	0.430	0.051	0.129	0.610
481077	10/12/92	130	0.321	0.038	0.094	0.452	70.90%	8.31%	20.79%	0.433	0.051	0.127	0.610

Table C-14 (Cont'd) Permanent Deformation Simulation (β_{r2} = 1.0 and β_{r3} = 1.2) Data

Section	Month	Time	Predicted							Measured			
			AC	GB	SG	Total	%AC	%GB	%SG	AC	GB	SG	Total
481077	03/10/95	159	0.351	0.038	0.096	0.485	72.33%	7.90%	19.77%	0.513	0.056	0.140	0.709
481077	03/26/98	195	0.387	0.039	0.098	0.525	73.80%	7.47%	18.73%	0.508	0.051	0.129	0.689
481109	01/04/90	68	0.227	0.000	0.193	0.420	54.12%	0.00%	45.88%	0.170	0.000	0.145	0.315
481109	09/21/90	76	0.244	0.000	0.197	0.440	55.36%	0.00%	44.64%	0.174	0.000	0.141	0.315
481109	03/10/92	94	0.262	0.000	0.202	0.464	56.42%	0.00%	43.58%	0.144	0.000	0.112	0.256
481109	02/12/93	105	0.279	0.000	0.206	0.485	57.57%	0.00%	42.43%	0.147	0.000	0.109	0.256
481109	02/16/95	129	0.309	0.000	0.212	0.521	59.26%	0.00%	40.74%	0.233	0.000	0.160	0.394
481130	04/11/89	201	0.363	0.156	0.181	0.700	51.87%	22.29%	25.84%	0.276	0.118	0.137	0.531
481130	10/12/90	219	0.386	0.159	0.185	0.729	52.93%	21.76%	25.31%	0.365	0.150	0.174	0.689
481130	03/12/92	236	0.396	0.160	0.187	0.744	53.28%	21.52%	25.19%	0.367	0.148	0.174	0.689
481169	03/04/90	212	0.087	0.106	0.076	0.268	32.39%	39.47%	28.14%	0.102	0.124	0.089	0.315
481169	09/18/90	218	0.089	0.106	0.076	0.271	32.81%	39.20%	27.98%	0.103	0.123	0.088	0.315
481169	03/07/91	224	0.089	0.106	0.076	0.272	32.82%	39.20%	27.99%	0.103	0.123	0.088	0.315
481169	01/30/92	234	0.092	0.107	0.077	0.275	33.31%	38.91%	27.78%	0.111	0.130	0.093	0.335
481169	02/27/93	247	0.094	0.108	0.077	0.279	33.76%	38.65%	27.59%	0.106	0.122	0.087	0.315
481169	03/03/95	272	0.098	0.109	0.078	0.285	34.49%	38.21%	27.30%	0.163	0.181	0.129	0.472
481174	10/17/90	186	0.408	0.069	0.170	0.646	63.07%	10.63%	26.30%	0.248	0.042	0.104	0.394
481174	02/14/91	190	0.408	0.069	0.170	0.647	63.05%	10.62%	26.33%	0.273	0.046	0.114	0.433
481174	03/16/92	203	0.419	0.069	0.172	0.660	63.41%	10.48%	26.11%	0.200	0.033	0.082	0.315
481174	02/18/93	214	0.427	0.070	0.174	0.670	63.68%	10.38%	25.94%	0.226	0.037	0.092	0.354
481174	02/21/95	238	0.449	0.070	0.177	0.696	64.42%	10.12%	25.46%	0.431	0.068	0.170	0.669
481174	03/20/98	275	0.474	0.071	0.182	0.727	65.17%	9.83%	25.01%	0.436	0.066	0.167	0.669
481178	04/10/89	10	0.089	0.028	0.090	0.207	42.96%	13.43%	43.61%	0.076	0.024	0.077	0.177
481178	02/22/91	32	0.167	0.034	0.117	0.317	52.56%	10.68%	36.76%	0.072	0.015	0.051	0.138
481178	03/10/92	45	0.196	0.035	0.125	0.356	55.07%	9.92%	35.01%	0.076	0.014	0.048	0.138
481178	02/16/93	56	0.216	0.036	0.130	0.383	56.45%	9.48%	34.07%	0.089	0.015	0.054	0.157
481178	02/17/95	80	0.262	0.038	0.141	0.442	59.35%	8.64%	32.00%	0.140	0.020	0.076	0.236
481183	12/06/89	179	0.212	0.074	0.208	0.494	42.91%	15.01%	42.08%	0.110	0.038	0.108	0.256
481183	09/15/90	188	0.223	0.076	0.212	0.510	43.66%	14.80%	41.53%	0.129	0.044	0.123	0.295
483749	10/17/90	116	0.294	0.215	0.183	0.693	42.52%	31.03%	26.45%	0.109	0.079	0.068	0.256
483749	02/14/91	120	0.295	0.216	0.184	0.695	42.44%	31.03%	26.53%	0.092	0.067	0.057	0.217
483749	03/16/92	133	0.305	0.219	0.188	0.713	42.85%	30.77%	26.37%	0.084	0.061	0.052	0.197
483749	02/21/93	144	0.315	0.222	0.191	0.728	43.31%	30.50%	26.19%	0.094	0.066	0.057	0.217
483749	02/21/95	168	0.321	0.228	0.196	0.745	43.06%	30.59%	26.35%	0.144	0.102	0.088	0.335
483749	03/28/97	193	0.321	0.233	0.201	0.755	42.48%	30.87%	26.65%	0.192	0.140	0.121	0.453
489005	10/14/90	50	0.044	0.179	0.250	0.473	9.29%	37.80%	52.91%	0.031	0.127	0.177	0.335
489005	03/12/92	67	0.049	0.185	0.264	0.499	9.87%	37.12%	53.00%	0.014	0.051	0.073	0.138
489005	02/17/93	78	0.052	0.189	0.272	0.514	10.21%	36.81%	52.98%	0.014	0.051	0.073	0.138
489005	02/20/95	102	0.058	0.195	0.286	0.540	10.80%	36.19%	53.01%	0.026	0.085	0.125	0.236
489005	07/10/98	143	0.067	0.205	0.305	0.577	11.65%	35.51%	52.84%	0.018	0.056	0.083	0.157
501002	08/09/89	58	0.063	0.037	0.054	0.154	40.95%	23.90%	35.15%	0.121	0.071	0.104	0.295
501002	08/08/90	70	0.070	0.038	0.056	0.164	42.92%	23.08%	34.00%	0.161	0.086	0.127	0.374
501002	09/04/91	83	0.074	0.039	0.057	0.170	43.62%	22.69%	33.70%	0.137	0.071	0.106	0.315
501002	04/27/93	102	0.080	0.039	0.059	0.178	44.71%	22.14%	33.16%	0.167	0.083	0.124	0.374
501002	05/25/94	115	0.085	0.040	0.060	0.186	45.80%	21.70%	32.50%	0.171	0.081	0.122	0.374
501002	08/17/94	118	0.089	0.041	0.061	0.190	46.61%	21.44%	31.96%	0.174	0.080	0.120	0.374

Table C-14 (Cont'd) Permanent Deformation Simulation ($\beta_{r2} = 1.0$ and $\beta_{r3} = 1.2$) Data

Section	Month	Time	Predicted							Measured			
			AC	GB	SG	Total	%AC	%GB	%SG	AC	GB	SG	Total
501002	04/27/95	126	0.089	0.041	0.061	0.191	46.53%	21.40%	32.07%	0.183	0.084	0.126	0.394
501002	10/12/95	132	0.095	0.042	0.062	0.199	47.88%	20.95%	31.17%	0.207	0.091	0.135	0.433
501002	10/17/96	144	0.098	0.042	0.063	0.202	48.28%	20.73%	31.00%	0.171	0.073	0.110	0.354
501002	05/15/97	151	0.098	0.042	0.063	0.203	48.24%	20.71%	31.05%	0.209	0.090	0.134	0.433
501002	10/23/97	156	0.102	0.043	0.064	0.209	49.09%	20.40%	30.51%	0.222	0.092	0.138	0.453
501002	06/06/98	164	0.104	0.043	0.064	0.211	49.34%	20.26%	30.40%	0.214	0.088	0.132	0.433
501004	08/09/89	58	0.038	0.039	0.060	0.138	27.82%	28.27%	43.91%	0.044	0.045	0.069	0.157
501004	08/07/90	70	0.045	0.040	0.062	0.146	30.61%	27.07%	42.32%	0.078	0.069	0.108	0.256
501004	09/20/91	83	0.052	0.041	0.064	0.157	33.36%	25.91%	40.72%	0.066	0.051	0.080	0.197
501004	04/27/93	102	0.060	0.042	0.066	0.168	35.84%	24.76%	39.40%	0.092	0.063	0.101	0.256
501004	10/12/95	132	0.076	0.043	0.070	0.189	40.37%	22.75%	36.88%	0.095	0.054	0.087	0.236
501004	11/04/97	157	0.090	0.044	0.073	0.207	43.43%	21.43%	35.14%	0.111	0.055	0.090	0.256
511002	10/15/89	121	0.154	0.054	0.107	0.316	48.90%	17.22%	33.89%	0.193	0.068	0.133	0.394
511023	10/12/89	107	0.367	0.054	0.143	0.564	65.09%	9.60%	25.31%	0.372	0.055	0.145	0.571
511023	03/20/91	124	0.390	0.055	0.145	0.589	66.15%	9.28%	24.57%	0.365	0.051	0.135	0.551
511023	10/10/92	143	0.430	0.056	0.148	0.634	67.88%	8.81%	23.31%	0.401	0.052	0.138	0.591
511023	12/07/93	157	0.452	0.056	0.149	0.658	68.73%	8.58%	22.69%	0.419	0.052	0.138	0.610
511023	09/18/95	178	0.489	0.057	0.152	0.698	70.07%	8.20%	21.73%	0.386	0.045	0.120	0.551
511023	02/09/96	183	0.490	0.057	0.152	0.699	70.07%	8.20%	21.74%	0.469	0.055	0.145	0.669
511023	03/24/97	196	0.503	0.057	0.153	0.713	70.51%	8.05%	21.44%	0.416	0.048	0.127	0.591
512021	10/15/89	54	0.105	0.015	0.104	0.224	46.94%	6.71%	46.36%	0.185	0.026	0.183	0.394
512021	03/11/91	71	0.119	0.016	0.107	0.241	49.22%	6.48%	44.30%	0.213	0.028	0.192	0.433
512021	10/20/92	90	0.139	0.016	0.112	0.267	51.98%	6.07%	41.95%	0.276	0.032	0.223	0.531
531008	07/17/89	129	0.157	0.065	0.091	0.313	50.08%	20.85%	29.07%	0.384	0.160	0.223	0.768
531008	07/17/89	142	0.169	0.066	0.092	0.328	51.64%	20.24%	28.12%	0.386	0.151	0.210	0.748
531008	08/02/90	151	0.171	0.067	0.093	0.330	51.70%	20.20%	28.10%	0.397	0.155	0.216	0.768
531008	08/02/90	153	0.173	0.067	0.093	0.333	52.04%	20.05%	27.91%	0.430	0.166	0.231	0.827
531008	05/28/91	188	0.189	0.068	0.095	0.353	53.56%	19.41%	27.03%	0.580	0.210	0.293	1.083
531801	07/17/89	190	0.070	0.008	0.060	0.138	50.47%	5.98%	43.55%	0.099	0.012	0.086	0.197
531801	08/09/90	203	0.073	0.008	0.061	0.142	51.38%	5.89%	42.72%	0.091	0.010	0.076	0.177
531801	06/05/91	213	0.074	0.008	0.061	0.144	51.63%	5.84%	42.52%	0.112	0.013	0.092	0.217
531801	06/22/94	249	0.084	0.009	0.063	0.155	53.94%	5.59%	40.47%	0.085	0.009	0.064	0.157
531801	05/08/95	260	0.086	0.009	0.063	0.158	54.31%	5.50%	40.19%	0.086	0.009	0.063	0.157
531801	10/31/95	265	0.089	0.009	0.064	0.162	55.03%	5.46%	39.51%	0.097	0.010	0.070	0.177
531801	03/27/97	282	0.092	0.009	0.064	0.165	55.63%	5.42%	38.95%	0.110	0.011	0.077	0.197
561007	09/26/89	111	0.101	0.033	0.095	0.229	43.97%	14.50%	41.53%	0.199	0.066	0.188	0.453
561007	07/22/90	121	0.103	0.034	0.096	0.233	44.12%	14.42%	41.46%	0.174	0.057	0.163	0.394
561007	05/13/91	131	0.104	0.034	0.097	0.236	44.24%	14.37%	41.39%	0.165	0.054	0.155	0.374
561007	08/03/91	134	0.111	0.034	0.098	0.243	45.62%	14.11%	40.27%	0.144	0.044	0.127	0.315
561007	12/09/93	162	0.121	0.035	0.101	0.257	47.02%	13.70%	39.28%	0.130	0.038	0.108	0.276
561007	03/16/94	165	0.121	0.035	0.101	0.257	46.98%	13.68%	39.34%	0.129	0.038	0.108	0.276
561007	04/19/94	166	0.121	0.035	0.101	0.257	46.96%	13.67%	39.37%	0.139	0.040	0.116	0.295
561007	08/19/94	170	0.123	0.035	0.102	0.260	47.29%	13.64%	39.08%	0.121	0.035	0.100	0.256
561007	02/16/95	176	0.123	0.035	0.102	0.261	47.27%	13.59%	39.14%	0.130	0.037	0.108	0.276
561007	05/17/95	179	0.123	0.036	0.102	0.261	47.23%	13.62%	39.16%	0.121	0.035	0.100	0.256
561007	09/08/95	183	0.126	0.036	0.103	0.264	47.63%	13.53%	38.84%	0.131	0.037	0.107	0.276
561007	06/11/96	192	0.127	0.036	0.103	0.266	47.67%	13.50%	38.84%	0.103	0.029	0.084	0.217

Table C-14 (Cont'd) Permanent Deformation Simulation (β_{r2} = 1.0 and β_{r3} = 1.2) Data

Section	Month	Time	Predicted							Measured			
			AC	GB	SG	Total	%AC	%GB	%SG	AC	GB	SG	Total
561007	10/24/96	196	0.132	0.036	0.104	0.271	48.51%	13.32%	38.17%	0.134	0.037	0.105	0.276
561007	11/19/96	197	0.132	0.036	0.104	0.272	48.48%	13.32%	38.20%	0.134	0.037	0.105	0.276
561007	03/10/97	201	0.132	0.036	0.104	0.272	48.44%	13.30%	38.26%	0.143	0.039	0.113	0.295
561007	03/24/97	202	0.132	0.036	0.104	0.272	48.43%	13.29%	38.28%	0.133	0.037	0.105	0.276
561007	08/07/97	206	0.138	0.036	0.105	0.279	49.44%	13.07%	37.49%	0.136	0.036	0.103	0.276
561007	09/30/97	207	0.138	0.037	0.105	0.279	49.48%	13.10%	37.42%	0.136	0.036	0.103	0.276
841684	08/29/90	144	0.154	0.076	0.068	0.298	51.60%	25.40%	22.99%	0.284	0.140	0.127	0.551
841684	08/28/91	156	0.160	0.076	0.069	0.306	52.38%	25.00%	22.62%	0.289	0.138	0.125	0.551
841684	05/03/93	177	0.166	0.077	0.070	0.314	52.96%	24.66%	22.39%	0.344	0.160	0.145	0.650
841684	10/24/95	206	0.185	0.079	0.072	0.337	55.07%	23.56%	21.38%	0.390	0.167	0.151	0.709

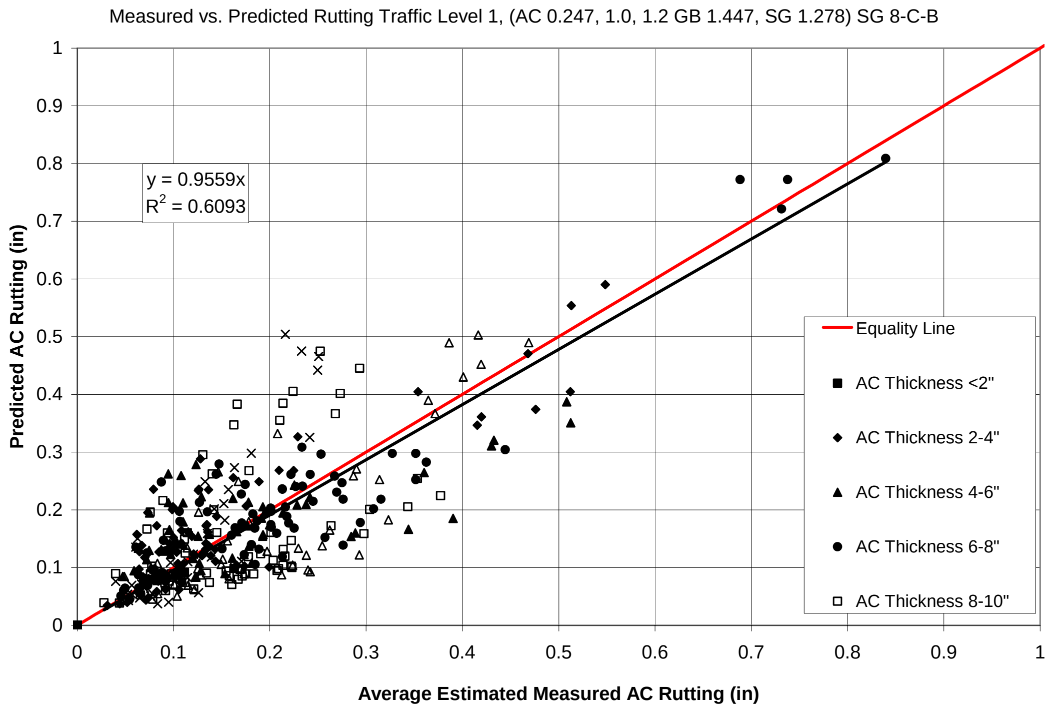


Figure C-120 Asphalt Concrete Layers Rut Depth (β_{r2} = 1.0 and β_{r3} = 1.2)

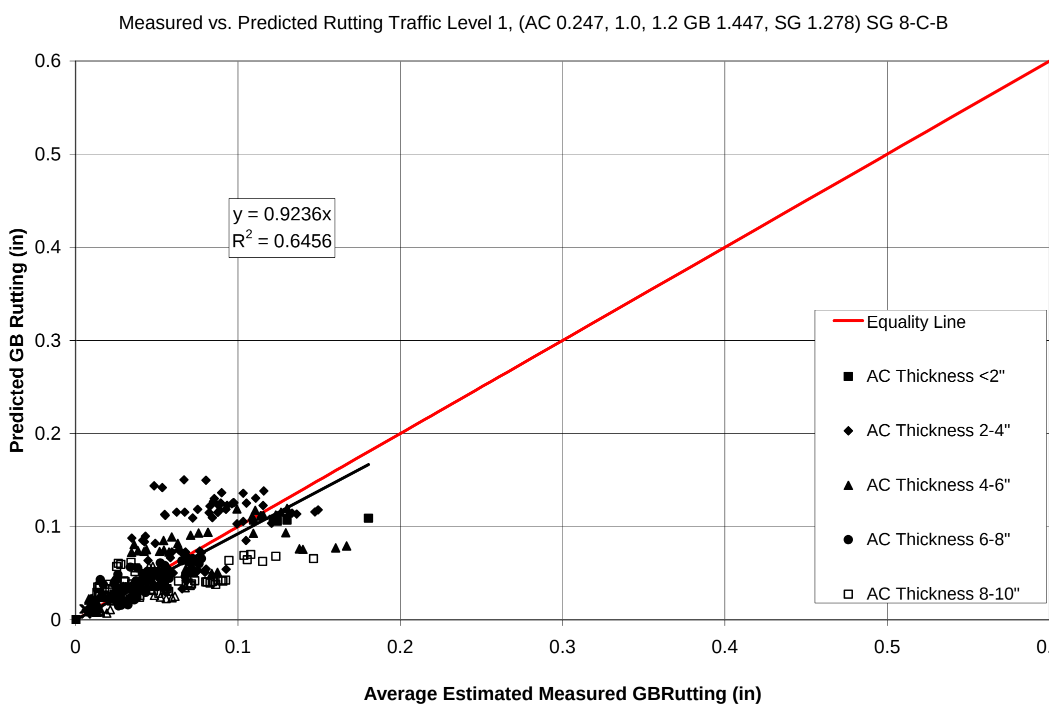


Figure C-121 Granular Base Layers Rut Depth (β_{r2} = 1.0 and β_{r3} = 1.2)

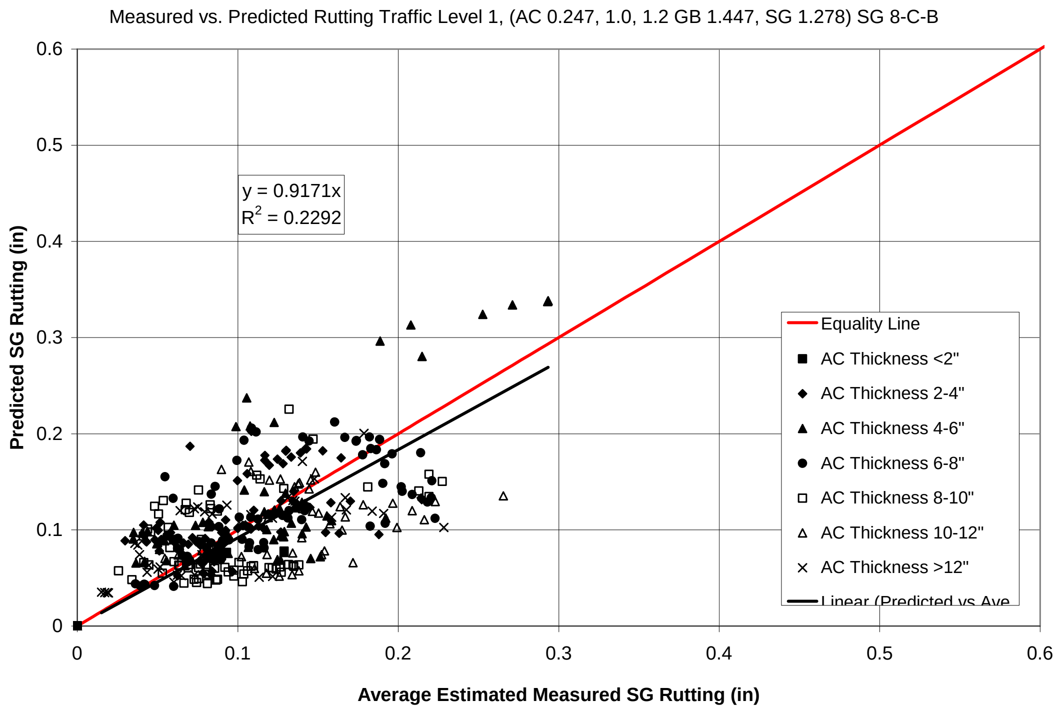


Figure C-122 Granular Subgrade Rut Depth (β_{r2} = 1.0 and β_{r3} = 1.2)

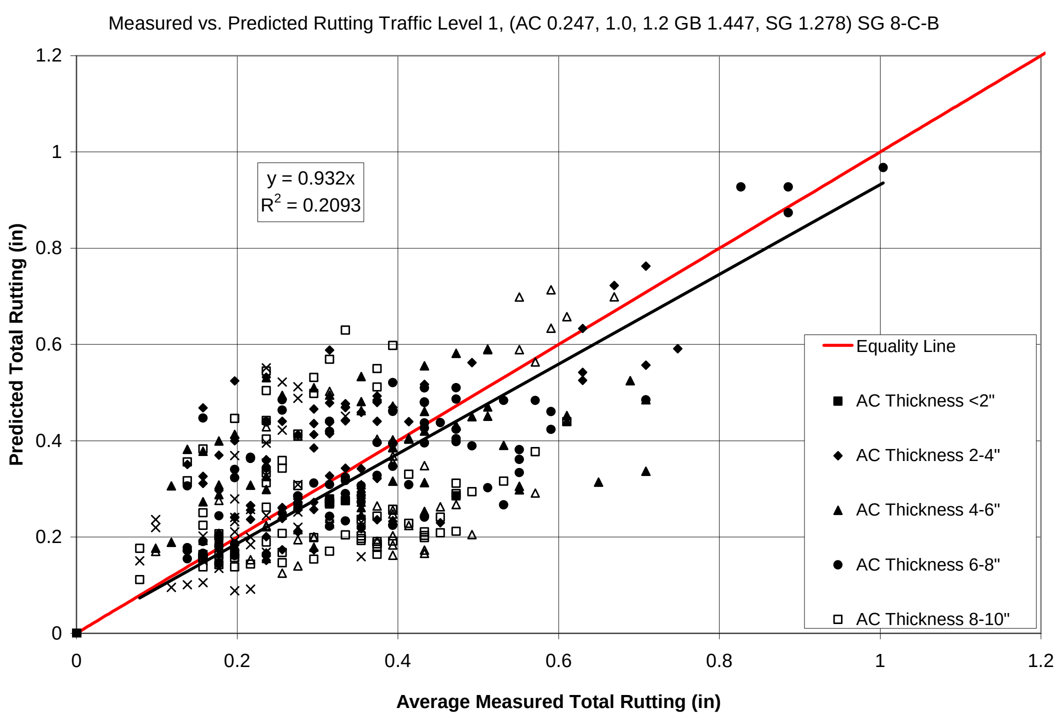


Figure C-123 Total Asphalt Pavement Rut Depth (β_{r2} = 1.0 and β_{r3} = 1.2)

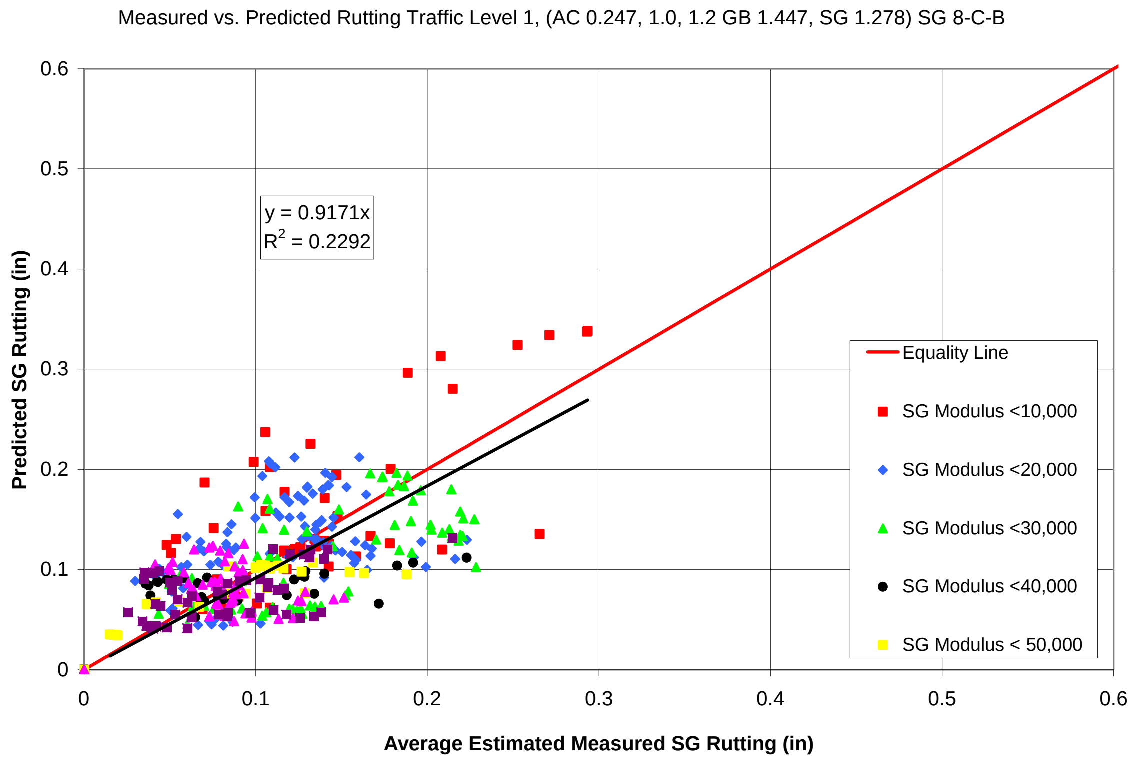


Figure C-124 Subgrade Rut Depth (β_{r2} = 1.0 and β_{r3} = 1.2) (By Subgrade Modulus)

Table C-65 Permanent Deformation Simulation (β_{r2} = 1.2 and β_{r3} = 0.8) Summary

	AC	GB	SG	Total
Average Predicted=	0.221	0.040	0.070	0.330
Sum of error =	0.477	-0.097	-0.379	0.000
Sum of error^2 =	2.863	0.126	0.296	6.108
Predicted % =	65.58%	12.04%	22.38%	100.00%
Se =	0.078	0.016	0.025	0.114
Average Measured =	0.040	0.070	0.330	0.346
Calibration Factor β_1 =	0.436	1.190	0.817	

Table C-66 Permanent Deformation Simulation (β_{r2} = 1.2 and β_{r3} = 0.8) Data

Section	Month	Time	Predicted							Measured			
			AC	GB	SG	Total	%AC	%GB	%SG	AC	GB	SG	Total
11001	04/05/89	103	0.548	0.123	0.071	0.742	73.77%	16.60%	9.63%	0.247	0.056	0.032	0.335
11001	02/12/91	125	0.593	0.126	0.073	0.792	74.90%	15.87%	9.24%	0.236	0.050	0.029	0.315
11001	04/02/92	139	0.602	0.127	0.074	0.803	75.03%	15.76%	9.21%	0.222	0.047	0.027	0.295
11019	05/15/89	32	0.223	0.018	0.082	0.323	69.00%	5.46%	25.55%	0.353	0.028	0.131	0.512
11019	04/16/90	43	0.248	0.018	0.085	0.352	70.55%	5.17%	24.27%	0.389	0.029	0.134	0.551
11019	01/15/91	52	0.270	0.019	0.088	0.376	71.77%	4.96%	23.26%	0.396	0.027	0.128	0.551
11019	03/31/92	66	0.281	0.019	0.090	0.390	72.18%	4.85%	22.97%	0.398	0.027	0.127	0.551
11019	03/22/94	90	0.309	0.022	0.093	0.423	72.97%	5.17%	21.86%	0.431	0.031	0.129	0.591
11019	01/08/96	112	0.334	0.024	0.095	0.453	73.72%	5.31%	20.97%	0.435	0.031	0.124	0.591
11019	01/23/98	136	0.348	0.024	0.097	0.469	74.21%	5.18%	20.62%	0.526	0.037	0.146	0.709
14126	06/05/89	15	0.103	0.009	0.029	0.141	72.68%	6.64%	20.68%	0.129	0.012	0.037	0.177
14126	03/03/91	36	0.138	0.010	0.034	0.182	75.75%	5.68%	18.57%	0.164	0.012	0.040	0.217
14126	04/08/92	49	0.148	0.011	0.036	0.194	76.14%	5.46%	18.40%	0.120	0.009	0.029	0.157
14126	04/08/94	73	0.164	0.011	0.038	0.213	77.00%	5.19%	17.80%	0.152	0.010	0.035	0.197
14126	12/11/95	93	0.179	0.011	0.039	0.230	77.96%	4.97%	17.07%	0.169	0.011	0.037	0.217
14126	12/05/97	117	0.190	0.012	0.040	0.242	78.51%	4.81%	16.68%	0.155	0.009	0.033	0.197
21001	08/21/91	98	0.046	0.032	0.077	0.156	29.70%	20.79%	49.51%	0.053	0.037	0.088	0.177
21001	08/26/93	122	0.049	0.033	0.079	0.161	30.39%	20.52%	49.10%	0.072	0.048	0.116	0.236
21001	06/15/95	144	0.050	0.034	0.083	0.167	30.14%	20.14%	49.72%	0.083	0.056	0.137	0.276
21001	08/22/97	170	0.054	0.034	0.084	0.172	31.25%	20.00%	48.75%	0.111	0.071	0.173	0.354
21001	08/26/98	182	0.055	0.035	0.085	0.175	31.34%	19.89%	48.76%	0.111	0.070	0.173	0.354
21002	08/22/91	83	0.075	0.041	0.034	0.149	49.87%	27.71%	22.42%	0.088	0.049	0.040	0.177
21002	07/30/92	94	0.075	0.042	0.034	0.151	49.69%	27.75%	22.57%	0.117	0.066	0.053	0.236
21002	06/14/95	129	0.090	0.044	0.035	0.169	53.11%	25.93%	20.96%	0.125	0.061	0.050	0.236
21002	08/21/97	155	0.092	0.045	0.036	0.173	53.11%	25.89%	21.00%	0.157	0.076	0.062	0.295
21002	05/14/98	164	0.092	0.045	0.036	0.173	53.04%	25.91%	21.05%	0.136	0.066	0.054	0.256
40114	03/30/95	20	0.208	0.037	0.108	0.354	58.92%	10.56%	30.52%	0.232	0.042	0.120	0.394
40114	11/07/95	28	0.239	0.039	0.114	0.392	60.92%	10.04%	29.04%	0.240	0.040	0.114	0.394
40114	02/04/96	31	0.239	0.039	0.115	0.393	60.82%	10.02%	29.16%	0.263	0.043	0.126	0.433
40114	04/04/96	33	0.239	0.039	0.115	0.394	60.75%	9.99%	29.26%	0.287	0.047	0.138	0.472
40114	07/09/96	36	0.263	0.040	0.117	0.421	62.48%	9.62%	27.90%	0.271	0.042	0.121	0.433
40114	08/13/96	37	0.272	0.041	0.118	0.431	63.10%	9.48%	27.42%	0.273	0.041	0.119	0.433
40114	01/07/98	54	0.296	0.042	0.123	0.461	64.17%	9.14%	26.69%	0.278	0.040	0.116	0.433
40114	04/21/98	57	0.296	0.042	0.123	0.461	64.12%	9.13%	26.75%	0.278	0.040	0.116	0.433
40114	06/12/98	59	0.299	0.042	0.124	0.465	64.21%	9.11%	26.68%	0.303	0.043	0.126	0.472
40114	10/23/98	63	0.317	0.043	0.126	0.485	65.30%	8.85%	25.85%	0.283	0.038	0.112	0.433
40114	02/12/99	65	0.317	0.043	0.126	0.486	65.27%	8.84%	25.89%	0.308	0.042	0.122	0.472
40115	02/15/95	19	0.119	0.000	0.047	0.166	71.43%	0.00%	28.57%	0.056	0.000	0.022	0.079
40115	03/30/95	20	0.119	0.000	0.047	0.166	71.41%	0.00%	28.59%	0.112	0.000	0.045	0.157
40115	01/07/98	54	0.168	0.000	0.054	0.222	75.73%	0.00%	24.27%	0.075	0.000	0.024	0.098
40115	02/11/99	65	0.180	0.000	0.055	0.235	76.61%	0.00%	23.39%	0.075	0.000	0.023	0.098
40116	03/30/95	20	0.088	0.000	0.066	0.153	57.28%	0.00%	42.72%	0.203	0.000	0.151	0.354
40116	01/08/98	54	0.125	0.000	0.075	0.199	62.47%	0.00%	37.53%	0.221	0.000	0.133	0.354
40116	02/12/99	65	0.133	0.000	0.076	0.210	63.60%	0.00%	36.40%	0.225	0.000	0.129	0.354

Table C-16 (Cont'd) Permanent Deformation Simulation (β_{r2} = 1.2 and β_{r3} = 0.8) Data

Section	Month	Time	Predicted							Measured			
			AC	GB	SG	Total	%AC	%GB	%SG	AC	GB	SG	Total
40117	03/30/95	20	0.145	0.006	0.042	0.193	75.07%	3.14%	21.79%	0.325	0.014	0.094	0.433
40117	01/08/98	54	0.206	0.007	0.048	0.261	79.11%	2.65%	18.25%	0.311	0.010	0.072	0.394
40117	02/11/99	65	0.221	0.007	0.049	0.276	79.91%	2.54%	17.55%	0.378	0.012	0.083	0.472
40118	03/30/95	20	0.142	0.009	0.066	0.217	65.61%	4.17%	30.22%	0.258	0.016	0.119	0.394
40118	01/08/98	54	0.199	0.010	0.076	0.285	69.74%	3.51%	26.75%	0.247	0.012	0.095	0.354
40118	02/12/99	65	0.213	0.010	0.078	0.301	70.69%	3.36%	25.95%	0.250	0.012	0.092	0.354
41007	11/20/89	140	0.778	0.034	0.071	0.883	88.12%	3.83%	8.05%	0.781	0.034	0.071	0.886
41007	09/05/91	162	0.833	0.034	0.072	0.940	88.64%	3.66%	7.70%	0.785	0.032	0.068	0.886
41007	09/20/91	163	0.833	0.034	0.072	0.940	88.64%	3.66%	7.70%	0.733	0.030	0.064	0.827
41007	09/16/94	198	0.901	0.035	0.074	1.010	89.21%	3.46%	7.33%	0.896	0.035	0.074	1.004
41016	11/30/89	122	0.329	0.000	0.102	0.432	76.30%	0.00%	23.70%	0.285	0.000	0.089	0.374
41016	07/02/90	130	0.334	0.000	0.103	0.437	76.44%	0.00%	23.56%	0.211	0.000	0.065	0.276
41016	09/25/91	144	0.347	0.000	0.104	0.451	76.88%	0.00%	23.12%	0.182	0.000	0.055	0.236
41016	09/18/96	204	0.399	0.000	0.109	0.508	78.51%	0.00%	21.49%	0.247	0.000	0.068	0.315
41024	11/03/89	149	0.379	0.023	0.095	0.496	76.28%	4.63%	19.10%	0.180	0.011	0.045	0.236
41024	08/26/90	158	0.392	0.023	0.096	0.510	76.74%	4.52%	18.74%	0.196	0.012	0.048	0.256
41024	09/04/91	171	0.409	0.023	0.097	0.529	77.30%	4.43%	18.27%	0.167	0.010	0.040	0.217
41024	08/22/95	218	0.458	0.024	0.100	0.582	78.70%	4.15%	17.16%	0.201	0.011	0.044	0.256
41024	11/09/95	221	0.459	0.024	0.100	0.583	78.71%	4.14%	17.15%	0.217	0.011	0.047	0.276
41024	02/08/96	224	0.459	0.024	0.100	0.584	78.70%	4.14%	17.17%	0.232	0.012	0.051	0.295
41024	04/04/96	226	0.459	0.024	0.100	0.584	78.70%	4.14%	17.17%	0.201	0.011	0.044	0.256
41024	06/13/96	228	0.461	0.024	0.100	0.585	78.74%	4.12%	17.14%	0.217	0.011	0.047	0.276
41024	07/11/96	229	0.469	0.024	0.101	0.594	78.97%	4.09%	16.94%	0.218	0.011	0.047	0.276
41024	08/15/96	230	0.474	0.024	0.101	0.600	79.13%	4.07%	16.80%	0.218	0.011	0.046	0.276
41024	01/15/98	247	0.491	0.025	0.102	0.617	79.53%	3.99%	16.48%	0.219	0.011	0.045	0.276
41024	04/22/98	250	0.491	0.025	0.102	0.617	79.52%	3.99%	16.49%	0.219	0.011	0.045	0.276
41024	06/15/98	252	0.494	0.025	0.102	0.620	79.59%	3.97%	16.44%	0.219	0.011	0.045	0.276
41024	10/26/98	256	0.498	0.025	0.102	0.625	79.70%	3.94%	16.36%	0.235	0.012	0.048	0.295
81029	10/20/89	209	0.202	0.060	0.066	0.328	61.67%	18.22%	20.11%	0.146	0.043	0.047	0.236
81029	08/25/91	231	0.210	0.060	0.067	0.338	62.27%	17.89%	19.84%	0.135	0.039	0.043	0.217
81029	10/21/91	233	0.211	0.060	0.067	0.338	62.28%	17.87%	19.84%	0.110	0.032	0.035	0.177
81029	09/08/95	280	0.224	0.062	0.069	0.355	63.19%	17.37%	19.44%	0.149	0.041	0.046	0.236
81047	10/20/89	73	0.170	0.085	0.079	0.334	50.79%	25.52%	23.69%	0.190	0.095	0.089	0.374
81047	08/25/91	95	0.184	0.087	0.083	0.354	52.03%	24.52%	23.44%	0.184	0.087	0.083	0.354
81047	10/22/91	97	0.184	0.087	0.083	0.355	52.00%	24.52%	23.48%	0.174	0.082	0.079	0.335
81053	10/19/89	60	0.180	0.076	0.064	0.321	56.15%	23.85%	20.00%	0.199	0.085	0.071	0.354
81053	07/07/90	69	0.191	0.077	0.066	0.334	57.23%	23.03%	19.74%	0.248	0.100	0.085	0.433
81053	12/06/93	110	0.237	0.088	0.074	0.399	59.33%	22.10%	18.57%	0.234	0.087	0.073	0.394
81053	03/14/94	113	0.237	0.088	0.075	0.400	59.24%	22.09%	18.67%	0.233	0.087	0.073	0.394
81053	08/08/94	118	0.245	0.091	0.076	0.413	59.42%	22.14%	18.44%	0.234	0.087	0.073	0.394
81053	10/21/94	120	0.245	0.092	0.076	0.414	59.33%	22.18%	18.49%	0.245	0.092	0.076	0.413
81053	02/13/95	124	0.245	0.092	0.077	0.414	59.27%	22.15%	18.57%	0.245	0.092	0.077	0.413
81053	05/08/95	127	0.246	0.092	0.077	0.415	59.25%	22.15%	18.60%	0.245	0.092	0.077	0.413
81053	05/10/96	139	0.258	0.092	0.078	0.428	60.20%	21.53%	18.26%	0.261	0.093	0.079	0.433
81053	10/21/96	144	0.266	0.092	0.079	0.437	60.87%	21.14%	17.99%	0.288	0.100	0.085	0.472
81053	11/14/96	145	0.266	0.092	0.079	0.437	60.86%	21.13%	18.01%	0.288	0.100	0.085	0.472
81053	03/20/97	149	0.266	0.093	0.079	0.438	60.78%	21.13%	18.09%	0.287	0.100	0.085	0.472

Table C-16 (Cont'd) Permanent Deformation Simulation (β_{r2} = 1.2 and β_{r3} = 0.8) Data

Section	Month	Time	Predicted							Measured			
			AC	GB	SG	Total	%AC	%GB	%SG	AC	GB	SG	Total
81053	08/05/97	154	0.280	0.095	0.080	0.455	61.46%	20.89%	17.65%	0.302	0.103	0.087	0.492
81053	09/26/97	155	0.280	0.095	0.080	0.456	61.45%	20.90%	17.65%	0.314	0.107	0.090	0.512
81053	08/25/98	166	0.291	0.098	0.082	0.472	61.71%	20.86%	17.43%	0.316	0.107	0.089	0.512
91803	09/05/90	63	0.090	0.024	0.045	0.160	56.55%	15.05%	28.40%	0.100	0.027	0.050	0.177
91803	08/22/91	74	0.101	0.025	0.047	0.173	58.48%	14.41%	27.11%	0.081	0.020	0.037	0.138
91803	09/30/92	87	0.104	0.026	0.049	0.178	58.28%	14.41%	27.31%	0.115	0.028	0.054	0.197
91803	05/12/94	107	0.112	0.027	0.051	0.189	59.12%	14.01%	26.88%	0.081	0.019	0.037	0.138
91803	09/25/94	111	0.116	0.027	0.052	0.195	59.64%	13.90%	26.46%	0.082	0.019	0.036	0.138
91803	05/25/95	119	0.117	0.027	0.052	0.196	59.48%	13.89%	26.63%	0.105	0.025	0.047	0.177
91803	10/30/95	124	0.121	0.028	0.053	0.202	59.95%	13.79%	26.26%	0.118	0.027	0.052	0.197
91803	10/08/96	136	0.131	0.029	0.054	0.214	61.32%	13.32%	25.36%	0.109	0.024	0.045	0.177
91803	05/08/97	143	0.131	0.029	0.055	0.215	61.19%	13.29%	25.52%	0.108	0.024	0.045	0.177
91803	10/16/97	148	0.134	0.029	0.056	0.219	61.30%	13.28%	25.42%	0.109	0.024	0.045	0.177
91803	06/17/98	156	0.137	0.029	0.056	0.222	61.56%	13.14%	25.31%	0.109	0.023	0.045	0.177
123995	04/18/89	161	0.671	0.086	0.056	0.814	82.52%	10.61%	6.87%	0.325	0.042	0.027	0.394
123995	02/05/91	183	0.695	0.087	0.057	0.839	82.85%	10.41%	6.74%	0.326	0.041	0.027	0.394
123995	04/15/92	197	0.704	0.088	0.057	0.849	82.95%	10.34%	6.71%	0.359	0.045	0.029	0.433
123995	03/09/94	220	0.731	0.089	0.058	0.877	83.32%	10.12%	6.56%	0.328	0.040	0.026	0.394
123995	01/21/96	242	0.750	0.089	0.058	0.897	83.56%	9.97%	6.47%	0.329	0.039	0.025	0.394
123997	12/14/89	187	0.400	0.093	0.042	0.535	74.75%	17.45%	7.80%	0.471	0.110	0.049	0.630
123997	02/09/91	201	0.411	0.094	0.042	0.548	75.05%	17.22%	7.73%	0.473	0.108	0.049	0.630
123997	04/13/92	215	0.419	0.095	0.043	0.557	75.22%	17.10%	7.68%	0.533	0.121	0.054	0.709
123997	03/08/94	238	0.442	0.097	0.044	0.583	75.83%	16.66%	7.50%	0.567	0.125	0.056	0.748
124105	04/12/89	53	0.283	0.107	0.066	0.457	62.03%	23.51%	14.45%	0.232	0.088	0.054	0.374
124105	02/09/91	75	0.322	0.112	0.069	0.503	64.02%	22.24%	13.75%	0.239	0.083	0.051	0.374
124105	04/13/92	89	0.339	0.114	0.071	0.523	64.74%	21.76%	13.50%	0.280	0.094	0.058	0.433
124106	04/18/89	21	0.224	0.042	0.052	0.318	70.30%	13.34%	16.35%	0.166	0.032	0.039	0.236
124106	02/05/91	43	0.264	0.046	0.058	0.368	71.85%	12.49%	15.66%	0.198	0.034	0.043	0.276
124106	04/15/92	57	0.279	0.047	0.060	0.386	72.29%	12.22%	15.49%	0.142	0.024	0.030	0.197
124106	03/09/94	80	0.311	0.049	0.063	0.422	73.60%	11.59%	14.81%	0.174	0.027	0.035	0.236
124106	01/21/96	102	0.329	0.050	0.065	0.443	74.17%	11.27%	14.56%	0.175	0.027	0.034	0.236
124106	01/17/97	114	0.343	0.051	0.066	0.459	74.69%	11.04%	14.27%	0.235	0.035	0.045	0.315
124107	12/06/89	75	0.165	0.068	0.062	0.294	55.93%	22.95%	21.12%	0.099	0.041	0.037	0.177
124107	02/05/91	89	0.174	0.069	0.064	0.307	56.71%	22.50%	20.79%	0.089	0.035	0.033	0.157
124107	04/15/92	103	0.183	0.070	0.065	0.319	57.50%	22.05%	20.45%	0.091	0.035	0.032	0.157
124107	03/09/94	126	0.201	0.072	0.067	0.340	58.98%	21.26%	19.76%	0.081	0.029	0.027	0.138
124107	01/22/96	148	0.212	0.074	0.069	0.354	59.70%	20.84%	19.46%	0.106	0.037	0.034	0.177
124108	04/27/89	35	0.198	0.023	0.031	0.252	78.38%	9.30%	12.32%	0.278	0.033	0.044	0.354
124108	01/16/91	56	0.257	0.025	0.033	0.316	81.52%	7.95%	10.53%	0.369	0.036	0.048	0.453
124108	04/01/92	71	0.267	0.026	0.034	0.327	81.64%	7.88%	10.48%	0.321	0.031	0.041	0.394
124108	03/21/94	94	0.306	0.027	0.036	0.369	82.98%	7.28%	9.74%	0.408	0.036	0.048	0.492
124108	01/16/96	116	0.319	0.028	0.037	0.384	83.13%	7.19%	9.68%	0.442	0.038	0.051	0.531
124135	12/10/89	227	0.392	0.200	0.092	0.684	57.36%	29.20%	13.44%	0.282	0.144	0.066	0.492
124135	01/29/91	240	0.392	0.200	0.092	0.685	57.27%	29.24%	13.49%	0.338	0.173	0.080	0.591

Table C-16 (Cont'd) Permanent Deformation Simulation (β_{r2} = 1.2 and β_{r3} = 0.8) Data

Section	Month	Time	Predicted							Measured			
			AC	GB	SG	Total	%AC	%GB	%SG	AC	GB	SG	Total
131031	01/09/90	104	0.139	0.019	0.033	0.191	72.75%	9.89%	17.35%	0.286	0.039	0.068	0.394
131031	03/04/91	118	0.147	0.020	0.034	0.201	73.25%	9.73%	17.03%	0.317	0.042	0.074	0.433
131031	04/28/92	131	0.155	0.020	0.035	0.210	73.74%	9.52%	16.74%	0.290	0.037	0.066	0.394
131031	04/04/94	155	0.172	0.021	0.037	0.230	74.89%	9.11%	16.00%	0.369	0.045	0.079	0.492
131031	01/13/96	176	0.185	0.022	0.038	0.245	75.57%	8.83%	15.60%	0.312	0.037	0.064	0.413
134111	03/20/89	101	0.225	0.032	0.092	0.348	64.57%	9.13%	26.30%	0.178	0.025	0.072	0.276
134111	03/04/91	125	0.250	0.034	0.098	0.381	65.54%	8.83%	25.63%	0.168	0.023	0.066	0.256
134111	04/27/92	138	0.261	0.034	0.100	0.396	65.96%	8.69%	25.35%	0.169	0.022	0.065	0.256
134112	05/04/89	144	0.207	0.000	0.075	0.281	73.51%	0.00%	26.49%	0.174	0.000	0.063	0.236
134112	02/10/91	165	0.222	0.000	0.076	0.298	74.53%	0.00%	25.47%	0.176	0.000	0.060	0.236
134112	04/13/92	179	0.231	0.000	0.077	0.308	75.04%	0.00%	24.96%	0.148	0.000	0.049	0.197
134112	02/24/94	201	0.245	0.000	0.078	0.323	75.85%	0.00%	24.15%	0.179	0.000	0.057	0.236
134112	01/25/96	224	0.259	0.000	0.079	0.339	76.61%	0.00%	23.39%	0.196	0.000	0.060	0.256
134112	04/23/98	251	0.275	0.000	0.080	0.355	77.37%	0.00%	22.63%	0.259	0.000	0.076	0.335
134113	05/04/89	144	0.242	0.000	0.101	0.342	70.63%	0.00%	29.37%	0.111	0.000	0.046	0.157
134113	02/10/91	165	0.256	0.000	0.102	0.358	71.46%	0.00%	28.54%	0.098	0.000	0.039	0.138
134113	04/13/92	179	0.264	0.000	0.103	0.367	71.94%	0.00%	28.06%	0.127	0.000	0.050	0.177
134113	02/24/94	201	0.278	0.000	0.105	0.383	72.66%	0.00%	27.34%	0.129	0.000	0.048	0.177
134113	01/25/96	224	0.292	0.000	0.106	0.398	73.38%	0.00%	26.62%	0.130	0.000	0.047	0.177
134113	04/23/98	251	0.307	0.000	0.107	0.415	74.11%	0.00%	25.89%	0.131	0.000	0.046	0.177
134119	01/08/90	140	0.367	0.010	0.022	0.399	92.10%	2.39%	5.51%	0.254	0.007	0.015	0.276
134119	03/04/91	154	0.382	0.010	0.022	0.414	92.30%	2.33%	5.37%	0.254	0.006	0.015	0.276
134119	04/28/92	167	0.386	0.010	0.022	0.418	92.36%	2.31%	5.34%	0.236	0.006	0.014	0.256
134119	04/07/94	191	0.399	0.010	0.023	0.432	92.51%	2.26%	5.23%	0.219	0.005	0.012	0.236
161001	07/17/89	192	0.236	0.090	0.055	0.382	61.90%	23.64%	14.46%	0.183	0.070	0.043	0.295
161001	08/02/90	205	0.245	0.092	0.056	0.393	62.32%	23.46%	14.22%	0.123	0.046	0.028	0.197
161001	07/04/91	216	0.248	0.093	0.056	0.398	62.42%	23.41%	14.17%	0.123	0.046	0.028	0.197
161001	08/25/94	253	0.271	0.095	0.057	0.423	63.97%	22.46%	13.57%	0.151	0.053	0.032	0.236
161001	05/17/95	262	0.271	0.095	0.058	0.424	63.96%	22.45%	13.59%	0.164	0.057	0.035	0.256
161001	07/09/97	288	0.287	0.098	0.059	0.443	64.75%	22.03%	13.23%	0.191	0.065	0.039	0.295
161001	09/23/98	302	0.297	0.098	0.059	0.453	65.48%	21.54%	12.99%	0.245	0.081	0.049	0.374
161009	09/20/89	180	0.291	0.017	0.048	0.356	81.74%	4.68%	13.58%	0.354	0.020	0.059	0.433
161009	07/19/90	190	0.295	0.017	0.049	0.360	81.85%	4.66%	13.50%	0.322	0.018	0.053	0.394
161009	07/26/91	202	0.304	0.017	0.049	0.370	82.22%	4.56%	13.22%	0.324	0.018	0.052	0.394
161021	09/21/89	48	0.246	0.017	0.056	0.319	77.33%	5.23%	17.44%	0.122	0.008	0.027	0.157
161021	07/21/90	58	0.258	0.017	0.057	0.332	77.80%	5.12%	17.08%	0.138	0.009	0.030	0.177
161021	07/28/91	70	0.272	0.017	0.058	0.347	78.29%	5.01%	16.70%	0.092	0.006	0.020	0.118
161021	09/12/95	120	0.330	0.018	0.062	0.410	80.41%	4.50%	15.09%	0.127	0.007	0.024	0.157
161021	06/05/96	129	0.331	0.019	0.062	0.412	80.38%	4.51%	15.12%	0.111	0.006	0.021	0.138
161021	07/29/97	142	0.346	0.019	0.063	0.428	80.87%	4.40%	14.73%	0.143	0.008	0.026	0.177
169034	07/17/89	10	0.076	0.020	0.031	0.126	59.91%	15.63%	24.45%	0.047	0.012	0.019	0.079
169034	08/02/90	23	0.134	0.024	0.035	0.193	69.58%	12.21%	18.21%	0.110	0.019	0.029	0.157
169034	07/04/91	34	0.143	0.024	0.037	0.204	70.09%	11.89%	18.02%	0.055	0.009	0.014	0.079
169034	05/17/95	80	0.178	0.027	0.041	0.245	72.61%	10.81%	16.58%	0.114	0.017	0.026	0.157
169034	07/09/97	106	0.199	0.028	0.042	0.269	74.02%	10.28%	15.70%	0.117	0.016	0.025	0.157
169034	09/24/98	120	0.207	0.028	0.043	0.278	74.48%	10.11%	15.41%	0.176	0.024	0.036	0.236

Table C-16 (Cont'd) Permanent Deformation Simulation (β_{r2} = 1.2 and β_{r3} = 0.8) Data

Section	Month	Time	Predicted							Measured			
			AC	GB	SG	Total	%AC	%GB	%SG	AC	GB	SG	Total
201009	05/02/89	53	0.092	0.000	0.047	0.139	65.87%	0.00%	34.13%	0.169	0.000	0.087	0.256
201009	12/10/90	72	0.106	0.000	0.050	0.156	68.03%	0.00%	31.97%	0.187	0.000	0.088	0.276
201009	04/08/93	100	0.117	0.000	0.052	0.169	69.09%	0.00%	30.91%	0.150	0.000	0.067	0.217
201009	04/23/96	136	0.132	0.000	0.055	0.186	70.62%	0.00%	29.38%	0.070	0.000	0.029	0.098
251003	08/04/89	180	0.116	0.038	0.026	0.181	64.46%	21.02%	14.53%	0.102	0.033	0.023	0.157
251003	09/06/90	193	0.118	0.038	0.026	0.182	64.49%	21.00%	14.51%	0.152	0.050	0.034	0.236
251003	08/23/91	204	0.120	0.039	0.027	0.186	64.82%	20.83%	14.35%	0.102	0.033	0.023	0.157
251003	09/30/92	217	0.126	0.039	0.027	0.193	65.64%	20.37%	13.99%	0.129	0.040	0.028	0.197
251003	10/27/95	254	0.132	0.040	0.028	0.200	66.12%	20.08%	13.80%	0.117	0.036	0.024	0.177
251003	10/23/96	266	0.135	0.040	0.028	0.203	66.36%	19.94%	13.70%	0.118	0.035	0.024	0.177
251003	06/16/98	286	0.141	0.041	0.028	0.210	67.10%	19.53%	13.37%	0.106	0.031	0.021	0.157
251004	08/04/89	178	0.117	0.052	0.028	0.197	59.58%	26.13%	14.30%	0.211	0.093	0.051	0.354
251004	09/05/90	191	0.122	0.052	0.029	0.203	60.06%	25.83%	14.11%	0.177	0.076	0.042	0.295
251004	08/22/91	202	0.125	0.053	0.029	0.207	60.39%	25.61%	14.00%	0.202	0.086	0.047	0.335
251004	09/30/92	215	0.130	0.054	0.029	0.214	60.97%	25.24%	13.79%	0.288	0.119	0.065	0.472
251004	10/29/95	252	0.140	0.056	0.031	0.227	61.86%	24.68%	13.46%	0.256	0.102	0.056	0.413
251004	06/05/97	272	0.146	0.057	0.031	0.234	62.29%	24.38%	13.32%	0.221	0.086	0.047	0.354
251004	06/15/98	284	0.150	0.058	0.031	0.239	62.74%	24.11%	13.15%	0.235	0.090	0.049	0.374
261001	09/07/89	217	0.126	0.059	0.054	0.239	52.81%	24.75%	22.44%	0.114	0.054	0.049	0.217
261001	07/21/90	227	0.127	0.059	0.054	0.240	52.80%	24.73%	22.47%	0.135	0.063	0.057	0.256
261001	07/16/91	239	0.129	0.060	0.054	0.243	53.02%	24.62%	22.36%	0.104	0.048	0.044	0.197
261001	06/09/93	262	0.132	0.061	0.055	0.248	53.36%	24.47%	22.18%	0.137	0.063	0.057	0.256
261001	07/05/96	299	0.138	0.062	0.056	0.256	53.99%	24.12%	21.90%	0.117	0.052	0.047	0.217
261004	10/21/90	64	0.138	0.021	0.040	0.199	69.39%	10.50%	20.12%	0.123	0.019	0.036	0.177
261004	05/13/93	95	0.143	0.022	0.042	0.207	69.23%	10.52%	20.25%	0.068	0.010	0.020	0.098
261004	07/07/94	109	0.155	0.022	0.043	0.220	70.26%	10.22%	19.53%	0.083	0.012	0.023	0.118
261004	06/15/95	120	0.156	0.023	0.044	0.223	70.23%	10.21%	19.56%	0.111	0.016	0.031	0.157
271018	06/22/89	126	0.243	0.023	0.063	0.329	73.84%	7.13%	19.03%	0.291	0.028	0.075	0.394
271018	10/30/90	142	0.256	0.024	0.063	0.343	74.59%	6.93%	18.48%	0.264	0.025	0.065	0.354
271018	06/02/93	174	0.276	0.024	0.065	0.365	75.48%	6.68%	17.84%	0.208	0.018	0.049	0.276
271018	03/08/94	183	0.286	0.025	0.065	0.376	76.10%	6.51%	17.39%	0.210	0.018	0.048	0.276
271087	06/09/89	126	0.050	0.000	0.033	0.082	60.39%	0.00%	39.61%	0.119	0.000	0.078	0.197
271087	11/13/90	143	0.052	0.000	0.033	0.085	61.10%	0.00%	38.90%	0.132	0.000	0.084	0.217
271087	05/11/93	173	0.054	0.000	0.034	0.088	61.84%	0.00%	38.16%	0.073	0.000	0.045	0.118
271087	06/25/96	210	0.058	0.000	0.034	0.092	62.81%	0.00%	37.19%	0.087	0.000	0.051	0.138
271087	08/03/99	240	0.061	0.000	0.035	0.096	63.73%	0.00%	36.27%	0.100	0.000	0.057	0.157
291008	03/13/89	35	0.104	0.007	0.059	0.169	61.18%	4.07%	34.74%	0.145	0.010	0.082	0.236
291008	11/07/90	55	0.121	0.007	0.064	0.192	62.83%	3.91%	33.26%	0.186	0.012	0.098	0.295
291008	03/05/93	85	0.135	0.008	0.068	0.211	63.95%	3.78%	32.26%	0.189	0.011	0.095	0.295
291008	04/17/96	120	0.152	0.008	0.072	0.233	65.43%	3.63%	30.95%	0.155	0.009	0.073	0.236
307088	09/27/89	100	0.249	0.097	0.088	0.434	57.36%	22.30%	20.34%	0.248	0.097	0.088	0.433
307088	07/29/90	110	0.257	0.098	0.089	0.444	57.79%	22.08%	20.13%	0.228	0.087	0.079	0.394
307088	05/20/91	120	0.261	0.099	0.090	0.450	57.91%	22.00%	20.08%	0.205	0.078	0.071	0.354
308129	10/03/89	17	0.117	0.070	0.082	0.269	43.40%	26.07%	30.53%	0.154	0.092	0.108	0.354
308129	07/29/90	26	0.126	0.085	0.089	0.300	41.89%	28.28%	29.83%	0.132	0.089	0.094	0.315
308129	07/30/91	38	0.137	0.090	0.097	0.324	42.37%	27.75%	29.88%	0.100	0.066	0.071	0.236
308129	12/14/93	67	0.168	0.095	0.107	0.370	45.46%	25.59%	28.94%	0.134	0.076	0.085	0.295

Table C-16 (Cont'd) Permanent Deformation Simulation ($\beta_{r2} = 1.2$ and $\beta_{r3} = 0.8$) Data

Section	Month	Time	Predicted							Measured			
			AC	GB	SG	Total	%AC	%GB	%SG	AC	GB	SG	Total
308129	03/17/94	70	0.168	0.095	0.108	0.371	45.29%	25.59%	29.12%	0.143	0.081	0.092	0.315
308129	08/22/94	75	0.177	0.100	0.110	0.388	45.70%	25.88%	28.41%	0.135	0.076	0.084	0.295
308129	10/31/94	77	0.177	0.101	0.111	0.389	45.58%	25.91%	28.50%	0.144	0.082	0.090	0.315
308129	02/17/95	81	0.177	0.101	0.112	0.390	45.47%	25.88%	28.66%	0.188	0.107	0.118	0.413
308129	05/18/95	84	0.178	0.101	0.112	0.391	45.40%	25.86%	28.74%	0.152	0.087	0.096	0.335
308129	06/10/96	97	0.186	0.102	0.115	0.404	46.13%	25.36%	28.51%	0.163	0.090	0.101	0.354
308129	10/28/96	101	0.192	0.103	0.116	0.411	46.68%	25.05%	28.27%	0.156	0.084	0.095	0.335
308129	01/23/97	104	0.192	0.103	0.117	0.412	46.63%	25.05%	28.32%	0.184	0.099	0.111	0.394
308129	03/25/97	106	0.192	0.103	0.117	0.412	46.60%	25.03%	28.37%	0.156	0.084	0.095	0.335
308129	08/11/97	111	0.202	0.103	0.118	0.423	47.78%	24.41%	27.81%	0.179	0.091	0.104	0.374
308129	10/01/97	113	0.204	0.103	0.118	0.425	47.91%	24.34%	27.75%	0.179	0.091	0.104	0.374
321020	08/29/89	63	0.199	0.017	0.051	0.266	74.61%	6.26%	19.13%	0.235	0.020	0.060	0.315
321020	08/22/90	75	0.206	0.017	0.052	0.275	74.96%	6.14%	18.89%	0.251	0.021	0.063	0.335
321020	07/23/91	86	0.213	0.017	0.053	0.283	75.25%	6.06%	18.68%	0.237	0.019	0.059	0.315
321020	09/14/94	124	0.251	0.018	0.055	0.324	77.36%	5.58%	17.06%	0.213	0.015	0.047	0.276
321020	04/25/95	131	0.251	0.018	0.055	0.324	77.32%	5.58%	17.10%	0.274	0.020	0.061	0.354
321020	06/05/97	157	0.265	0.019	0.057	0.341	77.89%	5.45%	16.67%	0.245	0.017	0.052	0.315
321020	06/09/98	169	0.271	0.019	0.057	0.347	78.11%	5.38%	16.51%	0.261	0.018	0.055	0.335
321020	04/13/99	175	0.282	0.019	0.058	0.358	78.64%	5.28%	16.08%	0.294	0.020	0.060	0.374
341003	09/11/90	195	0.178	0.020	0.033	0.230	77.18%	8.52%	14.30%	0.623	0.069	0.115	0.807
341003	08/15/91	206	0.181	0.020	0.033	0.235	77.36%	8.47%	14.18%	0.548	0.060	0.100	0.709
341003	09/28/92	219	0.185	0.020	0.034	0.239	77.46%	8.43%	14.11%	0.640	0.070	0.117	0.827
341011	04/17/99	214	0.387	0.021	0.075	0.483	80.10%	4.28%	15.62%	0.237	0.013	0.046	0.295
341011	04/18/99	227	0.393	0.021	0.076	0.491	80.16%	4.27%	15.57%	0.300	0.016	0.058	0.374
341011	04/19/99	244	0.406	0.021	0.077	0.504	80.46%	4.18%	15.36%	0.238	0.012	0.045	0.295
341011	04/20/99	254	0.419	0.021	0.078	0.519	80.82%	4.10%	15.07%	0.302	0.015	0.056	0.374
341011	04/21/99	287	0.447	0.022	0.080	0.549	81.36%	3.99%	14.66%	0.320	0.016	0.058	0.394
341011	04/22/99	307	0.469	0.022	0.082	0.572	81.85%	3.89%	14.26%	0.274	0.013	0.048	0.335
341031	10/05/89	194	0.293	0.049	0.071	0.413	70.90%	11.98%	17.12%	0.349	0.059	0.084	0.492
341031	09/12/90	205	0.303	0.050	0.072	0.425	71.24%	11.85%	16.91%	0.337	0.056	0.080	0.472
341031	04/06/92	224	0.319	0.051	0.073	0.444	71.90%	11.55%	16.55%	0.340	0.055	0.078	0.472
341031	02/24/93	234	0.328	0.052	0.074	0.454	72.22%	11.45%	16.33%	0.327	0.052	0.074	0.453
341031	10/26/95	266	0.358	0.054	0.077	0.489	73.23%	11.05%	15.72%	0.418	0.063	0.090	0.571
341031	11/04/95	267	0.358	0.054	0.077	0.489	73.23%	11.05%	15.72%	0.389	0.059	0.084	0.531
341033	10/05/89	181	0.211	0.036	0.044	0.291	72.52%	12.46%	15.02%	0.200	0.034	0.041	0.276
341033	09/12/90	192	0.213	0.037	0.044	0.294	72.59%	12.43%	14.99%	0.257	0.044	0.053	0.354
341033	04/05/92	211	0.223	0.037	0.045	0.304	73.12%	12.20%	14.69%	0.202	0.034	0.040	0.276
341033	02/24/93	221	0.227	0.037	0.045	0.310	73.41%	12.06%	14.53%	0.246	0.040	0.049	0.335
341033	11/03/95	254	0.239	0.038	0.046	0.323	73.99%	11.81%	14.20%	0.262	0.042	0.050	0.354
341033	07/23/97	274	0.242	0.038	0.046	0.327	74.06%	11.76%	14.18%	0.219	0.035	0.042	0.295
341034	10/05/89	48	0.137	0.000	0.045	0.182	75.29%	0.00%	24.71%	0.104	0.000	0.034	0.138
341034	09/12/90	59	0.150	0.000	0.046	0.196	76.45%	0.00%	23.55%	0.211	0.000	0.065	0.276
341034	04/06/92	78	0.159	0.000	0.047	0.206	77.10%	0.00%	22.90%	0.137	0.000	0.041	0.177
341034	02/24/93	88	0.168	0.000	0.048	0.216	77.75%	0.00%	22.25%	0.184	0.000	0.053	0.236
341034	11/04/95	121	0.193	0.000	0.050	0.243	79.37%	0.00%	20.63%	0.203	0.000	0.053	0.256
341034	07/30/97	141	0.204	0.000	0.051	0.255	80.01%	0.00%	19.99%	0.142	0.000	0.035	0.177

Table C-16 (Cont'd) Permanent Deformation Simulation (β_{r2} = 1.2 and β_{r3} = 0.8) Data

Section	Month	Time	Predicted							Measured			
			AC	GB	SG	Total	%AC	%GB	%SG	AC	GB	SG	Total
350101	05/01/97	19	0.188	0.035	0.110	0.333	56.34%	10.64%	33.03%	0.111	0.021	0.065	0.197
350101	03/19/99	38	0.253	0.040	0.124	0.417	60.76%	9.59%	29.66%	0.144	0.023	0.070	0.236
350102	05/01/97	19	0.191	0.060	0.133	0.383	49.80%	15.56%	34.64%	0.098	0.031	0.068	0.197
350102	03/19/99	38	0.261	0.067	0.152	0.479	54.45%	13.90%	31.65%	0.129	0.033	0.075	0.236
350103	05/01/97	19	0.106	0.000	0.109	0.215	49.12%	0.00%	50.88%	0.097	0.000	0.100	0.197
350103	03/19/99	38	0.142	0.000	0.128	0.270	52.51%	0.00%	47.49%	0.145	0.000	0.131	0.276
350104	05/01/97	19	0.082	0.000	0.072	0.155	53.24%	0.00%	46.76%	0.126	0.000	0.110	0.236
350104	03/19/99	38	0.110	0.000	0.085	0.196	56.35%	0.00%	43.65%	0.155	0.000	0.120	0.276
350105	05/02/97	19	0.158	0.013	0.124	0.295	53.50%	4.39%	42.11%	0.126	0.010	0.099	0.236
350105	03/22/99	38	0.210	0.015	0.144	0.369	56.90%	3.97%	39.13%	0.134	0.009	0.092	0.236
350106	05/02/96	19	0.083	0.005	0.084	0.171	48.24%	2.99%	48.77%	0.095	0.006	0.096	0.197
350106	03/22/99	38	0.109	0.006	0.098	0.212	51.13%	2.75%	46.12%	0.121	0.006	0.109	0.236
351005	10/31/89	73	0.182	0.020	0.086	0.288	63.22%	6.89%	29.88%	0.299	0.033	0.141	0.472
351005	08/21/91	95	0.192	0.020	0.090	0.302	63.57%	6.70%	29.73%	0.300	0.032	0.140	0.472
351005	10/24/92	109	0.202	0.021	0.092	0.315	64.15%	6.53%	29.33%	0.265	0.027	0.121	0.413
351005	03/18/95	138	0.239	0.022	0.096	0.356	67.00%	6.04%	26.96%	0.382	0.034	0.154	0.571
351005	03/16/99	183	0.275	0.022	0.101	0.398	69.02%	5.62%	25.36%	0.421	0.034	0.155	0.610
351022	10/31/89	37	0.137	0.029	0.078	0.243	56.24%	11.73%	32.03%	0.100	0.021	0.057	0.177
351022	08/22/91	59	0.193	0.031	0.085	0.309	62.39%	10.13%	27.48%	0.086	0.014	0.038	0.138
351022	10/24/92	73	0.201	0.032	0.088	0.320	62.62%	9.99%	27.39%	0.123	0.020	0.054	0.197
351022	03/18/95	102	0.229	0.033	0.093	0.355	64.44%	9.39%	26.17%	0.140	0.020	0.057	0.217
351022	03/17/99	147	0.284	0.036	0.099	0.419	67.82%	8.48%	23.69%	0.107	0.013	0.037	0.157
351112	12/05/89	67	0.345	0.026	0.054	0.425	81.18%	6.21%	12.61%	0.128	0.010	0.020	0.157
351112	01/22/91	80	0.351	0.027	0.054	0.433	81.23%	6.19%	12.58%	0.144	0.011	0.022	0.177
351112	09/27/91	88	0.360	0.027	0.055	0.442	81.43%	6.11%	12.46%	0.112	0.008	0.017	0.138
351112	01/27/93	104	0.371	0.027	0.056	0.454	81.68%	6.03%	12.29%	0.096	0.007	0.015	0.118
351112	03/15/95	130	0.399	0.028	0.057	0.484	82.42%	5.78%	11.79%	0.162	0.011	0.023	0.197
351112	09/09/97	160	0.417	0.029	0.058	0.504	82.77%	5.67%	11.57%	0.114	0.008	0.016	0.138
351112	03/15/99	175	0.428	0.029	0.059	0.515	83.03%	5.59%	11.38%	0.131	0.009	0.018	0.157
371006	10/13/89	88	0.384	0.027	0.092	0.503	76.36%	5.28%	18.36%	0.060	0.004	0.014	0.079
371006	03/19/91	105	0.401	0.027	0.094	0.522	76.84%	5.15%	18.00%	0.061	0.004	0.014	0.079
371006	10/11/92	124	0.438	0.028	0.096	0.563	77.92%	4.93%	17.15%	0.138	0.009	0.030	0.177
371006	04/18/94	142	0.452	0.028	0.098	0.578	78.18%	4.86%	16.96%	0.077	0.005	0.017	0.098
371006	09/20/94	147	0.460	0.028	0.099	0.587	78.39%	4.82%	16.79%	0.093	0.006	0.020	0.118
371024	11/03/89	109	0.146	0.042	0.070	0.258	56.67%	16.12%	27.22%	0.201	0.057	0.096	0.354
371024	03/09/91	125	0.150	0.042	0.072	0.264	56.87%	15.91%	27.21%	0.246	0.069	0.118	0.433
371024	04/10/92	138	0.155	0.043	0.073	0.271	57.28%	15.71%	27.01%	0.203	0.056	0.096	0.354
371802	10/13/89	49	0.160	0.068	0.179	0.407	39.27%	16.62%	44.11%	0.139	0.059	0.156	0.354
371802	03/18/91	66	0.175	0.070	0.190	0.435	40.30%	16.11%	43.59%	0.127	0.051	0.137	0.315
371802	10/10/92	85	0.193	0.073	0.200	0.466	41.32%	15.73%	42.96%	0.146	0.056	0.152	0.354
371802	04/15/94	103	0.203	0.075	0.207	0.485	41.83%	15.41%	42.76%	0.181	0.067	0.185	0.433
371802	07/18/95	118	0.216	0.077	0.214	0.507	42.69%	15.15%	42.16%	0.202	0.072	0.199	0.472
371802	02/09/96	125	0.220	0.077	0.216	0.513	42.86%	15.06%	42.08%	0.219	0.077	0.215	0.512
371802	04/02/96	127	0.220	0.077	0.216	0.513	42.82%	15.04%	42.15%	0.219	0.077	0.216	0.512
371817	10/15/89	71	0.183	0.041	0.049	0.273	67.08%	15.02%	17.91%	0.264	0.059	0.070	0.394
371817	03/18/91	88	0.190	0.042	0.050	0.283	67.31%	14.84%	17.85%	0.172	0.038	0.046	0.256
371817	10/18/92	107	0.216	0.044	0.052	0.312	69.19%	14.05%	16.76%	0.245	0.050	0.059	0.354

Table C-16 (Cont'd) Permanent Deformation Simulation (β_{r2} = 1.2 and β_{r3} = 0.8) Data

Section	Month	Time	Predicted							Measured			
			AC	GB	SG	Total	%AC	%GB	%SG	AC	GB	SG	Total
371992	10/15/92	33	0.227	0.107	0.050	0.384	59.07%	27.91%	13.02%	0.140	0.066	0.031	0.236
371992	04/20/94	51	0.263	0.113	0.053	0.429	61.34%	26.23%	12.42%	0.024	0.010	0.005	0.039
371992	02/06/96	73	0.306	0.118	0.057	0.481	63.64%	24.58%	11.78%	0.100	0.039	0.019	0.157
371992	04/22/98	99	0.351	0.124	0.060	0.535	65.64%	23.14%	11.22%	0.155	0.055	0.027	0.236
404087	01/17/90	43	0.144	0.024	0.069	0.238	60.80%	10.17%	29.04%	0.371	0.062	0.177	0.610
404087	10/13/91	64	0.166	0.026	0.077	0.269	61.73%	9.73%	28.54%	0.267	0.042	0.124	0.433
404087	02/08/93	80	0.175	0.027	0.081	0.283	61.93%	9.55%	28.52%	0.232	0.036	0.107	0.374
404087	02/09/95	104	0.190	0.028	0.087	0.305	62.32%	9.28%	28.40%	0.356	0.053	0.162	0.571
404163	01/23/90	34	0.124	0.000	0.068	0.192	64.75%	0.00%	35.25%	0.293	0.000	0.160	0.453
404163	03/17/91	48	0.136	0.000	0.071	0.206	65.70%	0.00%	34.30%	0.246	0.000	0.128	0.374
404163	10/28/91	55	0.141	0.000	0.073	0.214	66.07%	0.00%	33.93%	0.195	0.000	0.100	0.295
404163	03/10/93	72	0.154	0.000	0.075	0.229	67.19%	0.00%	32.81%	0.185	0.000	0.090	0.276
404163	04/22/96	109	0.169	0.000	0.079	0.249	68.05%	0.00%	31.95%	0.214	0.000	0.101	0.315
404163	08/20/97	125	0.184	0.000	0.082	0.265	69.21%	0.00%	30.79%	0.272	0.000	0.121	0.394
404163	01/11/99	141	0.188	0.000	0.083	0.271	69.42%	0.00%	30.58%	0.314	0.000	0.138	0.453
421599	07/18/89	24	0.091	0.019	0.067	0.177	51.33%	10.67%	37.99%	0.091	0.019	0.067	0.177
421599	09/27/90	38	0.099	0.019	0.072	0.190	52.14%	10.08%	37.77%	0.113	0.022	0.082	0.217
421599	08/07/91	49	0.106	0.019	0.074	0.199	53.14%	9.62%	37.24%	0.105	0.019	0.073	0.197
421599	03/01/93	68	0.117	0.019	0.077	0.213	54.67%	9.09%	36.24%	0.172	0.029	0.114	0.315
421599	06/21/95	95	0.133	0.020	0.081	0.234	56.75%	8.40%	34.85%	0.156	0.023	0.096	0.276
421599	07/19/96	108	0.141	0.020	0.083	0.244	57.79%	8.10%	34.10%	0.159	0.022	0.094	0.276
421599	03/26/98	128	0.153	0.020	0.085	0.258	59.20%	7.74%	33.05%	0.163	0.021	0.091	0.276
451011	04/11/89	34	0.377	0.052	0.055	0.485	77.77%	10.79%	11.44%	0.260	0.036	0.038	0.335
451011	03/05/91	57	0.428	0.055	0.058	0.541	79.10%	10.14%	10.77%	0.389	0.050	0.053	0.492
451011	10/24/92	76	0.472	0.057	0.060	0.588	80.19%	9.62%	10.19%	0.505	0.061	0.064	0.630
451011	01/27/96	115	0.525	0.059	0.062	0.646	81.30%	9.07%	9.62%	0.544	0.061	0.064	0.669
451011	02/11/99	150	0.565	0.060	0.064	0.688	82.04%	8.71%	9.25%	0.581	0.062	0.066	0.709
473104	11/01/89	42	0.018	0.042	0.057	0.117	15.00%	36.28%	48.72%	0.041	0.100	0.134	0.276
473104	05/06/91	60	0.018	0.045	0.062	0.126	14.66%	35.76%	49.58%	0.046	0.113	0.156	0.315
473104	10/26/92	77	0.021	0.047	0.067	0.135	15.41%	34.92%	49.67%	0.055	0.124	0.176	0.354
473104	11/30/95	114	0.023	0.052	0.076	0.152	15.48%	34.27%	50.25%	0.098	0.216	0.317	0.630
480001	04/10/89	1	0.041	0.060	0.054	0.155	26.66%	38.77%	34.57%	0.063	0.092	0.082	0.236
480001	10/11/90	19	0.221	0.105	0.101	0.427	51.81%	24.47%	23.71%	0.143	0.067	0.065	0.276
480001	03/11/92	36	0.267	0.112	0.114	0.493	54.19%	22.77%	23.03%	0.171	0.072	0.073	0.315
480001	02/17/93	47	0.304	0.117	0.120	0.540	56.23%	21.63%	22.14%	0.111	0.043	0.044	0.197
480001	02/20/95	71	0.336	0.123	0.130	0.589	57.11%	20.92%	21.98%	0.180	0.066	0.069	0.315
480001	03/19/98	108	0.403	0.131	0.141	0.676	59.65%	19.42%	20.92%	0.094	0.031	0.033	0.157
481060	06/18/90	52	0.232	0.044	0.055	0.331	69.92%	13.33%	16.75%	0.289	0.055	0.069	0.413
481060	02/14/91	60	0.242	0.045	0.057	0.344	70.48%	13.05%	16.47%	0.236	0.044	0.055	0.335
481060	03/18/92	73	0.254	0.046	0.058	0.358	70.90%	12.79%	16.31%	0.167	0.030	0.039	0.236
481060	02/23/93	84	0.267	0.047	0.060	0.373	71.47%	12.49%	16.04%	0.155	0.027	0.035	0.217
481060	02/23/95	108	0.286	0.048	0.062	0.397	72.18%	12.08%	15.74%	0.270	0.045	0.059	0.374
481060	01/05/99	154	0.324	0.050	0.066	0.441	73.61%	11.39%	15.00%	0.290	0.045	0.059	0.394
481077	04/25/89	88	0.331	0.030	0.058	0.418	79.18%	7.06%	13.76%	0.421	0.038	0.073	0.531
481077	10/13/91	118	0.365	0.031	0.059	0.455	80.24%	6.71%	13.04%	0.490	0.041	0.080	0.610
481077	10/12/92	130	0.371	0.031	0.060	0.462	80.31%	6.69%	13.00%	0.490	0.041	0.079	0.610

Table C-16 (Cont'd) Permanent Deformation Simulation (β_{r2} = 1.2 and β_{r3} = 0.8) Data

Section	Month	Time	Predicted							Measured			
			AC	GB	SG	Total	%AC	%GB	%SG	AC	GB	SG	Total
481077	03/10/95	159	0.394	0.032	0.061	0.487	80.91%	6.48%	12.61%	0.573	0.046	0.089	0.709
481077	03/26/98	195	0.418	0.032	0.063	0.513	81.46%	6.29%	12.25%	0.561	0.043	0.084	0.689
481109	01/04/90	68	0.355	0.000	0.123	0.478	74.22%	0.00%	25.78%	0.234	0.000	0.081	0.315
481109	09/21/90	76	0.370	0.000	0.126	0.495	74.61%	0.00%	25.39%	0.235	0.000	0.080	0.315
481109	03/10/92	94	0.385	0.000	0.129	0.514	74.87%	0.00%	25.13%	0.192	0.000	0.064	0.256
481109	02/12/93	105	0.402	0.000	0.132	0.534	75.33%	0.00%	24.67%	0.193	0.000	0.063	0.256
481109	02/16/95	129	0.426	0.000	0.136	0.562	75.83%	0.00%	24.17%	0.299	0.000	0.095	0.394
481130	04/11/89	201	0.506	0.128	0.116	0.750	67.45%	17.12%	15.43%	0.359	0.091	0.082	0.531
481130	10/12/90	219	0.526	0.130	0.118	0.775	67.92%	16.84%	15.24%	0.468	0.116	0.105	0.689
481130	03/12/92	236	0.535	0.132	0.120	0.786	68.00%	16.75%	15.25%	0.469	0.115	0.105	0.689
481169	03/04/90	212	0.108	0.087	0.048	0.243	44.38%	35.78%	19.84%	0.140	0.113	0.062	0.315
481169	09/18/90	218	0.110	0.087	0.049	0.246	44.64%	35.60%	19.76%	0.141	0.112	0.062	0.315
481169	03/07/91	224	0.110	0.088	0.049	0.246	44.61%	35.61%	19.78%	0.141	0.112	0.062	0.315
481169	01/30/92	234	0.112	0.088	0.049	0.249	44.93%	35.41%	19.66%	0.150	0.118	0.066	0.335
481169	02/27/93	247	0.114	0.089	0.049	0.252	45.20%	35.23%	19.56%	0.142	0.111	0.062	0.315
481169	03/03/95	272	0.117	0.090	0.050	0.256	45.59%	34.98%	19.44%	0.215	0.165	0.092	0.472
481174	10/17/90	186	0.478	0.057	0.109	0.644	74.33%	8.78%	16.89%	0.293	0.035	0.066	0.394
481174	02/14/91	190	0.478	0.057	0.109	0.644	74.30%	8.78%	16.92%	0.322	0.038	0.073	0.433
481174	03/16/92	203	0.486	0.057	0.110	0.653	74.42%	8.71%	16.88%	0.234	0.027	0.053	0.315
481174	02/18/93	214	0.491	0.057	0.111	0.660	74.47%	8.67%	16.86%	0.264	0.031	0.060	0.354
481174	02/21/95	238	0.508	0.058	0.113	0.680	74.79%	8.52%	16.69%	0.501	0.057	0.112	0.669
481174	03/20/98	275	0.525	0.059	0.116	0.700	74.99%	8.40%	16.62%	0.502	0.056	0.111	0.669
481178	04/10/89	10	0.190	0.023	0.058	0.271	70.26%	8.43%	21.30%	0.124	0.015	0.038	0.177
481178	02/22/91	32	0.284	0.028	0.075	0.386	73.49%	7.21%	19.30%	0.101	0.010	0.027	0.138
481178	03/10/92	45	0.317	0.029	0.080	0.425	74.44%	6.83%	18.73%	0.103	0.009	0.026	0.138
481178	02/16/93	56	0.334	0.030	0.083	0.447	74.67%	6.68%	18.65%	0.118	0.011	0.029	0.157
481178	02/17/95	80	0.377	0.031	0.090	0.498	75.55%	6.30%	18.15%	0.178	0.015	0.043	0.236
481183	12/06/89	179	0.292	0.061	0.133	0.486	60.06%	12.56%	27.38%	0.154	0.032	0.070	0.256
481183	09/15/90	188	0.300	0.062	0.135	0.498	60.30%	12.48%	27.22%	0.178	0.037	0.080	0.295
483749	10/17/90	116	0.381	0.177	0.117	0.675	56.44%	26.20%	17.36%	0.144	0.067	0.044	0.256
483749	02/14/91	120	0.381	0.177	0.118	0.676	56.33%	26.23%	17.44%	0.122	0.057	0.038	0.217
483749	03/16/92	133	0.387	0.180	0.120	0.688	56.31%	26.22%	17.47%	0.111	0.052	0.034	0.197
483749	02/21/93	144	0.394	0.183	0.122	0.699	56.42%	26.13%	17.45%	0.122	0.057	0.038	0.217
483749	02/21/95	168	0.409	0.187	0.126	0.722	56.66%	25.96%	17.39%	0.190	0.087	0.058	0.335
483749	03/28/97	193	0.420	0.192	0.129	0.740	56.69%	25.91%	17.40%	0.257	0.117	0.079	0.453
489005	10/14/90	50	0.076	0.147	0.160	0.383	19.79%	38.41%	41.81%	0.066	0.129	0.140	0.335
489005	03/12/92	67	0.081	0.152	0.169	0.403	20.19%	37.82%	41.99%	0.028	0.052	0.058	0.138
489005	02/17/93	78	0.084	0.155	0.174	0.414	20.35%	37.58%	42.07%	0.028	0.052	0.058	0.138
489005	02/20/95	102	0.090	0.161	0.183	0.433	20.71%	37.06%	42.22%	0.049	0.088	0.100	0.236
489005	07/10/98	143	0.098	0.168	0.195	0.461	21.24%	36.51%	42.25%	0.033	0.057	0.067	0.157
501002	08/09/89	58	0.104	0.030	0.035	0.169	61.67%	17.88%	20.45%	0.182	0.053	0.060	0.295
501002	08/08/90	70	0.114	0.031	0.036	0.180	62.93%	17.28%	19.79%	0.235	0.065	0.074	0.374
501002	09/04/91	83	0.116	0.032	0.037	0.185	62.94%	17.20%	19.86%	0.198	0.054	0.063	0.315
501002	04/27/93	102	0.122	0.032	0.038	0.192	63.37%	16.92%	19.71%	0.237	0.063	0.074	0.374
501002	05/25/94	115	0.127	0.033	0.039	0.198	63.79%	16.73%	19.48%	0.239	0.063	0.073	0.374
501002	08/17/94	118	0.130	0.034	0.039	0.202	64.23%	16.57%	19.21%	0.240	0.062	0.072	0.374

Table C-16 (Cont'd) Permanent Deformation Simulation (β_{r2} = 1.2 and β_{r3} = 0.8) Data

Section	Month	Time	Predicted							Measured			
			AC	GB	SG	Total	%AC	%GB	%SG	AC	GB	SG	Total
501002	04/27/95	126	0.130	0.034	0.039	0.203	64.11%	16.58%	19.31%	0.252	0.065	0.076	0.394
501002	10/12/95	132	0.137	0.034	0.040	0.211	64.98%	16.24%	18.78%	0.281	0.070	0.081	0.433
501002	10/17/96	144	0.139	0.034	0.040	0.213	65.02%	16.17%	18.80%	0.230	0.057	0.067	0.354
501002	05/15/97	151	0.139	0.035	0.040	0.214	64.94%	16.19%	18.87%	0.281	0.070	0.082	0.433
501002	10/23/97	156	0.143	0.035	0.041	0.219	65.43%	15.98%	18.59%	0.296	0.072	0.084	0.453
501002	06/06/98	164	0.144	0.035	0.041	0.220	65.51%	15.92%	18.57%	0.284	0.069	0.080	0.433
501004	08/09/89	58	0.073	0.032	0.039	0.144	50.90%	22.24%	26.86%	0.080	0.035	0.042	0.157
501004	08/07/90	70	0.082	0.033	0.040	0.154	53.14%	21.15%	25.71%	0.136	0.054	0.066	0.256
501004	09/20/91	83	0.090	0.033	0.041	0.165	54.86%	20.31%	24.83%	0.108	0.040	0.049	0.197
501004	04/27/93	102	0.100	0.034	0.042	0.176	56.68%	19.36%	23.96%	0.145	0.050	0.061	0.256
501004	10/12/95	132	0.117	0.035	0.045	0.197	59.38%	17.97%	22.65%	0.140	0.042	0.054	0.236
501004	11/04/97	157	0.131	0.037	0.047	0.214	61.17%	17.07%	21.77%	0.157	0.044	0.056	0.256
511002	10/15/89	121	0.211	0.045	0.068	0.324	65.07%	13.80%	21.13%	0.256	0.054	0.083	0.394
511023	10/12/89	107	0.365	0.044	0.091	0.501	72.90%	8.88%	18.22%	0.416	0.051	0.104	0.571
511023	03/20/91	124	0.380	0.045	0.093	0.517	73.41%	8.69%	17.89%	0.405	0.048	0.099	0.551
511023	10/10/92	143	0.404	0.046	0.094	0.545	74.23%	8.43%	17.34%	0.438	0.050	0.102	0.591
511023	12/07/93	157	0.420	0.046	0.095	0.562	74.75%	8.26%	16.99%	0.456	0.050	0.104	0.610
511023	09/18/95	178	0.441	0.047	0.097	0.585	75.35%	8.05%	16.60%	0.415	0.044	0.091	0.551
511023	02/09/96	183	0.441	0.047	0.097	0.585	75.34%	8.05%	16.61%	0.504	0.054	0.111	0.669
511023	03/24/97	196	0.447	0.047	0.098	0.592	75.50%	7.98%	16.52%	0.446	0.047	0.098	0.591
512021	10/15/89	54	0.160	0.012	0.067	0.239	67.03%	5.17%	27.80%	0.264	0.020	0.109	0.394
512021	03/11/91	71	0.174	0.013	0.068	0.255	68.18%	5.04%	26.78%	0.295	0.022	0.116	0.433
512021	10/20/92	90	0.193	0.013	0.072	0.278	69.43%	4.80%	25.77%	0.369	0.025	0.137	0.531
531008	07/17/89	129	0.226	0.054	0.058	0.338	66.92%	15.87%	17.21%	0.514	0.122	0.132	0.768
531008	07/17/89	142	0.240	0.055	0.059	0.354	67.88%	15.44%	16.68%	0.508	0.115	0.125	0.748
531008	08/02/90	151	0.241	0.055	0.059	0.355	67.84%	15.45%	16.71%	0.521	0.119	0.128	0.768
531008	08/02/90	153	0.243	0.055	0.059	0.358	68.00%	15.37%	16.63%	0.562	0.127	0.138	0.827
531008	05/28/91	188	0.255	0.056	0.061	0.372	68.52%	15.11%	16.37%	0.742	0.164	0.177	1.083
531801	07/17/89	190	0.105	0.007	0.038	0.150	69.89%	4.52%	25.59%	0.138	0.009	0.050	0.197
531801	08/09/90	203	0.108	0.007	0.039	0.154	70.31%	4.47%	25.22%	0.125	0.008	0.045	0.177
531801	06/05/91	213	0.109	0.007	0.039	0.155	70.37%	4.45%	25.18%	0.152	0.010	0.055	0.217
531801	06/22/94	249	0.119	0.007	0.040	0.166	71.48%	4.30%	24.22%	0.113	0.007	0.038	0.157
531801	05/08/95	260	0.120	0.007	0.041	0.168	71.58%	4.26%	24.16%	0.113	0.007	0.038	0.157
531801	10/31/95	265	0.124	0.007	0.041	0.172	71.98%	4.23%	23.79%	0.128	0.007	0.042	0.177
531801	03/27/97	282	0.126	0.007	0.041	0.175	72.22%	4.22%	23.56%	0.142	0.008	0.046	0.197
561007	09/26/89	111	0.192	0.027	0.061	0.281	68.52%	9.75%	21.73%	0.310	0.044	0.098	0.453
561007	07/22/90	121	0.194	0.028	0.062	0.283	68.44%	9.75%	21.80%	0.269	0.038	0.086	0.394
561007	05/13/91	131	0.195	0.028	0.062	0.285	68.34%	9.77%	21.89%	0.256	0.037	0.082	0.374
561007	08/03/91	134	0.205	0.028	0.063	0.296	69.33%	9.52%	21.14%	0.218	0.030	0.067	0.315
561007	12/09/93	162	0.218	0.029	0.064	0.312	70.03%	9.28%	20.69%	0.193	0.026	0.057	0.276
561007	03/16/94	165	0.218	0.029	0.065	0.312	69.99%	9.27%	20.73%	0.193	0.026	0.057	0.276
561007	04/19/94	166	0.218	0.029	0.065	0.312	69.98%	9.27%	20.75%	0.207	0.027	0.061	0.295
561007	08/19/94	170	0.220	0.029	0.065	0.314	70.05%	9.28%	20.68%	0.179	0.024	0.053	0.256
561007	02/16/95	176	0.220	0.029	0.065	0.315	69.99%	9.26%	20.75%	0.193	0.026	0.057	0.276
561007	05/17/95	179	0.220	0.029	0.065	0.315	69.93%	9.29%	20.78%	0.179	0.024	0.053	0.256
561007	09/08/95	183	0.222	0.029	0.066	0.317	70.06%	9.26%	20.68%	0.193	0.026	0.057	0.276
561007	06/11/96	192	0.223	0.030	0.066	0.318	70.00%	9.27%	20.74%	0.152	0.020	0.045	0.217

Table C-16 (Cont'd) Permanent Deformation Simulation (β_{r2} = 1.2 and β_{r3} = 0.8) Data

Section	Month	Time	Predicted							Measured			
			AC	GB	SG	Total	%AC	%GB	%SG	AC	GB	SG	Total
561007	10/24/96	196	0.230	0.030	0.066	0.326	70.59%	9.11%	20.30%	0.195	0.025	0.056	0.276
561007	11/19/96	197	0.230	0.030	0.066	0.327	70.57%	9.11%	20.32%	0.194	0.025	0.056	0.276
561007	03/10/97	201	0.230	0.030	0.067	0.327	70.54%	9.10%	20.36%	0.208	0.027	0.060	0.295
561007	03/24/97	202	0.230	0.030	0.067	0.327	70.52%	9.10%	20.38%	0.194	0.025	0.056	0.276
561007	08/07/97	206	0.240	0.030	0.067	0.336	71.22%	8.91%	19.87%	0.196	0.025	0.055	0.276
561007	09/30/97	207	0.240	0.030	0.067	0.337	71.22%	8.94%	19.85%	0.196	0.025	0.055	0.276
841684	08/29/90	144	0.204	0.062	0.044	0.310	65.76%	20.09%	14.14%	0.362	0.111	0.078	0.551
841684	08/28/91	156	0.209	0.063	0.044	0.316	66.16%	19.86%	13.98%	0.365	0.109	0.077	0.551
841684	05/03/93	177	0.214	0.064	0.045	0.322	66.32%	19.74%	13.94%	0.431	0.128	0.091	0.650
841684	10/24/95	206	0.231	0.065	0.046	0.342	67.46%	19.08%	13.46%	0.478	0.135	0.095	0.709

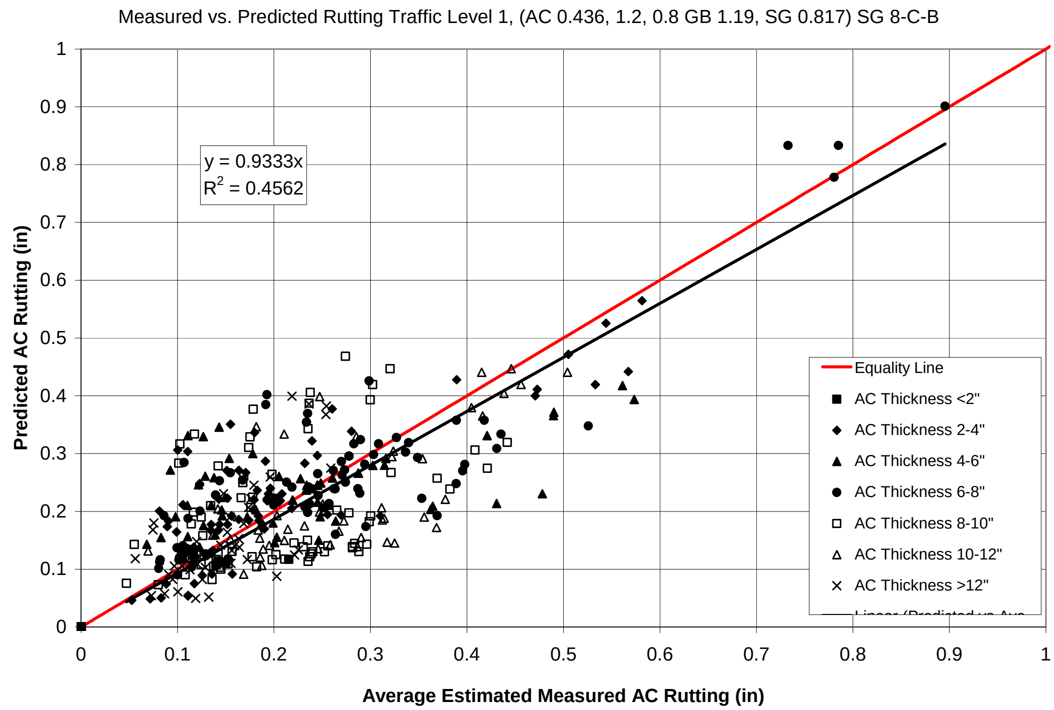


Figure C-125 Asphalt Concrete Layers Rut Depth (β_{r2} = 1.2 and β_{r3} = 0.8)

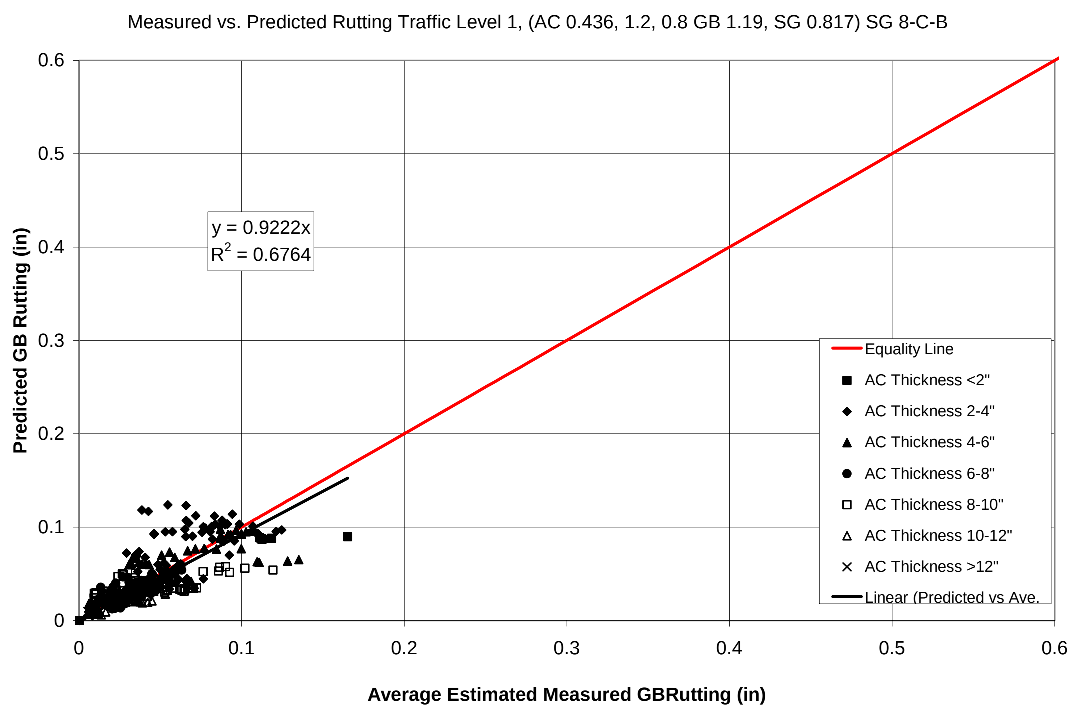


Figure C-126 Granular Base Layers Rut Depth (β_{r2} = 1.2 and β_{r3} = 0.8)

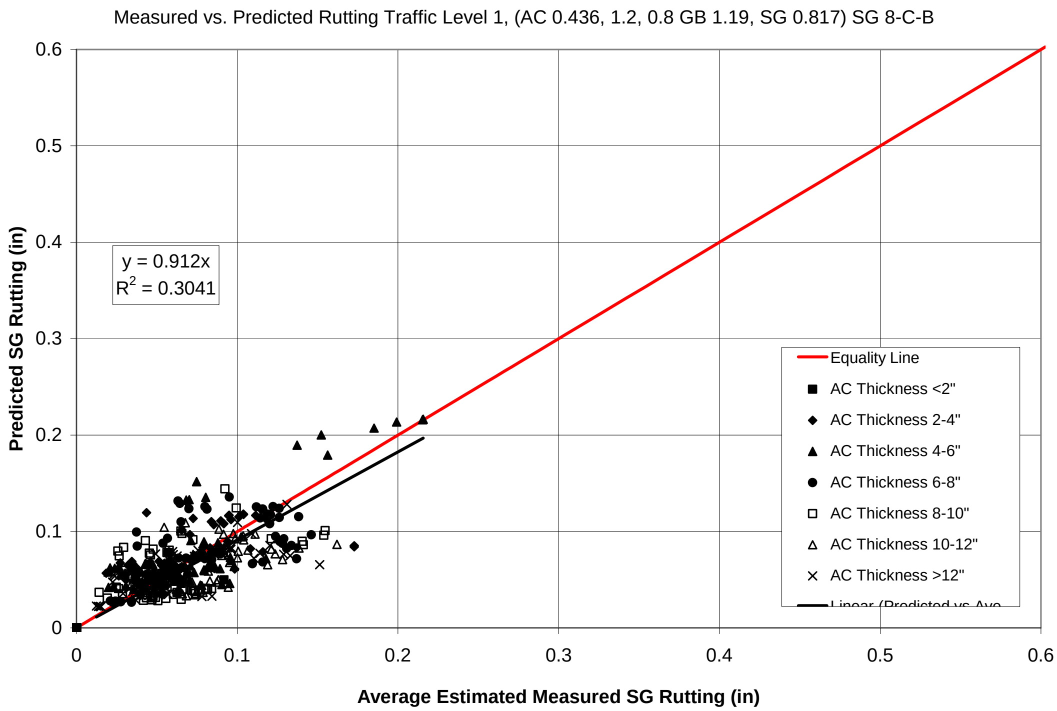


Figure C-127 Granular Subgrade Rut Depth (β_{r2} = 1.2 and β_{r3} = 0.8)

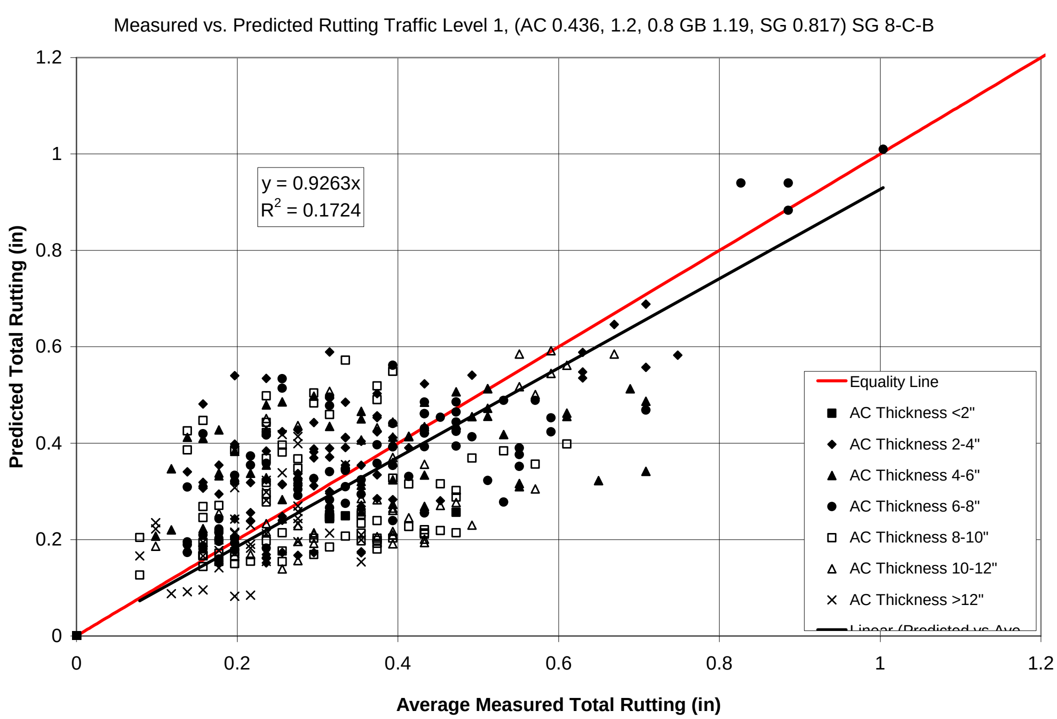


Figure C-128 Total Asphalt Pavement Rut Depth (β_{r2} = 1.2 and β_{r3} = 0.8)

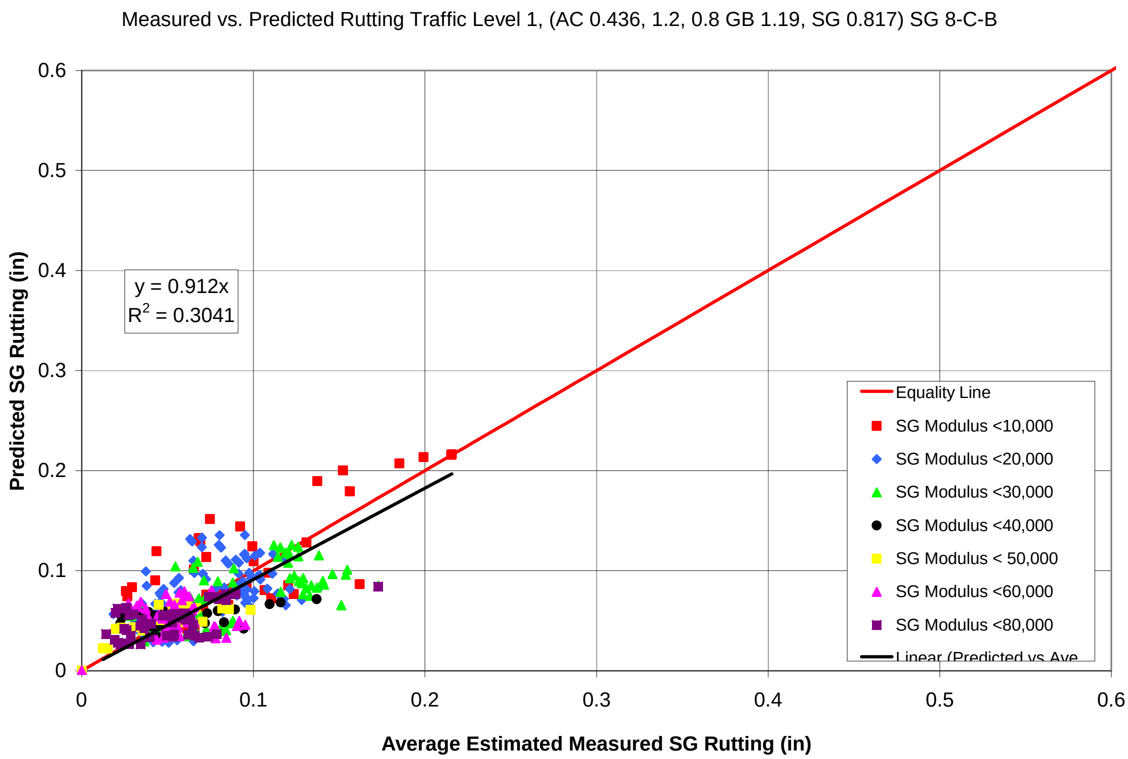


Figure C-129 Subgrade Rut Depth (β_{r2} = 1.2 and β_{r3} = 0.8) (By Subgrade Modulus)

Table C-67 Permanent Deformation Simulation (β_{r2} = 1.2 and β_{r3} = 1.0) Summary

	AC	GB	SG	Total
Average Predicted=	0.217	0.045	0.069	0.330
Sum of error =	0.616	-0.140	-0.476	0.000
Sum of error^2 =	3.111	0.163	0.301	6.619
Predicted % =	64.12%	13.67%	22.21%	100.00%
Se =	0.081	0.019	0.025	0.119
Average Measured =	0.045	0.070	0.330	0.346
Calibration Factor β_1 =	0.174	1.346	0.806	

Table C-68 Permanent Deformation Simulation (β_{r2} = 1.2 and β_{r3} = 1.0) Data

Section	Month	Time	Predicted							Measured			
			AC	GB	SG	Total	%AC	%GB	%SG	AC	GB	SG	Total
11001	04/05/89	103	0.471	0.139	0.071	0.681	69.15%	20.48%	10.36%	0.231	0.069	0.035	0.335
11001	02/12/91	125	0.471	0.142	0.072	0.685	68.72%	20.75%	10.53%	0.216	0.065	0.033	0.315
11001	04/02/92	139	0.471	0.143	0.073	0.687	68.53%	20.85%	10.62%	0.202	0.062	0.031	0.295
11019	05/15/89	32	0.215	0.020	0.081	0.316	67.94%	6.31%	25.75%	0.348	0.032	0.132	0.512
11019	04/16/90	43	0.245	0.021	0.084	0.350	70.07%	5.88%	24.05%	0.386	0.032	0.133	0.551
11019	01/15/91	52	0.273	0.021	0.086	0.380	71.75%	5.56%	22.70%	0.395	0.031	0.125	0.551
11019	03/31/92	66	0.289	0.021	0.088	0.399	72.51%	5.36%	22.13%	0.400	0.030	0.122	0.551
11019	03/22/94	90	0.326	0.025	0.091	0.442	73.74%	5.60%	20.66%	0.435	0.033	0.122	0.591
11019	01/08/96	112	0.359	0.027	0.094	0.480	74.82%	5.67%	19.52%	0.442	0.033	0.115	0.591
11019	01/23/98	136	0.380	0.027	0.095	0.503	75.58%	5.46%	18.96%	0.536	0.039	0.134	0.709
14126	06/05/89	15	0.106	0.011	0.029	0.145	72.79%	7.33%	19.89%	0.129	0.013	0.035	0.177
14126	03/03/91	36	0.151	0.012	0.033	0.196	77.04%	5.96%	17.00%	0.167	0.013	0.037	0.217
14126	04/08/92	49	0.166	0.012	0.035	0.213	77.87%	5.62%	16.52%	0.123	0.009	0.026	0.157
14126	04/08/94	73	0.175	0.013	0.037	0.224	77.76%	5.58%	16.66%	0.153	0.011	0.033	0.197
14126	12/11/95	93	0.177	0.013	0.039	0.228	77.41%	5.66%	16.94%	0.168	0.012	0.037	0.217
14126	12/05/97	117	0.179	0.013	0.040	0.232	77.12%	5.69%	17.20%	0.152	0.011	0.034	0.197
21001	08/21/91	98	0.043	0.037	0.076	0.156	27.78%	23.48%	48.74%	0.049	0.042	0.086	0.177
21001	08/26/93	122	0.047	0.037	0.078	0.162	28.79%	23.07%	48.14%	0.068	0.055	0.114	0.236
21001	06/15/95	144	0.049	0.038	0.082	0.169	28.80%	22.59%	48.61%	0.079	0.062	0.134	0.276
21001	08/22/97	170	0.053	0.039	0.083	0.175	30.20%	22.34%	47.46%	0.107	0.079	0.168	0.354
21001	08/26/98	182	0.054	0.039	0.084	0.177	30.42%	22.18%	47.40%	0.108	0.079	0.168	0.354
21002	08/22/91	83	0.064	0.047	0.033	0.144	44.55%	32.51%	22.94%	0.079	0.058	0.041	0.177
21002	07/30/92	94	0.065	0.048	0.034	0.147	44.60%	32.42%	22.99%	0.105	0.077	0.054	0.236
21002	06/14/95	129	0.080	0.050	0.035	0.164	48.61%	30.15%	21.24%	0.115	0.071	0.050	0.236
21002	08/21/97	155	0.083	0.051	0.036	0.170	49.04%	29.85%	21.11%	0.145	0.088	0.062	0.295
21002	05/14/98	164	0.083	0.051	0.036	0.170	48.99%	29.86%	21.15%	0.125	0.076	0.054	0.256
40114	03/30/95	20	0.196	0.042	0.106	0.345	56.83%	12.27%	30.91%	0.224	0.048	0.122	0.394
40114	11/07/95	28	0.236	0.045	0.112	0.393	60.07%	11.34%	28.59%	0.236	0.045	0.113	0.394
40114	02/04/96	31	0.236	0.045	0.113	0.394	59.97%	11.32%	28.71%	0.260	0.049	0.124	0.433
40114	04/04/96	33	0.237	0.045	0.114	0.395	59.97%	11.27%	28.76%	0.283	0.053	0.136	0.472
40114	07/09/96	36	0.266	0.046	0.116	0.427	62.21%	10.71%	27.08%	0.269	0.046	0.117	0.433
40114	08/13/96	37	0.277	0.046	0.116	0.439	62.99%	10.50%	26.50%	0.273	0.045	0.115	0.433
40114	01/07/98	54	0.311	0.048	0.121	0.480	64.81%	9.92%	25.26%	0.281	0.043	0.109	0.433
40114	04/21/98	57	0.311	0.048	0.122	0.481	64.77%	9.91%	25.32%	0.281	0.043	0.110	0.433
40114	06/12/98	59	0.316	0.048	0.122	0.486	64.97%	9.86%	25.18%	0.307	0.047	0.119	0.472
40114	10/23/98	63	0.339	0.049	0.124	0.512	66.31%	9.50%	24.20%	0.287	0.041	0.105	0.433
40114	02/12/99	65	0.339	0.049	0.124	0.512	66.28%	9.49%	24.23%	0.313	0.045	0.114	0.472
40115	02/15/95	19	0.112	0.000	0.047	0.159	70.56%	0.00%	29.44%	0.056	0.000	0.023	0.079
40115	03/30/95	20	0.112	0.000	0.047	0.159	70.54%	0.00%	29.46%	0.111	0.000	0.046	0.157
40115	01/07/98	54	0.178	0.000	0.053	0.231	77.02%	0.00%	22.98%	0.076	0.000	0.023	0.098
40115	02/11/99	65	0.194	0.000	0.054	0.248	78.16%	0.00%	21.84%	0.077	0.000	0.021	0.098
40116	03/30/95	20	0.083	0.000	0.065	0.148	56.24%	0.00%	43.76%	0.199	0.000	0.155	0.354
40116	01/08/98	54	0.132	0.000	0.074	0.206	64.09%	0.00%	35.91%	0.227	0.000	0.127	0.354
40116	02/12/99	65	0.144	0.000	0.075	0.219	65.59%	0.00%	34.41%	0.232	0.000	0.122	0.354

Table C-18 (Cont'd) Permanent Deformation Simulation (β_{r2} = 1.2 and β_{r3} = 1.0) Data

Section	Month	Time	Predicted							Measured			
			AC	GB	SG	Total	%AC	%GB	%SG	AC	GB	SG	Total
40117	03/30/95	20	0.137	0.007	0.042	0.185	73.87%	3.70%	22.42%	0.320	0.016	0.097	0.433
40117	01/08/98	54	0.218	0.008	0.047	0.272	79.91%	2.87%	17.22%	0.315	0.011	0.068	0.394
40117	02/11/99	65	0.237	0.008	0.048	0.293	80.95%	2.71%	16.34%	0.382	0.013	0.077	0.472
40118	03/30/95	20	0.133	0.010	0.065	0.208	63.97%	4.92%	31.11%	0.252	0.019	0.122	0.394
40118	01/08/98	54	0.209	0.011	0.075	0.295	70.68%	3.83%	25.49%	0.250	0.014	0.090	0.354
40118	02/12/99	65	0.227	0.011	0.077	0.316	71.96%	3.62%	24.42%	0.255	0.013	0.087	0.354
41007	11/20/89	140	0.599	0.038	0.070	0.707	84.68%	5.40%	9.91%	0.750	0.048	0.088	0.886
41007	09/05/91	162	0.615	0.039	0.071	0.725	84.79%	5.36%	9.84%	0.751	0.047	0.087	0.886
41007	09/20/91	163	0.615	0.039	0.071	0.725	84.79%	5.36%	9.84%	0.701	0.044	0.081	0.827
41007	09/16/94	198	0.635	0.040	0.073	0.748	84.94%	5.29%	9.77%	0.853	0.053	0.098	1.004
41016	11/30/89	122	0.335	0.000	0.101	0.436	76.87%	0.00%	23.13%	0.288	0.000	0.086	0.374
41016	07/02/90	130	0.342	0.000	0.101	0.443	77.10%	0.00%	22.90%	0.212	0.000	0.063	0.276
41016	09/25/91	144	0.360	0.000	0.103	0.463	77.77%	0.00%	22.23%	0.184	0.000	0.053	0.236
41016	09/18/96	204	0.414	0.000	0.108	0.522	79.37%	0.00%	20.63%	0.250	0.000	0.065	0.315
41024	11/03/89	149	0.424	0.026	0.094	0.543	78.00%	4.78%	17.21%	0.184	0.011	0.041	0.236
41024	08/26/90	158	0.434	0.026	0.094	0.555	78.30%	4.71%	17.00%	0.200	0.012	0.043	0.256
41024	09/04/91	171	0.448	0.027	0.095	0.570	78.62%	4.65%	16.73%	0.170	0.010	0.036	0.217
41024	08/22/95	218	0.489	0.027	0.099	0.615	79.53%	4.44%	16.03%	0.204	0.011	0.041	0.256
41024	11/09/95	221	0.490	0.027	0.099	0.616	79.53%	4.44%	16.03%	0.219	0.012	0.044	0.276
41024	02/08/96	224	0.490	0.027	0.099	0.616	79.52%	4.44%	16.04%	0.235	0.013	0.047	0.295
41024	04/04/96	226	0.490	0.027	0.099	0.616	79.52%	4.44%	16.04%	0.204	0.011	0.041	0.256
41024	06/13/96	228	0.491	0.027	0.099	0.618	79.55%	4.42%	16.03%	0.219	0.012	0.044	0.276
41024	07/11/96	229	0.495	0.027	0.099	0.622	79.64%	4.41%	15.95%	0.219	0.012	0.044	0.276
41024	08/15/96	230	0.499	0.028	0.099	0.626	79.70%	4.41%	15.89%	0.220	0.012	0.044	0.276
41024	01/15/98	247	0.509	0.028	0.100	0.637	79.88%	4.37%	15.74%	0.220	0.012	0.043	0.276
41024	04/22/98	250	0.509	0.028	0.100	0.637	79.88%	4.37%	15.75%	0.220	0.012	0.043	0.276
41024	06/15/98	252	0.511	0.028	0.101	0.639	79.91%	4.36%	15.74%	0.220	0.012	0.043	0.276
41024	10/26/98	256	0.514	0.028	0.101	0.643	79.98%	4.33%	15.69%	0.236	0.013	0.046	0.295
81029	10/20/89	209	0.181	0.068	0.065	0.314	57.72%	21.55%	20.73%	0.136	0.051	0.049	0.236
81029	08/25/91	231	0.190	0.068	0.066	0.325	58.58%	21.06%	20.36%	0.127	0.046	0.044	0.217
81029	10/21/91	233	0.191	0.068	0.066	0.325	58.61%	21.03%	20.35%	0.104	0.037	0.036	0.177
81029	09/08/95	280	0.206	0.070	0.068	0.344	59.94%	20.28%	19.79%	0.142	0.048	0.047	0.236
81047	10/20/89	73	0.146	0.097	0.078	0.320	45.49%	30.12%	24.38%	0.170	0.113	0.091	0.374
81047	08/25/91	95	0.162	0.098	0.082	0.342	47.34%	28.72%	23.94%	0.168	0.102	0.085	0.354
81047	10/22/91	97	0.162	0.098	0.082	0.343	47.33%	28.70%	23.96%	0.158	0.096	0.080	0.335
81053	10/19/89	60	0.161	0.087	0.063	0.310	51.74%	27.88%	20.38%	0.183	0.099	0.072	0.354
81053	07/07/90	69	0.172	0.087	0.065	0.324	53.10%	26.84%	20.06%	0.230	0.116	0.087	0.433
81053	12/06/93	110	0.226	0.100	0.073	0.400	56.69%	25.00%	18.32%	0.223	0.098	0.072	0.394
81053	03/14/94	113	0.226	0.100	0.074	0.400	56.60%	24.99%	18.41%	0.223	0.098	0.072	0.394
81053	08/08/94	118	0.237	0.103	0.075	0.416	57.06%	24.88%	18.06%	0.225	0.098	0.071	0.394
81053	10/21/94	120	0.237	0.104	0.075	0.417	56.99%	24.90%	18.11%	0.236	0.103	0.075	0.413
81053	02/13/95	124	0.237	0.104	0.076	0.417	56.93%	24.88%	18.19%	0.235	0.103	0.075	0.413
81053	05/08/95	127	0.238	0.104	0.076	0.418	56.94%	24.86%	18.20%	0.235	0.103	0.075	0.413
81053	05/10/96	139	0.252	0.104	0.077	0.434	58.17%	24.05%	17.78%	0.252	0.104	0.077	0.433
81053	10/21/96	144	0.263	0.105	0.078	0.445	59.07%	23.49%	17.44%	0.279	0.111	0.082	0.472
81053	11/14/96	145	0.263	0.105	0.078	0.445	59.06%	23.49%	17.45%	0.279	0.111	0.082	0.472
81053	03/20/97	149	0.263	0.105	0.078	0.446	58.97%	23.49%	17.54%	0.279	0.111	0.083	0.472

Table C-18 (Cont'd) Permanent Deformation Simulation (β_{r2} = 1.2 and β_{r3} = 1.0) Data

Section	Month	Time	Predicted							Measured			
			AC	GB	SG	Total	%AC	%GB	%SG	AC	GB	SG	Total
81053	08/05/97	154	0.279	0.108	0.079	0.466	59.91%	23.08%	17.01%	0.295	0.114	0.084	0.492
81053	09/26/97	155	0.280	0.108	0.079	0.467	59.92%	23.08%	17.00%	0.307	0.118	0.087	0.512
81053	08/25/98	166	0.294	0.111	0.081	0.487	60.41%	22.90%	16.68%	0.309	0.117	0.085	0.512
91803	09/05/90	63	0.073	0.027	0.045	0.145	50.35%	18.77%	30.88%	0.089	0.033	0.055	0.177
91803	08/22/91	74	0.083	0.028	0.046	0.157	52.59%	17.96%	29.45%	0.072	0.025	0.041	0.138
91803	09/30/92	87	0.086	0.029	0.048	0.163	52.79%	17.80%	29.41%	0.104	0.035	0.058	0.197
91803	05/12/94	107	0.094	0.030	0.050	0.175	54.07%	17.18%	28.75%	0.075	0.024	0.040	0.138
91803	09/25/94	111	0.099	0.031	0.051	0.181	54.93%	16.94%	28.12%	0.076	0.023	0.039	0.138
91803	05/25/95	119	0.100	0.031	0.052	0.182	54.82%	16.91%	28.26%	0.097	0.030	0.050	0.177
91803	10/30/95	124	0.105	0.031	0.052	0.189	55.62%	16.68%	27.70%	0.109	0.033	0.055	0.197
91803	10/08/96	136	0.115	0.032	0.054	0.201	57.26%	16.07%	26.67%	0.101	0.028	0.047	0.177
91803	05/08/97	143	0.115	0.032	0.054	0.202	57.14%	16.03%	26.84%	0.101	0.028	0.048	0.177
91803	10/16/97	148	0.118	0.033	0.055	0.206	57.48%	15.93%	26.59%	0.102	0.028	0.047	0.177
91803	06/17/98	156	0.121	0.033	0.055	0.210	57.84%	15.74%	26.42%	0.102	0.028	0.047	0.177
123995	04/18/89	161	0.631	0.098	0.055	0.784	80.50%	12.46%	7.03%	0.317	0.049	0.028	0.394
123995	02/05/91	183	0.640	0.099	0.056	0.795	80.56%	12.43%	7.02%	0.317	0.049	0.028	0.394
123995	04/15/92	197	0.645	0.099	0.056	0.800	80.56%	12.42%	7.02%	0.349	0.054	0.030	0.433
123995	03/09/94	220	0.654	0.100	0.057	0.811	80.63%	12.37%	6.99%	0.317	0.049	0.028	0.394
123995	01/21/96	242	0.662	0.101	0.057	0.821	80.68%	12.34%	6.98%	0.318	0.049	0.027	0.394
123997	12/14/89	187	0.405	0.106	0.041	0.552	73.38%	19.15%	7.47%	0.462	0.121	0.047	0.630
123997	02/09/91	201	0.406	0.107	0.042	0.555	73.22%	19.25%	7.53%	0.461	0.121	0.047	0.630
123997	04/13/92	215	0.407	0.108	0.042	0.557	73.06%	19.36%	7.58%	0.518	0.137	0.054	0.709
123997	03/08/94	238	0.409	0.110	0.043	0.562	72.80%	19.53%	7.67%	0.545	0.146	0.057	0.748
124105	04/12/89	53	0.251	0.122	0.065	0.437	57.30%	27.80%	14.90%	0.214	0.104	0.056	0.374
124105	02/09/91	75	0.254	0.127	0.068	0.449	56.61%	28.19%	15.20%	0.212	0.105	0.057	0.374
124105	04/13/92	89	0.256	0.129	0.070	0.454	56.29%	28.37%	15.34%	0.244	0.123	0.066	0.433
124106	04/18/89	21	0.244	0.048	0.051	0.343	71.05%	14.00%	14.96%	0.168	0.033	0.035	0.236
124106	02/05/91	43	0.307	0.052	0.057	0.415	73.82%	12.51%	13.68%	0.203	0.034	0.038	0.276
124106	04/15/92	57	0.331	0.053	0.059	0.443	74.67%	12.03%	13.30%	0.147	0.024	0.026	0.197
124106	03/09/94	80	0.379	0.055	0.062	0.495	76.39%	11.16%	12.44%	0.180	0.026	0.029	0.236
124106	01/21/96	102	0.408	0.057	0.064	0.528	77.23%	10.71%	12.06%	0.182	0.025	0.028	0.236
124106	01/17/97	114	0.419	0.057	0.065	0.541	77.46%	10.60%	11.95%	0.244	0.033	0.038	0.315
124107	12/06/89	75	0.160	0.076	0.061	0.298	53.79%	25.64%	20.57%	0.095	0.045	0.036	0.177
124107	02/05/91	89	0.172	0.078	0.063	0.313	54.94%	24.96%	20.10%	0.087	0.039	0.032	0.157
124107	04/15/92	103	0.184	0.080	0.064	0.328	56.09%	24.28%	19.63%	0.088	0.038	0.031	0.157
124107	03/09/94	126	0.205	0.082	0.066	0.353	58.07%	23.16%	18.77%	0.080	0.032	0.026	0.138
124107	01/22/96	148	0.220	0.084	0.068	0.372	59.24%	22.47%	18.29%	0.105	0.040	0.032	0.177
124108	04/27/89	35	0.182	0.027	0.031	0.239	76.09%	11.10%	12.82%	0.270	0.039	0.045	0.354
124108	01/16/91	56	0.238	0.028	0.033	0.299	79.56%	9.48%	10.96%	0.360	0.043	0.050	0.453
124108	04/01/92	71	0.253	0.029	0.034	0.316	80.05%	9.24%	10.71%	0.315	0.036	0.042	0.394
124108	03/21/94	94	0.296	0.030	0.035	0.362	81.79%	8.41%	9.80%	0.403	0.041	0.048	0.492
124108	01/16/96	116	0.316	0.031	0.037	0.384	82.30%	8.14%	9.56%	0.437	0.043	0.051	0.531
124135	12/10/89	227	0.157	0.226	0.091	0.473	33.15%	47.71%	19.14%	0.163	0.235	0.094	0.492
124135	01/29/91	240	0.157	0.227	0.091	0.475	33.07%	47.74%	19.19%	0.195	0.282	0.113	0.591

Table C-18 (Cont'd) Permanent Deformation Simulation (β_{r2} = 1.2 and β_{r3} = 1.0) Data

Section	Month	Time	Predicted							Measured			
			AC	GB	SG	Total	%AC	%GB	%SG	AC	GB	SG	Total
131031	01/09/90	104	0.129	0.021	0.033	0.183	70.44%	11.69%	17.87%	0.277	0.046	0.070	0.394
131031	03/04/91	118	0.139	0.022	0.034	0.194	71.32%	11.35%	17.33%	0.309	0.049	0.075	0.433
131031	04/28/92	131	0.149	0.023	0.035	0.206	72.18%	10.98%	16.84%	0.284	0.043	0.066	0.394
131031	04/04/94	155	0.170	0.024	0.036	0.230	73.88%	10.32%	15.80%	0.364	0.051	0.078	0.492
131031	01/13/96	176	0.187	0.024	0.038	0.249	75.03%	9.83%	15.14%	0.310	0.041	0.063	0.413
134111	03/20/89	101	0.196	0.036	0.090	0.322	60.78%	11.17%	28.05%	0.168	0.031	0.077	0.276
134111	03/04/91	125	0.225	0.038	0.096	0.360	62.63%	10.58%	26.78%	0.160	0.027	0.069	0.256
134111	04/27/92	138	0.239	0.039	0.099	0.377	63.38%	10.33%	26.29%	0.162	0.026	0.067	0.256
134112	05/04/89	144	0.244	0.000	0.074	0.318	76.85%	0.00%	23.15%	0.182	0.000	0.055	0.236
134112	02/10/91	165	0.267	0.000	0.075	0.342	78.09%	0.00%	21.91%	0.184	0.000	0.052	0.236
134112	04/13/92	179	0.280	0.000	0.076	0.356	78.72%	0.00%	21.28%	0.155	0.000	0.042	0.197
134112	02/24/94	201	0.302	0.000	0.077	0.379	79.71%	0.00%	20.29%	0.188	0.000	0.048	0.236
134112	01/25/96	224	0.325	0.000	0.078	0.403	80.63%	0.00%	19.37%	0.206	0.000	0.050	0.256
134112	04/23/98	251	0.350	0.000	0.079	0.429	81.51%	0.00%	18.49%	0.273	0.000	0.062	0.335
134113	05/04/89	144	0.288	0.000	0.099	0.387	74.36%	0.00%	25.64%	0.117	0.000	0.040	0.157
134113	02/10/91	165	0.309	0.000	0.101	0.410	75.42%	0.00%	24.58%	0.104	0.000	0.034	0.138
134113	04/13/92	179	0.322	0.000	0.102	0.424	76.01%	0.00%	23.99%	0.135	0.000	0.042	0.177
134113	02/24/94	201	0.344	0.000	0.103	0.447	76.92%	0.00%	23.08%	0.136	0.000	0.041	0.177
134113	01/25/96	224	0.366	0.000	0.104	0.471	77.80%	0.00%	22.20%	0.138	0.000	0.039	0.177
134113	04/23/98	251	0.391	0.000	0.106	0.496	78.67%	0.00%	21.33%	0.139	0.000	0.038	0.177
134119	01/08/90	140	0.418	0.011	0.022	0.450	92.79%	2.39%	4.82%	0.256	0.007	0.013	0.276
134119	03/04/91	154	0.424	0.011	0.022	0.457	92.82%	2.39%	4.80%	0.256	0.007	0.013	0.276
134119	04/28/92	167	0.426	0.011	0.022	0.459	92.83%	2.37%	4.79%	0.238	0.006	0.012	0.256
134119	04/07/94	191	0.433	0.011	0.022	0.466	92.86%	2.37%	4.77%	0.219	0.006	0.011	0.236
161001	07/17/89	192	0.244	0.102	0.054	0.400	60.86%	25.53%	13.62%	0.180	0.075	0.040	0.295
161001	08/02/90	205	0.255	0.104	0.055	0.415	61.54%	25.16%	13.30%	0.121	0.050	0.026	0.197
161001	07/04/91	216	0.260	0.105	0.056	0.421	61.75%	25.04%	13.21%	0.122	0.049	0.026	0.197
161001	08/25/94	253	0.290	0.108	0.057	0.454	63.83%	23.69%	12.48%	0.151	0.056	0.029	0.236
161001	05/17/95	262	0.291	0.108	0.057	0.455	63.86%	23.66%	12.49%	0.163	0.061	0.032	0.256
161001	07/09/97	288	0.312	0.110	0.058	0.480	64.97%	22.99%	12.04%	0.192	0.068	0.036	0.295
161001	09/23/98	302	0.325	0.110	0.058	0.494	65.89%	22.35%	11.75%	0.246	0.084	0.044	0.374
161009	09/20/89	180	0.318	0.019	0.048	0.385	82.71%	4.89%	12.40%	0.358	0.021	0.054	0.433
161009	07/19/90	190	0.324	0.019	0.048	0.391	82.89%	4.85%	12.26%	0.326	0.019	0.048	0.394
161009	07/26/91	202	0.337	0.019	0.048	0.405	83.34%	4.72%	11.93%	0.328	0.019	0.047	0.394
161021	09/21/89	48	0.234	0.019	0.055	0.308	76.07%	6.12%	17.81%	0.120	0.010	0.028	0.157
161021	07/21/90	58	0.249	0.019	0.056	0.324	76.81%	5.94%	17.26%	0.136	0.011	0.031	0.177
161021	07/28/91	70	0.266	0.020	0.057	0.343	77.60%	5.73%	16.67%	0.092	0.007	0.020	0.118
161021	09/12/95	120	0.339	0.021	0.061	0.420	80.53%	4.96%	14.51%	0.127	0.008	0.023	0.157
161021	06/05/96	129	0.341	0.021	0.061	0.423	80.54%	4.96%	14.51%	0.111	0.007	0.020	0.138
161021	07/29/97	142	0.359	0.021	0.062	0.443	81.16%	4.80%	14.04%	0.144	0.009	0.025	0.177
169034	07/17/89	10	0.063	0.022	0.030	0.115	54.27%	19.35%	26.38%	0.043	0.015	0.021	0.079
169034	08/02/90	23	0.120	0.027	0.035	0.181	66.20%	14.69%	19.11%	0.104	0.023	0.030	0.157
169034	07/04/91	34	0.131	0.027	0.036	0.195	67.31%	14.08%	18.61%	0.053	0.011	0.015	0.079
169034	05/17/95	80	0.175	0.030	0.040	0.245	71.40%	12.23%	16.36%	0.112	0.019	0.026	0.157
169034	07/09/97	106	0.201	0.031	0.042	0.274	73.39%	11.41%	15.20%	0.116	0.018	0.024	0.157
169034	09/24/98	120	0.211	0.032	0.042	0.285	74.08%	11.13%	14.80%	0.175	0.026	0.035	0.236

Table C-18 (Cont'd) Permanent Deformation Simulation (β_{r2} = 1.2 and β_{r3} = 1.0) Data

Section	Month	Time	Predicted							Measured			
			AC	GB	SG	Total	%AC	%GB	%SG	AC	GB	SG	Total
201009	05/02/89	53	0.079	0.000	0.047	0.126	62.89%	0.00%	37.11%	0.161	0.000	0.095	0.256
201009	12/10/90	72	0.095	0.000	0.049	0.144	65.72%	0.00%	34.28%	0.181	0.000	0.094	0.276
201009	04/08/93	100	0.106	0.000	0.052	0.158	67.39%	0.00%	32.61%	0.146	0.000	0.071	0.217
201009	04/23/96	136	0.123	0.000	0.054	0.177	69.51%	0.00%	30.49%	0.068	0.000	0.030	0.098
251003	08/04/89	180	0.105	0.043	0.026	0.174	60.35%	24.74%	14.91%	0.095	0.039	0.023	0.157
251003	09/06/90	193	0.107	0.043	0.026	0.176	60.53%	24.63%	14.84%	0.143	0.058	0.035	0.236
251003	08/23/91	204	0.110	0.044	0.026	0.180	61.02%	24.35%	14.63%	0.096	0.038	0.023	0.157
251003	09/30/92	217	0.116	0.044	0.027	0.187	62.01%	23.76%	14.23%	0.122	0.047	0.028	0.197
251003	10/27/95	254	0.123	0.045	0.027	0.195	62.88%	23.21%	13.90%	0.111	0.041	0.025	0.177
251003	10/23/96	266	0.126	0.046	0.027	0.199	63.28%	22.97%	13.76%	0.112	0.041	0.024	0.177
251003	06/16/98	286	0.132	0.046	0.028	0.206	64.17%	22.43%	13.40%	0.101	0.035	0.021	0.157
251004	08/04/89	178	0.115	0.058	0.028	0.201	57.19%	28.98%	13.83%	0.203	0.103	0.049	0.354
251004	09/05/90	191	0.120	0.059	0.028	0.208	57.89%	28.52%	13.59%	0.171	0.084	0.040	0.295
251004	08/22/91	202	0.124	0.060	0.029	0.213	58.39%	28.18%	13.43%	0.195	0.094	0.045	0.335
251004	09/30/92	215	0.131	0.061	0.029	0.221	59.19%	27.65%	13.16%	0.280	0.131	0.062	0.472
251004	10/29/95	252	0.144	0.063	0.030	0.237	60.60%	26.70%	12.70%	0.251	0.110	0.052	0.413
251004	06/05/97	272	0.151	0.064	0.031	0.246	61.27%	26.23%	12.49%	0.217	0.093	0.044	0.354
251004	06/15/98	284	0.156	0.065	0.031	0.253	61.86%	25.85%	12.29%	0.231	0.097	0.046	0.374
261001	09/07/89	217	0.115	0.067	0.053	0.235	48.95%	28.51%	22.54%	0.106	0.062	0.049	0.217
261001	07/21/90	227	0.116	0.067	0.053	0.236	49.02%	28.45%	22.53%	0.125	0.073	0.058	0.256
261001	07/16/91	239	0.118	0.068	0.054	0.239	49.32%	28.28%	22.39%	0.097	0.056	0.044	0.197
261001	06/09/93	262	0.122	0.069	0.054	0.245	49.83%	28.03%	22.15%	0.128	0.072	0.057	0.256
261001	07/05/96	299	0.129	0.070	0.055	0.254	50.74%	27.49%	21.76%	0.110	0.060	0.047	0.217
261004	10/21/90	64	0.118	0.024	0.040	0.181	65.08%	13.07%	21.84%	0.115	0.023	0.039	0.177
261004	05/13/93	95	0.125	0.025	0.041	0.191	65.47%	12.89%	21.64%	0.064	0.013	0.021	0.098
261004	07/07/94	109	0.138	0.025	0.042	0.205	66.98%	12.38%	20.64%	0.079	0.015	0.024	0.118
261004	06/15/95	120	0.140	0.026	0.043	0.209	67.15%	12.30%	20.55%	0.106	0.019	0.032	0.157
271018	06/22/89	126	0.242	0.027	0.062	0.330	73.28%	8.03%	18.69%	0.288	0.032	0.074	0.394
271018	10/30/90	142	0.260	0.027	0.063	0.350	74.38%	7.70%	17.92%	0.264	0.027	0.063	0.354
271018	06/02/93	174	0.285	0.028	0.064	0.377	75.63%	7.32%	17.05%	0.208	0.020	0.047	0.276
271018	03/08/94	183	0.298	0.028	0.065	0.390	76.33%	7.11%	16.56%	0.210	0.020	0.046	0.276
271087	06/09/89	126	0.049	0.000	0.032	0.081	60.46%	0.00%	39.54%	0.119	0.000	0.078	0.197
271087	11/13/90	143	0.052	0.000	0.032	0.084	61.50%	0.00%	38.50%	0.133	0.000	0.083	0.217
271087	05/11/93	173	0.055	0.000	0.033	0.088	62.49%	0.00%	37.51%	0.074	0.000	0.044	0.118
271087	06/25/96	210	0.060	0.000	0.034	0.093	63.87%	0.00%	36.13%	0.088	0.000	0.050	0.138
271087	08/03/99	240	0.063	0.000	0.034	0.098	64.99%	0.00%	35.01%	0.102	0.000	0.055	0.157
291008	03/13/89	35	0.089	0.008	0.058	0.155	57.45%	5.04%	37.50%	0.136	0.012	0.089	0.236
291008	11/07/90	55	0.108	0.008	0.063	0.179	60.18%	4.73%	35.09%	0.178	0.014	0.104	0.295
291008	03/05/93	85	0.125	0.009	0.067	0.201	62.13%	4.49%	33.38%	0.183	0.013	0.099	0.295
291008	04/17/96	120	0.146	0.010	0.071	0.227	64.39%	4.22%	31.39%	0.152	0.010	0.074	0.236
307088	09/27/89	100	0.260	0.110	0.087	0.456	56.91%	24.00%	19.09%	0.246	0.104	0.083	0.433
307088	07/29/90	110	0.269	0.111	0.088	0.468	57.44%	23.71%	18.85%	0.226	0.093	0.074	0.394
307088	05/20/91	120	0.275	0.112	0.089	0.476	57.73%	23.54%	18.73%	0.205	0.083	0.066	0.354
308129	10/03/89	17	0.107	0.079	0.081	0.267	40.04%	29.67%	30.29%	0.142	0.105	0.107	0.354
308129	07/29/90	26	0.118	0.096	0.088	0.302	39.02%	31.77%	29.22%	0.123	0.100	0.092	0.315
308129	07/30/91	38	0.132	0.102	0.096	0.330	40.18%	30.86%	28.97%	0.095	0.073	0.068	0.236
308129	12/14/93	67	0.170	0.107	0.106	0.382	44.41%	27.99%	27.60%	0.131	0.083	0.081	0.295

Table C-18 (Cont'd) Permanent Deformation Simulation (β_{r2} = 1.2 and β_{r3} = 1.0) Data

Section	Month	Time	Predicted							Measured			
			AC	GB	SG	Total	%AC	%GB	%SG	AC	GB	SG	Total
308129	03/17/94	70	0.170	0.107	0.107	0.384	44.25%	27.99%	27.77%	0.139	0.088	0.087	0.315
308129	08/22/94	75	0.181	0.114	0.109	0.404	44.94%	28.13%	26.93%	0.133	0.083	0.080	0.295
308129	10/31/94	77	0.182	0.114	0.109	0.406	44.87%	28.14%	26.99%	0.141	0.089	0.085	0.315
308129	02/17/95	81	0.182	0.114	0.110	0.407	44.76%	28.10%	27.14%	0.185	0.116	0.112	0.413
308129	05/18/95	84	0.182	0.114	0.111	0.407	44.72%	28.08%	27.20%	0.150	0.094	0.091	0.335
308129	06/10/96	97	0.194	0.116	0.114	0.423	45.82%	27.36%	26.82%	0.162	0.097	0.095	0.354
308129	10/28/96	101	0.202	0.117	0.115	0.433	46.59%	26.92%	26.49%	0.156	0.090	0.089	0.335
308129	01/23/97	104	0.202	0.117	0.115	0.433	46.54%	26.92%	26.54%	0.183	0.106	0.104	0.394
308129	03/25/97	106	0.202	0.117	0.115	0.434	46.51%	26.90%	26.59%	0.156	0.090	0.089	0.335
308129	08/11/97	111	0.214	0.117	0.116	0.447	47.87%	26.15%	25.97%	0.179	0.098	0.097	0.374
308129	10/01/97	113	0.216	0.117	0.116	0.450	48.08%	26.04%	25.88%	0.180	0.097	0.097	0.374
321020	08/29/89	63	0.184	0.019	0.050	0.253	72.67%	7.46%	19.88%	0.229	0.023	0.063	0.315
321020	08/22/90	75	0.194	0.019	0.051	0.264	73.37%	7.23%	19.40%	0.246	0.024	0.065	0.335
321020	07/23/91	86	0.203	0.019	0.052	0.274	73.93%	7.07%	19.00%	0.233	0.022	0.060	0.315
321020	09/14/94	124	0.248	0.020	0.054	0.323	76.79%	6.34%	16.88%	0.212	0.017	0.047	0.276
321020	04/25/95	131	0.248	0.020	0.055	0.323	76.76%	6.33%	16.91%	0.272	0.022	0.060	0.354
321020	06/05/97	157	0.269	0.021	0.056	0.346	77.75%	6.06%	16.18%	0.245	0.019	0.051	0.315
321020	06/09/98	169	0.277	0.021	0.057	0.355	78.11%	5.96%	15.93%	0.261	0.020	0.053	0.335
321020	04/13/99	175	0.289	0.021	0.057	0.368	78.72%	5.82%	15.46%	0.294	0.022	0.058	0.374
341003	09/11/90	195	0.179	0.022	0.032	0.233	76.56%	9.52%	13.92%	0.618	0.077	0.112	0.807
341003	08/15/91	206	0.184	0.022	0.033	0.239	76.87%	9.40%	13.73%	0.545	0.067	0.097	0.709
341003	09/28/92	219	0.188	0.023	0.033	0.244	77.10%	9.31%	13.59%	0.637	0.077	0.112	0.827
341011	04/17/99	214	0.431	0.023	0.074	0.529	81.49%	4.43%	14.08%	0.241	0.013	0.042	0.295
341011	04/18/99	227	0.441	0.024	0.075	0.540	81.66%	4.39%	13.95%	0.305	0.016	0.052	0.374
341011	04/19/99	244	0.456	0.024	0.076	0.556	81.98%	4.28%	13.74%	0.242	0.013	0.041	0.295
341011	04/20/99	254	0.461	0.024	0.077	0.562	81.99%	4.29%	13.72%	0.307	0.016	0.051	0.374
341011	04/21/99	287	0.472	0.025	0.079	0.577	81.94%	4.29%	13.77%	0.323	0.017	0.054	0.394
341011	04/22/99	307	0.480	0.025	0.081	0.586	81.97%	4.29%	13.74%	0.274	0.014	0.046	0.335
341031	10/05/89	194	0.294	0.056	0.070	0.420	70.02%	13.34%	16.63%	0.345	0.066	0.082	0.492
341031	09/12/90	205	0.307	0.057	0.071	0.435	70.59%	13.10%	16.30%	0.334	0.062	0.077	0.472
341031	04/06/92	224	0.326	0.058	0.072	0.457	71.42%	12.71%	15.87%	0.337	0.060	0.075	0.472
341031	02/24/93	234	0.338	0.059	0.073	0.470	71.94%	12.51%	15.55%	0.326	0.057	0.070	0.453
341031	10/26/95	266	0.379	0.061	0.076	0.516	73.48%	11.84%	14.68%	0.419	0.068	0.084	0.571
341031	11/04/95	267	0.379	0.061	0.076	0.516	73.48%	11.84%	14.68%	0.391	0.063	0.078	0.531
341033	10/05/89	181	0.210	0.041	0.043	0.294	71.34%	13.98%	14.68%	0.197	0.039	0.040	0.276
341033	09/12/90	192	0.213	0.041	0.043	0.297	71.51%	13.89%	14.60%	0.253	0.049	0.052	0.354
341033	04/05/92	211	0.224	0.042	0.044	0.310	72.21%	13.55%	14.23%	0.199	0.037	0.039	0.276
341033	02/24/93	221	0.230	0.042	0.044	0.317	72.62%	13.35%	14.03%	0.243	0.045	0.047	0.335
341033	11/03/95	254	0.245	0.043	0.045	0.334	73.47%	12.95%	13.58%	0.260	0.046	0.048	0.354
341033	07/23/97	274	0.249	0.043	0.046	0.338	73.64%	12.85%	13.51%	0.217	0.038	0.040	0.295
341034	10/05/89	48	0.140	0.000	0.044	0.184	75.89%	0.00%	24.11%	0.105	0.000	0.033	0.138
341034	09/12/90	59	0.156	0.000	0.046	0.202	77.43%	0.00%	22.57%	0.213	0.000	0.062	0.276
341034	04/06/92	78	0.168	0.000	0.047	0.215	78.32%	0.00%	21.68%	0.139	0.000	0.038	0.177
341034	02/24/93	88	0.181	0.000	0.047	0.228	79.23%	0.00%	20.77%	0.187	0.000	0.049	0.236
341034	11/04/95	121	0.215	0.000	0.049	0.264	81.30%	0.00%	18.70%	0.208	0.000	0.048	0.256
341034	07/30/97	141	0.231	0.000	0.050	0.281	82.11%	0.00%	17.89%	0.145	0.000	0.032	0.177

Table C-18 (Cont'd) Permanent Deformation Simulation (β_{r2} = 1.2 and β_{r3} = 1.0) Data

Section	Month	Time	Predicted							Measured			
			AC	GB	SG	Total	%AC	%GB	%SG	AC	GB	SG	Total
350101	05/01/97	19	0.179	0.040	0.109	0.328	54.66%	12.23%	33.11%	0.108	0.024	0.065	0.197
350101	03/19/99	38	0.262	0.045	0.122	0.429	61.05%	10.54%	28.41%	0.144	0.025	0.067	0.236
350102	05/01/97	19	0.185	0.067	0.131	0.384	48.31%	17.58%	34.12%	0.095	0.035	0.067	0.197
350102	03/19/99	38	0.274	0.075	0.150	0.499	54.94%	15.09%	29.97%	0.130	0.036	0.071	0.236
350103	05/01/97	19	0.100	0.000	0.108	0.208	48.12%	0.00%	51.88%	0.095	0.000	0.102	0.197
350103	03/19/99	38	0.146	0.000	0.126	0.272	53.54%	0.00%	46.46%	0.148	0.000	0.128	0.276
350104	05/01/97	19	0.079	0.000	0.071	0.150	52.58%	0.00%	47.42%	0.124	0.000	0.112	0.236
350104	03/19/99	38	0.115	0.000	0.084	0.199	57.67%	0.00%	42.33%	0.159	0.000	0.117	0.276
350105	05/02/97	19	0.149	0.015	0.123	0.286	52.01%	5.13%	42.86%	0.123	0.012	0.101	0.236
350105	03/22/99	38	0.215	0.017	0.142	0.374	57.52%	4.43%	38.05%	0.136	0.010	0.090	0.236
350106	05/02/96	19	0.079	0.006	0.082	0.167	47.15%	3.47%	49.38%	0.093	0.007	0.097	0.197
350106	03/22/99	38	0.112	0.007	0.097	0.216	52.14%	3.06%	44.80%	0.123	0.007	0.106	0.236
351005	10/31/89	73	0.179	0.022	0.085	0.287	62.55%	7.84%	29.62%	0.295	0.037	0.140	0.472
351005	08/21/91	95	0.194	0.023	0.089	0.306	63.56%	7.48%	28.96%	0.300	0.035	0.137	0.472
351005	10/24/92	109	0.209	0.023	0.091	0.323	64.57%	7.20%	28.23%	0.267	0.030	0.117	0.413
351005	03/18/95	138	0.254	0.024	0.095	0.373	68.06%	6.53%	25.41%	0.389	0.037	0.145	0.571
351005	03/16/99	183	0.307	0.025	0.100	0.432	71.05%	5.86%	23.08%	0.434	0.036	0.141	0.610
351022	10/31/89	37	0.127	0.032	0.077	0.236	53.74%	13.69%	32.58%	0.095	0.024	0.058	0.177
351022	08/22/91	59	0.188	0.035	0.084	0.307	61.25%	11.51%	27.24%	0.084	0.016	0.038	0.138
351022	10/24/92	73	0.200	0.036	0.087	0.323	61.94%	11.22%	26.84%	0.122	0.022	0.053	0.197
351022	03/18/95	102	0.236	0.038	0.092	0.365	64.60%	10.32%	25.08%	0.140	0.022	0.054	0.217
351022	03/17/99	147	0.309	0.040	0.098	0.448	69.11%	8.99%	21.90%	0.109	0.014	0.034	0.157
351112	12/05/89	67	0.333	0.030	0.053	0.416	80.09%	7.19%	12.72%	0.126	0.011	0.020	0.157
351112	01/22/91	80	0.343	0.030	0.054	0.427	80.32%	7.10%	12.59%	0.142	0.013	0.022	0.177
351112	09/27/91	88	0.355	0.031	0.054	0.440	80.72%	6.94%	12.34%	0.111	0.010	0.017	0.138
351112	01/27/93	104	0.370	0.031	0.055	0.456	81.14%	6.79%	12.07%	0.096	0.008	0.014	0.118
351112	03/15/95	130	0.406	0.032	0.056	0.494	82.19%	6.41%	11.40%	0.162	0.013	0.022	0.197
351112	09/09/97	160	0.422	0.032	0.057	0.512	82.45%	6.32%	11.24%	0.114	0.009	0.015	0.138
351112	03/15/99	175	0.430	0.033	0.058	0.520	82.62%	6.26%	11.12%	0.130	0.010	0.018	0.157
371006	10/13/89	88	0.400	0.030	0.091	0.521	76.77%	5.76%	17.47%	0.060	0.005	0.014	0.079
371006	03/19/91	105	0.408	0.030	0.093	0.531	76.83%	5.72%	17.44%	0.060	0.005	0.014	0.079
371006	10/11/92	124	0.426	0.031	0.095	0.553	77.11%	5.67%	17.21%	0.137	0.010	0.030	0.177
371006	04/18/94	142	0.433	0.032	0.097	0.562	77.14%	5.65%	17.21%	0.076	0.006	0.017	0.098
371006	09/20/94	147	0.438	0.032	0.097	0.568	77.22%	5.64%	17.14%	0.091	0.007	0.020	0.118
371024	11/03/89	109	0.129	0.047	0.069	0.245	52.58%	19.18%	28.24%	0.186	0.068	0.100	0.354
371024	03/09/91	125	0.134	0.048	0.071	0.252	53.09%	18.83%	28.08%	0.230	0.082	0.122	0.433
371024	04/10/92	138	0.140	0.048	0.072	0.260	53.74%	18.51%	27.75%	0.190	0.066	0.098	0.354
371802	10/13/89	49	0.145	0.076	0.177	0.399	36.42%	19.18%	44.40%	0.129	0.068	0.157	0.354
371802	03/18/91	66	0.162	0.079	0.187	0.428	37.82%	18.51%	43.67%	0.119	0.058	0.138	0.315
371802	10/10/92	85	0.183	0.083	0.197	0.463	39.47%	17.90%	42.63%	0.140	0.063	0.151	0.354
371802	04/15/94	103	0.194	0.085	0.204	0.483	40.18%	17.49%	42.32%	0.174	0.076	0.183	0.433
371802	07/18/95	118	0.210	0.087	0.211	0.508	41.40%	17.10%	41.50%	0.196	0.081	0.196	0.472
371802	02/09/96	125	0.214	0.087	0.213	0.514	41.64%	16.98%	41.38%	0.213	0.087	0.212	0.512
371802	04/02/96	127	0.214	0.087	0.213	0.515	41.60%	16.96%	41.44%	0.213	0.087	0.212	0.512
371817	10/15/89	71	0.163	0.046	0.048	0.257	63.18%	18.05%	18.77%	0.249	0.071	0.074	0.394
371817	03/18/91	88	0.171	0.048	0.050	0.269	63.79%	17.67%	18.53%	0.163	0.045	0.047	0.256
371817	10/18/92	107	0.199	0.050	0.052	0.301	66.30%	16.52%	17.18%	0.235	0.059	0.061	0.354

Table C-18 (Cont'd) Permanent Deformation Simulation (β_{r2} = 1.2 and β_{r3} = 1.0) Data

Section	Month	Time	Predicted							Measured			
			AC	GB	SG	Total	%AC	%GB	%SG	AC	GB	SG	Total
371992	10/15/92	33	0.215	0.121	0.049	0.386	55.81%	31.42%	12.77%	0.132	0.074	0.030	0.236
371992	04/20/94	51	0.259	0.127	0.053	0.439	58.96%	29.05%	11.99%	0.023	0.011	0.005	0.039
371992	02/06/96	73	0.273	0.134	0.056	0.463	58.97%	28.94%	12.09%	0.093	0.046	0.019	0.157
371992	04/22/98	99	0.278	0.140	0.059	0.477	58.24%	29.35%	12.41%	0.138	0.069	0.029	0.236
404087	01/17/90	43	0.124	0.027	0.068	0.219	56.55%	12.45%	31.00%	0.345	0.076	0.189	0.610
404087	10/13/91	64	0.149	0.030	0.076	0.254	58.55%	11.66%	29.79%	0.254	0.050	0.129	0.433
404087	02/08/93	80	0.159	0.031	0.080	0.269	59.13%	11.34%	29.53%	0.221	0.042	0.110	0.374
404087	02/09/95	104	0.178	0.032	0.085	0.295	60.20%	10.85%	28.95%	0.344	0.062	0.165	0.571
404163	01/23/90	34	0.110	0.000	0.067	0.177	62.25%	0.00%	37.75%	0.282	0.000	0.171	0.453
404163	03/17/91	48	0.123	0.000	0.070	0.193	63.78%	0.00%	36.22%	0.239	0.000	0.135	0.374
404163	10/28/91	55	0.130	0.000	0.072	0.202	64.53%	0.00%	35.47%	0.191	0.000	0.105	0.295
404163	03/10/93	72	0.144	0.000	0.074	0.218	66.04%	0.00%	33.96%	0.182	0.000	0.094	0.276
404163	04/22/96	109	0.163	0.000	0.078	0.242	67.60%	0.00%	32.40%	0.213	0.000	0.102	0.315
404163	08/20/97	125	0.180	0.000	0.081	0.261	69.12%	0.00%	30.88%	0.272	0.000	0.122	0.394
404163	01/11/99	141	0.186	0.000	0.082	0.268	69.49%	0.00%	30.51%	0.315	0.000	0.138	0.453
421599	07/18/89	24	0.081	0.021	0.066	0.168	47.84%	12.71%	39.45%	0.085	0.023	0.070	0.177
421599	09/27/90	38	0.092	0.022	0.071	0.184	49.75%	11.78%	38.47%	0.108	0.026	0.083	0.217
421599	08/07/91	49	0.100	0.022	0.073	0.195	51.29%	11.14%	37.57%	0.101	0.022	0.074	0.197
421599	03/01/93	68	0.113	0.022	0.076	0.211	53.40%	10.41%	36.19%	0.168	0.033	0.114	0.315
421599	06/21/95	95	0.132	0.022	0.080	0.235	56.38%	9.45%	34.17%	0.155	0.026	0.094	0.276
421599	07/19/96	108	0.143	0.022	0.082	0.247	57.77%	9.04%	33.18%	0.159	0.025	0.091	0.276
421599	03/26/98	128	0.157	0.023	0.084	0.264	59.55%	8.57%	31.88%	0.164	0.024	0.088	0.276
451011	04/11/89	34	0.395	0.059	0.055	0.509	77.60%	11.64%	10.76%	0.260	0.039	0.036	0.335
451011	03/05/91	57	0.429	0.062	0.057	0.549	78.21%	11.31%	10.48%	0.385	0.056	0.052	0.492
451011	10/24/92	76	0.435	0.064	0.059	0.558	77.92%	11.48%	10.60%	0.491	0.072	0.067	0.630
451011	01/27/96	115	0.441	0.066	0.061	0.569	77.56%	11.66%	10.78%	0.519	0.078	0.072	0.669
451011	02/11/99	150	0.446	0.068	0.063	0.577	77.35%	11.76%	10.89%	0.548	0.083	0.077	0.709
473104	11/01/89	42	0.011	0.048	0.056	0.115	9.37%	41.75%	48.88%	0.026	0.115	0.135	0.276
473104	05/06/91	60	0.012	0.051	0.062	0.124	9.35%	41.04%	49.61%	0.029	0.129	0.156	0.315
473104	10/26/92	77	0.014	0.053	0.066	0.133	10.17%	40.10%	49.73%	0.036	0.142	0.176	0.354
473104	11/30/95	114	0.016	0.059	0.075	0.150	10.57%	39.25%	50.18%	0.067	0.247	0.316	0.630
480001	04/10/89	1	0.030	0.068	0.053	0.151	19.91%	45.06%	35.04%	0.047	0.106	0.083	0.236
480001	10/11/90	19	0.196	0.118	0.100	0.414	47.28%	28.58%	24.14%	0.130	0.079	0.067	0.276
480001	03/11/92	36	0.244	0.127	0.112	0.483	50.54%	26.28%	23.18%	0.159	0.083	0.073	0.315
480001	02/17/93	47	0.277	0.132	0.118	0.527	52.54%	25.08%	22.38%	0.103	0.049	0.044	0.197
480001	02/20/95	71	0.280	0.139	0.128	0.547	51.17%	25.48%	23.35%	0.161	0.080	0.074	0.315
480001	03/19/98	108	0.288	0.148	0.139	0.576	50.04%	25.76%	24.20%	0.079	0.041	0.038	0.157
481060	06/18/90	52	0.232	0.050	0.055	0.337	68.91%	14.83%	16.26%	0.285	0.061	0.067	0.413
481060	02/14/91	60	0.246	0.051	0.056	0.353	69.77%	14.39%	15.84%	0.233	0.048	0.053	0.335
481060	03/18/92	73	0.263	0.052	0.058	0.372	70.58%	13.93%	15.49%	0.167	0.033	0.037	0.236
481060	02/23/93	84	0.280	0.053	0.059	0.392	71.46%	13.46%	15.08%	0.155	0.029	0.033	0.217
481060	02/23/95	108	0.308	0.054	0.062	0.424	72.69%	12.79%	14.52%	0.272	0.048	0.054	0.374
481060	01/05/99	154	0.343	0.057	0.065	0.465	73.78%	12.21%	14.01%	0.290	0.048	0.055	0.394
481077	04/25/89	88	0.329	0.033	0.057	0.419	78.47%	7.97%	13.55%	0.417	0.042	0.072	0.531
481077	10/13/91	118	0.354	0.035	0.059	0.447	79.16%	7.74%	13.11%	0.483	0.047	0.080	0.610
481077	10/12/92	130	0.359	0.035	0.059	0.453	79.18%	7.72%	13.09%	0.483	0.047	0.080	0.610

Table C-18 (Cont'd) Permanent Deformation Simulation (β_{r2} = 1.2 and β_{r3} = 1.0) Data

Section	Month	Time	Predicted							Measured			
			AC	GB	SG	Total	%AC	%GB	%SG	AC	GB	SG	Total
481077	03/10/95	159	0.375	0.036	0.061	0.471	79.59%	7.57%	12.84%	0.564	0.054	0.091	0.709
481077	03/26/98	195	0.394	0.036	0.062	0.492	80.01%	7.41%	12.59%	0.551	0.051	0.087	0.689
481109	01/04/90	68	0.334	0.000	0.121	0.456	73.36%	0.00%	26.64%	0.231	0.000	0.084	0.315
481109	09/21/90	76	0.354	0.000	0.124	0.478	74.04%	0.00%	25.96%	0.233	0.000	0.082	0.315
481109	03/10/92	94	0.374	0.000	0.127	0.501	74.57%	0.00%	25.43%	0.191	0.000	0.065	0.256
481109	02/12/93	105	0.395	0.000	0.130	0.525	75.25%	0.00%	24.75%	0.193	0.000	0.063	0.256
481109	02/16/95	129	0.414	0.000	0.134	0.548	75.58%	0.00%	24.42%	0.298	0.000	0.096	0.394
481130	04/11/89	201	0.330	0.145	0.114	0.589	56.00%	24.64%	19.36%	0.298	0.131	0.103	0.531
481130	10/12/90	219	0.332	0.148	0.116	0.596	55.66%	24.78%	19.55%	0.384	0.171	0.135	0.689
481130	03/12/92	236	0.332	0.149	0.118	0.600	55.43%	24.85%	19.72%	0.382	0.171	0.136	0.689
481169	03/04/90	212	0.105	0.099	0.048	0.251	41.72%	39.29%	19.00%	0.131	0.124	0.060	0.315
481169	09/18/90	218	0.105	0.099	0.048	0.251	41.61%	39.35%	19.04%	0.131	0.124	0.060	0.315
481169	03/07/91	224	0.105	0.099	0.048	0.252	41.57%	39.37%	19.06%	0.131	0.124	0.060	0.315
481169	01/30/92	234	0.105	0.100	0.048	0.253	41.41%	39.48%	19.11%	0.139	0.132	0.064	0.335
481169	02/27/93	247	0.105	0.100	0.049	0.254	41.25%	39.59%	19.16%	0.130	0.125	0.060	0.315
481169	03/03/95	272	0.105	0.101	0.049	0.255	40.98%	39.76%	19.26%	0.194	0.188	0.091	0.472
481174	10/17/90	186	0.477	0.064	0.107	0.648	73.59%	9.87%	16.54%	0.290	0.039	0.065	0.394
481174	02/14/91	190	0.477	0.064	0.107	0.648	73.56%	9.86%	16.58%	0.319	0.043	0.072	0.433
481174	03/16/92	203	0.483	0.064	0.109	0.656	73.63%	9.80%	16.57%	0.232	0.031	0.052	0.315
481174	02/18/93	214	0.488	0.065	0.110	0.662	73.66%	9.78%	16.56%	0.261	0.035	0.059	0.354
481174	02/21/95	238	0.501	0.066	0.112	0.679	73.86%	9.66%	16.48%	0.494	0.065	0.110	0.669
481174	03/20/98	275	0.516	0.066	0.115	0.697	74.00%	9.54%	16.46%	0.495	0.064	0.110	0.669
481178	04/10/89	10	0.154	0.026	0.057	0.237	65.02%	10.92%	24.06%	0.115	0.019	0.043	0.177
481178	02/22/91	32	0.257	0.031	0.074	0.362	71.02%	8.69%	20.29%	0.098	0.012	0.028	0.138
481178	03/10/92	45	0.295	0.033	0.079	0.406	72.57%	8.08%	19.34%	0.100	0.011	0.027	0.138
481178	02/16/93	56	0.318	0.034	0.082	0.434	73.25%	7.79%	18.97%	0.115	0.012	0.030	0.157
481178	02/17/95	80	0.365	0.036	0.089	0.490	74.53%	7.25%	18.22%	0.176	0.017	0.043	0.236
481183	12/06/89	179	0.289	0.069	0.131	0.489	59.06%	14.12%	26.83%	0.151	0.036	0.069	0.256
481183	09/15/90	188	0.300	0.070	0.134	0.504	59.54%	13.94%	26.52%	0.176	0.041	0.078	0.295
483749	10/17/90	116	0.227	0.200	0.116	0.542	41.80%	36.88%	21.32%	0.107	0.094	0.055	0.256
483749	02/14/91	120	0.227	0.201	0.116	0.544	41.69%	36.91%	21.40%	0.090	0.080	0.046	0.217
483749	03/16/92	133	0.227	0.204	0.119	0.549	41.26%	37.15%	21.59%	0.081	0.073	0.042	0.197
483749	02/21/93	144	0.227	0.207	0.120	0.554	40.93%	37.34%	21.73%	0.089	0.081	0.047	0.217
483749	02/21/95	168	0.227	0.212	0.124	0.563	40.28%	37.70%	22.02%	0.135	0.126	0.074	0.335
483749	03/28/97	193	0.227	0.217	0.127	0.571	39.72%	38.02%	22.26%	0.180	0.172	0.101	0.453
489005	10/14/90	50	0.067	0.166	0.158	0.391	17.19%	42.49%	40.32%	0.058	0.142	0.135	0.335
489005	03/12/92	67	0.074	0.172	0.167	0.413	17.87%	41.73%	40.40%	0.025	0.058	0.056	0.138
489005	02/17/93	78	0.077	0.176	0.172	0.425	18.21%	41.39%	40.40%	0.025	0.057	0.056	0.138
489005	02/20/95	102	0.084	0.182	0.180	0.446	18.87%	40.70%	40.43%	0.045	0.096	0.095	0.236
489005	07/10/98	143	0.094	0.191	0.192	0.477	19.79%	39.93%	40.29%	0.031	0.063	0.063	0.157
501002	08/09/89	58	0.093	0.034	0.034	0.161	57.62%	21.22%	21.16%	0.170	0.063	0.062	0.295
501002	08/08/90	70	0.103	0.035	0.035	0.173	59.27%	20.38%	20.35%	0.222	0.076	0.076	0.374
501002	09/04/91	83	0.106	0.036	0.036	0.179	59.60%	20.13%	20.27%	0.188	0.063	0.064	0.315
501002	04/27/93	102	0.113	0.037	0.037	0.187	60.35%	19.67%	19.98%	0.226	0.074	0.075	0.374
501002	05/25/94	115	0.119	0.038	0.038	0.195	61.10%	19.30%	19.60%	0.229	0.072	0.073	0.374
501002	08/17/94	118	0.123	0.038	0.038	0.199	61.71%	19.04%	19.25%	0.231	0.071	0.072	0.374

Table C-18 (Cont'd) Permanent Deformation Simulation (β_{r2} = 1.2 and β_{r3} = 1.0) Data

Section	Month	Time	Predicted							Measured			
			AC	GB	SG	Total	%AC	%GB	%SG	AC	GB	SG	Total
501002	04/27/95	126	0.123	0.038	0.039	0.200	61.61%	19.04%	19.34%	0.243	0.075	0.076	0.394
501002	10/12/95	132	0.131	0.039	0.039	0.209	62.70%	18.57%	18.73%	0.272	0.080	0.081	0.433
501002	10/17/96	144	0.133	0.039	0.040	0.212	62.90%	18.42%	18.68%	0.223	0.065	0.066	0.354
501002	05/15/97	151	0.134	0.039	0.040	0.213	62.84%	18.43%	18.73%	0.272	0.080	0.081	0.433
501002	10/23/97	156	0.139	0.040	0.040	0.218	63.49%	18.12%	18.39%	0.287	0.082	0.083	0.453
501002	06/06/98	164	0.140	0.040	0.040	0.220	63.65%	18.02%	18.33%	0.276	0.078	0.079	0.433
501004	08/09/89	58	0.061	0.036	0.038	0.135	45.01%	26.78%	28.20%	0.071	0.042	0.044	0.157
501004	08/07/90	70	0.070	0.037	0.039	0.146	47.82%	25.33%	26.85%	0.122	0.065	0.069	0.256
501004	09/20/91	83	0.079	0.038	0.040	0.157	50.27%	24.08%	25.66%	0.099	0.047	0.051	0.197
501004	04/27/93	102	0.089	0.039	0.042	0.169	52.60%	22.80%	24.60%	0.135	0.058	0.063	0.256
501004	10/12/95	132	0.109	0.040	0.044	0.193	56.38%	20.78%	22.84%	0.133	0.049	0.054	0.236
501004	11/04/97	157	0.125	0.041	0.046	0.212	58.85%	19.48%	21.67%	0.151	0.050	0.055	0.256
511002	10/15/89	121	0.209	0.051	0.068	0.327	63.86%	15.48%	20.66%	0.251	0.061	0.081	0.394
511023	10/12/89	107	0.422	0.050	0.090	0.562	75.04%	8.95%	16.01%	0.428	0.051	0.091	0.571
511023	03/20/91	124	0.430	0.051	0.091	0.572	75.14%	8.90%	15.97%	0.414	0.049	0.088	0.551
511023	10/10/92	143	0.444	0.052	0.093	0.589	75.35%	8.83%	15.83%	0.445	0.052	0.093	0.591
511023	12/07/93	157	0.451	0.052	0.094	0.598	75.48%	8.78%	15.74%	0.461	0.054	0.096	0.610
511023	09/18/95	178	0.464	0.053	0.096	0.613	75.67%	8.70%	15.63%	0.417	0.048	0.086	0.551
511023	02/09/96	183	0.464	0.053	0.096	0.613	75.66%	8.70%	15.64%	0.506	0.058	0.105	0.669
511023	03/24/97	196	0.468	0.053	0.096	0.618	75.72%	8.65%	15.62%	0.447	0.051	0.092	0.591
512021	10/15/89	54	0.150	0.014	0.066	0.229	65.27%	6.11%	28.62%	0.257	0.024	0.113	0.394
512021	03/11/91	71	0.166	0.015	0.067	0.248	66.90%	5.87%	27.22%	0.290	0.025	0.118	0.433
512021	10/20/92	90	0.188	0.015	0.071	0.274	68.74%	5.50%	25.76%	0.365	0.029	0.137	0.531
531008	07/17/89	129	0.216	0.061	0.057	0.334	64.67%	18.16%	17.17%	0.497	0.139	0.132	0.768
531008	07/17/89	142	0.232	0.062	0.058	0.352	65.90%	17.56%	16.54%	0.493	0.131	0.124	0.748
531008	08/02/90	151	0.233	0.062	0.059	0.353	65.89%	17.55%	16.55%	0.506	0.135	0.127	0.768
531008	08/02/90	153	0.236	0.062	0.059	0.357	66.14%	17.42%	16.44%	0.547	0.144	0.136	0.827
531008	05/28/91	188	0.252	0.064	0.060	0.376	67.07%	16.94%	16.00%	0.726	0.183	0.173	1.083
531801	07/17/89	190	0.098	0.008	0.038	0.144	68.34%	5.33%	26.33%	0.135	0.010	0.052	0.197
531801	08/09/90	203	0.103	0.008	0.038	0.149	68.95%	5.25%	25.80%	0.122	0.009	0.046	0.177
531801	06/05/91	213	0.104	0.008	0.039	0.150	69.08%	5.21%	25.71%	0.150	0.011	0.056	0.217
531801	06/22/94	249	0.115	0.008	0.040	0.162	70.62%	4.97%	24.41%	0.111	0.008	0.038	0.157
531801	05/08/95	260	0.117	0.008	0.040	0.165	70.83%	4.90%	24.27%	0.112	0.008	0.038	0.157
531801	10/31/95	265	0.121	0.008	0.040	0.169	71.33%	4.85%	23.82%	0.126	0.009	0.042	0.177
531801	03/27/97	282	0.124	0.008	0.041	0.173	71.69%	4.82%	23.48%	0.141	0.009	0.046	0.197
561007	09/26/89	111	0.162	0.031	0.060	0.253	63.94%	12.25%	23.80%	0.290	0.055	0.108	0.453
561007	07/22/90	121	0.163	0.031	0.061	0.256	63.97%	12.22%	23.81%	0.252	0.048	0.094	0.394
561007	05/13/91	131	0.165	0.031	0.062	0.258	63.95%	12.21%	23.84%	0.239	0.046	0.089	0.374
561007	08/03/91	134	0.175	0.032	0.062	0.269	65.15%	11.87%	22.98%	0.205	0.037	0.072	0.315
561007	12/09/93	162	0.188	0.033	0.064	0.285	66.16%	11.49%	22.35%	0.182	0.032	0.062	0.276
561007	03/16/94	165	0.188	0.033	0.064	0.285	66.12%	11.49%	22.39%	0.182	0.032	0.062	0.276
561007	04/19/94	166	0.188	0.033	0.064	0.285	66.11%	11.48%	22.41%	0.195	0.034	0.066	0.295
561007	08/19/94	170	0.191	0.033	0.064	0.288	66.30%	11.45%	22.25%	0.170	0.029	0.057	0.256
561007	02/16/95	176	0.191	0.033	0.064	0.288	66.24%	11.43%	22.33%	0.183	0.032	0.062	0.276
561007	05/17/95	179	0.191	0.033	0.065	0.289	66.19%	11.46%	22.35%	0.169	0.029	0.057	0.256
561007	09/08/95	183	0.194	0.033	0.065	0.292	66.43%	11.39%	22.18%	0.183	0.031	0.061	0.276
561007	06/11/96	192	0.195	0.033	0.065	0.293	66.41%	11.38%	22.21%	0.144	0.025	0.048	0.217

Table C-18 (Cont'd) Permanent Deformation Simulation (β_{r2} = 1.2 and β_{r3} = 1.0) Data

Section	Month	Time	Predicted							Measured			
			AC	GB	SG	Total	%AC	%GB	%SG	AC	GB	SG	Total
561007	10/24/96	196	0.202	0.034	0.065	0.301	67.11%	11.18%	21.71%	0.185	0.031	0.060	0.276
561007	11/19/96	197	0.202	0.034	0.065	0.301	67.09%	11.17%	21.73%	0.185	0.031	0.060	0.276
561007	03/10/97	201	0.202	0.034	0.066	0.301	67.06%	11.17%	21.77%	0.198	0.033	0.064	0.295
561007	03/24/97	202	0.202	0.034	0.066	0.302	67.06%	11.16%	21.78%	0.185	0.031	0.060	0.276
561007	08/07/97	206	0.211	0.034	0.066	0.311	67.89%	10.91%	21.20%	0.187	0.030	0.058	0.276
561007	09/30/97	207	0.211	0.034	0.066	0.311	67.90%	10.93%	21.17%	0.187	0.030	0.058	0.276
841684	08/29/90	144	0.203	0.070	0.043	0.316	64.09%	22.25%	13.66%	0.353	0.123	0.075	0.551
841684	08/28/91	156	0.210	0.071	0.044	0.324	64.65%	21.91%	13.44%	0.356	0.121	0.074	0.551
841684	05/03/93	177	0.216	0.072	0.044	0.332	64.99%	21.67%	13.34%	0.422	0.141	0.087	0.650
841684	10/24/95	206	0.237	0.074	0.045	0.356	66.54%	20.72%	12.75%	0.472	0.147	0.090	0.709

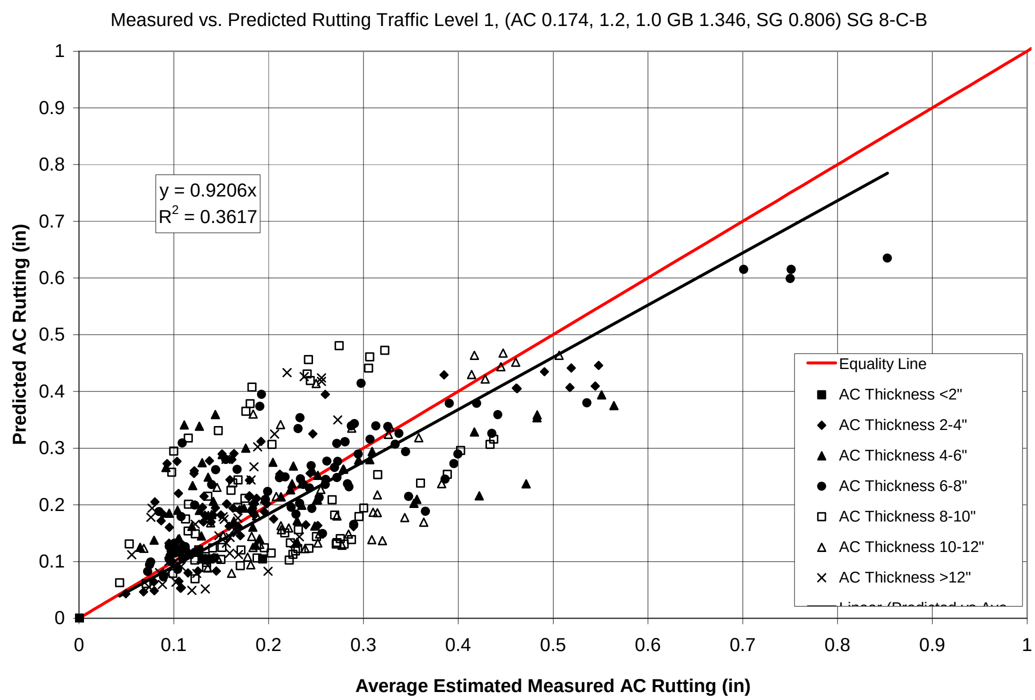


Figure C-130 Asphalt Concrete Layers Rut Depth (β_{r2} = 1.2 and β_{r3} = 1.0)

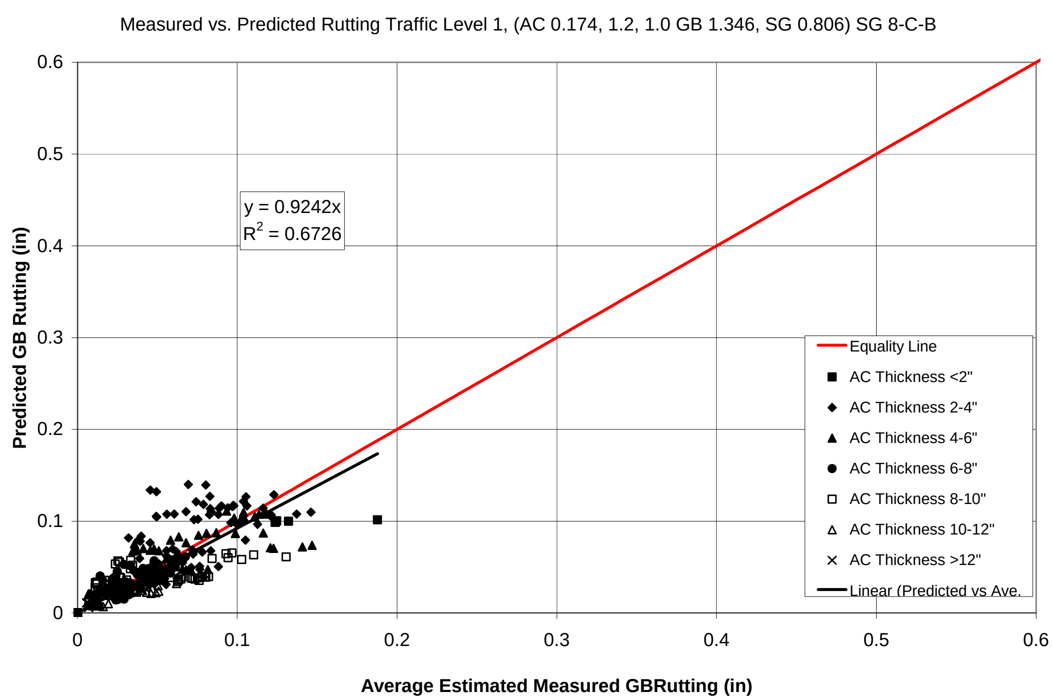


Figure C-131 Granular Base Layers Rut Depth (β_{r2} = 1.2 and β_{r3} = 1.0)

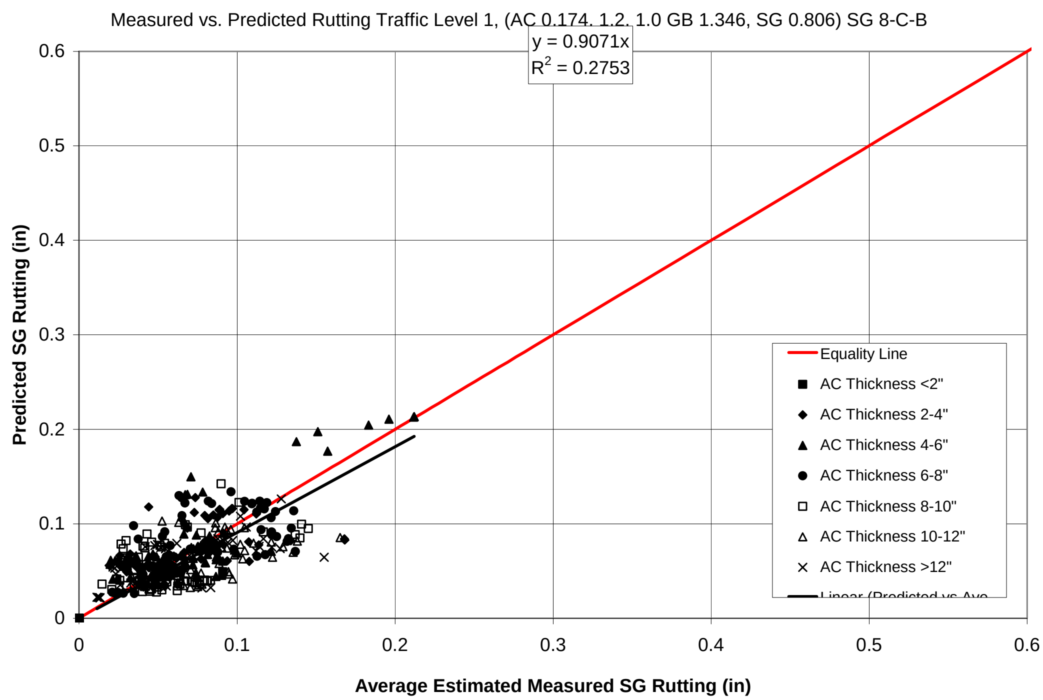


Figure C-132 Granular Subgrade Rut Depth (β_{r2} = 1.2 and β_{r3} = 1.0)

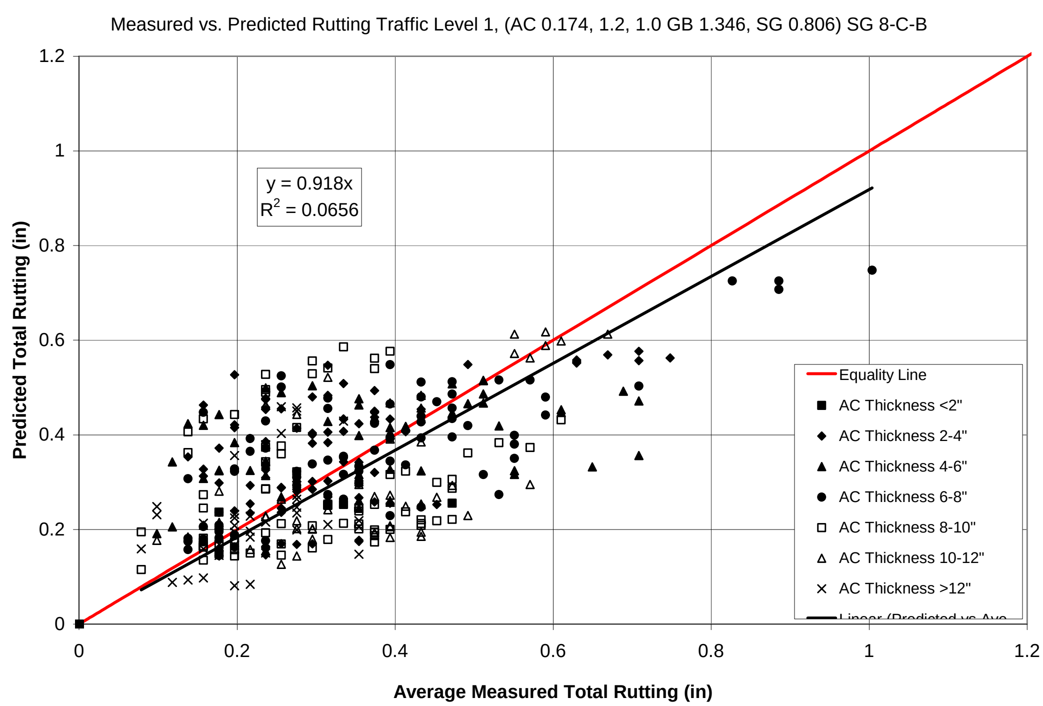


Figure C-133 Total Asphalt Pavement Rut Depth (β_{r2} = 1.2 and β_{r3} = 1.0)

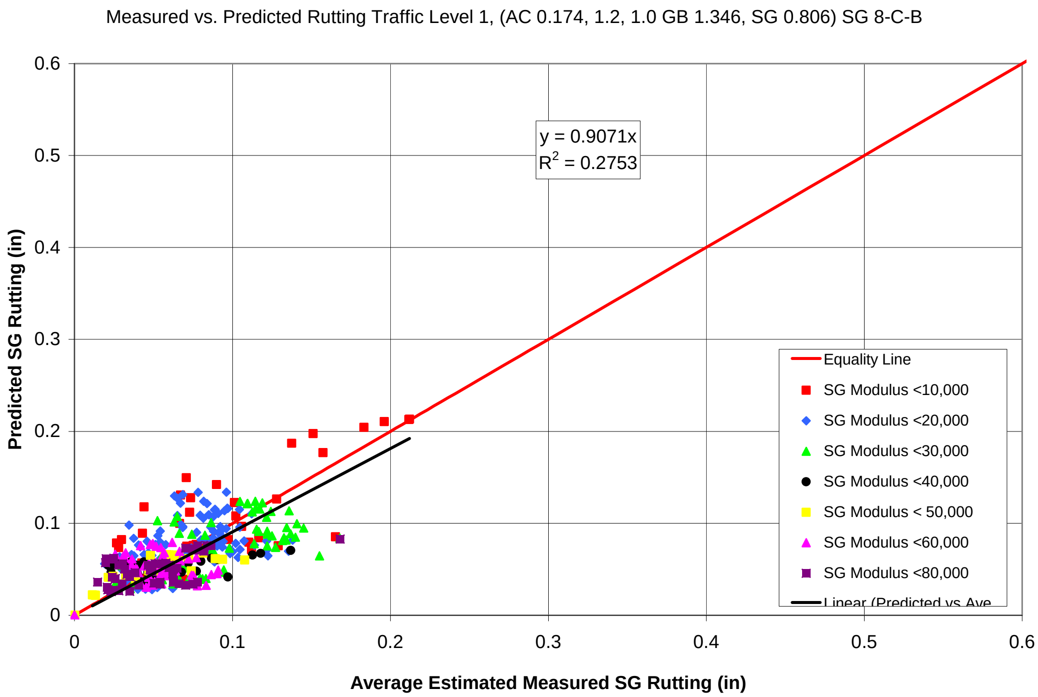


Figure C-134 Subgrade Rut Depth (β_{r2} = 1.2 and β_{r3} = 1.0) (By Subgrade Modulus)

Table C-69 Permanent Deformation Simulation (β_{r2} = 1.2 and β_{r3} = 1.2) Summary

	AC	GB	SG	Total
Average Predicted=	0.269	0.052	0.009	0.330
Sum of error =	0.349	-0.285	-0.064	0.000
Sum of error^2 =	4.260	0.245	0.005	6.190
Predicted % =	81.15%	15.93%	2.93%	100.00%
Se =	0.095	0.023	0.003	0.115
Average Measured =	0.053	0.009	0.330	0.346
Calibration Factor β_1 =	0.112	1.571	0.107	

Table C-70 Permanent Deformation Simulation (β_{r2} = 1.2 and β_{r3} = 1.2) Data

Section	Month	Time	Predicted							Measured			
			AC	GB	SG	Total	%AC	%GB	%SG	AC	GB	SG	Total
11001	04/05/89	103	0.301	0.163	0.009	0.474	63.65%	34.37%	1.98%	0.213	0.115	0.007	0.335
11001	02/12/91	125	0.301	0.166	0.010	0.477	63.21%	34.79%	2.01%	0.199	0.110	0.006	0.315
11001	04/02/92	139	0.301	0.167	0.010	0.478	63.03%	34.95%	2.02%	0.186	0.103	0.006	0.295
11019	05/15/89	32	0.323	0.023	0.011	0.357	90.46%	6.51%	3.02%	0.463	0.033	0.015	0.512
11019	04/16/90	43	0.360	0.024	0.011	0.395	91.08%	6.09%	2.83%	0.502	0.034	0.016	0.551
11019	01/15/91	52	0.388	0.025	0.011	0.424	91.48%	5.82%	2.70%	0.504	0.032	0.015	0.551
11019	03/31/92	66	0.406	0.025	0.012	0.443	91.72%	5.64%	2.65%	0.506	0.031	0.015	0.551
11019	03/22/94	90	0.421	0.029	0.012	0.462	91.12%	6.26%	2.62%	0.538	0.037	0.015	0.591
11019	01/08/96	112	0.431	0.032	0.012	0.476	90.71%	6.67%	2.61%	0.536	0.039	0.015	0.591
11019	01/23/98	136	0.438	0.032	0.013	0.483	90.74%	6.64%	2.62%	0.643	0.047	0.019	0.709
14126	06/05/89	15	0.117	0.012	0.004	0.134	87.85%	9.28%	2.87%	0.156	0.016	0.005	0.177
14126	03/03/91	36	0.127	0.014	0.004	0.145	87.51%	9.44%	3.06%	0.189	0.020	0.007	0.217
14126	04/08/92	49	0.131	0.014	0.005	0.150	87.53%	9.35%	3.13%	0.138	0.015	0.005	0.157
14126	04/08/94	73	0.138	0.015	0.005	0.157	87.56%	9.29%	3.16%	0.172	0.018	0.006	0.197
14126	12/11/95	93	0.143	0.015	0.005	0.164	87.65%	9.21%	3.14%	0.190	0.020	0.007	0.217
14126	12/05/97	117	0.149	0.015	0.005	0.170	87.80%	9.08%	3.12%	0.173	0.018	0.006	0.197
21001	08/21/91	98	0.068	0.043	0.010	0.121	56.40%	35.27%	8.33%	0.100	0.062	0.015	0.177
21001	08/26/93	122	0.075	0.044	0.010	0.128	58.09%	33.87%	8.04%	0.137	0.080	0.019	0.236
21001	06/15/95	144	0.079	0.044	0.011	0.134	58.74%	33.15%	8.11%	0.162	0.091	0.022	0.276
21001	08/22/97	170	0.087	0.046	0.011	0.143	60.57%	31.75%	7.67%	0.215	0.113	0.027	0.354
21001	08/26/98	182	0.089	0.046	0.011	0.146	61.02%	31.36%	7.62%	0.216	0.111	0.027	0.354
21002	08/22/91	83	0.094	0.055	0.004	0.153	61.52%	35.62%	2.86%	0.109	0.063	0.005	0.177
21002	07/30/92	94	0.097	0.055	0.004	0.157	61.82%	35.33%	2.85%	0.146	0.083	0.007	0.236
21002	06/14/95	129	0.121	0.058	0.005	0.183	65.96%	31.51%	2.52%	0.156	0.074	0.006	0.236
21002	08/21/97	155	0.128	0.059	0.005	0.192	66.80%	30.73%	2.47%	0.197	0.091	0.007	0.295
21002	05/14/98	164	0.129	0.059	0.005	0.193	66.79%	30.73%	2.48%	0.171	0.079	0.006	0.256
40114	03/30/95	20	0.289	0.049	0.014	0.352	81.99%	14.00%	4.01%	0.323	0.055	0.016	0.394
40114	11/07/95	28	0.337	0.052	0.015	0.403	83.41%	12.89%	3.70%	0.328	0.051	0.015	0.394
40114	02/04/96	31	0.337	0.052	0.015	0.404	83.40%	12.88%	3.72%	0.361	0.056	0.016	0.433
40114	04/04/96	33	0.338	0.052	0.015	0.405	83.45%	12.82%	3.72%	0.394	0.061	0.018	0.472
40114	07/09/96	36	0.360	0.053	0.015	0.429	83.96%	12.46%	3.58%	0.364	0.054	0.016	0.433
40114	08/13/96	37	0.364	0.054	0.015	0.433	83.99%	12.44%	3.57%	0.364	0.054	0.015	0.433
40114	01/07/98	54	0.378	0.056	0.016	0.450	84.07%	12.36%	3.58%	0.364	0.054	0.015	0.433
40114	04/21/98	57	0.378	0.056	0.016	0.450	84.06%	12.35%	3.59%	0.364	0.053	0.016	0.433
40114	06/12/98	59	0.380	0.056	0.016	0.453	84.06%	12.36%	3.59%	0.397	0.058	0.017	0.472
40114	10/23/98	63	0.389	0.057	0.016	0.462	84.18%	12.27%	3.55%	0.365	0.053	0.015	0.433
40114	02/12/99	65	0.389	0.057	0.016	0.462	84.17%	12.27%	3.56%	0.398	0.058	0.017	0.472
40115	02/15/95	19	0.176	0.000	0.006	0.182	96.60%	0.00%	3.40%	0.076	0.000	0.003	0.079
40115	03/30/95	20	0.176	0.000	0.006	0.183	96.60%	0.00%	3.40%	0.152	0.000	0.005	0.157
40115	01/07/98	54	0.286	0.000	0.007	0.293	97.60%	0.00%	2.40%	0.096	0.000	0.002	0.098
40115	02/11/99	65	0.305	0.000	0.007	0.313	97.70%	0.00%	2.30%	0.096	0.000	0.002	0.098
40116	03/30/95	20	0.131	0.000	0.009	0.139	93.84%	0.00%	6.16%	0.332	0.000	0.022	0.354
40116	01/08/98	54	0.231	0.000	0.010	0.241	95.94%	0.00%	4.06%	0.340	0.000	0.014	0.354
40116	02/12/99	65	0.253	0.000	0.010	0.263	96.19%	0.00%	3.81%	0.341	0.000	0.013	0.354

Table C-20 (Cont'd) Permanent Deformation Simulation (β_{r2} = 1.2 and β_{r3} = 1.2) Data

Section	Month	Time	Predicted							Measured			
			AC	GB	SG	Total	%AC	%GB	%SG	AC	GB	SG	Total
40117	03/30/95	20	0.215	0.008	0.006	0.228	94.07%	3.51%	2.42%	0.407	0.015	0.010	0.433
40117	01/08/98	54	0.316	0.009	0.006	0.331	95.36%	2.75%	1.88%	0.375	0.011	0.007	0.394
40117	02/11/99	65	0.331	0.009	0.006	0.347	95.50%	2.67%	1.83%	0.451	0.013	0.009	0.472
40118	03/30/95	20	0.207	0.012	0.009	0.227	90.97%	5.25%	3.78%	0.358	0.021	0.015	0.394
40118	01/08/98	54	0.308	0.013	0.010	0.331	93.00%	3.99%	3.01%	0.330	0.014	0.011	0.354
40118	02/12/99	65	0.324	0.013	0.010	0.347	93.20%	3.85%	2.95%	0.330	0.014	0.010	0.354
41007	11/20/89	140	0.509	0.045	0.009	0.563	90.42%	7.92%	1.65%	0.801	0.070	0.015	0.886
41007	09/05/91	162	0.523	0.045	0.009	0.578	90.51%	7.85%	1.64%	0.802	0.070	0.015	0.886
41007	09/20/91	163	0.523	0.045	0.009	0.578	90.51%	7.85%	1.64%	0.748	0.065	0.014	0.827
41007	09/16/94	198	0.542	0.046	0.010	0.598	90.65%	7.72%	1.62%	0.910	0.078	0.016	1.004
41016	11/30/89	122	0.364	0.000	0.013	0.377	96.45%	0.00%	3.55%	0.361	0.000	0.013	0.374
41016	07/02/90	130	0.366	0.000	0.013	0.379	96.45%	0.00%	3.55%	0.266	0.000	0.010	0.276
41016	09/25/91	144	0.372	0.000	0.014	0.385	96.46%	0.00%	3.54%	0.228	0.000	0.008	0.236
41016	09/18/96	204	0.395	0.000	0.014	0.410	96.51%	0.00%	3.49%	0.304	0.000	0.011	0.315
41024	11/03/89	149	0.408	0.030	0.012	0.451	90.52%	6.73%	2.75%	0.214	0.016	0.007	0.236
41024	08/26/90	158	0.415	0.030	0.013	0.458	90.61%	6.66%	2.73%	0.232	0.017	0.007	0.256
41024	09/04/91	171	0.424	0.031	0.013	0.467	90.67%	6.62%	2.71%	0.196	0.014	0.006	0.217
41024	08/22/95	218	0.437	0.032	0.013	0.482	90.66%	6.62%	2.72%	0.232	0.017	0.007	0.256
41024	11/09/95	221	0.437	0.032	0.013	0.482	90.66%	6.62%	2.72%	0.250	0.018	0.007	0.276
41024	02/08/96	224	0.437	0.032	0.013	0.482	90.66%	6.62%	2.72%	0.268	0.020	0.008	0.295
41024	04/04/96	226	0.437	0.032	0.013	0.482	90.66%	6.62%	2.72%	0.232	0.017	0.007	0.256
41024	06/13/96	228	0.437	0.032	0.013	0.482	90.66%	6.61%	2.72%	0.250	0.018	0.008	0.276
41024	07/11/96	229	0.438	0.032	0.013	0.483	90.64%	6.63%	2.73%	0.250	0.018	0.008	0.276
41024	08/15/96	230	0.439	0.032	0.013	0.484	90.62%	6.65%	2.72%	0.250	0.018	0.008	0.276
41024	01/15/98	247	0.441	0.033	0.013	0.487	90.59%	6.68%	2.73%	0.250	0.018	0.008	0.276
41024	04/22/98	250	0.441	0.033	0.013	0.487	90.59%	6.68%	2.73%	0.250	0.018	0.008	0.276
41024	06/15/98	252	0.442	0.033	0.013	0.488	90.59%	6.67%	2.74%	0.250	0.018	0.008	0.276
41024	10/26/98	256	0.443	0.033	0.013	0.489	90.60%	6.66%	2.74%	0.268	0.020	0.008	0.295
81029	10/20/89	209	0.270	0.079	0.009	0.358	75.49%	22.10%	2.42%	0.178	0.052	0.006	0.236
81029	08/25/91	231	0.279	0.080	0.009	0.367	75.89%	21.72%	2.39%	0.164	0.047	0.005	0.217
81029	10/21/91	233	0.279	0.080	0.009	0.368	75.92%	21.69%	2.39%	0.135	0.038	0.004	0.177
81029	09/08/95	280	0.296	0.081	0.009	0.386	76.60%	21.06%	2.34%	0.181	0.050	0.006	0.236
81047	10/20/89	73	0.212	0.113	0.010	0.335	63.26%	33.64%	3.10%	0.237	0.126	0.012	0.374
81047	08/25/91	95	0.241	0.115	0.011	0.366	65.71%	31.32%	2.97%	0.233	0.111	0.011	0.354
81047	10/22/91	97	0.241	0.115	0.011	0.367	65.75%	31.28%	2.97%	0.220	0.105	0.010	0.335
81053	10/19/89	60	0.242	0.101	0.008	0.351	68.87%	28.74%	2.39%	0.244	0.102	0.008	0.354
81053	07/07/90	69	0.262	0.101	0.009	0.372	70.39%	27.29%	2.32%	0.305	0.118	0.010	0.433
81053	12/06/93	110	0.326	0.117	0.010	0.453	72.09%	25.76%	2.15%	0.284	0.101	0.008	0.394
81053	03/14/94	113	0.326	0.117	0.010	0.453	72.06%	25.78%	2.16%	0.284	0.101	0.009	0.394
81053	08/08/94	118	0.340	0.121	0.010	0.471	72.24%	25.64%	2.12%	0.284	0.101	0.008	0.394
81053	10/21/94	120	0.341	0.121	0.010	0.472	72.22%	25.66%	2.12%	0.299	0.106	0.009	0.413
81053	02/13/95	124	0.341	0.121	0.010	0.472	72.21%	25.65%	2.13%	0.299	0.106	0.009	0.413
81053	05/08/95	127	0.342	0.121	0.010	0.473	72.23%	25.63%	2.13%	0.299	0.106	0.009	0.413
81053	05/10/96	139	0.352	0.122	0.010	0.484	72.75%	25.13%	2.11%	0.315	0.109	0.009	0.433
81053	10/21/96	144	0.358	0.122	0.010	0.491	73.03%	24.87%	2.10%	0.345	0.117	0.010	0.472
81053	11/14/96	145	0.358	0.122	0.010	0.491	73.03%	24.87%	2.10%	0.345	0.117	0.010	0.472
81053	03/20/97	149	0.358	0.122	0.010	0.491	73.00%	24.89%	2.11%	0.345	0.118	0.010	0.472

Table C-20 (Cont'd) Permanent Deformation Simulation (β_{r2} = 1.2 and β_{r3} = 1.2) Data

Section	Month	Time	Predicted							Measured			
			AC	GB	SG	Total	%AC	%GB	%SG	AC	GB	SG	Total
81053	08/05/97	154	0.369	0.126	0.011	0.505	73.05%	24.87%	2.08%	0.359	0.122	0.010	0.492
81053	09/26/97	155	0.369	0.126	0.011	0.506	73.04%	24.88%	2.08%	0.374	0.127	0.011	0.512
81053	08/25/98	166	0.379	0.130	0.011	0.520	72.90%	25.03%	2.07%	0.373	0.128	0.011	0.512
91803	09/05/90	63	0.100	0.032	0.006	0.137	72.57%	23.11%	4.32%	0.129	0.041	0.008	0.177
91803	08/22/91	74	0.114	0.033	0.006	0.154	74.51%	21.48%	4.01%	0.103	0.030	0.006	0.138
91803	09/30/92	87	0.121	0.034	0.006	0.162	75.05%	21.00%	3.95%	0.148	0.041	0.008	0.197
91803	05/12/94	107	0.135	0.035	0.007	0.177	76.40%	19.83%	3.77%	0.105	0.027	0.005	0.138
91803	09/25/94	111	0.144	0.036	0.007	0.187	77.18%	19.19%	3.62%	0.106	0.026	0.005	0.138
91803	05/25/95	119	0.145	0.036	0.007	0.188	77.20%	19.16%	3.64%	0.137	0.034	0.006	0.177
91803	10/30/95	124	0.154	0.037	0.007	0.198	77.91%	18.58%	3.51%	0.153	0.037	0.007	0.197
91803	10/08/96	136	0.171	0.038	0.007	0.215	79.19%	17.50%	3.30%	0.140	0.031	0.006	0.177
91803	05/08/97	143	0.171	0.038	0.007	0.216	79.20%	17.48%	3.33%	0.140	0.031	0.006	0.177
91803	10/16/97	148	0.178	0.038	0.007	0.223	79.56%	17.18%	3.26%	0.141	0.030	0.006	0.177
91803	06/17/98	156	0.182	0.038	0.007	0.228	79.90%	16.88%	3.22%	0.142	0.030	0.006	0.177
123995	04/18/89	161	0.502	0.114	0.007	0.624	80.54%	18.28%	1.17%	0.317	0.072	0.005	0.394
123995	02/05/91	183	0.502	0.115	0.007	0.625	80.37%	18.45%	1.18%	0.316	0.073	0.005	0.394
123995	04/15/92	197	0.502	0.116	0.007	0.626	80.28%	18.53%	1.19%	0.348	0.080	0.005	0.433
123995	03/09/94	220	0.502	0.117	0.008	0.627	80.11%	18.69%	1.20%	0.315	0.074	0.005	0.394
123995	01/21/96	242	0.502	0.118	0.008	0.628	79.98%	18.81%	1.21%	0.315	0.074	0.005	0.394
123997	12/14/89	187	0.290	0.123	0.005	0.419	69.27%	29.43%	1.30%	0.436	0.185	0.008	0.630
123997	02/09/91	201	0.290	0.125	0.006	0.420	69.05%	29.63%	1.32%	0.435	0.187	0.008	0.630
123997	04/13/92	215	0.290	0.126	0.006	0.422	68.83%	29.84%	1.33%	0.488	0.211	0.009	0.709
123997	03/08/94	238	0.290	0.128	0.006	0.424	68.43%	30.22%	1.35%	0.512	0.226	0.010	0.748
124105	04/12/89	53	0.183	0.142	0.009	0.333	54.81%	42.60%	2.60%	0.205	0.159	0.010	0.374
124105	02/09/91	75	0.189	0.148	0.009	0.346	54.71%	42.67%	2.62%	0.205	0.160	0.010	0.374
124105	04/13/92	89	0.192	0.150	0.009	0.352	54.66%	42.72%	2.63%	0.237	0.185	0.011	0.433
124106	04/18/89	21	0.350	0.056	0.007	0.413	84.78%	13.57%	1.65%	0.200	0.032	0.004	0.236
124106	02/05/91	43	0.376	0.061	0.008	0.444	84.64%	13.67%	1.70%	0.233	0.038	0.005	0.276
124106	04/15/92	57	0.386	0.062	0.008	0.456	84.65%	13.64%	1.71%	0.167	0.027	0.003	0.197
124106	03/09/94	80	0.406	0.065	0.008	0.478	84.79%	13.50%	1.71%	0.200	0.032	0.004	0.236
124106	01/21/96	102	0.419	0.066	0.008	0.494	84.92%	13.37%	1.71%	0.201	0.032	0.004	0.236
124106	01/17/97	114	0.428	0.067	0.009	0.503	85.00%	13.30%	1.70%	0.268	0.042	0.005	0.315
124107	12/06/89	75	0.200	0.089	0.008	0.297	67.20%	30.06%	2.74%	0.119	0.053	0.005	0.177
124107	02/05/91	89	0.200	0.091	0.008	0.300	66.81%	30.41%	2.78%	0.105	0.048	0.004	0.157
124107	04/15/92	103	0.201	0.093	0.009	0.302	66.47%	30.71%	2.82%	0.105	0.048	0.004	0.157
124107	03/09/94	126	0.203	0.096	0.009	0.307	66.00%	31.13%	2.87%	0.091	0.043	0.004	0.138
124107	01/22/96	148	0.203	0.098	0.009	0.310	65.61%	31.48%	2.91%	0.116	0.056	0.005	0.177
124108	04/27/89	35	0.272	0.031	0.004	0.307	88.59%	10.08%	1.32%	0.314	0.036	0.005	0.354
124108	01/16/91	56	0.323	0.033	0.004	0.360	89.59%	9.20%	1.21%	0.406	0.042	0.005	0.453
124108	04/01/92	71	0.337	0.034	0.004	0.376	89.73%	9.08%	1.20%	0.353	0.036	0.005	0.394
124108	03/21/94	94	0.372	0.036	0.005	0.412	90.25%	8.61%	1.14%	0.444	0.042	0.006	0.492
124108	01/16/96	116	0.392	0.036	0.005	0.433	90.46%	8.41%	1.12%	0.481	0.045	0.006	0.531
124135	12/10/89	227	0.100	0.264	0.012	0.376	26.72%	70.09%	3.20%	0.131	0.345	0.016	0.492
124135	01/29/91	240	0.100	0.264	0.012	0.377	26.66%	70.14%	3.21%	0.157	0.414	0.019	0.591

Table C-20 (Cont'd) Permanent Deformation Simulation (β_{r2} = 1.2 and β_{r3} = 1.2) Data

Section	Month	Time	Predicted							Measured			
			AC	GB	SG	Total	%AC	%GB	%SG	AC	GB	SG	Total
131031	01/09/90	104	0.200	0.025	0.004	0.229	87.20%	10.91%	1.90%	0.343	0.043	0.007	0.394
131031	03/04/91	118	0.218	0.026	0.004	0.249	87.84%	10.36%	1.80%	0.380	0.045	0.008	0.433
131031	04/28/92	131	0.238	0.026	0.005	0.269	88.48%	9.81%	1.71%	0.348	0.039	0.007	0.394
131031	04/04/94	155	0.263	0.028	0.005	0.295	89.00%	9.37%	1.63%	0.438	0.046	0.008	0.492
131031	01/13/96	176	0.280	0.029	0.005	0.314	89.30%	9.11%	1.59%	0.369	0.038	0.007	0.413
134111	03/20/89	101	0.272	0.042	0.012	0.326	83.46%	12.86%	3.67%	0.230	0.035	0.010	0.276
134111	03/04/91	125	0.303	0.044	0.013	0.360	84.11%	12.34%	3.55%	0.215	0.032	0.009	0.256
134111	04/27/92	138	0.317	0.045	0.013	0.375	84.41%	12.09%	3.50%	0.216	0.031	0.009	0.256
134112	05/04/89	144	0.376	0.000	0.010	0.386	97.47%	0.00%	2.53%	0.230	0.000	0.006	0.236
134112	02/10/91	165	0.389	0.000	0.010	0.399	97.51%	0.00%	2.49%	0.230	0.000	0.006	0.236
134112	04/13/92	179	0.394	0.000	0.010	0.405	97.51%	0.00%	2.49%	0.192	0.000	0.005	0.197
134112	02/24/94	201	0.403	0.000	0.010	0.413	97.53%	0.00%	2.47%	0.230	0.000	0.006	0.236
134112	01/25/96	224	0.413	0.000	0.010	0.423	97.55%	0.00%	2.45%	0.250	0.000	0.006	0.256
134112	04/23/98	251	0.423	0.000	0.011	0.433	97.57%	0.00%	2.43%	0.327	0.000	0.008	0.335
134113	05/04/89	144	0.402	0.000	0.013	0.416	96.83%	0.00%	3.17%	0.152	0.000	0.005	0.157
134113	02/10/91	165	0.407	0.000	0.013	0.420	96.82%	0.00%	3.18%	0.133	0.000	0.004	0.138
134113	04/13/92	179	0.409	0.000	0.014	0.423	96.81%	0.00%	3.19%	0.172	0.000	0.006	0.177
134113	02/24/94	201	0.414	0.000	0.014	0.427	96.80%	0.00%	3.20%	0.171	0.000	0.006	0.177
134113	01/25/96	224	0.418	0.000	0.014	0.432	96.79%	0.00%	3.21%	0.171	0.000	0.006	0.177
134113	04/23/98	251	0.423	0.000	0.014	0.437	96.78%	0.00%	3.22%	0.171	0.000	0.006	0.177
134119	01/08/90	140	0.392	0.013	0.003	0.407	96.21%	3.09%	0.71%	0.265	0.009	0.002	0.276
134119	03/04/91	154	0.396	0.013	0.003	0.412	96.20%	3.09%	0.71%	0.265	0.009	0.002	0.276
134119	04/28/92	167	0.397	0.013	0.003	0.413	96.21%	3.08%	0.71%	0.246	0.008	0.002	0.256
134119	04/07/94	191	0.400	0.013	0.003	0.416	96.20%	3.09%	0.71%	0.227	0.007	0.002	0.236
161001	07/17/89	192	0.327	0.119	0.007	0.453	72.08%	26.32%	1.60%	0.213	0.078	0.005	0.295
161001	08/02/90	205	0.327	0.122	0.007	0.456	71.67%	26.72%	1.61%	0.141	0.053	0.003	0.197
161001	07/04/91	216	0.327	0.123	0.007	0.458	71.50%	26.89%	1.61%	0.141	0.053	0.003	0.197
161001	08/25/94	253	0.332	0.126	0.008	0.465	71.38%	27.00%	1.62%	0.169	0.064	0.004	0.236
161001	05/17/95	262	0.332	0.126	0.008	0.465	71.35%	27.03%	1.62%	0.183	0.069	0.004	0.256
161001	07/09/97	288	0.334	0.129	0.008	0.470	70.96%	27.40%	1.63%	0.210	0.081	0.005	0.295
161001	09/23/98	302	0.337	0.129	0.008	0.473	71.14%	27.23%	1.63%	0.266	0.102	0.006	0.374
161009	09/20/89	180	0.361	0.022	0.006	0.389	92.72%	5.65%	1.63%	0.402	0.024	0.007	0.433
161009	07/19/90	190	0.363	0.022	0.006	0.391	92.71%	5.66%	1.63%	0.365	0.022	0.006	0.394
161009	07/26/91	202	0.367	0.022	0.006	0.396	92.74%	5.64%	1.62%	0.365	0.022	0.006	0.394
161021	09/21/89	48	0.323	0.022	0.007	0.352	91.69%	6.24%	2.06%	0.144	0.010	0.003	0.157
161021	07/21/90	58	0.338	0.022	0.007	0.368	91.87%	6.11%	2.02%	0.163	0.011	0.004	0.177
161021	07/28/91	70	0.352	0.023	0.008	0.382	92.02%	6.00%	1.98%	0.109	0.007	0.002	0.118
161021	09/12/95	120	0.376	0.024	0.008	0.408	92.05%	5.96%	1.98%	0.145	0.009	0.003	0.157
161021	06/05/96	129	0.377	0.025	0.008	0.410	92.03%	5.98%	1.99%	0.127	0.008	0.003	0.138
161021	07/29/97	142	0.383	0.025	0.008	0.416	92.05%	5.96%	1.98%	0.163	0.011	0.004	0.177
169034	07/17/89	10	0.087	0.026	0.004	0.117	74.27%	22.28%	3.45%	0.058	0.018	0.003	0.079
169034	08/02/90	23	0.180	0.031	0.005	0.215	83.43%	14.44%	2.14%	0.131	0.023	0.003	0.157
169034	07/04/91	34	0.202	0.032	0.005	0.238	84.54%	13.44%	2.02%	0.067	0.011	0.002	0.079
169034	05/17/95	80	0.273	0.035	0.005	0.313	87.12%	11.18%	1.70%	0.137	0.018	0.003	0.157
169034	07/09/97	106	0.300	0.036	0.006	0.342	87.71%	10.67%	1.62%	0.138	0.017	0.003	0.157
169034	09/24/98	120	0.308	0.037	0.006	0.351	87.83%	10.57%	1.60%	0.207	0.025	0.004	0.236

Table C-20 (Cont'd) Permanent Deformation Simulation (β_{r2} = 1.2 and β_{r3} = 1.2) Data

Section	Month	Time	Predicted							Measured			
			AC	GB	SG	Total	%AC	%GB	%SG	AC	GB	SG	Total
201009	05/02/89	53	0.115	0.000	0.006	0.121	94.87%	0.00%	5.13%	0.243	0.000	0.013	0.256
201009	12/10/90	72	0.141	0.000	0.007	0.147	95.55%	0.00%	4.45%	0.263	0.000	0.012	0.276
201009	04/08/93	100	0.162	0.000	0.007	0.169	95.96%	0.00%	4.04%	0.208	0.000	0.009	0.217
201009	04/23/96	136	0.193	0.000	0.007	0.200	96.41%	0.00%	3.59%	0.095	0.000	0.004	0.098
251003	08/04/89	180	0.160	0.050	0.003	0.213	74.90%	23.49%	1.61%	0.118	0.037	0.003	0.157
251003	09/06/90	193	0.164	0.051	0.003	0.218	75.17%	23.24%	1.59%	0.178	0.055	0.004	0.236
251003	08/23/91	204	0.169	0.051	0.003	0.224	75.63%	22.81%	1.56%	0.119	0.036	0.002	0.157
251003	09/30/92	217	0.180	0.052	0.004	0.236	76.51%	22.00%	1.50%	0.151	0.043	0.003	0.197
251003	10/27/95	254	0.194	0.053	0.004	0.251	77.44%	21.12%	1.44%	0.137	0.037	0.003	0.177
251003	10/23/96	266	0.200	0.053	0.004	0.257	77.82%	20.76%	1.41%	0.138	0.037	0.003	0.177
251003	06/16/98	286	0.212	0.054	0.004	0.269	78.57%	20.07%	1.36%	0.124	0.032	0.002	0.157
251004	08/04/89	178	0.191	0.068	0.004	0.263	72.71%	25.89%	1.40%	0.258	0.092	0.005	0.354
251004	09/05/90	191	0.201	0.069	0.004	0.274	73.43%	25.20%	1.37%	0.217	0.074	0.004	0.295
251004	08/22/91	202	0.210	0.070	0.004	0.284	73.97%	24.69%	1.34%	0.248	0.083	0.004	0.335
251004	09/30/92	215	0.223	0.071	0.004	0.298	74.75%	23.95%	1.30%	0.353	0.113	0.006	0.472
251004	10/29/95	252	0.249	0.074	0.004	0.327	76.11%	22.66%	1.23%	0.315	0.094	0.005	0.413
251004	06/05/97	272	0.257	0.075	0.004	0.336	76.40%	22.39%	1.21%	0.271	0.079	0.004	0.354
251004	06/15/98	284	0.264	0.076	0.004	0.344	76.65%	22.15%	1.20%	0.287	0.083	0.004	0.374
261001	09/07/89	217	0.152	0.078	0.007	0.237	64.03%	33.00%	2.97%	0.139	0.071	0.006	0.217
261001	07/21/90	227	0.152	0.078	0.007	0.237	63.95%	33.07%	2.98%	0.164	0.085	0.008	0.256
261001	07/16/91	239	0.152	0.079	0.007	0.238	63.84%	33.17%	2.99%	0.126	0.065	0.006	0.197
261001	06/09/93	262	0.153	0.080	0.007	0.240	63.62%	33.38%	3.00%	0.163	0.085	0.008	0.256
261001	07/05/96	299	0.154	0.082	0.007	0.243	63.42%	33.56%	3.02%	0.137	0.073	0.007	0.217
261004	10/21/90	64	0.172	0.028	0.005	0.205	83.95%	13.48%	2.56%	0.149	0.024	0.005	0.177
261004	05/13/93	95	0.187	0.029	0.005	0.222	84.56%	12.97%	2.48%	0.083	0.013	0.002	0.098
261004	07/07/94	109	0.210	0.030	0.006	0.245	85.58%	12.12%	2.30%	0.101	0.014	0.003	0.118
261004	06/15/95	120	0.216	0.030	0.006	0.251	85.80%	11.94%	2.27%	0.135	0.019	0.004	0.157
271018	06/22/89	126	0.345	0.031	0.008	0.384	89.82%	8.05%	2.13%	0.354	0.032	0.008	0.394
271018	10/30/90	142	0.356	0.031	0.008	0.395	89.95%	7.95%	2.10%	0.319	0.028	0.007	0.354
271018	06/02/93	174	0.370	0.032	0.009	0.411	90.08%	7.84%	2.08%	0.248	0.022	0.006	0.276
271018	03/08/94	183	0.376	0.032	0.009	0.417	90.18%	7.76%	2.06%	0.249	0.021	0.006	0.276
271087	06/09/89	126	0.081	0.000	0.004	0.086	95.03%	0.00%	4.97%	0.187	0.000	0.010	0.197
271087	11/13/90	143	0.087	0.000	0.004	0.092	95.29%	0.00%	4.71%	0.206	0.000	0.010	0.217
271087	05/11/93	173	0.094	0.000	0.004	0.098	95.53%	0.00%	4.47%	0.113	0.000	0.005	0.118
271087	06/25/96	210	0.103	0.000	0.004	0.108	95.84%	0.00%	4.16%	0.132	0.000	0.006	0.138
271087	08/03/99	240	0.111	0.000	0.005	0.115	96.07%	0.00%	3.93%	0.151	0.000	0.006	0.157
291008	03/13/89	35	0.128	0.009	0.008	0.144	88.35%	6.31%	5.34%	0.209	0.015	0.013	0.236
291008	11/07/90	55	0.162	0.010	0.008	0.180	89.86%	5.50%	4.64%	0.265	0.016	0.014	0.295
291008	03/05/93	85	0.193	0.011	0.009	0.213	90.87%	4.95%	4.18%	0.268	0.015	0.012	0.295
291008	04/17/96	120	0.234	0.011	0.009	0.254	91.90%	4.39%	3.71%	0.217	0.010	0.009	0.236
307088	09/27/89	100	0.369	0.128	0.012	0.508	72.57%	25.15%	2.27%	0.314	0.109	0.010	0.433
307088	07/29/90	110	0.375	0.129	0.012	0.516	72.64%	25.09%	2.27%	0.286	0.099	0.009	0.394
307088	05/20/91	120	0.380	0.131	0.012	0.522	72.68%	25.06%	2.27%	0.258	0.089	0.008	0.354
308129	10/03/89	17	0.164	0.093	0.011	0.268	61.41%	34.58%	4.01%	0.218	0.123	0.014	0.354
308129	07/29/90	26	0.186	0.112	0.012	0.309	60.00%	36.22%	3.79%	0.189	0.114	0.012	0.315
308129	07/30/91	38	0.215	0.119	0.013	0.346	62.04%	34.30%	3.66%	0.147	0.081	0.009	0.236
308129	12/14/93	67	0.261	0.125	0.014	0.400	65.27%	31.23%	3.50%	0.193	0.092	0.010	0.295

Table C-20 (Cont'd) Permanent Deformation Simulation (β_{r2} = 1.2 and β_{r3} = 1.2) Data

Section	Month	Time	Predicted							Measured			
			AC	GB	SG	Total	%AC	%GB	%SG	AC	GB	SG	Total
308129	03/17/94	70	0.261	0.125	0.014	0.401	65.17%	31.30%	3.53%	0.205	0.099	0.011	0.315
308129	08/22/94	75	0.262	0.133	0.014	0.409	64.02%	32.45%	3.53%	0.189	0.096	0.010	0.295
308129	10/31/94	77	0.262	0.133	0.015	0.409	63.91%	32.55%	3.55%	0.201	0.103	0.011	0.315
308129	02/17/95	81	0.262	0.133	0.015	0.410	63.86%	32.56%	3.58%	0.264	0.135	0.015	0.413
308129	05/18/95	84	0.262	0.134	0.015	0.410	63.83%	32.58%	3.59%	0.214	0.109	0.012	0.335
308129	06/10/96	97	0.263	0.135	0.015	0.413	63.64%	32.71%	3.65%	0.226	0.116	0.013	0.354
308129	10/28/96	101	0.264	0.136	0.015	0.415	63.58%	32.76%	3.67%	0.213	0.110	0.012	0.335
308129	01/23/97	104	0.264	0.136	0.015	0.416	63.55%	32.78%	3.67%	0.250	0.129	0.014	0.394
308129	03/25/97	106	0.264	0.136	0.015	0.416	63.54%	32.78%	3.68%	0.213	0.110	0.012	0.335
308129	08/11/97	111	0.266	0.137	0.015	0.418	63.65%	32.66%	3.69%	0.238	0.122	0.014	0.374
308129	10/01/97	113	0.266	0.137	0.015	0.418	63.64%	32.67%	3.69%	0.238	0.122	0.014	0.374
321020	08/29/89	63	0.274	0.022	0.007	0.303	90.54%	7.26%	2.20%	0.285	0.023	0.007	0.315
321020	08/22/90	75	0.287	0.022	0.007	0.316	90.78%	7.07%	2.16%	0.304	0.024	0.007	0.335
321020	07/23/91	86	0.297	0.023	0.007	0.327	90.95%	6.93%	2.12%	0.286	0.022	0.007	0.315
321020	09/14/94	124	0.344	0.024	0.007	0.375	91.70%	6.37%	1.93%	0.253	0.018	0.005	0.276
321020	04/25/95	131	0.344	0.024	0.007	0.375	91.70%	6.37%	1.93%	0.325	0.023	0.007	0.354
321020	06/05/97	157	0.356	0.025	0.007	0.388	91.77%	6.31%	1.91%	0.289	0.020	0.006	0.315
321020	06/09/98	169	0.359	0.025	0.007	0.392	91.79%	6.30%	1.92%	0.307	0.021	0.006	0.335
321020	04/13/99	175	0.363	0.025	0.008	0.396	91.78%	6.31%	1.91%	0.343	0.024	0.007	0.374
341003	09/11/90	195	0.274	0.026	0.004	0.304	90.07%	8.52%	1.42%	0.727	0.069	0.011	0.807
341003	08/15/91	206	0.279	0.026	0.004	0.310	90.13%	8.47%	1.40%	0.639	0.060	0.010	0.709
341003	09/28/92	219	0.285	0.027	0.004	0.316	90.19%	8.41%	1.40%	0.746	0.070	0.012	0.827
341011	04/17/99	214	0.397	0.027	0.010	0.435	91.44%	6.29%	2.27%	0.270	0.019	0.007	0.295
341011	04/18/99	227	0.400	0.028	0.010	0.437	91.39%	6.32%	2.29%	0.342	0.024	0.009	0.374
341011	04/19/99	244	0.403	0.028	0.010	0.441	91.40%	6.30%	2.30%	0.270	0.019	0.007	0.295
341011	04/20/99	254	0.407	0.028	0.010	0.445	91.39%	6.31%	2.30%	0.342	0.024	0.009	0.374
341011	04/21/99	287	0.416	0.029	0.011	0.455	91.34%	6.35%	2.31%	0.360	0.025	0.009	0.394
341011	04/22/99	307	0.422	0.029	0.011	0.462	91.33%	6.36%	2.31%	0.306	0.021	0.008	0.335
341031	10/05/89	194	0.351	0.065	0.009	0.426	82.49%	15.34%	2.17%	0.406	0.075	0.011	0.492
341031	09/12/90	205	0.357	0.066	0.009	0.433	82.47%	15.35%	2.17%	0.390	0.073	0.010	0.472
341031	04/06/92	224	0.364	0.068	0.010	0.441	82.48%	15.34%	2.18%	0.390	0.072	0.010	0.472
341031	02/24/93	234	0.369	0.069	0.010	0.447	82.49%	15.34%	2.17%	0.373	0.069	0.010	0.453
341031	10/26/95	266	0.386	0.071	0.010	0.468	82.60%	15.25%	2.15%	0.472	0.087	0.012	0.571
341031	11/04/95	267	0.386	0.071	0.010	0.468	82.60%	15.25%	2.15%	0.439	0.081	0.011	0.531
341033	10/05/89	181	0.314	0.048	0.006	0.368	85.41%	13.03%	1.56%	0.235	0.036	0.004	0.276
341033	09/12/90	192	0.317	0.048	0.006	0.371	85.43%	13.01%	1.56%	0.303	0.046	0.006	0.354
341033	04/05/92	211	0.324	0.049	0.006	0.379	85.53%	12.93%	1.54%	0.236	0.036	0.004	0.276
341033	02/24/93	221	0.329	0.049	0.006	0.384	85.62%	12.85%	1.54%	0.287	0.043	0.005	0.335
341033	11/03/95	254	0.340	0.050	0.006	0.396	85.76%	12.72%	1.52%	0.304	0.045	0.005	0.354
341033	07/23/97	274	0.343	0.051	0.006	0.400	85.80%	12.68%	1.52%	0.253	0.037	0.004	0.295
341034	10/05/89	48	0.239	0.000	0.006	0.245	97.59%	0.00%	2.41%	0.134	0.000	0.003	0.138
341034	09/12/90	59	0.273	0.000	0.006	0.279	97.83%	0.00%	2.17%	0.270	0.000	0.006	0.276
341034	04/06/92	78	0.287	0.000	0.006	0.293	97.89%	0.00%	2.11%	0.173	0.000	0.004	0.177
341034	02/24/93	88	0.298	0.000	0.006	0.304	97.93%	0.00%	2.07%	0.231	0.000	0.005	0.236
341034	11/04/95	121	0.316	0.000	0.007	0.322	97.97%	0.00%	2.03%	0.251	0.000	0.005	0.256
341034	07/30/97	141	0.324	0.000	0.007	0.331	97.98%	0.00%	2.02%	0.174	0.000	0.004	0.177

Table C-20 (Cont'd) Permanent Deformation Simulation (β_{r2} = 1.2 and β_{r3} = 1.2) Data

Section	Month	Time	Predicted							Measured			
			AC	GB	SG	Total	%AC	%GB	%SG	AC	GB	SG	Total
350101	05/01/97	19	0.282	0.047	0.014	0.343	82.15%	13.65%	4.20%	0.162	0.027	0.008	0.197
350101	03/19/99	38	0.367	0.053	0.016	0.436	84.18%	12.11%	3.71%	0.199	0.029	0.009	0.236
350102	05/01/97	19	0.302	0.079	0.017	0.398	75.87%	19.77%	4.36%	0.149	0.039	0.009	0.197
350102	03/19/99	38	0.385	0.088	0.020	0.493	78.14%	17.84%	4.03%	0.185	0.042	0.010	0.236
350103	05/01/97	19	0.159	0.000	0.014	0.173	91.73%	0.00%	8.27%	0.181	0.000	0.016	0.197
350103	03/19/99	38	0.250	0.000	0.017	0.267	93.71%	0.00%	6.29%	0.258	0.000	0.017	0.276
350104	05/01/97	19	0.127	0.000	0.009	0.137	93.07%	0.00%	6.93%	0.220	0.000	0.016	0.236
350104	03/19/99	38	0.199	0.000	0.011	0.210	94.69%	0.00%	5.31%	0.261	0.000	0.015	0.276
350105	05/02/97	19	0.235	0.017	0.016	0.268	87.56%	6.38%	6.06%	0.207	0.015	0.014	0.236
350105	03/22/99	38	0.329	0.019	0.019	0.367	89.60%	5.26%	5.14%	0.212	0.012	0.012	0.236
350106	05/02/96	19	0.125	0.007	0.011	0.143	87.64%	4.72%	7.64%	0.173	0.009	0.015	0.197
350106	03/22/99	38	0.194	0.008	0.013	0.215	90.45%	3.59%	5.97%	0.214	0.008	0.014	0.236
351005	10/31/89	73	0.279	0.026	0.011	0.316	88.14%	8.30%	3.57%	0.416	0.039	0.017	0.472
351005	08/21/91	95	0.298	0.027	0.012	0.336	88.56%	7.95%	3.50%	0.418	0.038	0.017	0.472
351005	10/24/92	109	0.313	0.027	0.012	0.352	88.84%	7.72%	3.44%	0.367	0.032	0.014	0.413
351005	03/18/95	138	0.342	0.028	0.013	0.383	89.30%	7.42%	3.28%	0.510	0.042	0.019	0.571
351005	03/16/99	183	0.359	0.030	0.013	0.402	89.36%	7.35%	3.29%	0.545	0.045	0.020	0.610
351022	10/31/89	37	0.197	0.038	0.010	0.245	80.42%	15.41%	4.17%	0.142	0.027	0.007	0.177
351022	08/22/91	59	0.294	0.041	0.011	0.346	84.85%	11.94%	3.21%	0.117	0.016	0.004	0.138
351022	10/24/92	73	0.309	0.042	0.011	0.363	85.18%	11.66%	3.17%	0.168	0.023	0.006	0.197
351022	03/18/95	102	0.353	0.044	0.012	0.409	86.28%	10.75%	2.97%	0.187	0.023	0.006	0.217
351022	03/17/99	147	0.392	0.047	0.013	0.452	86.74%	10.38%	2.88%	0.137	0.016	0.005	0.157
351112	12/05/89	67	0.372	0.035	0.007	0.414	89.89%	8.42%	1.69%	0.142	0.013	0.003	0.157
351112	01/22/91	80	0.377	0.035	0.007	0.419	89.87%	8.43%	1.70%	0.159	0.015	0.003	0.177
351112	09/27/91	88	0.382	0.036	0.007	0.425	89.92%	8.39%	1.70%	0.124	0.012	0.002	0.138
351112	01/27/93	104	0.388	0.036	0.007	0.431	89.93%	8.38%	1.69%	0.106	0.010	0.002	0.118
351112	03/15/95	130	0.401	0.037	0.007	0.445	90.03%	8.29%	1.68%	0.177	0.016	0.003	0.197
351112	09/09/97	160	0.413	0.038	0.008	0.458	90.10%	8.23%	1.67%	0.124	0.011	0.002	0.138
351112	03/15/99	175	0.418	0.038	0.008	0.464	90.14%	8.20%	1.66%	0.142	0.013	0.003	0.157
371006	10/13/89	88	0.379	0.035	0.012	0.427	88.96%	8.21%	2.83%	0.070	0.006	0.002	0.079
371006	03/19/91	105	0.387	0.036	0.012	0.435	89.00%	8.17%	2.83%	0.070	0.006	0.002	0.079
371006	10/11/92	124	0.403	0.037	0.013	0.452	89.11%	8.09%	2.79%	0.158	0.014	0.005	0.177
371006	04/18/94	142	0.409	0.037	0.013	0.459	89.14%	8.07%	2.79%	0.088	0.008	0.003	0.098
371006	09/20/94	147	0.414	0.037	0.013	0.465	89.17%	8.05%	2.78%	0.105	0.010	0.003	0.118
371024	11/03/89	109	0.191	0.055	0.009	0.255	74.91%	21.49%	3.60%	0.265	0.076	0.013	0.354
371024	03/09/91	125	0.201	0.055	0.009	0.266	75.62%	20.84%	3.53%	0.327	0.090	0.015	0.433
371024	04/10/92	138	0.212	0.056	0.010	0.278	76.31%	20.24%	3.45%	0.270	0.072	0.012	0.354
371802	10/13/89	49	0.222	0.089	0.023	0.335	66.36%	26.63%	7.01%	0.235	0.094	0.025	0.354
371802	03/18/91	66	0.252	0.093	0.025	0.370	68.26%	25.03%	6.71%	0.215	0.079	0.021	0.315
371802	10/10/92	85	0.292	0.097	0.026	0.415	70.39%	23.30%	6.31%	0.249	0.083	0.022	0.354
371802	04/15/94	103	0.313	0.099	0.027	0.439	71.36%	22.46%	6.18%	0.309	0.097	0.027	0.433
371802	07/18/95	118	0.342	0.101	0.028	0.472	72.59%	21.48%	5.93%	0.343	0.101	0.028	0.472
371802	02/09/96	125	0.347	0.102	0.028	0.477	72.71%	21.37%	5.92%	0.372	0.109	0.030	0.512
371802	04/02/96	127	0.347	0.102	0.028	0.477	72.71%	21.36%	5.93%	0.372	0.109	0.030	0.512
371817	10/15/89	71	0.243	0.054	0.006	0.303	80.01%	17.87%	2.11%	0.315	0.070	0.008	0.394
371817	03/18/91	88	0.260	0.055	0.007	0.322	80.73%	17.21%	2.05%	0.207	0.044	0.005	0.256
371817	10/18/92	107	0.284	0.058	0.007	0.349	81.40%	16.63%	1.97%	0.288	0.059	0.007	0.354

Table C-20 (Cont'd) Permanent Deformation Simulation (β_{r2} = 1.2 and β_{r3} = 1.2) Data

Section	Month	Time	Predicted							Measured			
			AC	GB	SG	Total	%AC	%GB	%SG	AC	GB	SG	Total
371992	10/15/92	33	0.187	0.141	0.007	0.335	55.79%	42.26%	1.95%	0.132	0.100	0.005	0.236
371992	04/20/94	51	0.194	0.149	0.007	0.350	55.46%	42.54%	2.00%	0.022	0.017	0.001	0.039
371992	02/06/96	73	0.203	0.156	0.007	0.366	55.32%	42.65%	2.03%	0.087	0.067	0.003	0.157
371992	04/22/98	99	0.212	0.163	0.008	0.383	55.33%	42.62%	2.05%	0.131	0.101	0.005	0.236
404087	01/17/90	43	0.180	0.032	0.009	0.221	81.52%	14.40%	4.08%	0.497	0.088	0.025	0.610
404087	10/13/91	64	0.226	0.035	0.010	0.270	83.49%	12.79%	3.72%	0.362	0.055	0.016	0.433
404087	02/08/93	80	0.245	0.036	0.011	0.292	84.15%	12.23%	3.62%	0.315	0.046	0.014	0.374
404087	02/09/95	104	0.263	0.037	0.011	0.312	84.37%	11.99%	3.64%	0.482	0.068	0.021	0.571
404163	01/23/90	34	0.163	0.000	0.009	0.172	94.87%	0.00%	5.13%	0.430	0.000	0.023	0.453
404163	03/17/91	48	0.187	0.000	0.009	0.196	95.28%	0.00%	4.72%	0.356	0.000	0.018	0.374
404163	10/28/91	55	0.202	0.000	0.010	0.211	95.50%	0.00%	4.50%	0.282	0.000	0.013	0.295
404163	03/10/93	72	0.227	0.000	0.010	0.236	95.84%	0.00%	4.16%	0.264	0.000	0.011	0.276
404163	04/22/96	109	0.265	0.000	0.010	0.275	96.22%	0.00%	3.78%	0.303	0.000	0.012	0.315
404163	08/20/97	125	0.284	0.000	0.011	0.295	96.37%	0.00%	3.63%	0.379	0.000	0.014	0.394
404163	01/11/99	141	0.288	0.000	0.011	0.299	96.37%	0.00%	3.63%	0.436	0.000	0.016	0.453
421599	07/18/89	24	0.119	0.025	0.009	0.153	77.85%	16.37%	5.78%	0.138	0.029	0.010	0.177
421599	09/27/90	38	0.141	0.025	0.009	0.176	80.28%	14.38%	5.34%	0.174	0.031	0.012	0.217
421599	08/07/91	49	0.157	0.025	0.010	0.192	81.78%	13.17%	5.05%	0.161	0.026	0.010	0.197
421599	03/01/93	68	0.181	0.026	0.010	0.217	83.53%	11.81%	4.67%	0.263	0.037	0.015	0.315
421599	06/21/95	95	0.221	0.026	0.011	0.257	85.79%	10.07%	4.14%	0.236	0.028	0.011	0.276
421599	07/19/96	108	0.241	0.026	0.011	0.278	86.72%	9.37%	3.91%	0.239	0.026	0.011	0.276
421599	03/26/98	128	0.258	0.026	0.011	0.295	87.29%	8.93%	3.78%	0.241	0.025	0.010	0.276
451011	04/11/89	34	0.301	0.069	0.007	0.378	79.78%	18.29%	1.92%	0.267	0.061	0.006	0.335
451011	03/05/91	57	0.301	0.072	0.008	0.381	79.02%	18.98%	2.00%	0.389	0.093	0.010	0.492
451011	10/24/92	76	0.301	0.075	0.008	0.384	78.49%	19.47%	2.04%	0.494	0.123	0.013	0.630
451011	01/27/96	115	0.301	0.077	0.008	0.387	77.89%	20.01%	2.10%	0.521	0.134	0.014	0.669
451011	02/11/99	150	0.301	0.079	0.008	0.389	77.50%	20.36%	2.14%	0.549	0.144	0.015	0.709
473104	11/01/89	42	0.011	0.056	0.007	0.075	15.26%	74.79%	9.96%	0.042	0.206	0.027	0.276
473104	05/06/91	60	0.013	0.059	0.008	0.080	15.67%	74.14%	10.19%	0.049	0.234	0.032	0.315
473104	10/26/92	77	0.015	0.062	0.009	0.086	17.48%	72.32%	10.20%	0.062	0.256	0.036	0.354
473104	11/30/95	114	0.018	0.069	0.010	0.097	18.87%	70.83%	10.30%	0.119	0.446	0.065	0.630
480001	04/10/89	1	0.036	0.079	0.007	0.123	29.57%	64.71%	5.72%	0.070	0.153	0.014	0.236
480001	10/11/90	19	0.185	0.138	0.013	0.336	54.98%	41.08%	3.95%	0.152	0.113	0.011	0.276
480001	03/11/92	36	0.194	0.148	0.015	0.358	54.36%	41.48%	4.16%	0.171	0.131	0.013	0.315
480001	02/17/93	47	0.202	0.154	0.016	0.372	54.37%	41.42%	4.20%	0.107	0.082	0.008	0.197
480001	02/20/95	71	0.209	0.163	0.017	0.389	53.74%	41.89%	4.36%	0.169	0.132	0.014	0.315
480001	03/19/98	108	0.224	0.173	0.019	0.416	53.87%	41.68%	4.45%	0.085	0.066	0.007	0.157
481060	06/18/90	52	0.277	0.058	0.007	0.342	80.86%	17.02%	2.12%	0.334	0.070	0.009	0.413
481060	02/14/91	60	0.288	0.059	0.007	0.355	81.23%	16.68%	2.09%	0.272	0.056	0.007	0.335
481060	03/18/92	73	0.303	0.060	0.008	0.371	81.64%	16.30%	2.06%	0.193	0.039	0.005	0.236
481060	02/23/93	84	0.318	0.062	0.008	0.387	82.06%	15.91%	2.03%	0.178	0.034	0.004	0.217
481060	02/23/95	108	0.342	0.063	0.008	0.413	82.70%	15.32%	1.98%	0.309	0.057	0.007	0.374
481060	01/05/99	154	0.366	0.066	0.009	0.441	83.00%	15.04%	1.96%	0.327	0.059	0.008	0.394
481077	04/25/89	88	0.368	0.039	0.008	0.415	88.79%	9.40%	1.82%	0.472	0.050	0.010	0.531
481077	10/13/91	118	0.397	0.040	0.008	0.445	89.19%	9.07%	1.75%	0.544	0.055	0.011	0.610
481077	10/12/92	130	0.401	0.041	0.008	0.450	89.18%	9.08%	1.75%	0.544	0.055	0.011	0.610

Table C-20 (Cont'd) Permanent Deformation Simulation (β_{r2} = 1.2 and β_{r3} = 1.2) Data

Section	Month	Time	Predicted							Measured			
			AC	GB	SG	Total	%AC	%GB	%SG	AC	GB	SG	Total
481077	03/10/95	159	0.409	0.042	0.008	0.459	89.17%	9.08%	1.75%	0.632	0.064	0.012	0.709
481077	03/26/98	195	0.418	0.043	0.008	0.469	89.17%	9.07%	1.75%	0.614	0.063	0.012	0.689
481109	01/04/90	68	0.385	0.000	0.016	0.401	95.98%	0.00%	4.02%	0.302	0.000	0.013	0.315
481109	09/21/90	76	0.397	0.000	0.016	0.414	96.02%	0.00%	3.98%	0.302	0.000	0.013	0.315
481109	03/10/92	94	0.406	0.000	0.017	0.423	96.00%	0.00%	4.00%	0.246	0.000	0.010	0.256
481109	02/12/93	105	0.414	0.000	0.017	0.431	96.00%	0.00%	4.00%	0.246	0.000	0.010	0.256
481109	02/16/95	129	0.427	0.000	0.018	0.445	96.01%	0.00%	3.99%	0.378	0.000	0.016	0.394
481130	04/11/89	201	0.242	0.170	0.015	0.427	56.71%	39.74%	3.55%	0.301	0.211	0.019	0.531
481130	10/12/90	219	0.245	0.172	0.015	0.433	56.60%	39.82%	3.57%	0.390	0.274	0.025	0.689
481130	03/12/92	236	0.246	0.174	0.016	0.435	56.44%	39.96%	3.61%	0.389	0.275	0.025	0.689
481169	03/04/90	212	0.067	0.115	0.006	0.188	35.57%	61.07%	3.36%	0.112	0.192	0.011	0.315
481169	09/18/90	218	0.067	0.115	0.006	0.189	35.48%	61.16%	3.37%	0.112	0.193	0.011	0.315
481169	03/07/91	224	0.067	0.116	0.006	0.189	35.45%	61.18%	3.37%	0.112	0.193	0.011	0.315
481169	01/30/92	234	0.067	0.116	0.006	0.190	35.29%	61.33%	3.38%	0.118	0.205	0.011	0.335
481169	02/27/93	247	0.067	0.117	0.006	0.191	35.14%	61.48%	3.38%	0.111	0.194	0.011	0.315
481169	03/03/95	272	0.067	0.118	0.007	0.192	34.90%	61.71%	3.40%	0.165	0.292	0.016	0.472
481174	10/17/90	186	0.440	0.075	0.014	0.528	83.18%	14.12%	2.69%	0.327	0.056	0.011	0.394
481174	02/14/91	190	0.440	0.075	0.014	0.529	83.18%	14.12%	2.70%	0.360	0.061	0.012	0.433
481174	03/16/92	203	0.443	0.075	0.014	0.532	83.19%	14.10%	2.71%	0.262	0.044	0.009	0.315
481174	02/18/93	214	0.446	0.076	0.015	0.536	83.18%	14.11%	2.72%	0.295	0.050	0.010	0.354
481174	02/21/95	238	0.452	0.077	0.015	0.543	83.18%	14.09%	2.73%	0.557	0.094	0.018	0.669
481174	03/20/98	275	0.460	0.078	0.015	0.552	83.19%	14.05%	2.76%	0.557	0.094	0.018	0.669
481178	04/10/89	10	0.207	0.030	0.008	0.245	84.61%	12.31%	3.08%	0.150	0.022	0.005	0.177
481178	02/22/91	32	0.294	0.037	0.010	0.341	86.35%	10.79%	2.86%	0.119	0.015	0.004	0.138
481178	03/10/92	45	0.315	0.038	0.010	0.363	86.58%	10.55%	2.87%	0.119	0.015	0.004	0.138
481178	02/16/93	56	0.329	0.039	0.011	0.380	86.73%	10.39%	2.88%	0.137	0.016	0.005	0.157
481178	02/17/95	80	0.355	0.041	0.012	0.409	86.95%	10.15%	2.90%	0.205	0.024	0.007	0.236
481183	12/06/89	179	0.386	0.081	0.017	0.484	79.73%	16.67%	3.60%	0.204	0.043	0.009	0.256
481183	09/15/90	188	0.393	0.082	0.018	0.493	79.78%	16.63%	3.60%	0.236	0.049	0.011	0.295
483749	10/17/90	116	0.145	0.233	0.015	0.394	36.84%	59.26%	3.89%	0.094	0.152	0.010	0.256
483749	02/14/91	120	0.145	0.234	0.015	0.395	36.76%	59.33%	3.91%	0.080	0.128	0.008	0.217
483749	03/16/92	133	0.145	0.238	0.016	0.399	36.37%	59.68%	3.94%	0.072	0.117	0.008	0.197
483749	02/21/93	144	0.145	0.241	0.016	0.402	36.07%	59.96%	3.97%	0.078	0.130	0.009	0.217
483749	02/21/95	168	0.145	0.248	0.016	0.409	35.47%	60.51%	4.02%	0.119	0.202	0.013	0.335
483749	03/28/97	193	0.145	0.253	0.017	0.415	34.95%	60.99%	4.06%	0.158	0.276	0.018	0.453
489005	10/14/90	50	0.073	0.194	0.021	0.288	25.24%	67.48%	7.28%	0.084	0.226	0.024	0.335
489005	03/12/92	67	0.073	0.201	0.022	0.296	24.53%	67.98%	7.48%	0.034	0.094	0.010	0.138
489005	02/17/93	78	0.073	0.205	0.023	0.301	24.13%	68.29%	7.58%	0.033	0.094	0.010	0.138
489005	02/20/95	102	0.073	0.212	0.024	0.309	23.52%	68.72%	7.76%	0.056	0.162	0.018	0.236
489005	07/10/98	143	0.073	0.222	0.026	0.321	22.64%	69.40%	7.96%	0.036	0.109	0.013	0.157
501002	08/09/89	58	0.139	0.040	0.005	0.183	75.78%	21.75%	2.47%	0.224	0.064	0.007	0.295
501002	08/08/90	70	0.156	0.041	0.005	0.202	77.27%	20.41%	2.32%	0.289	0.076	0.009	0.374
501002	09/04/91	83	0.164	0.042	0.005	0.211	77.80%	19.92%	2.28%	0.245	0.063	0.007	0.315
501002	04/27/93	102	0.176	0.043	0.005	0.224	78.63%	19.15%	2.21%	0.294	0.072	0.008	0.374
501002	05/25/94	115	0.188	0.044	0.005	0.237	79.35%	18.51%	2.14%	0.297	0.069	0.008	0.374
501002	08/17/94	118	0.196	0.044	0.005	0.245	79.85%	18.08%	2.08%	0.299	0.068	0.008	0.374

Table C-20 (Cont'd) Permanent Deformation Simulation (β_{r2} = 1.2 and β_{r3} = 1.2) Data

Section	Month	Time	Predicted							Measured			
			AC	GB	SG	Total	%AC	%GB	%SG	AC	GB	SG	Total
501002	04/27/95	126	0.196	0.044	0.005	0.246	79.83%	18.08%	2.09%	0.314	0.071	0.008	0.394
501002	10/12/95	132	0.210	0.045	0.005	0.261	80.66%	17.35%	1.99%	0.349	0.075	0.009	0.433
501002	10/17/96	144	0.215	0.046	0.005	0.266	80.92%	17.11%	1.97%	0.287	0.061	0.007	0.354
501002	05/15/97	151	0.216	0.046	0.005	0.267	80.92%	17.10%	1.98%	0.350	0.074	0.009	0.433
501002	10/23/97	156	0.226	0.046	0.005	0.277	81.43%	16.65%	1.92%	0.369	0.075	0.009	0.453
501002	06/06/98	164	0.229	0.046	0.005	0.281	81.60%	16.49%	1.91%	0.353	0.071	0.008	0.433
501004	08/09/89	58	0.085	0.042	0.005	0.132	64.20%	31.97%	3.83%	0.101	0.050	0.006	0.157
501004	08/07/90	70	0.099	0.043	0.005	0.148	67.33%	29.15%	3.51%	0.172	0.075	0.009	0.256
501004	09/20/91	83	0.116	0.044	0.005	0.165	70.08%	26.69%	3.23%	0.138	0.053	0.006	0.197
501004	04/27/93	102	0.133	0.045	0.006	0.184	72.48%	24.52%	3.01%	0.185	0.063	0.008	0.256
501004	10/12/95	132	0.170	0.047	0.006	0.222	76.31%	21.06%	2.63%	0.180	0.050	0.006	0.236
501004	11/04/97	157	0.200	0.048	0.006	0.254	78.61%	18.99%	2.40%	0.201	0.049	0.006	0.256
511002	10/15/89	121	0.342	0.059	0.009	0.410	83.42%	14.40%	2.19%	0.328	0.057	0.009	0.394
511023	10/12/89	107	0.400	0.059	0.012	0.470	84.97%	12.49%	2.54%	0.485	0.071	0.015	0.571
511023	03/20/91	124	0.404	0.059	0.012	0.475	84.95%	12.50%	2.55%	0.468	0.069	0.014	0.551
511023	10/10/92	143	0.411	0.061	0.012	0.484	84.91%	12.53%	2.56%	0.501	0.074	0.015	0.591
511023	12/07/93	157	0.415	0.061	0.012	0.488	84.90%	12.54%	2.56%	0.518	0.077	0.016	0.610
511023	09/18/95	178	0.421	0.062	0.013	0.496	84.90%	12.54%	2.56%	0.468	0.069	0.014	0.551
511023	02/09/96	183	0.421	0.062	0.013	0.496	84.90%	12.54%	2.56%	0.568	0.084	0.017	0.669
511023	03/24/97	196	0.424	0.062	0.013	0.499	84.93%	12.50%	2.57%	0.502	0.074	0.015	0.591
512021	10/15/89	54	0.233	0.016	0.009	0.258	90.31%	6.32%	3.37%	0.356	0.025	0.013	0.394
512021	03/11/91	71	0.263	0.017	0.009	0.289	91.04%	5.87%	3.09%	0.394	0.025	0.013	0.433
512021	10/20/92	90	0.295	0.018	0.009	0.322	91.63%	5.46%	2.91%	0.487	0.029	0.015	0.531
531008	07/17/89	129	0.303	0.071	0.008	0.381	79.42%	18.58%	2.00%	0.610	0.143	0.015	0.768
531008	07/17/89	142	0.306	0.072	0.008	0.386	79.30%	18.69%	2.00%	0.593	0.140	0.015	0.748
531008	08/02/90	151	0.306	0.072	0.008	0.386	79.24%	18.75%	2.01%	0.608	0.144	0.015	0.768
531008	08/02/90	153	0.307	0.073	0.008	0.387	79.24%	18.75%	2.01%	0.655	0.155	0.017	0.827
531008	05/28/91	188	0.310	0.074	0.008	0.392	79.01%	18.95%	2.04%	0.855	0.205	0.022	1.083
531801	07/17/89	190	0.155	0.009	0.005	0.169	91.70%	5.31%	2.98%	0.181	0.010	0.006	0.197
531801	08/09/90	203	0.163	0.009	0.005	0.177	91.96%	5.16%	2.88%	0.163	0.009	0.005	0.177
531801	06/05/91	213	0.165	0.009	0.005	0.179	92.05%	5.09%	2.86%	0.199	0.011	0.006	0.217
531801	06/22/94	249	0.186	0.009	0.005	0.201	92.68%	4.69%	2.62%	0.146	0.007	0.004	0.157
531801	05/08/95	260	0.190	0.009	0.005	0.205	92.81%	4.60%	2.59%	0.146	0.007	0.004	0.157
531801	10/31/95	265	0.198	0.010	0.005	0.213	92.98%	4.51%	2.52%	0.165	0.008	0.004	0.177
531801	03/27/97	282	0.204	0.010	0.005	0.220	93.11%	4.44%	2.46%	0.183	0.009	0.005	0.197
561007	09/26/89	111	0.224	0.036	0.008	0.268	83.52%	13.50%	2.98%	0.378	0.061	0.014	0.453
561007	07/22/90	121	0.224	0.036	0.008	0.268	83.40%	13.59%	3.01%	0.328	0.053	0.012	0.394
561007	05/13/91	131	0.224	0.037	0.008	0.269	83.30%	13.67%	3.03%	0.312	0.051	0.011	0.374
561007	08/03/91	134	0.226	0.037	0.008	0.271	83.24%	13.74%	3.02%	0.262	0.043	0.010	0.315
561007	12/09/93	162	0.228	0.038	0.008	0.274	83.01%	13.91%	3.08%	0.229	0.038	0.008	0.276
561007	03/16/94	165	0.228	0.038	0.008	0.274	83.00%	13.91%	3.08%	0.229	0.038	0.008	0.276
561007	04/19/94	166	0.228	0.038	0.008	0.274	83.00%	13.91%	3.09%	0.245	0.041	0.009	0.295
561007	08/19/94	170	0.228	0.038	0.009	0.275	82.92%	13.99%	3.09%	0.212	0.036	0.008	0.256
561007	02/16/95	176	0.228	0.038	0.009	0.275	82.91%	13.98%	3.11%	0.228	0.039	0.009	0.276
561007	05/17/95	179	0.228	0.039	0.009	0.275	82.86%	14.03%	3.11%	0.212	0.036	0.008	0.256
561007	09/08/95	183	0.229	0.039	0.009	0.276	82.83%	14.06%	3.11%	0.228	0.039	0.009	0.276
561007	06/11/96	192	0.229	0.039	0.009	0.276	82.77%	14.10%	3.13%	0.179	0.031	0.007	0.217

Table C-20 (Cont'd) Permanent Deformation Simulation (β_{r2} = 1.2 and β_{r3} = 1.2) Data

Section	Month	Time	Predicted							Measured			
			AC	GB	SG	Total	%AC	%GB	%SG	AC	GB	SG	Total
561007	10/24/96	196	0.230	0.039	0.009	0.278	82.75%	14.13%	3.12%	0.228	0.039	0.009	0.276
561007	11/19/96	197	0.230	0.039	0.009	0.278	82.74%	14.13%	3.13%	0.228	0.039	0.009	0.276
561007	03/10/97	201	0.230	0.039	0.009	0.278	82.74%	14.13%	3.13%	0.244	0.042	0.009	0.295
561007	03/24/97	202	0.230	0.039	0.009	0.278	82.74%	14.13%	3.14%	0.228	0.039	0.009	0.276
561007	08/07/97	206	0.231	0.040	0.009	0.280	82.72%	14.15%	3.13%	0.228	0.039	0.009	0.276
561007	09/30/97	207	0.231	0.040	0.009	0.280	82.68%	14.20%	3.13%	0.228	0.039	0.009	0.276
841684	08/29/90	144	0.316	0.082	0.006	0.404	78.26%	20.32%	1.42%	0.431	0.112	0.008	0.551
841684	08/28/91	156	0.325	0.083	0.006	0.413	78.53%	20.07%	1.40%	0.433	0.111	0.008	0.551
841684	05/03/93	177	0.330	0.084	0.006	0.420	78.56%	20.03%	1.40%	0.510	0.130	0.009	0.650
841684	10/24/95	206	0.344	0.086	0.006	0.437	78.90%	19.72%	1.38%	0.559	0.140	0.010	0.709

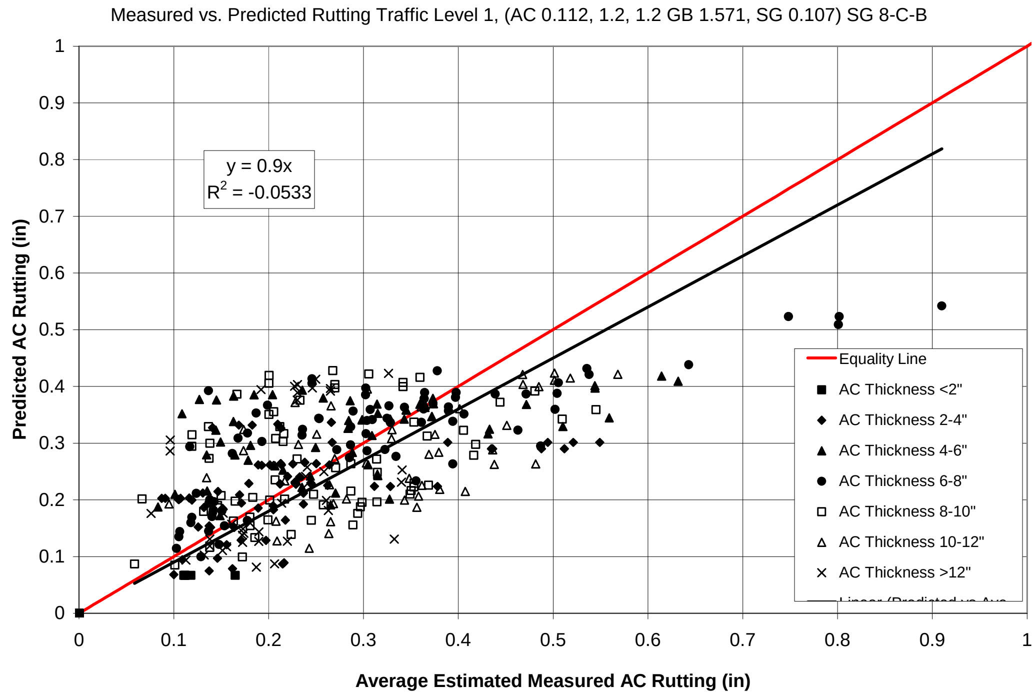


Figure C-135 Asphalt Concrete Layers Rut Depth (β_{r2} = 1.2 and β_{r3} = 1.2)

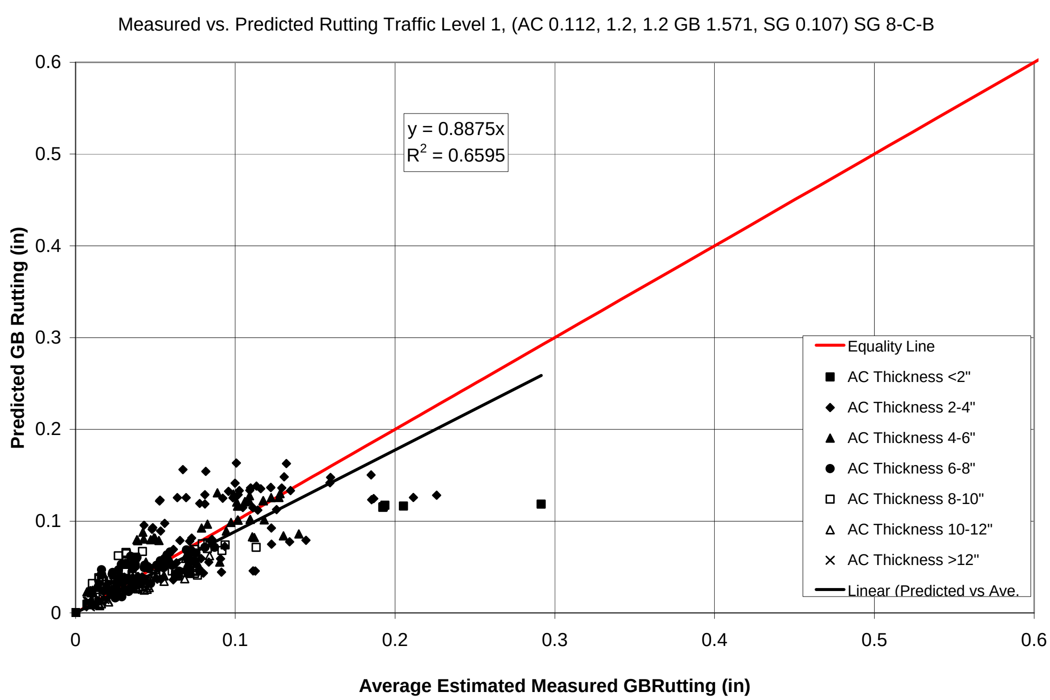


Figure C-136 Granular Base Layers Rut Depth (β_{r2} = 1.2 and β_{r3} = 1.2)

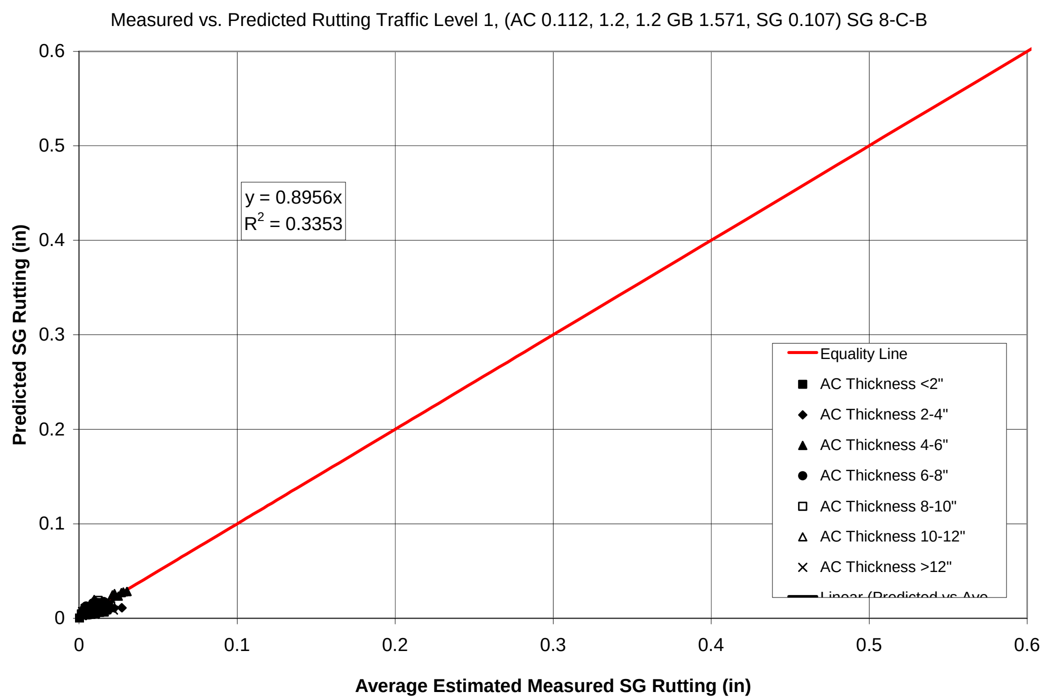


Figure C-137 Granular Subgrade Rut Depth (β_{r2} = 1.2 and β_{r3} = 1.2)

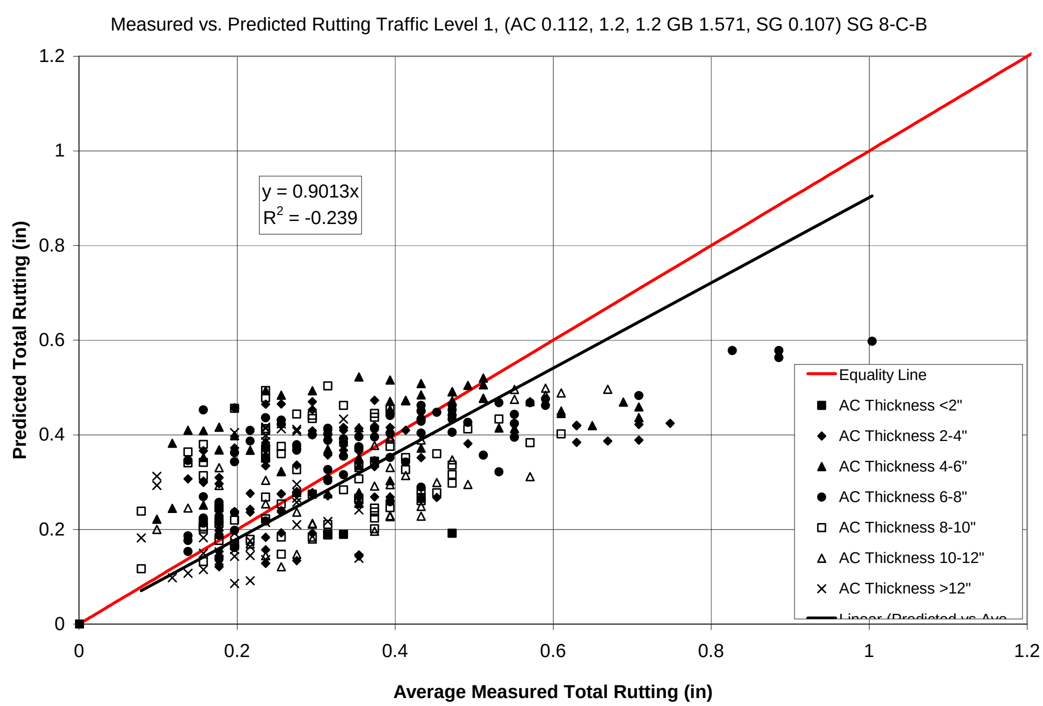


Figure C-138 Total Asphalt Pavement Rut Depth (β_{r2} = 1.2 and β_{r3} = 1.2)

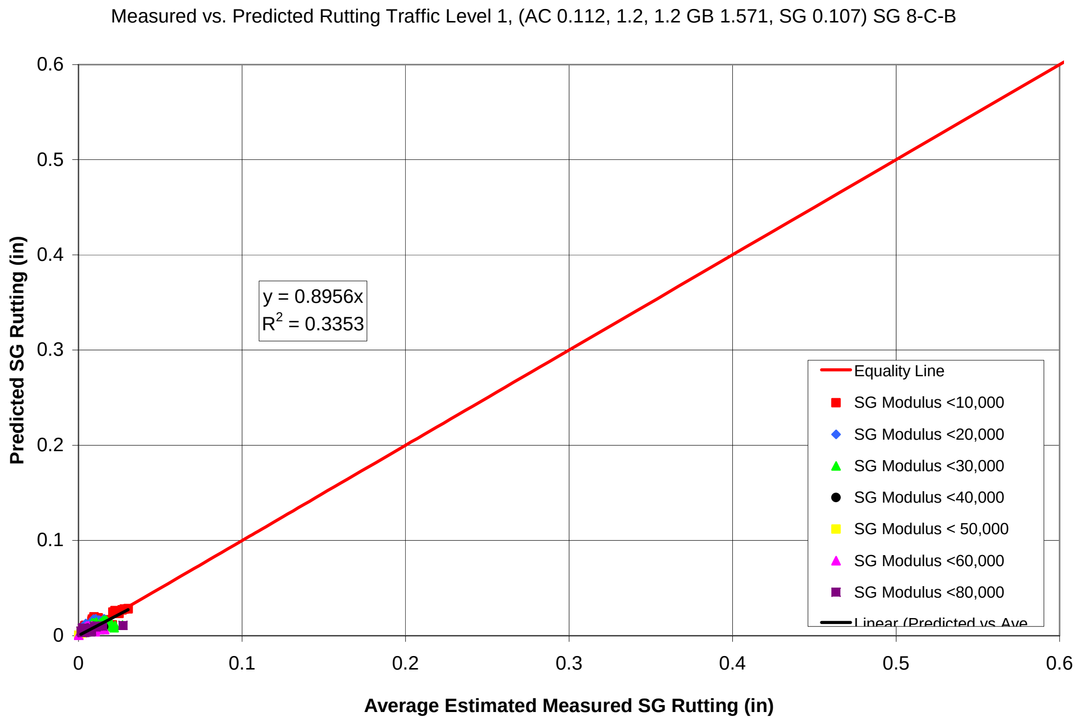


Figure C-139 Subgrade Rut Depth (β_{r2} = 1.2 and β_{r3} = 1.2) (By Subgrade Modulus)

Annex D

AASHTO Study for Unbound Permanent Deformation Data

Table D-71 AASHTO Study Data – Set 1-A (β_{acr1} = 0.508, β_{acr2} = 0.9, β_{acr3} = 1.2, β_{GB} = 3.2, β_{SG} = 6.25)

				Rut Depth Value			
Hac	***CBRsg***	***N Design***	***SN***	***AC***	***GB***	***SG***	***Total***
2	2	1.00E+05	3.22	0.047	0.075	0.041	0.163
4	2	1.00E+05	3.22	0.070	0.027	0.044	0.141
3	5	1.00E+05	2.57	0.078	0.030	0.095	0.203
2	10	1.00E+05	2.17	0.065	0.044	0.143	0.251
1	20	1.00E+05	1.82	0.012	0.077	0.183	0.272
			Average	***0.054***	***0.050***	***0.101***	***0.206***
2	2	1.00E+06	4.64	0.152	0.126	0.084	0.362
4	2	1.00E+06	4.64	0.199	0.070	0.093	0.363
6	2	1.00E+06	4.64	0.172	0.034	0.098	0.304
2	5	1.00E+06	3.76	0.157	0.108	0.139	0.404
5	5	1.00E+06	3.76	0.187	0.029	0.156	0.372
2	10	1.00E+06	3.18	0.162	0.095	0.178	0.435
4	10	1.00E+06	3.18	0.206	0.034	0.198	0.438
3	20	1.00E+06	2.68	0.219	0.046	0.230	0.495
			Average	***0.182***	***0.068***	***0.147***	***0.397***
2	2	1.00E+07	6.37	0.481	0.181	0.147	0.809
5	2	1.00E+07	6.37	0.577	0.092	0.174	0.844
7	2	1.00E+07	6.37	0.507	0.058	0.184	0.750
10	2	1.00E+07	6.37	0.390	0.020	0.196	0.606
2	5	1.00E+07	5.31	0.486	0.167	0.178	0.831
5	5	1.00E+07	5.31	0.558	0.073	0.199	0.831
8	5	1.00E+07	5.31	0.458	0.023	0.220	0.701
2	10	1.00E+07	4.58	0.472	0.154	0.195	0.821
5	10	1.00E+07	4.58	0.580	0.059	0.221	0.859
6	10	1.00E+07	4.58	0.541	0.040	0.231	0.812
5	20	1.00E+07	3.91	0.575	0.042	0.245	0.861
			Average	***0.511***	***0.083***	***0.199***	***0.793***
2	2	1.00E+08	8.49	0.906	0.234	0.244	1.384
5	2	1.00E+08	8.49	1.820	0.132	0.271	2.223
8	2	1.00E+08	8.49	1.522	0.080	0.296	1.899
12	2	1.00E+08	8.49	0.960	0.035	0.339	1.334
14	2	1.00E+08	8.49	0.611	0.017	0.356	0.984
2	5	1.00E+08	7.18	0.901	0.222	0.196	1.319
5	5	1.00E+08	7.18	1.760	0.118	0.217	2.095
8	5	1.00E+08	7.18	1.462	0.063	0.249	1.774
11	5	1.00E+08	7.18	1.108	0.027	0.276	1.411
2	10	1.00E+08	6.3	0.900	0.212	0.178	1.291
5	10	1.00E+08	6.3	1.726	0.105	0.208	2.040
8	10	1.00E+08	6.3	1.432	0.047	0.234	1.713
10	10	1.00E+08	6.3	1.234	0.021	0.256	1.510
8	20	1.00E+08	5.49	1.461	0.033	0.239	1.732
			Average	***1.272***	***0.096***	***0.254***	***1.622***

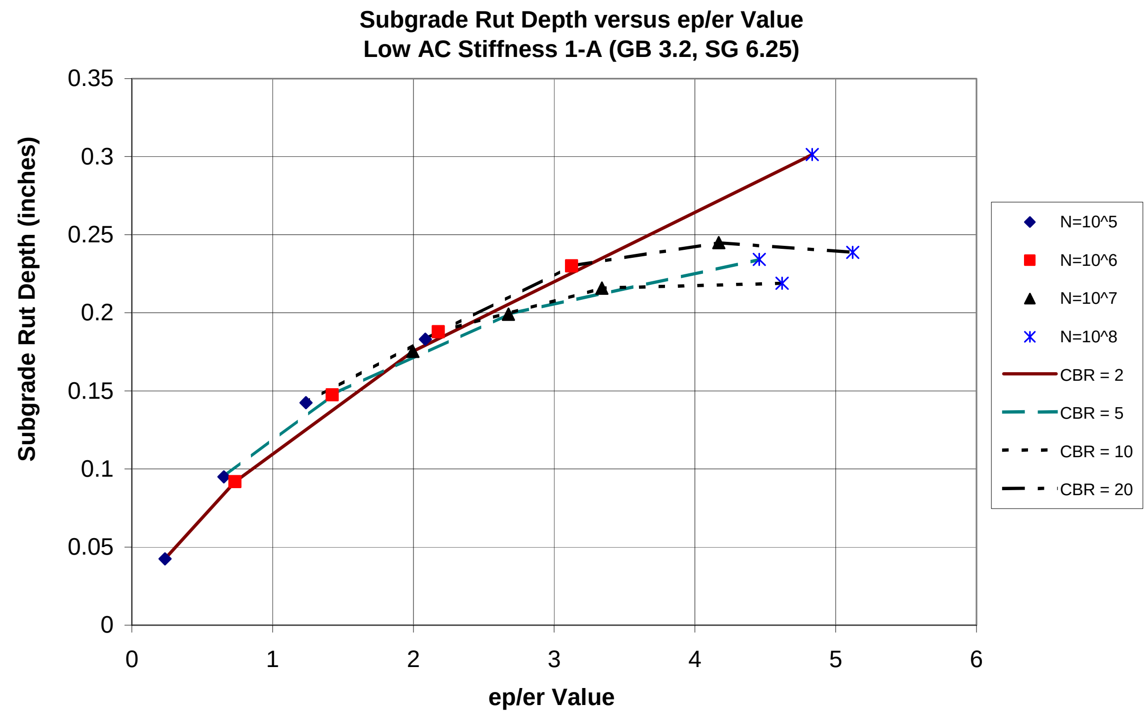


Figure D-140 Subgrade Rut Depth versus ep/er Value Set 1-A

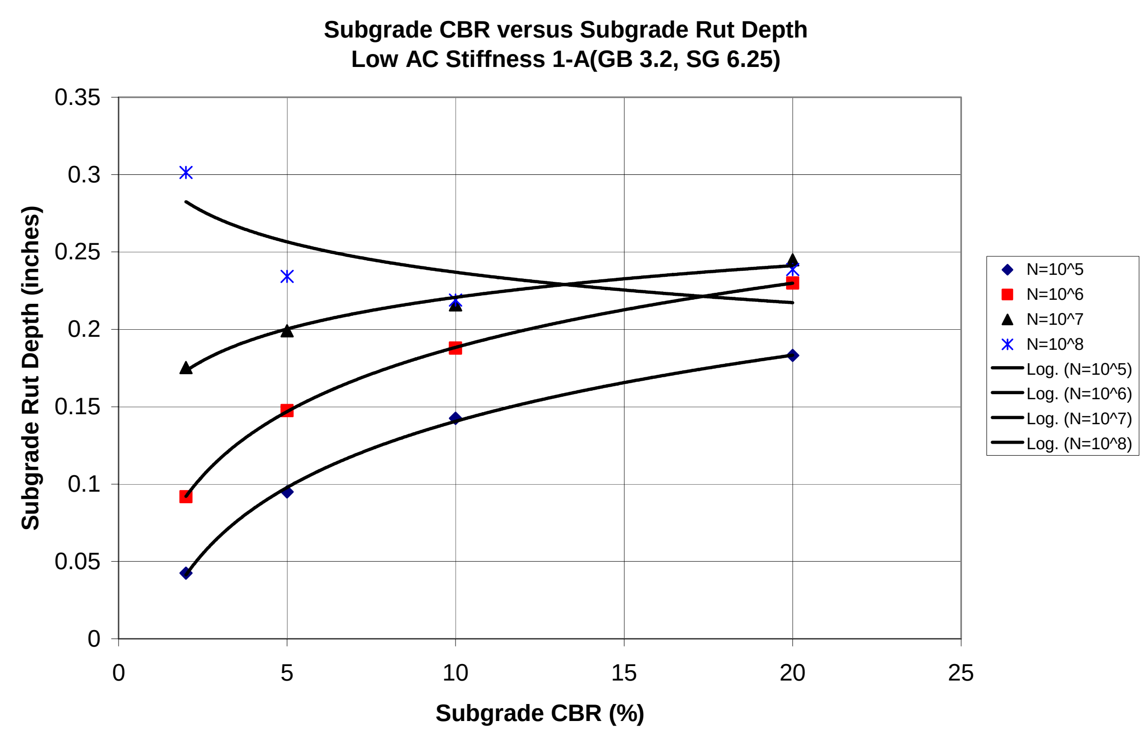
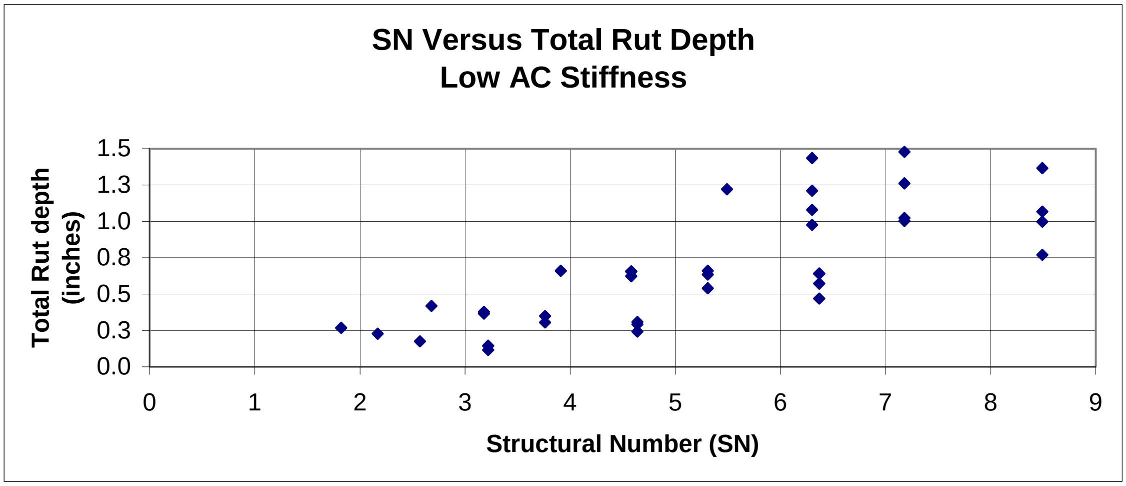
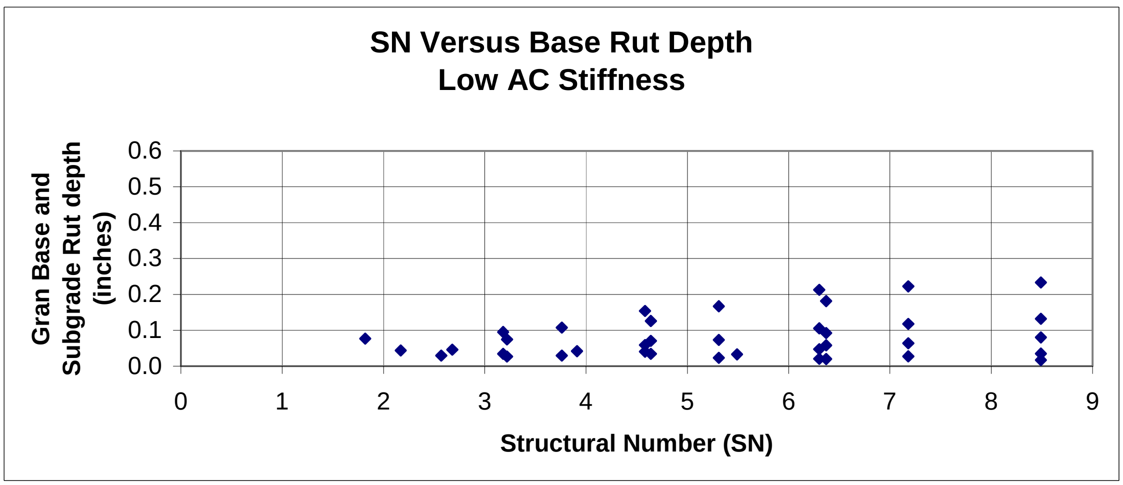


Figure D-141 Average Subgrade Rut Depth versus Subgrade CBR (%) Set 1-A





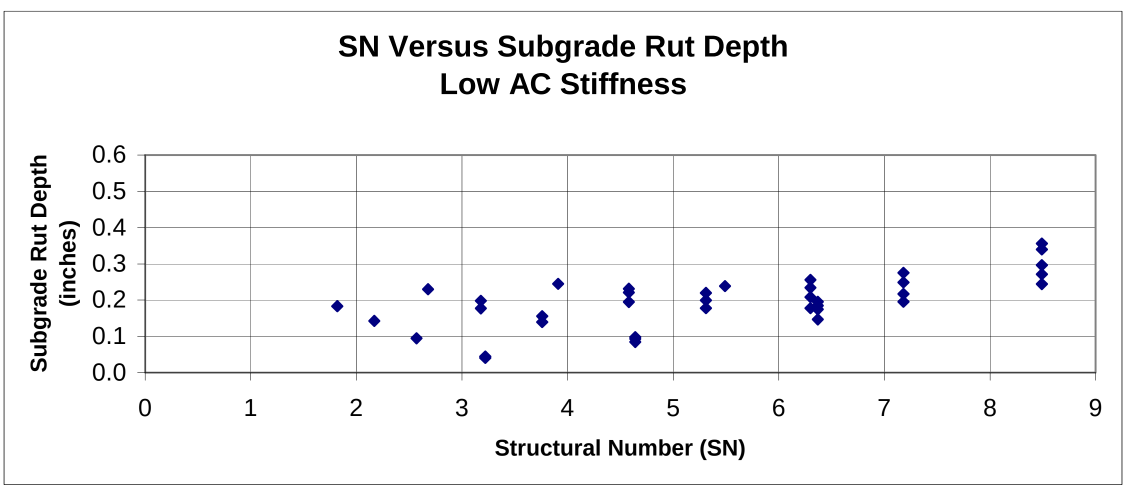
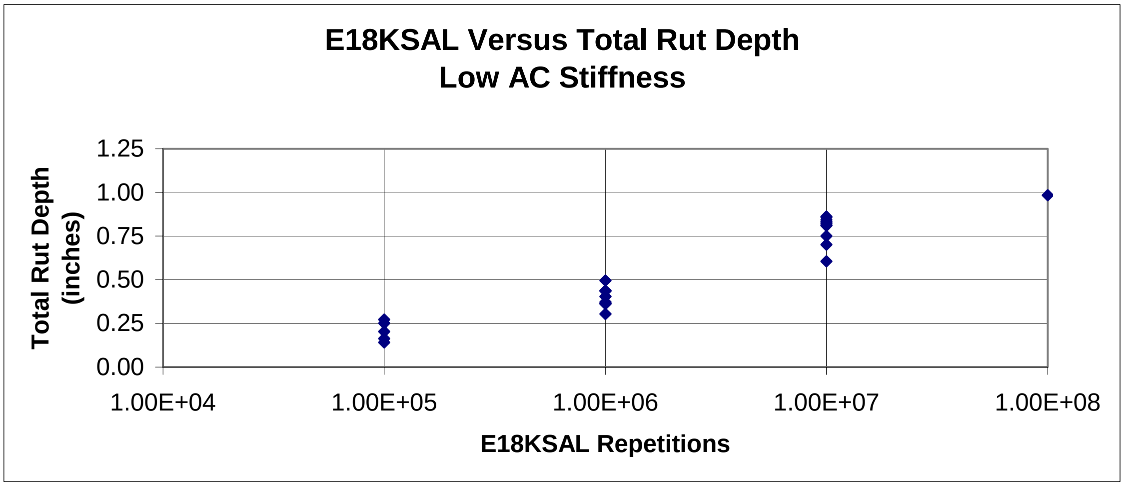
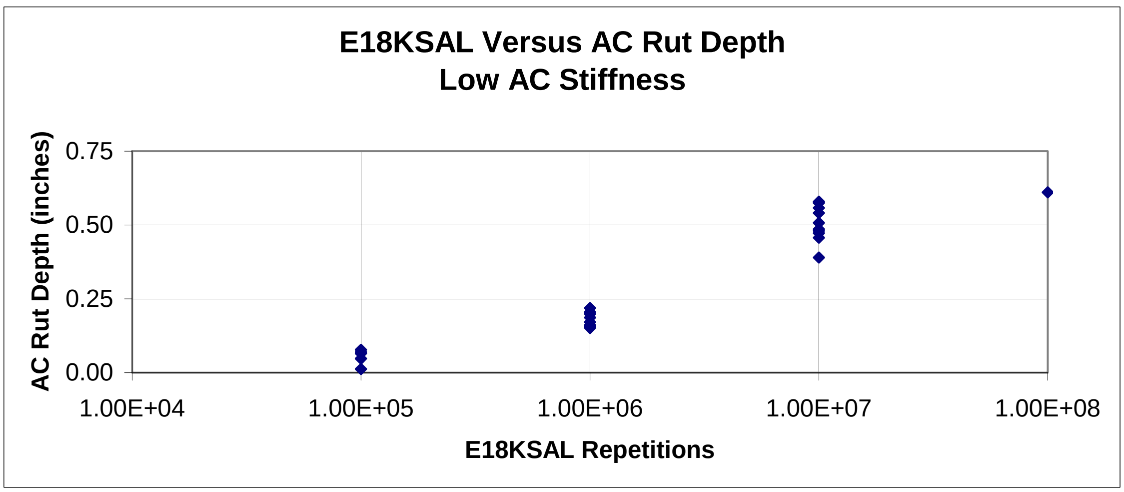


Figure D-142 Rut Depths versus Structural Number Set 1-A





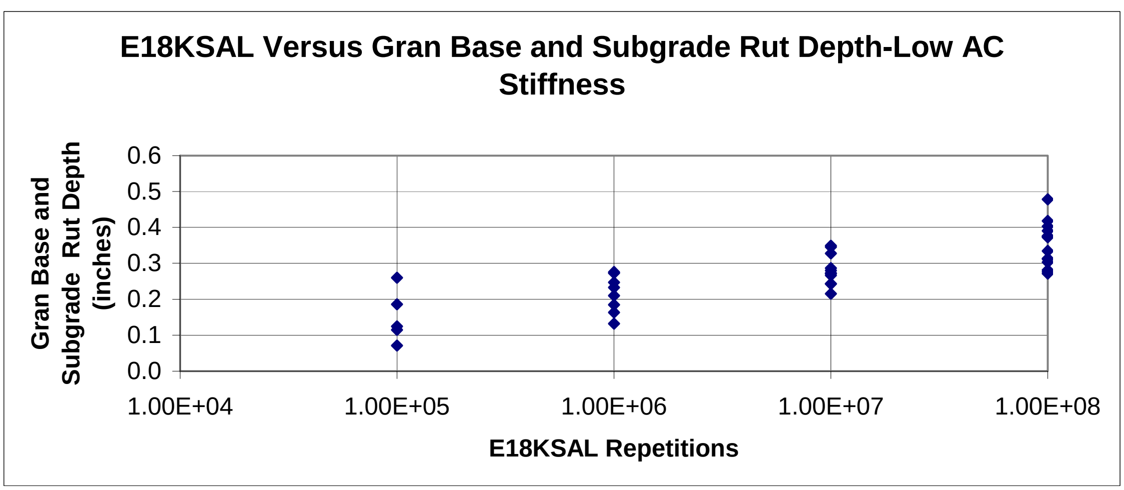
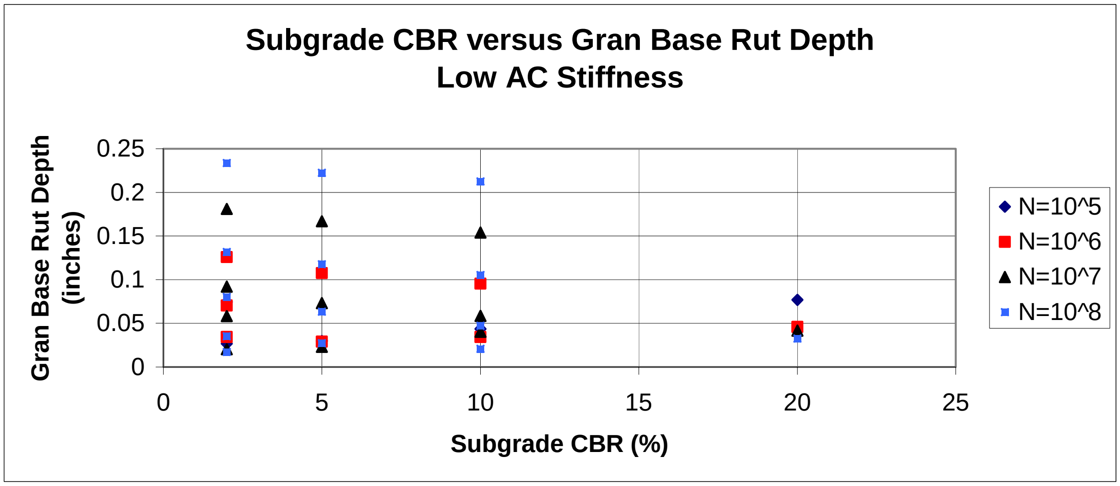


Figure D-143 Rut Depths versus 18KESAL Repetitions Set 1-A



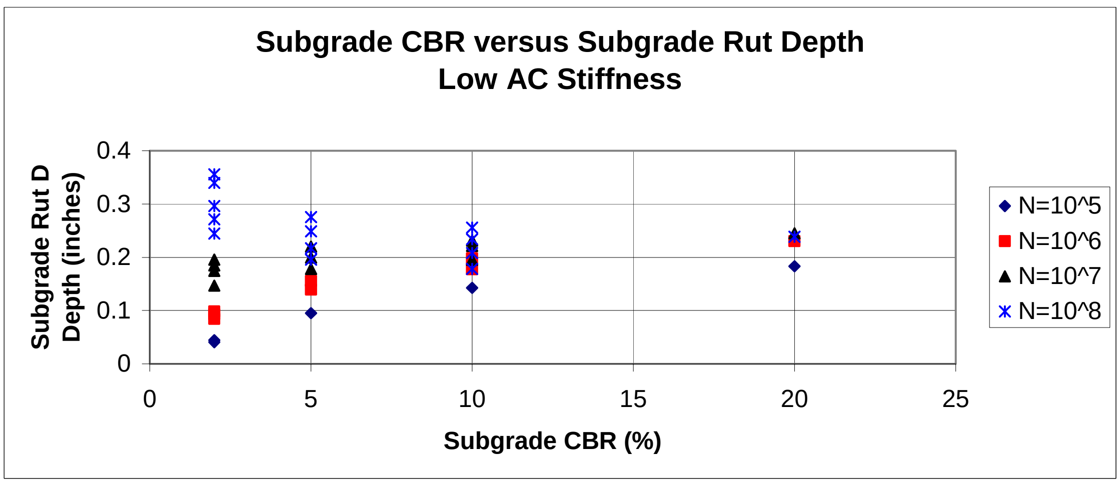


Figure D-144 Base / Subgrade Rut Depths versus Subgrade CBR (All data) Set 1-A

Table D-72 AASHTO Study Data – Set 2-A (β_{acr1} = 0.508, β_{acr2} = 0.9, β_{acr3} = 1.2, β_{GB} = 3.4, β_{SG} = 6.0)

				Rut Depth Value			
Hac	***CBRsg***	***N Design***	***SN***	***AC***	***GB***	***SG***	***Total***
2	2	1.00E+05	3.22	0.047	0.065	0.014	0.127
4	2	1.00E+05	3.22	0.070	0.021	0.015	0.106
3	5	1.00E+05	2.57	0.078	0.023	0.046	0.148
2	10	1.00E+05	2.17	0.065	0.035	0.086	0.185
1	20	1.00E+05	1.82	0.012	0.062	0.127	0.202
			Average	***0.054***	***0.041***	***0.058***	***0.153***
2	2	1.00E+06	4.64	0.152	0.119	0.050	0.321
4	2	1.00E+06	4.64	0.199	0.066	0.056	0.321
6	2	1.00E+06	4.64	0.172	0.031	0.058	0.260
2	5	1.00E+06	3.76	0.157	0.101	0.099	0.357
5	5	1.00E+06	3.76	0.187	0.026	0.109	0.322
2	10	1.00E+06	3.18	0.162	0.089	0.139	0.390
4	10	1.00E+06	3.18	0.206	0.031	0.152	0.388
3	20	1.00E+06	2.68	0.219	0.041	0.188	0.449
			Average	***0.182***	***0.063***	***0.106***	***0.351***
2	2	1.00E+07	6.37	0.481	0.184	0.142	0.806
5	2	1.00E+07	6.37	0.577	0.093	0.167	0.838
7	2	1.00E+07	6.37	0.507	0.058	0.175	0.741
10	2	1.00E+07	6.37	0.390	0.020	0.181	0.591
2	5	1.00E+07	5.31	0.486	0.169	0.171	0.826
5	5	1.00E+07	5.31	0.558	0.073	0.190	0.822
8	5	1.00E+07	5.31	0.458	0.023	0.202	0.683
2	10	1.00E+07	4.58	0.472	0.155	0.186	0.814
5	10	1.00E+07	4.58	0.580	0.059	0.207	0.845
6	10	1.00E+07	4.58	0.541	0.040	0.214	0.795
5	20	1.00E+07	3.91	0.575	0.041	0.226	0.842
			Average	***0.511***	***0.083***	***0.187***	***0.782***
2	2	1.00E+08	8.49	0.906	0.250	0.358	1.514
5	2	1.00E+08	8.49	1.820	0.140	0.397	2.357
8	2	1.00E+08	8.49	1.522	0.086	0.431	2.039
12	2	1.00E+08	8.49	0.960	0.037	0.482	1.479
14	2	1.00E+08	8.49	0.611	0.018	0.496	1.125
2	5	1.00E+08	7.18	0.901	0.237	0.238	1.377
5	5	1.00E+08	7.18	1.760	0.125	0.263	2.148
8	5	1.00E+08	7.18	1.462	0.067	0.296	1.826
11	5	1.00E+08	7.18	1.108	0.029	0.320	1.457
2	10	1.00E+08	6.3	0.900	0.227	0.198	1.325
5	10	1.00E+08	6.3	1.726	0.112	0.229	2.067
8	10	1.00E+08	6.3	1.432	0.050	0.251	1.733
10	10	1.00E+08	6.3	1.234	0.022	0.271	1.527
8	20	1.00E+08	5.49	1.461	0.035	0.241	1.736
			Average	***1.272***	***0.102***	***0.319***	***1.693***

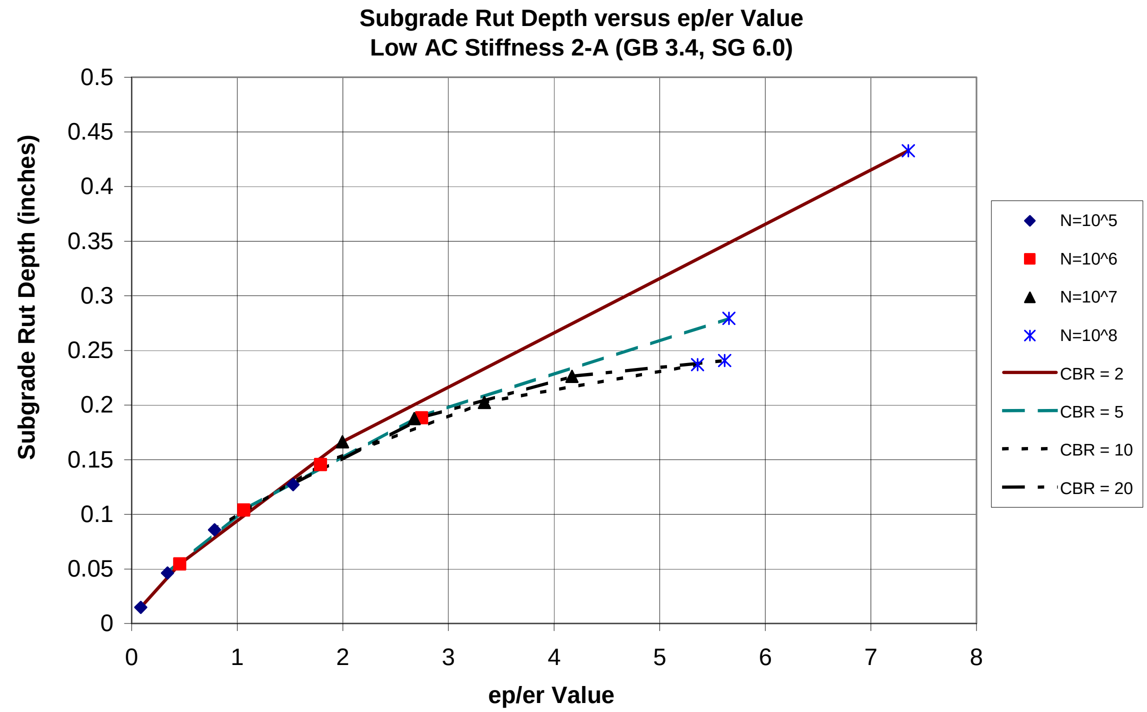


Figure D-145 Subgrade Rut Depth versus ep/er Value Set 2-A

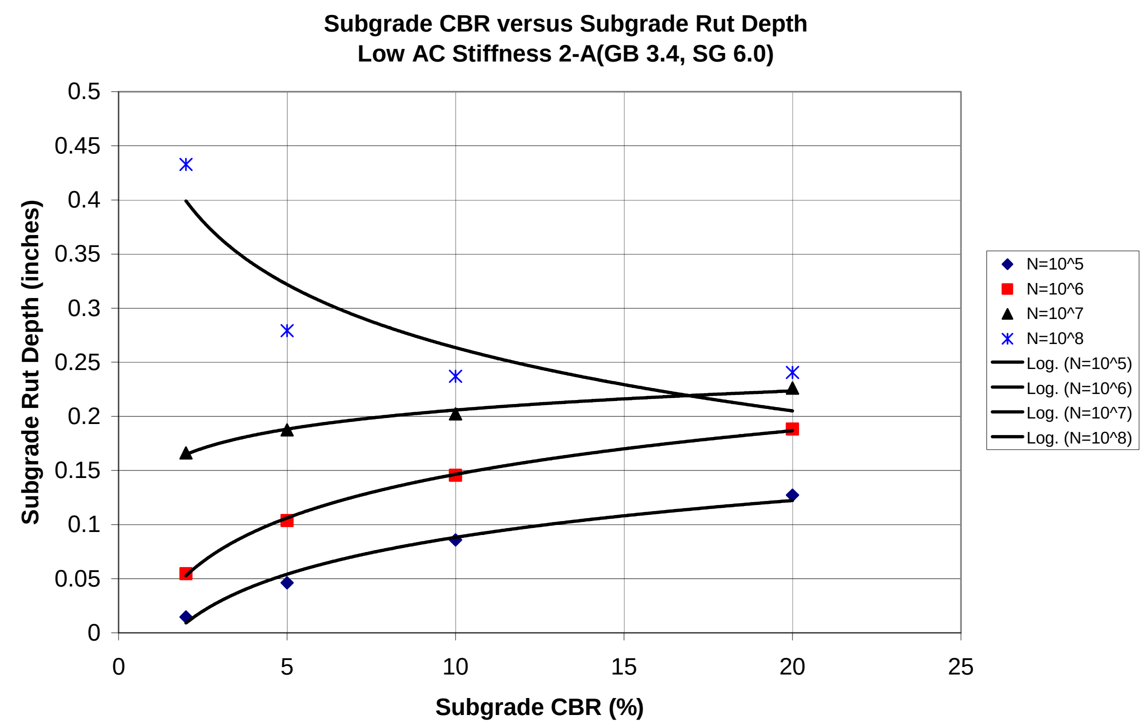
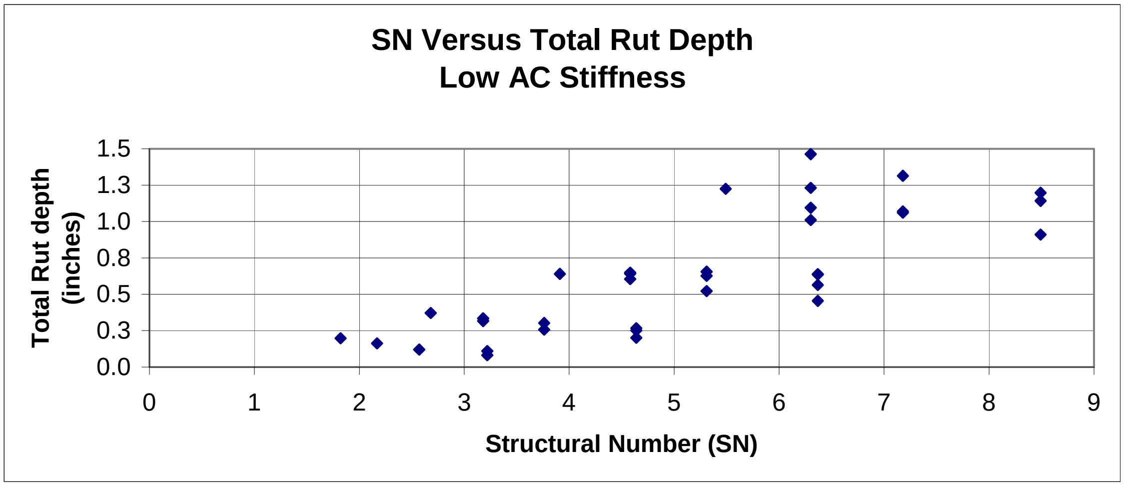
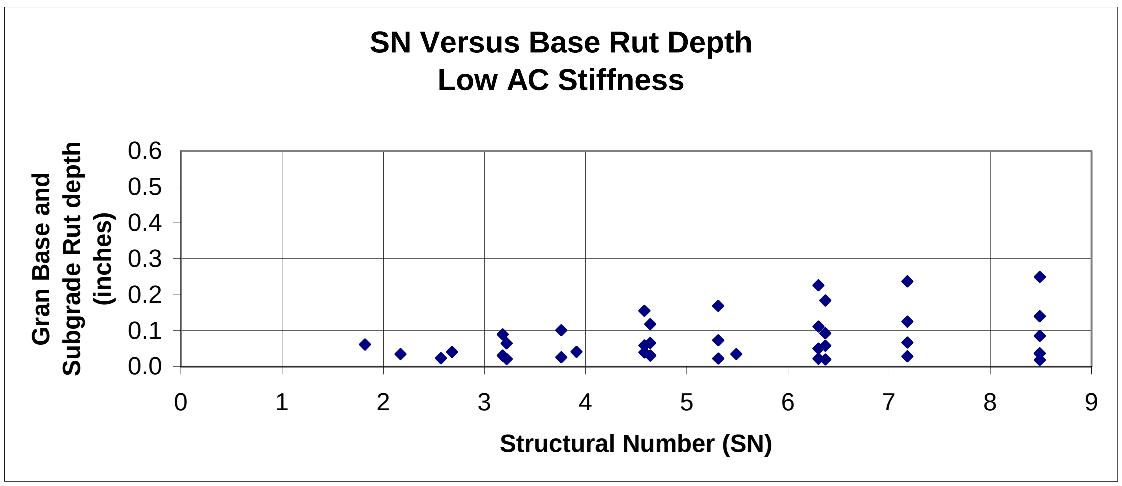


Figure D-146 Average Subgrade Rut Depth versus Subgrade CBR (%) Set 2-A





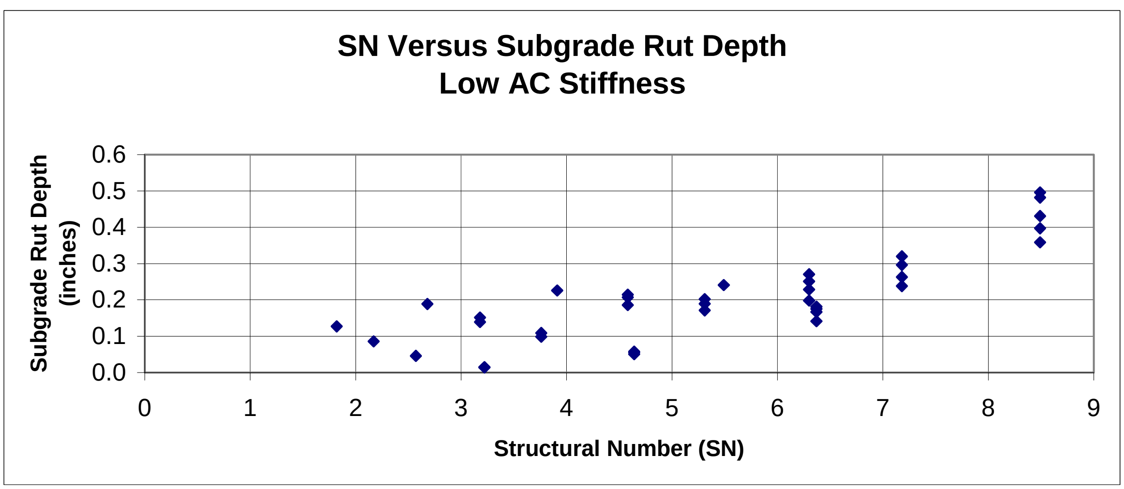
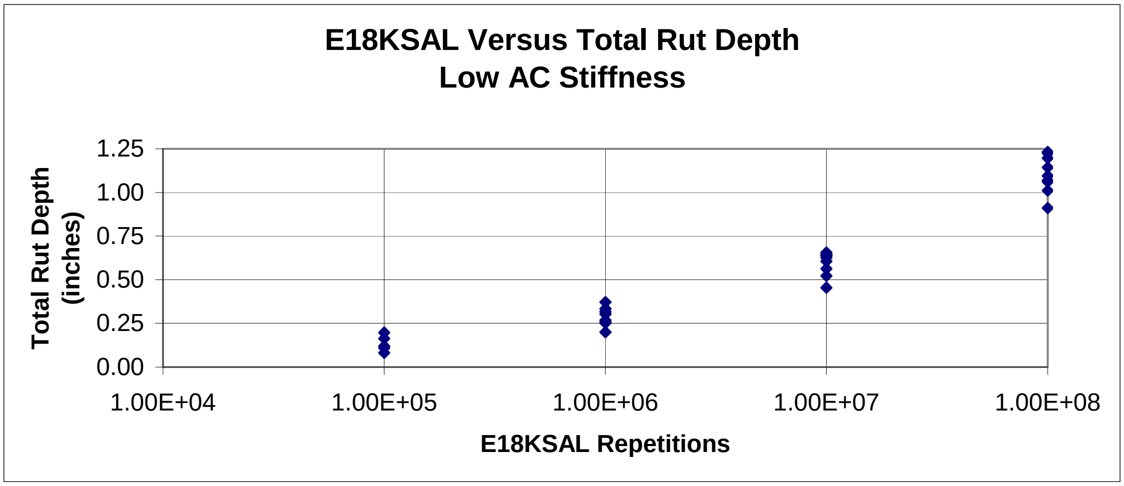
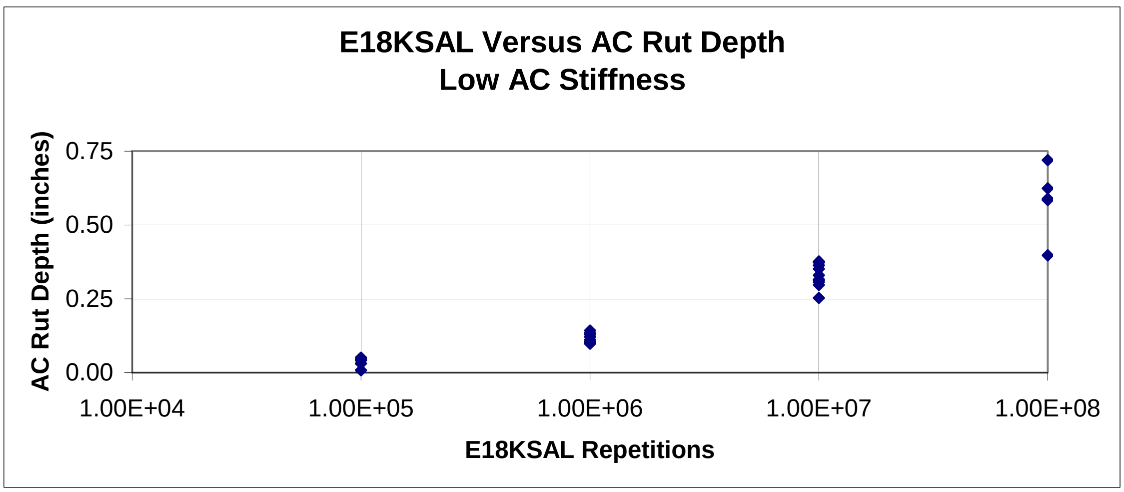


Figure D-147 Rut Depths versus Structural Number Set 2-A





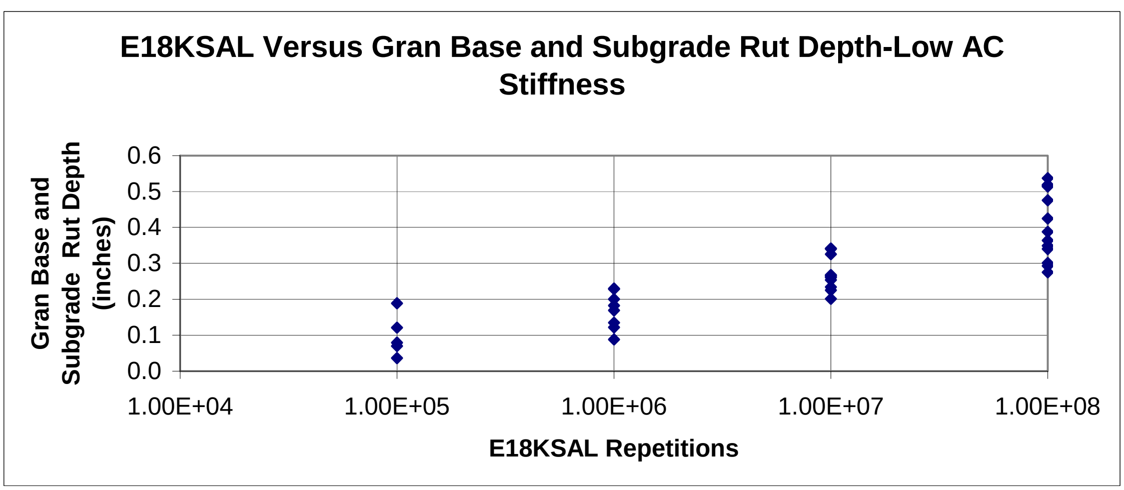
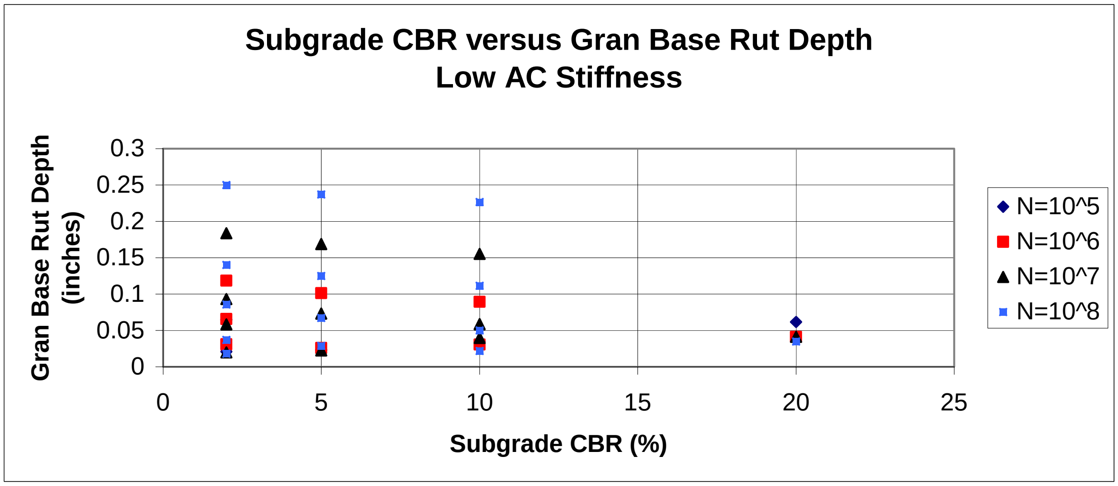


Figure D-148 Rut Depths versus 18KESAL Repetitions Set 2-A



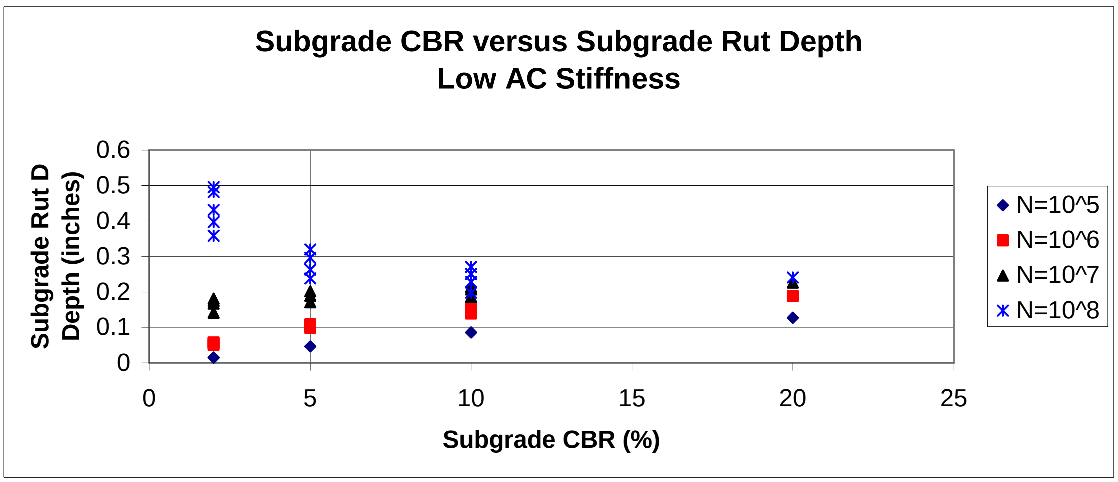


Figure D-149 Base / Subgrade Rut Depths versus Subgrade CBR (All data) Set 2-A

Table D-73 AASHTO Study Data – Set 3-A (β_{acr1} = 0.508, β_{acr2} = 0.9, β_{acr3} = 1.2, β_{GB} = 3.0, β_{SG} = 6.1)

				Rut Depth Value			
Hac	***CBRsg***	***N Design***	***SN***	***AC***	***GB***	***SG***	***Total***
2	2	1.00E+05	3.22	0.047	0.082	0.081	0.210
4	2	1.00E+05	3.22	0.070	0.032	0.089	0.190
3	5	1.00E+05	2.57	0.078	0.035	0.149	0.262
2	10	1.00E+05	2.17	0.065	0.051	0.195	0.310
1	20	1.00E+05	1.82	0.012	0.090	0.226	0.328
			Average	***0.054***	***0.058***	***0.148***	***0.260***
2	2	1.00E+06	4.64	0.152	0.130	0.115	0.396
4	2	1.00E+06	4.64	0.199	0.072	0.127	0.399
6	2	1.00E+06	4.64	0.172	0.037	0.137	0.346
2	5	1.00E+06	3.76	0.157	0.111	0.168	0.436
5	5	1.00E+06	3.76	0.187	0.031	0.193	0.412
2	10	1.00E+06	3.18	0.162	0.099	0.201	0.462
4	10	1.00E+06	3.18	0.206	0.037	0.230	0.473
3	20	1.00E+06	2.68	0.219	0.049	0.253	0.521
			Average	***0.182***	***0.071***	***0.178***	***0.431***
2	2	1.00E+07	6.37	0.481	0.177	0.143	0.802
5	2	1.00E+07	6.37	0.577	0.091	0.171	0.839
7	2	1.00E+07	6.37	0.507	0.057	0.183	0.748
10	2	1.00E+07	6.37	0.390	0.020	0.201	0.611
2	5	1.00E+07	5.31	0.486	0.164	0.174	0.824
5	5	1.00E+07	5.31	0.558	0.072	0.198	0.829
8	5	1.00E+07	5.31	0.458	0.023	0.226	0.706
2	10	1.00E+07	4.58	0.472	0.151	0.192	0.815
5	10	1.00E+07	4.58	0.580	0.058	0.223	0.860
6	10	1.00E+07	4.58	0.541	0.040	0.235	0.816
5	20	1.00E+07	3.91	0.575	0.042	0.249	0.865
			Average	***0.511***	***0.081***	***0.200***	***0.792***
2	2	1.00E+08	8.49	0.906	0.219	0.178	1.303
5	2	1.00E+08	8.49	1.820	0.124	0.198	2.143
8	2	1.00E+08	8.49	1.522	0.076	0.218	1.817
12	2	1.00E+08	8.49	0.960	0.033	0.257	1.250
14	2	1.00E+08	8.49	0.611	0.017	0.275	0.903
2	5	1.00E+08	7.18	0.901	0.209	0.162	1.273
5	5	1.00E+08	7.18	1.760	0.111	0.181	2.052
8	5	1.00E+08	7.18	1.462	0.060	0.212	1.734
11	5	1.00E+08	7.18	1.108	0.026	0.240	1.374
2	10	1.00E+08	6.3	0.900	0.201	0.158	1.259
5	10	1.00E+08	6.3	1.726	0.100	0.187	2.013
8	10	1.00E+08	6.3	1.432	0.045	0.214	1.690
10	10	1.00E+08	6.3	1.234	0.020	0.236	1.490
8	20	1.00E+08	5.49	1.461	0.031	0.227	1.719
			Average	***1.272***	***0.091***	***0.210***	***1.573***

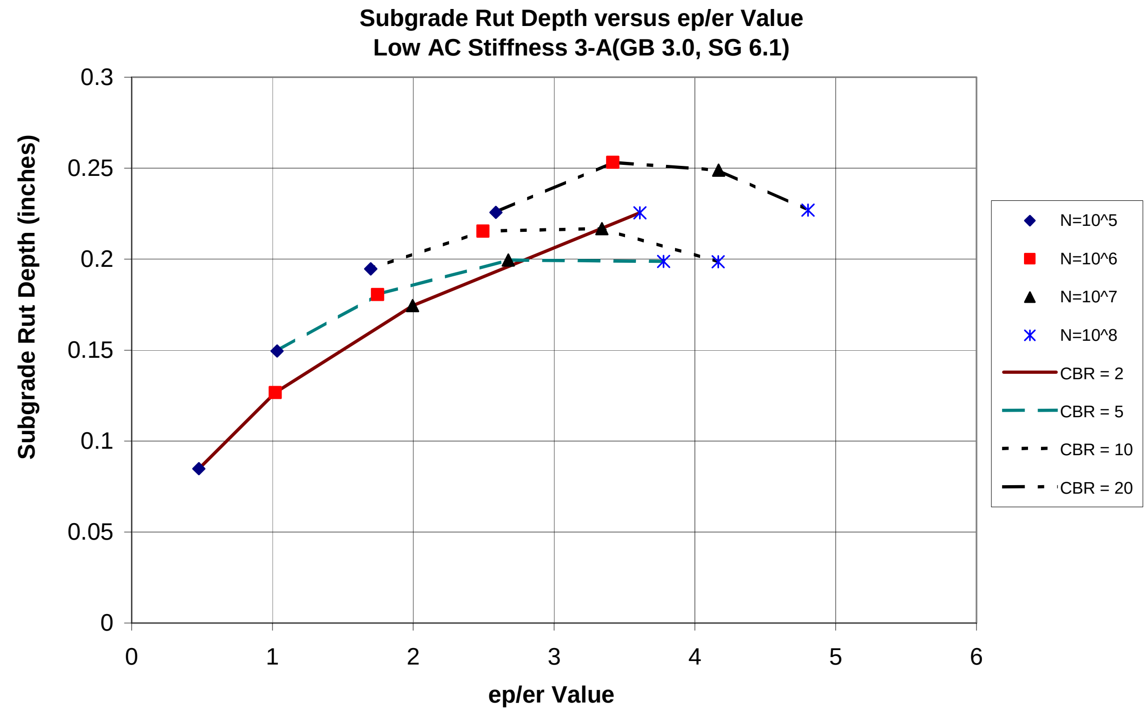


Figure D-150 Subgrade Rut Depth versus ep/er Value Set 3-A

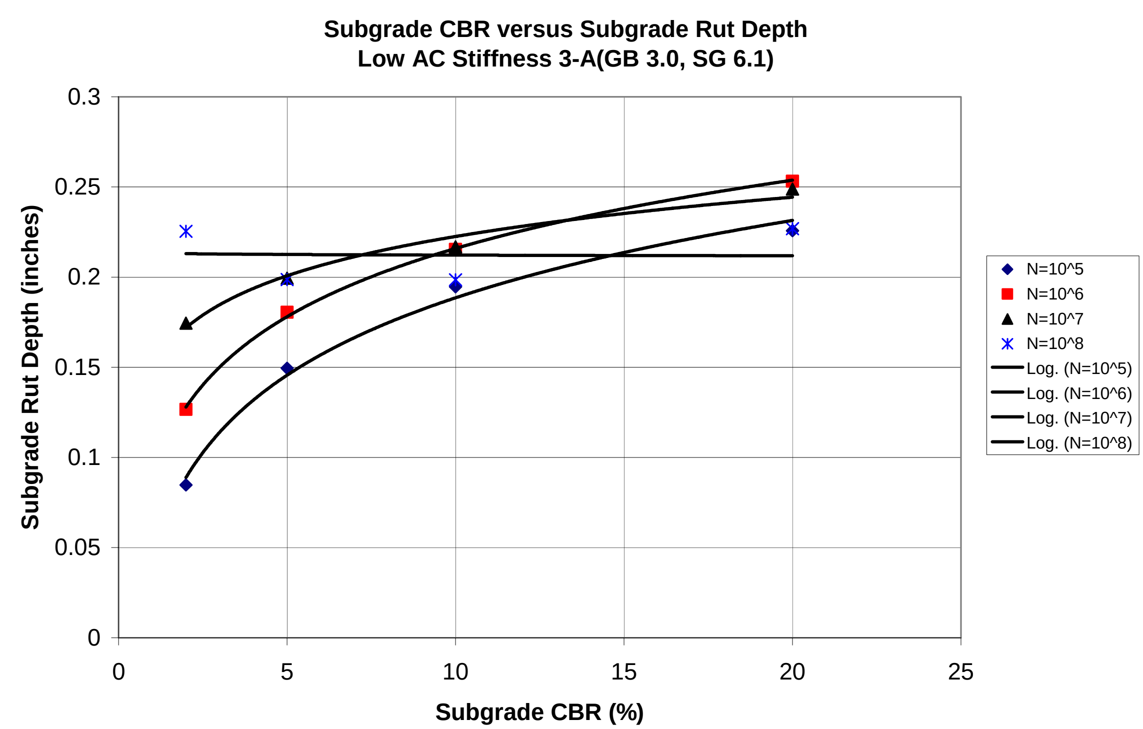
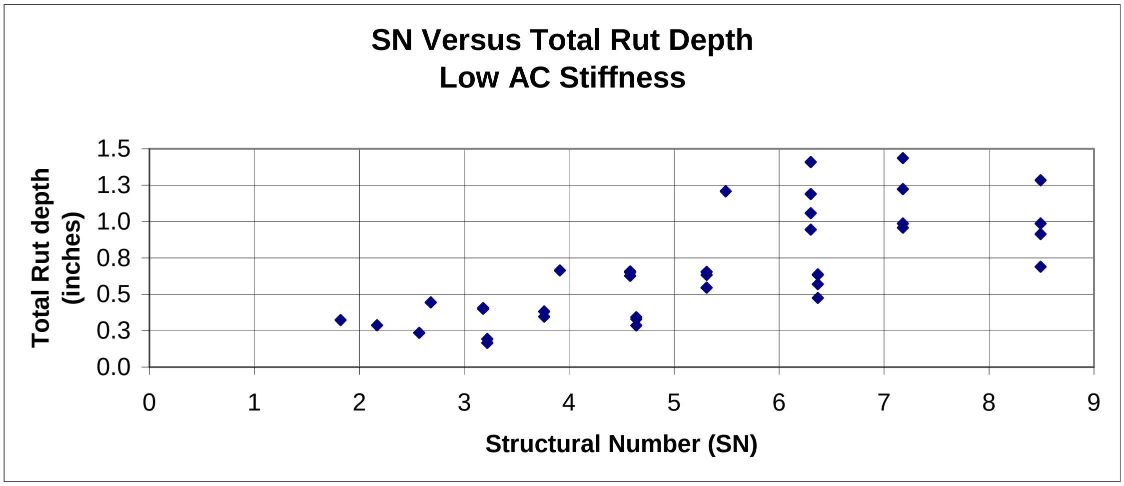
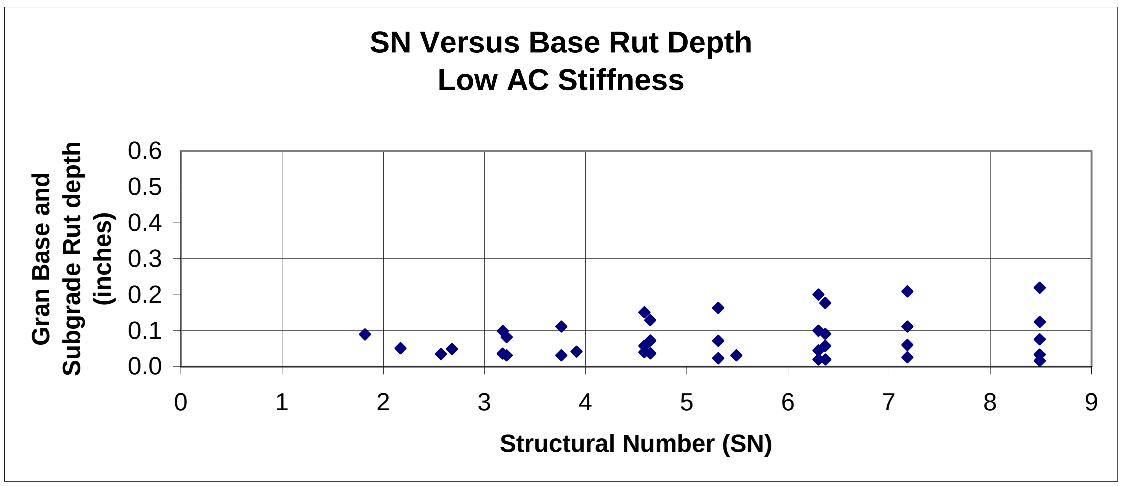


Figure D-151 Average Subgrade Rut Depth versus Subgrade CBR (%) Set 3-A





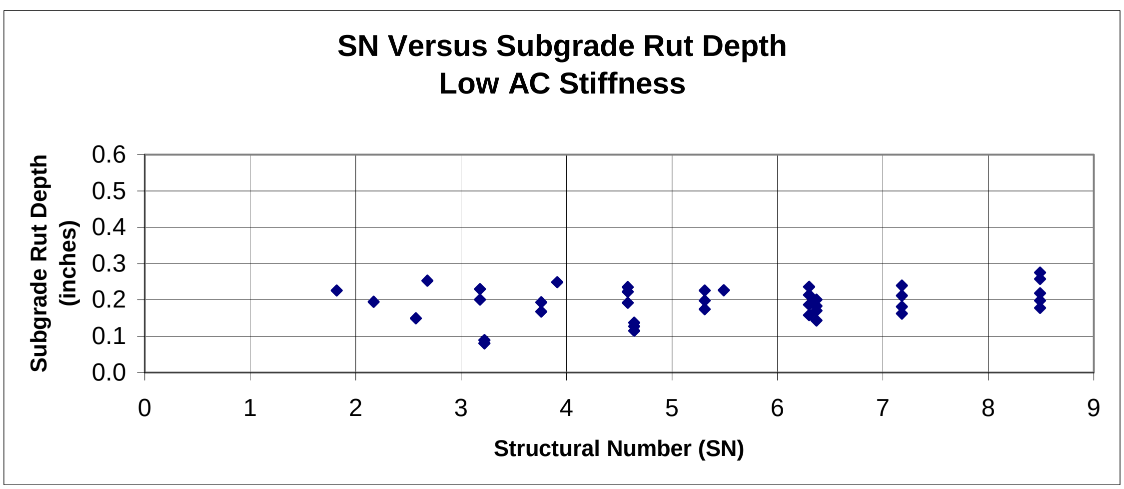
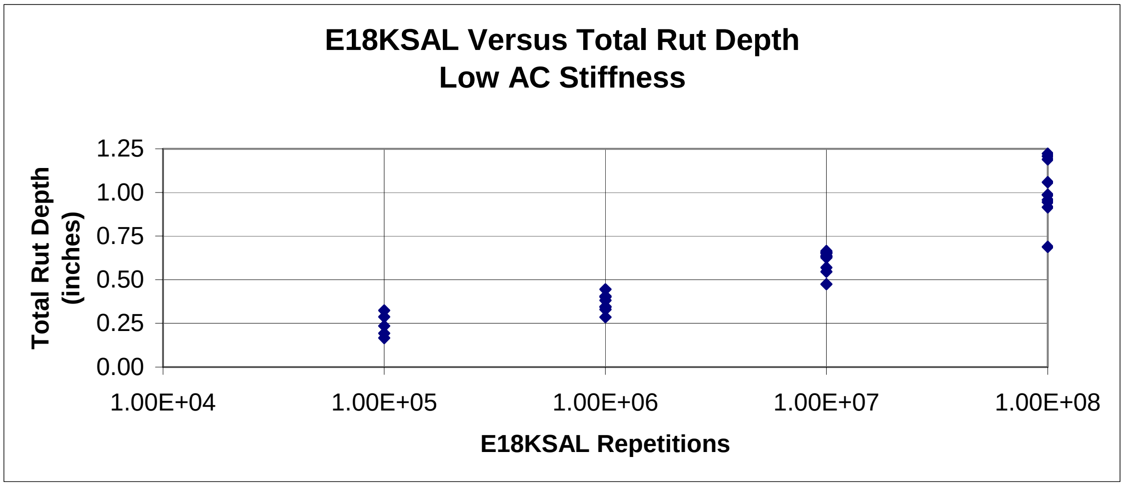
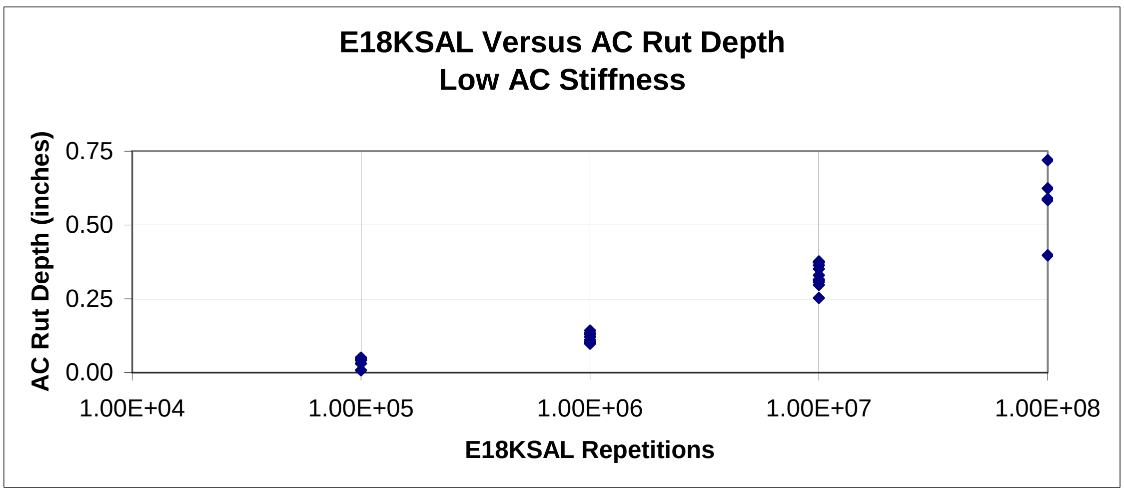


Figure D-152 Rut Depths versus Structural Number Set 3-A





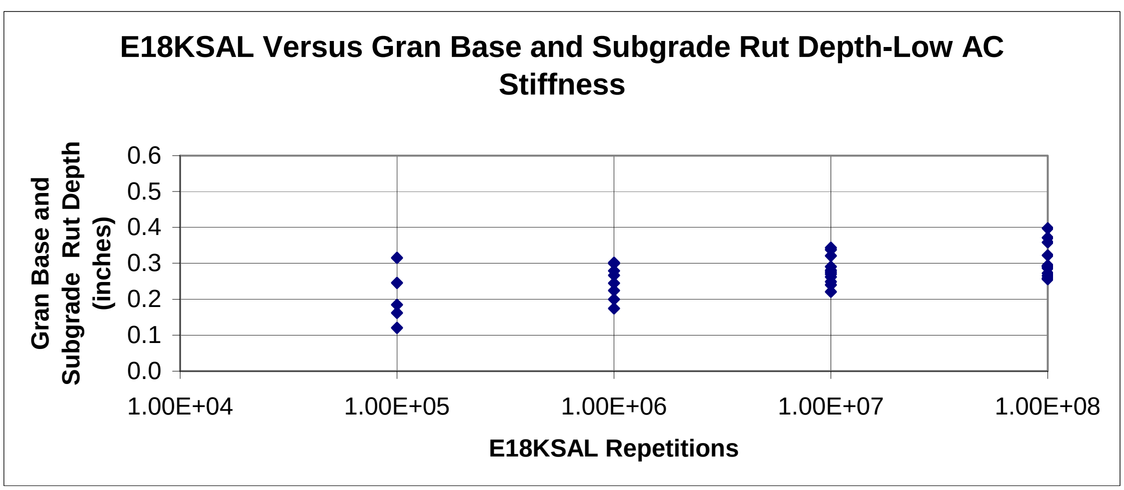
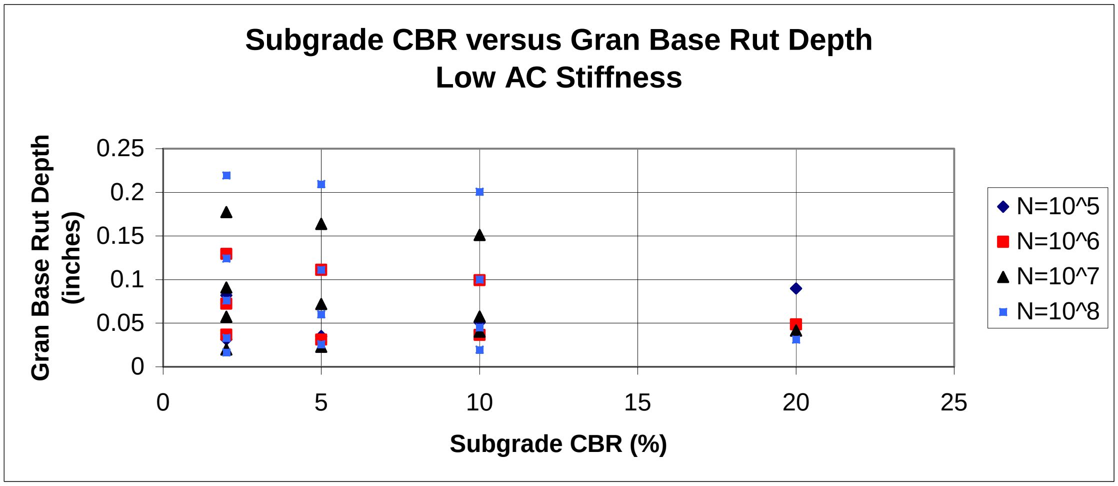


Figure D-153 Rut Depths versus 18KESAL Repetitions Set 3-A



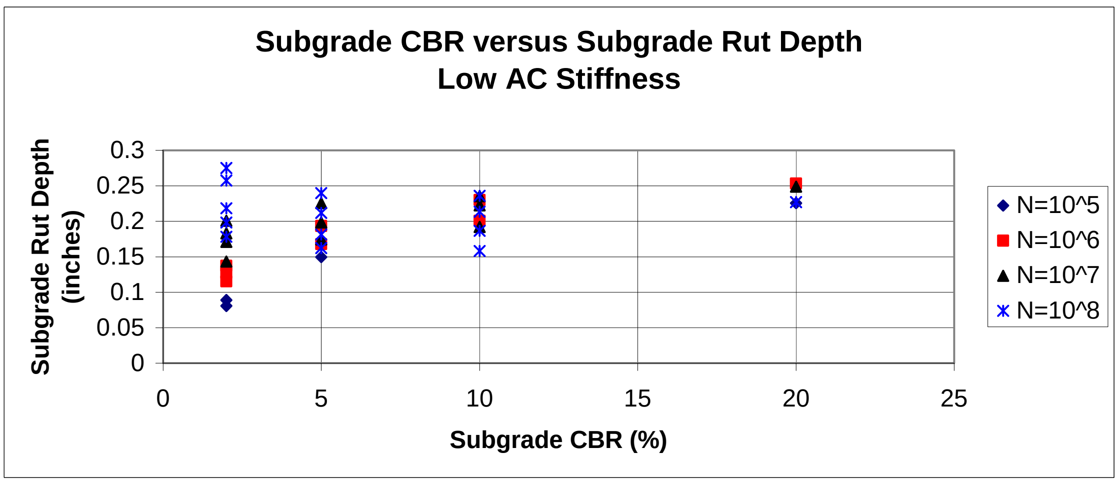


Figure D-154 Base / Subgrade Rut Depths versus Subgrade CBR (All data) Set 3-A

Table D-74 AASHTO Study Data – Set 1-2-A (β_{acr1} = 0.508, β_{acr2} = 0.9, β_{acr3} = 1.2, β_{GB} = 3.3, β_{SG} = 6.25)

				Rut Depth Value			
Hac	***CBRsg***	***N Design***	***SN***	***AC***	***GB***	***SG***	***Total***
2	2	1.00E+05	3.22	0.047	0.070	0.025	0.142
4	2	1.00E+05	3.22	0.070	0.024	0.027	0.120
3	5	1.00E+05	2.57	0.078	0.027	0.069	0.173
2	10	1.00E+05	2.17	0.065	0.039	0.114	0.217
1	20	1.00E+05	1.82	0.012	0.069	0.157	0.238
			Average	***0.054***	***0.046***	***0.078***	***0.178***
2	2	1.00E+06	4.64	0.152	0.122	0.068	0.341
4	2	1.00E+06	4.64	0.199	0.068	0.074	0.342
6	2	1.00E+06	4.64	0.172	0.033	0.077	0.282
2	5	1.00E+06	3.76	0.157	0.105	0.121	0.382
5	5	1.00E+06	3.76	0.187	0.028	0.133	0.348
2	10	1.00E+06	3.18	0.162	0.093	0.161	0.415
4	10	1.00E+06	3.18	0.206	0.033	0.177	0.416
3	20	1.00E+06	2.68	0.219	0.043	0.213	0.476
			Average	***0.182***	***0.065***	***0.128***	***0.375***
2	2	1.00E+07	6.37	0.481	0.183	0.147	0.810
5	2	1.00E+07	6.37	0.577	0.093	0.174	0.844
7	2	1.00E+07	6.37	0.507	0.059	0.183	0.749
10	2	1.00E+07	6.37	0.390	0.020	0.192	0.602
2	5	1.00E+07	5.31	0.486	0.168	0.178	0.832
5	5	1.00E+07	5.31	0.558	0.074	0.198	0.830
8	5	1.00E+07	5.31	0.458	0.023	0.215	0.696
2	10	1.00E+07	4.58	0.472	0.155	0.194	0.821
5	10	1.00E+07	4.58	0.580	0.059	0.218	0.856
6	10	1.00E+07	4.58	0.541	0.040	0.227	0.807
5	20	1.00E+07	3.91	0.575	0.042	0.240	0.856
			Average	***0.511***	***0.083***	***0.197***	***0.791***
2	2	1.00E+08	8.49	0.906	0.241	0.299	1.447
5	2	1.00E+08	8.49	1.820	0.136	0.332	2.288
8	2	1.00E+08	8.49	1.522	0.083	0.361	1.966
12	2	1.00E+08	8.49	0.960	0.036	0.408	1.404
14	2	1.00E+08	8.49	0.611	0.018	0.424	1.053
2	5	1.00E+08	7.18	0.901	0.230	0.219	1.350
5	5	1.00E+08	7.18	1.760	0.121	0.243	2.124
8	5	1.00E+08	7.18	1.462	0.065	0.275	1.803
11	5	1.00E+08	7.18	1.108	0.028	0.301	1.437
2	10	1.00E+08	6.3	0.900	0.219	0.191	1.311
5	10	1.00E+08	6.3	1.726	0.108	0.222	2.056
8	10	1.00E+08	6.3	1.432	0.049	0.246	1.727
10	10	1.00E+08	6.3	1.234	0.021	0.267	1.523
8	20	1.00E+08	5.49	1.461	0.034	0.244	1.738
			Average	***1.272***	***0.099***	***0.288***	***1.659***

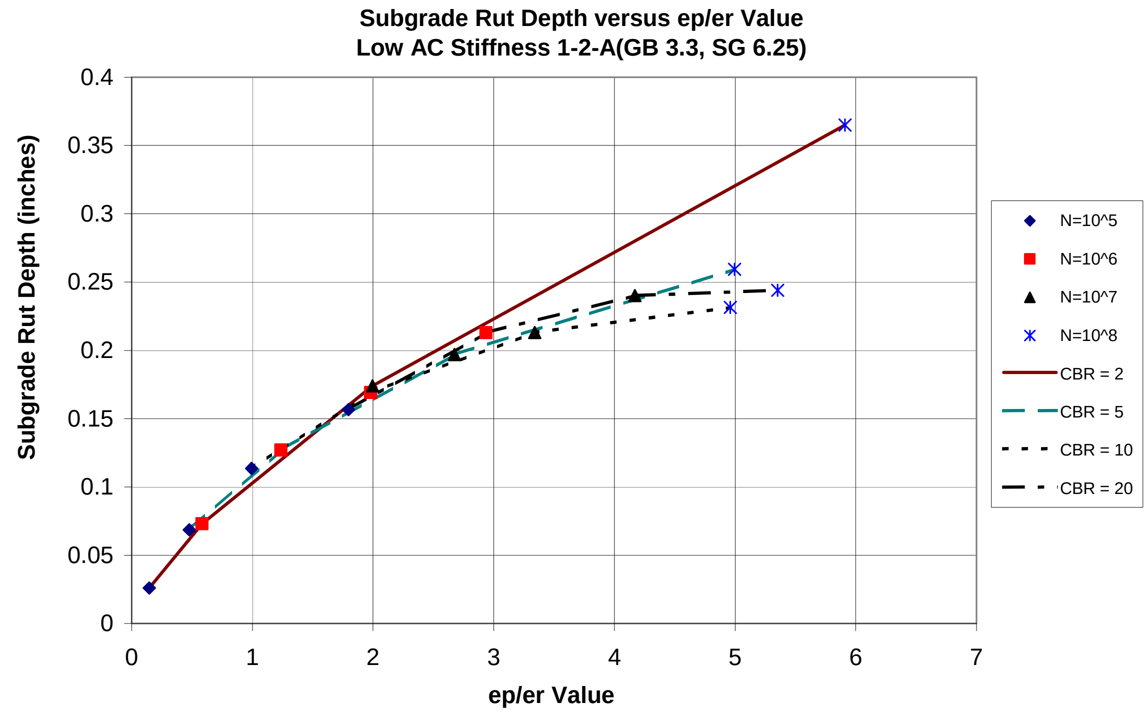


Figure D-155 Subgrade Rut Depth versus ep/er Value Set 1-2-A

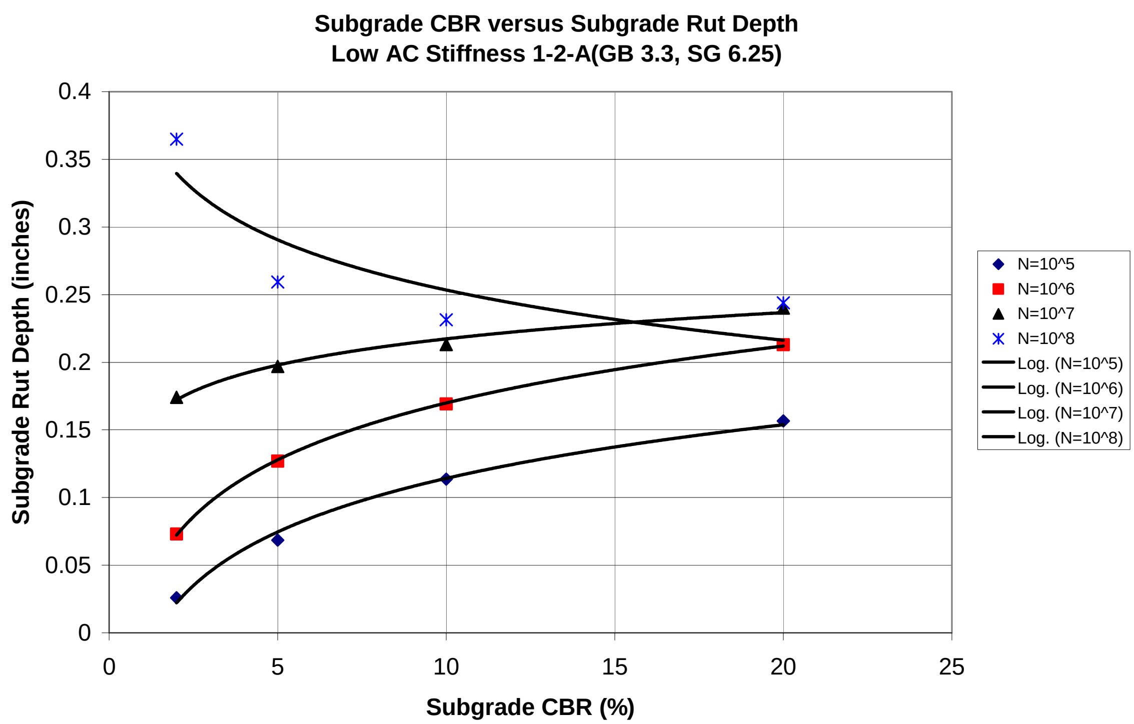
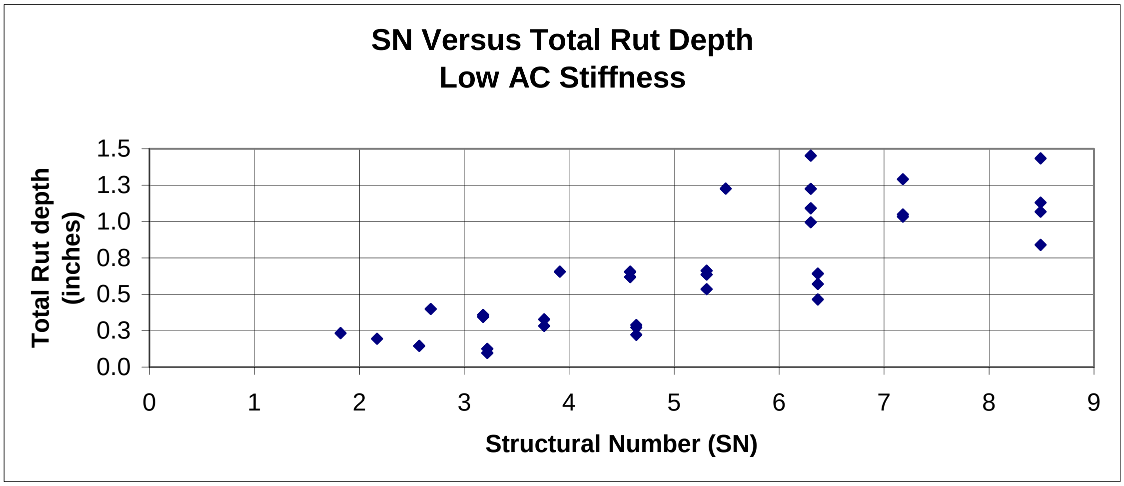
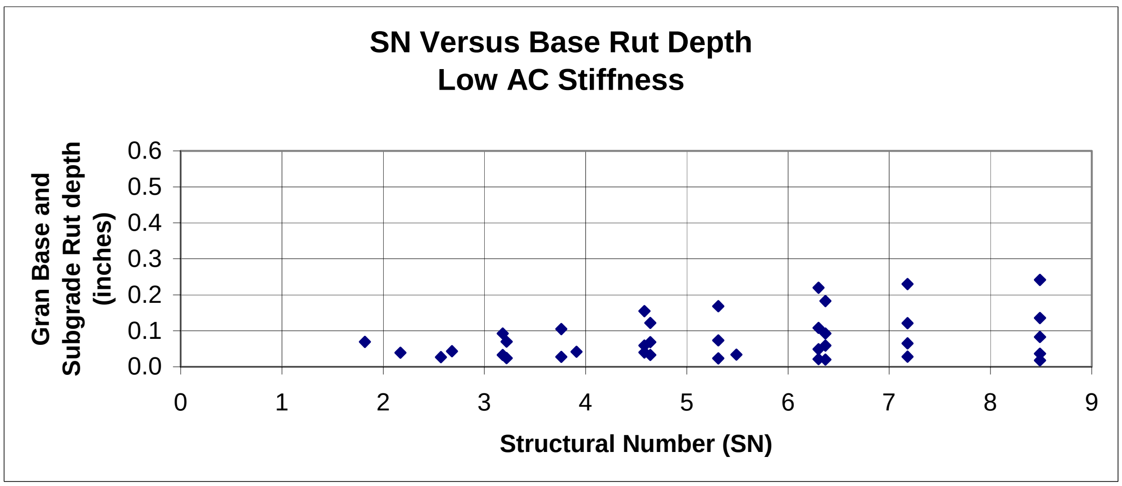


Figure D-156 Average Subgrade Rut Depth versus Subgrade CBR (%) Set 1-2-A





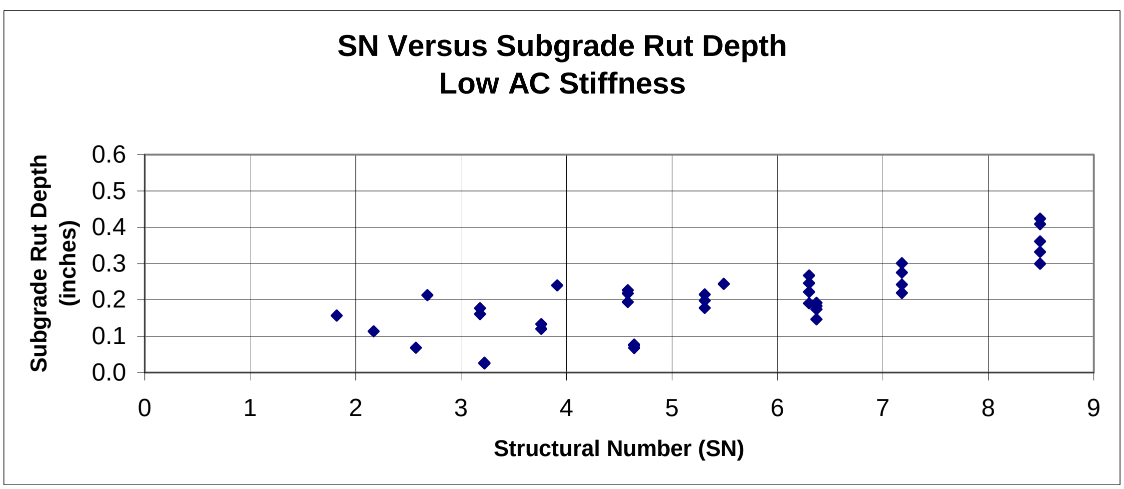
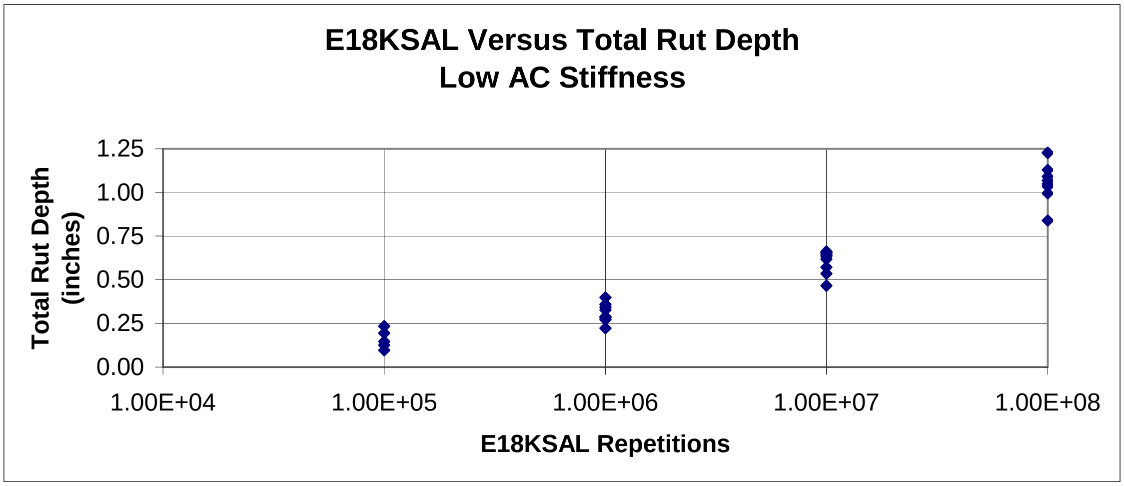
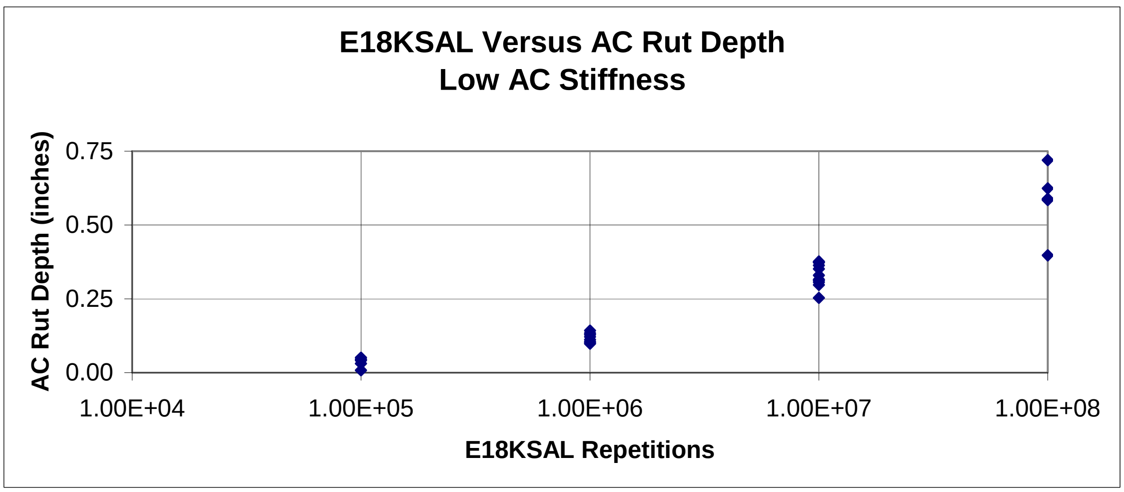


Figure D-157 Rut Depths versus Structural Number Set 1-2-A





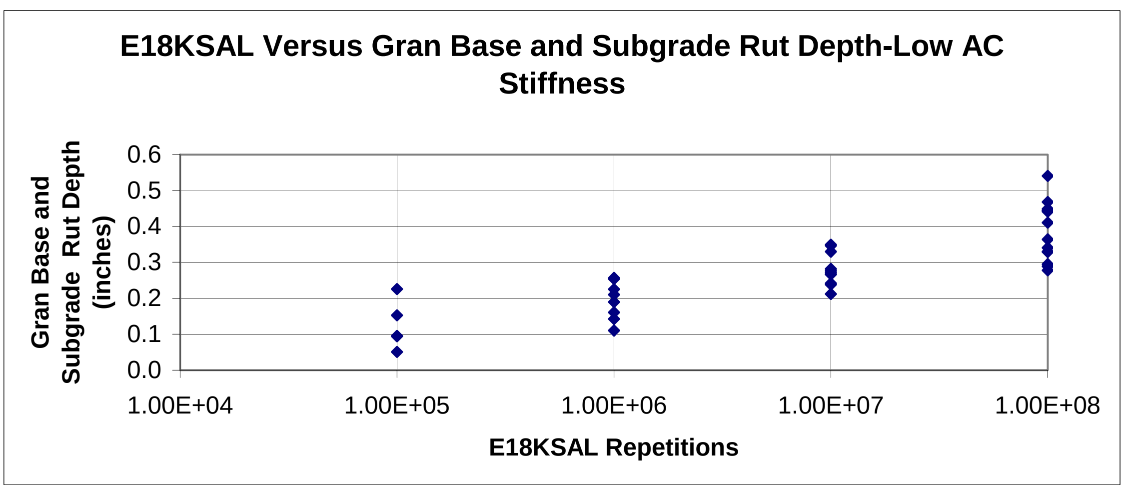
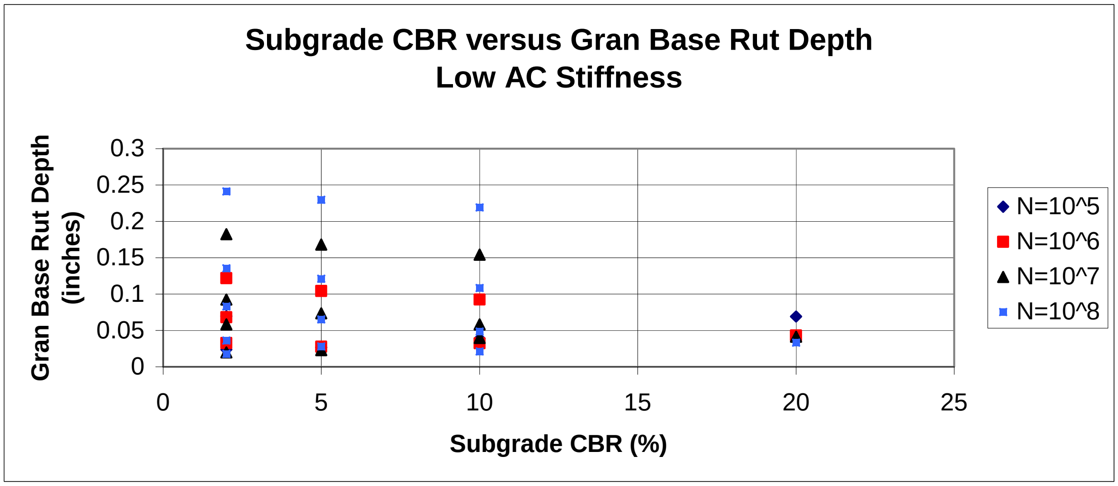


Figure D-158 Rut Depths versus 18KESAL Repetitions Set 1-2-A



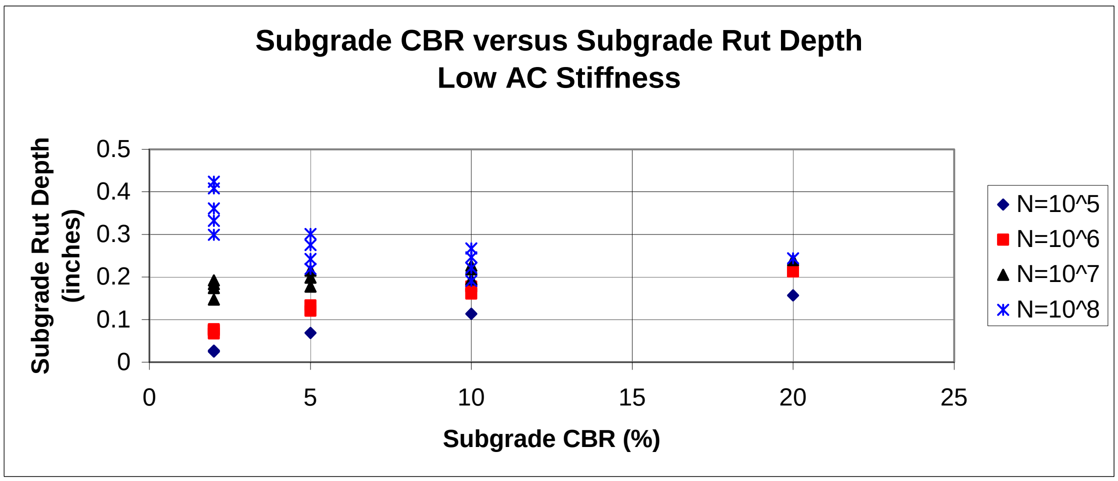


Figure D-159 Base / Subgrade Rut Depths versus Subgrade CBR (All data) Set 1-2-A

Table D-75 AASHTO Study Data – Set 1-CB (β_{acr1} = 0.508, β_{acr2} = 0.9, β_{acr3} = 1.2, β_{GB} = 2.15, β_{SG} = 1.75)

				Rut Depth Value			
Hac	**CBRsg**	**N Design**	**SN**	**AC**	**GB**	**SG**	**Total**
2	2	1.00E+05	3.22	0.047	0.035	0.029	0.112
4	2	1.00E+05	3.22	0.070	0.014	0.031	0.115
3	5	1.00E+05	2.57	0.078	0.016	0.047	0.141
2	10	1.00E+05	2.17	0.065	0.025	0.057	0.146
1	20	1.00E+05	1.82	0.012	0.044	0.060	0.116
			Average	***0.054***	***0.027***	***0.045***	***0.126***
2	2	1.00E+06	4.64	0.152	0.093	0.086	0.331
4	2	1.00E+06	4.64	0.199	0.049	0.095	0.343
6	2	1.00E+06	4.64	0.172	0.028	0.099	0.298
2	5	1.00E+06	3.76	0.157	0.076	0.104	0.338
5	5	1.00E+06	3.76	0.187	0.023	0.114	0.324
2	10	1.00E+06	3.18	0.162	0.069	0.108	0.339
4	10	1.00E+06	3.18	0.206	0.027	0.117	0.350
3	20	1.00E+06	2.68	0.219	0.037	0.111	0.367
			Average	***0.182***	***0.050***	***0.104***	***0.336***
2	2	1.00E+07	6.37	0.481	0.180	0.207	0.868
5	2	1.00E+07	6.37	0.577	0.089	0.244	0.911
7	2	1.00E+07	6.37	0.507	0.054	0.257	0.818
10	2	1.00E+07	6.37	0.390	0.022	0.267	0.679
2	5	1.00E+07	5.31	0.486	0.163	0.186	0.835
5	5	1.00E+07	5.31	0.558	0.067	0.206	0.832
8	5	1.00E+07	5.31	0.458	0.025	0.220	0.702
2	10	1.00E+07	4.58	0.472	0.146	0.162	0.781
5	10	1.00E+07	4.58	0.580	0.054	0.179	0.813
6	10	1.00E+07	4.58	0.541	0.043	0.184	0.767
5	20	1.00E+07	3.91	0.575	0.045	0.153	0.773
			Average	***0.511***	***0.081***	***0.206***	***0.798***
2	2	1.00E+08	8.49	0.906	0.284	0.455	1.645
5	2	1.00E+08	8.49	1.820	0.160	0.505	2.485
8	2	1.00E+08	8.49	1.522	0.096	0.548	2.167
12	2	1.00E+08	8.49	0.960	0.039	0.617	1.616
14	2	1.00E+08	8.49	0.611	0.023	0.639	1.272
2	5	1.00E+08	7.18	0.901	0.267	0.267	1.435
5	5	1.00E+08	7.18	1.760	0.140	0.295	2.195
8	5	1.00E+08	7.18	1.462	0.073	0.332	1.867
11	5	1.00E+08	7.18	1.108	0.036	0.358	1.502
2	10	1.00E+08	6.3	0.900	0.252	0.188	1.341
5	10	1.00E+08	6.3	1.726	0.123	0.217	2.066
8	10	1.00E+08	6.3	1.432	0.053	0.236	1.720
10	10	1.00E+08	6.3	1.234	0.027	0.252	1.514
8	20	1.00E+08	5.49	1.461	0.043	0.181	1.685
			Average	***1.272***	***0.115***	***0.364***	***1.751***

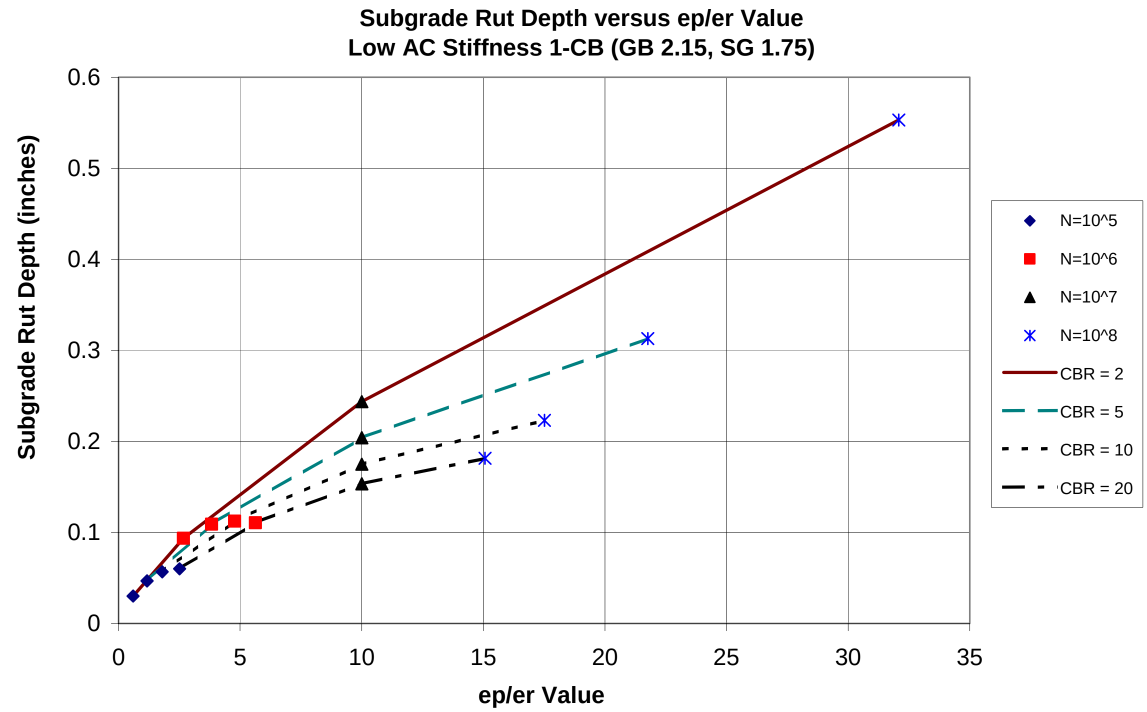


Figure D-160 Subgrade Rut Depth versus ep/er Value Set 1-CB

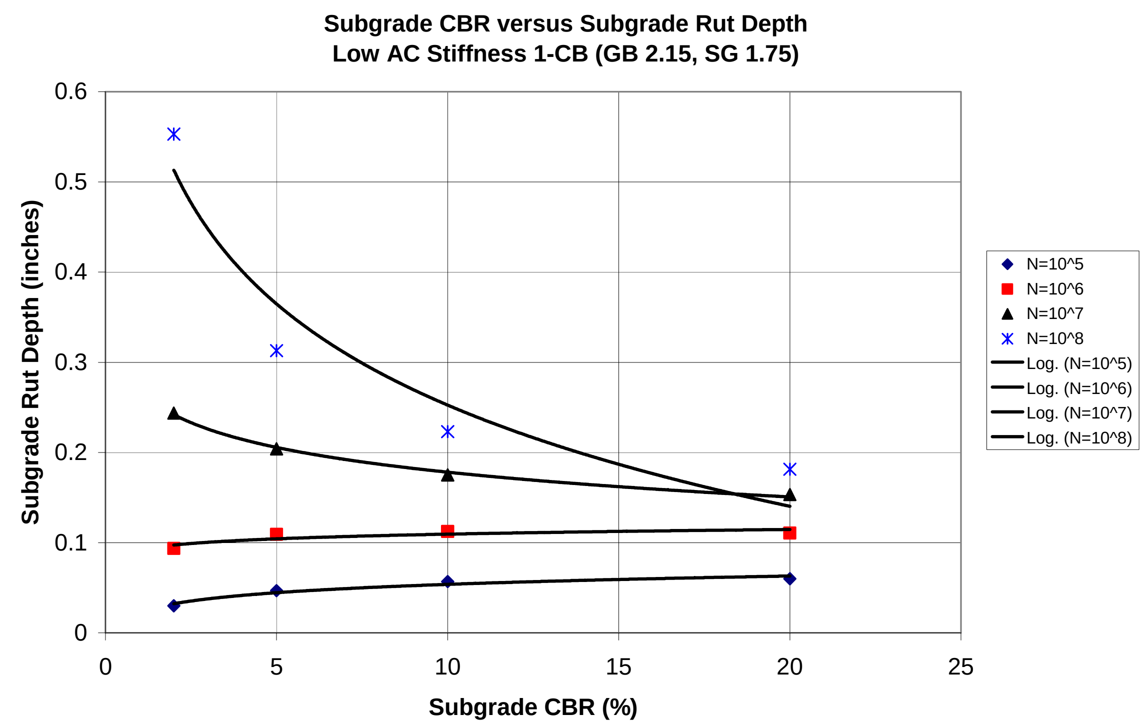
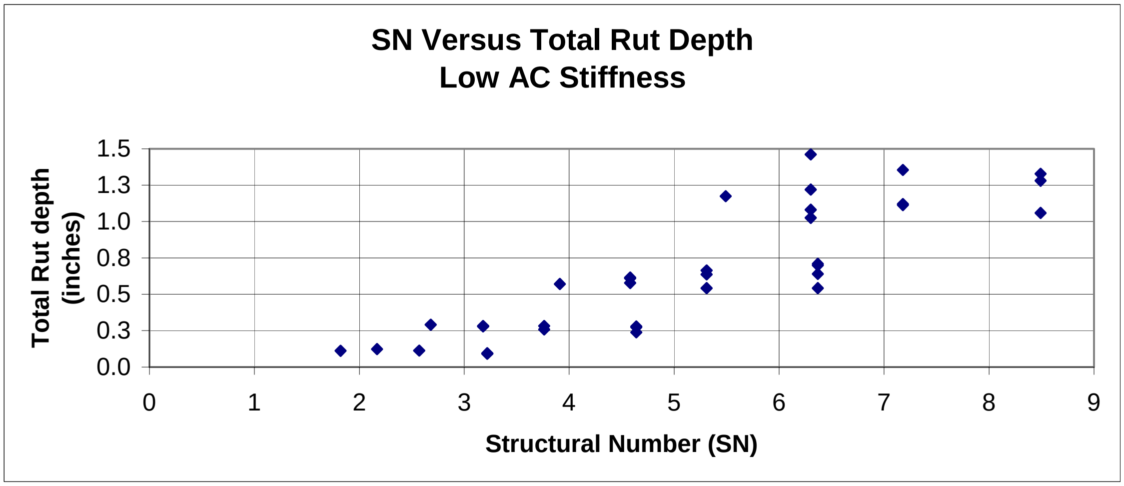
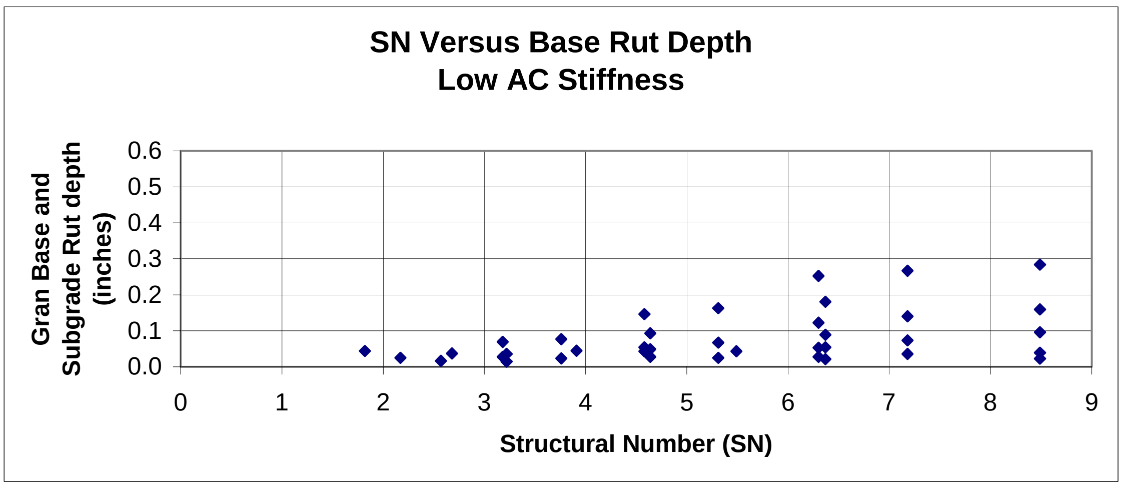


Figure D-161 Average Subgrade Rut Depth versus Subgrade CBR (%) Set 1-CB





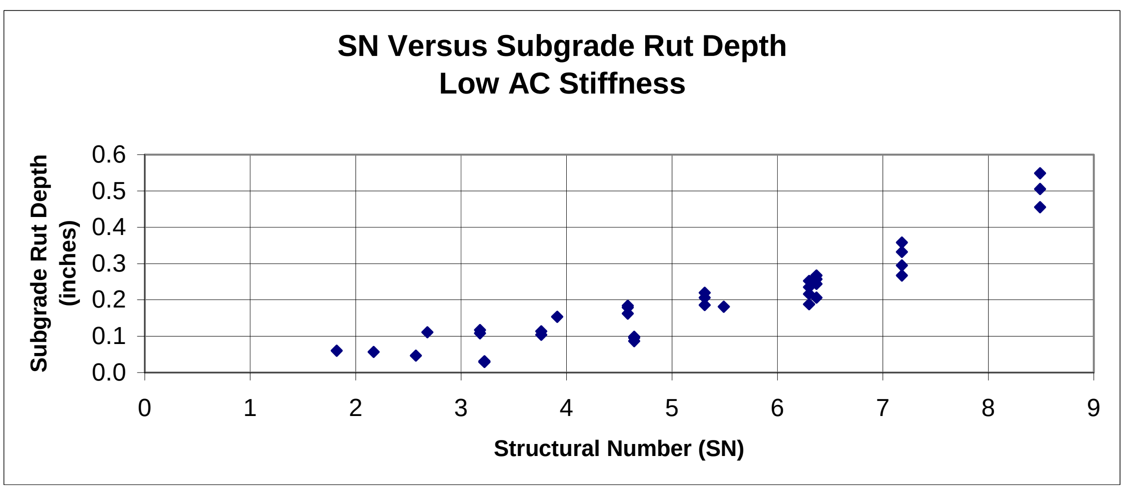
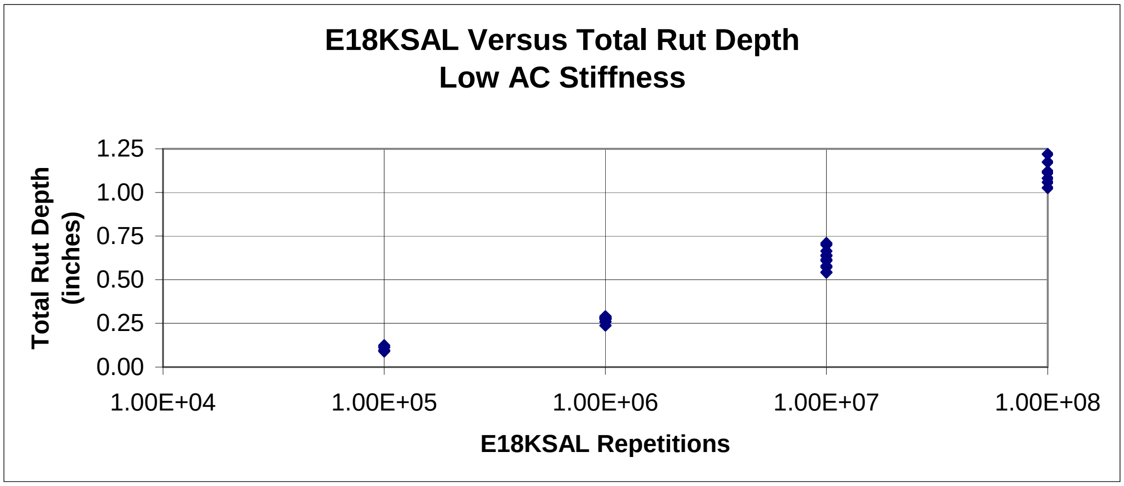
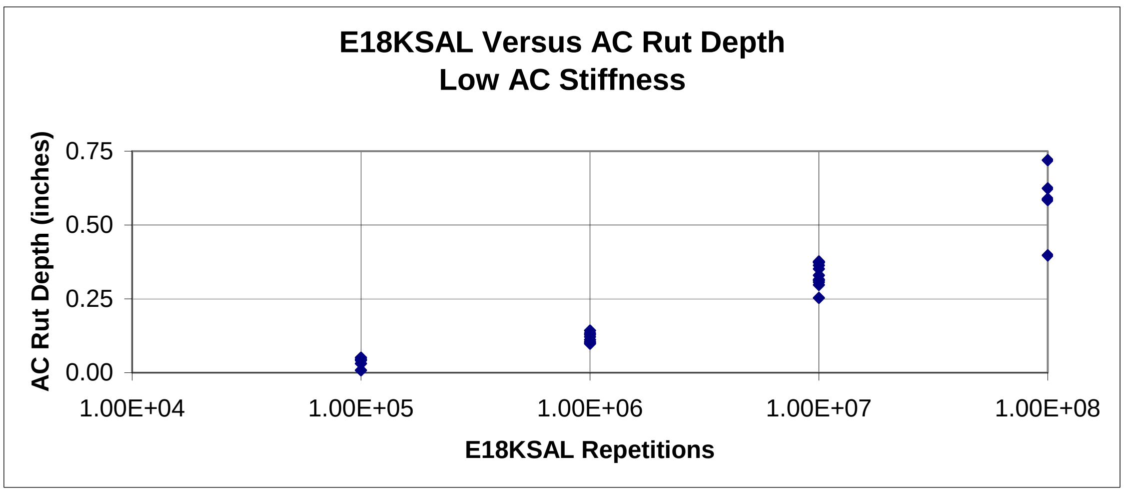


Figure D-162 Rut Depths versus Structural Number Set 1-CB





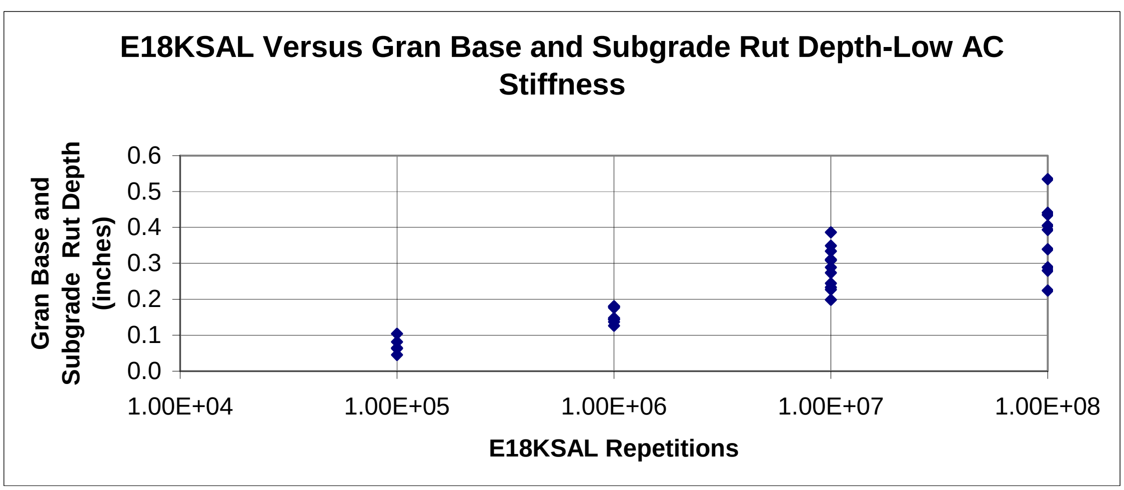
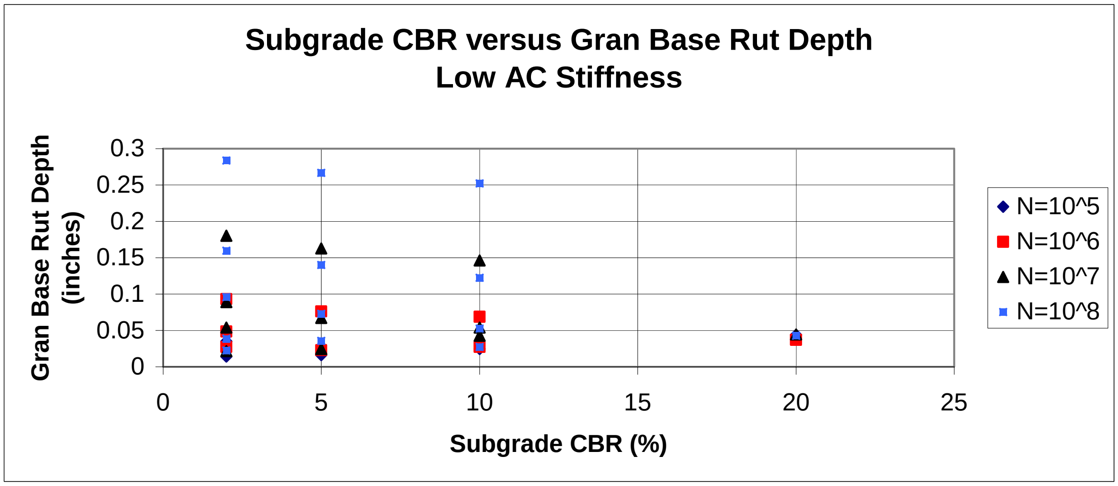


Figure D-163 Rut Depths versus 18KESAL Repetitions Set 1-CB



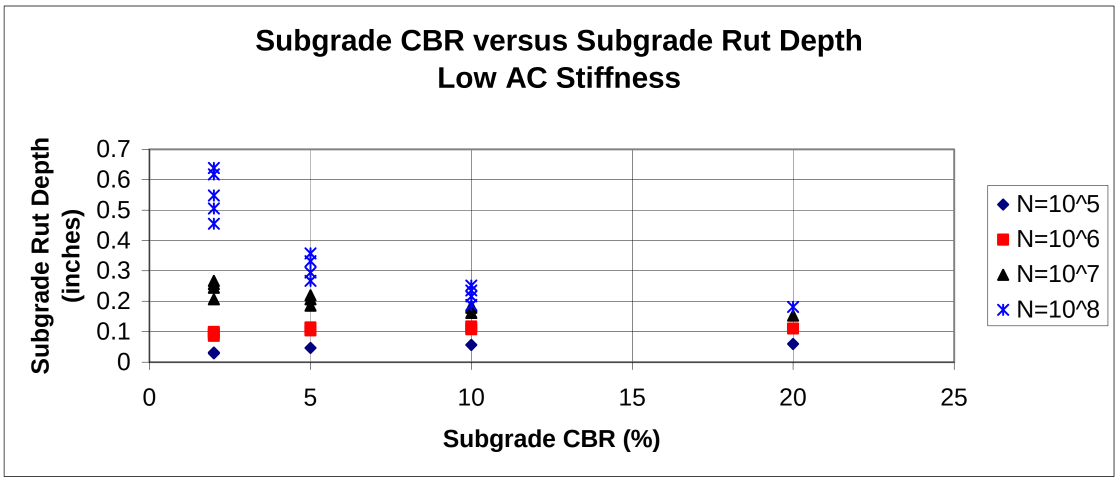


Figure D-164 Base / Subgrade Rut Depths versus Subgrade CBR (All data) Set 1-CB

Table D-76 AASHTO Study Data – Set 2-CB (β_{acr1} = 0.508, β_{acr2} = 0.9, β_{acr3} = 1.2, β_{GB} = 2.0, β_{SG} = 1.85)

				Rut Depth Value			
Hac	***CBRsg***	***N Design***	***SN***	***AC***	***GB***	***SG***	***Total***
2	2	1.00E+05	3.22	0.047	0.049	0.078	0.174
4	2	1.00E+05	3.22	0.070	0.022	0.085	0.177
3	5	1.00E+05	2.57	0.078	0.024	0.102	0.205
2	10	1.00E+05	2.17	0.065	0.036	0.108	0.209
1	20	1.00E+05	1.82	0.012	0.064	0.102	0.179
			Average	***0.054***	***0.039***	***0.095***	***0.189***
2	2	1.00E+06	4.64	0.152	0.105	0.142	0.398
4	2	1.00E+06	4.64	0.199	0.056	0.157	0.412
6	2	1.00E+06	4.64	0.172	0.033	0.166	0.371
2	5	1.00E+06	3.76	0.157	0.086	0.153	0.396
5	5	1.00E+06	3.76	0.187	0.028	0.170	0.385
2	10	1.00E+06	3.18	0.162	0.078	0.147	0.387
4	10	1.00E+06	3.18	0.206	0.033	0.163	0.402
3	20	1.00E+06	2.68	0.219	0.044	0.145	0.409
			Average	***0.182***	***0.058***	***0.155***	***0.395***
2	2	1.00E+07	6.37	0.481	0.177	0.218	0.875
5	2	1.00E+07	6.37	0.577	0.089	0.259	0.925
7	2	1.00E+07	6.37	0.507	0.054	0.275	0.836
10	2	1.00E+07	6.37	0.390	0.022	0.295	0.707
2	5	1.00E+07	5.31	0.486	0.160	0.197	0.843
5	5	1.00E+07	5.31	0.558	0.068	0.221	0.847
8	5	1.00E+07	5.31	0.458	0.025	0.243	0.726
2	10	1.00E+07	4.58	0.472	0.145	0.172	0.789
5	10	1.00E+07	4.58	0.580	0.055	0.194	0.828
6	10	1.00E+07	4.58	0.541	0.044	0.202	0.787
5	20	1.00E+07	3.91	0.575	0.046	0.169	0.789
			Average	***0.511***	***0.080***	***0.222***	***0.814***
2	2	1.00E+08	8.49	0.906	0.252	0.326	1.484
5	2	1.00E+08	8.49	1.820	0.143	0.362	2.325
8	2	1.00E+08	8.49	1.522	0.087	0.396	2.005
12	2	1.00E+08	8.49	0.960	0.035	0.457	1.452
14	2	1.00E+08	8.49	0.611	0.021	0.483	1.115
2	5	1.00E+08	7.18	0.901	0.238	0.218	1.357
5	5	1.00E+08	7.18	1.760	0.126	0.242	2.128
8	5	1.00E+08	7.18	1.462	0.066	0.277	1.805
11	5	1.00E+08	7.18	1.108	0.033	0.307	1.447
2	10	1.00E+08	6.3	0.900	0.225	0.166	1.291
5	10	1.00E+08	6.3	1.726	0.111	0.193	2.030
8	10	1.00E+08	6.3	1.432	0.048	0.215	1.695
10	10	1.00E+08	6.3	1.234	0.025	0.233	1.493
8	20	1.00E+08	5.49	1.461	0.039	0.176	1.675
			Average	***1.272***	***0.104***	***0.289***	***1.664***

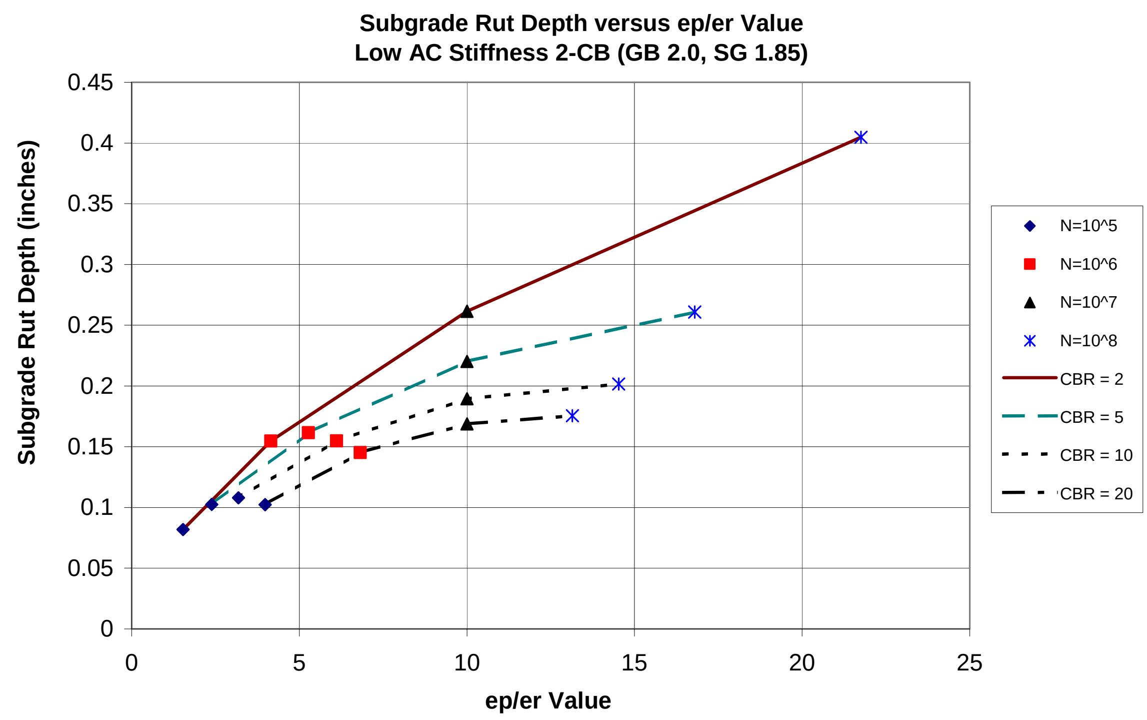


Figure D-165 Subgrade Rut Depth versus ep/er Value Set 2-CB

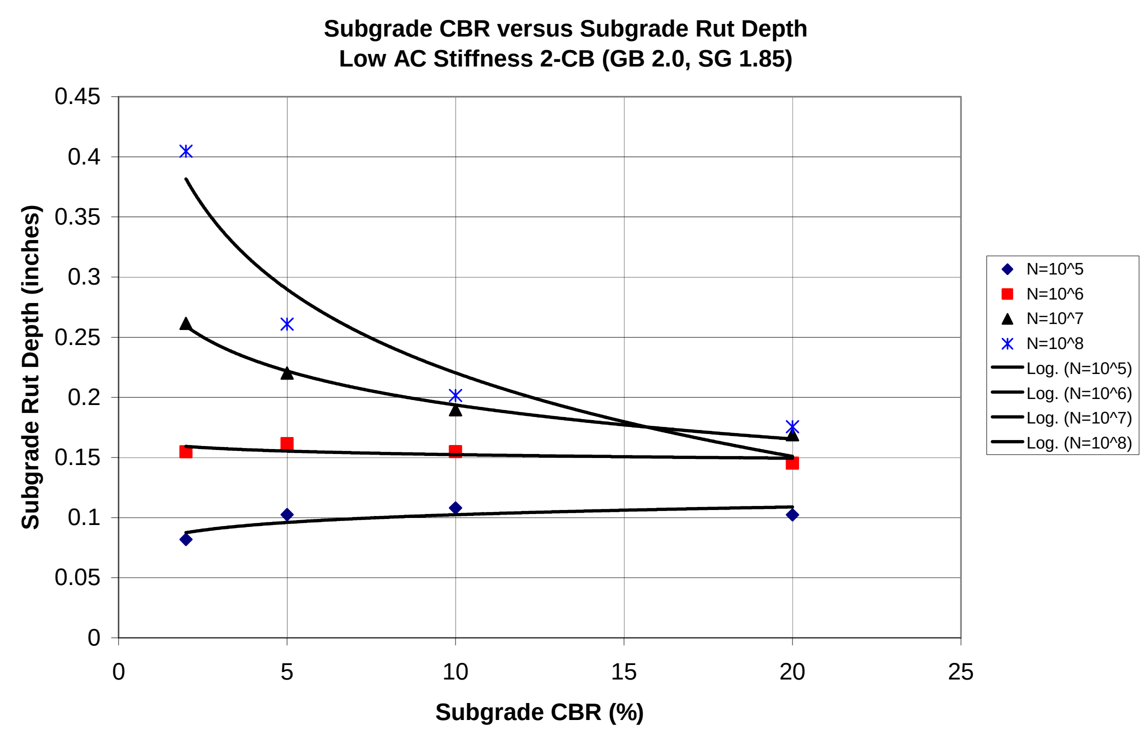
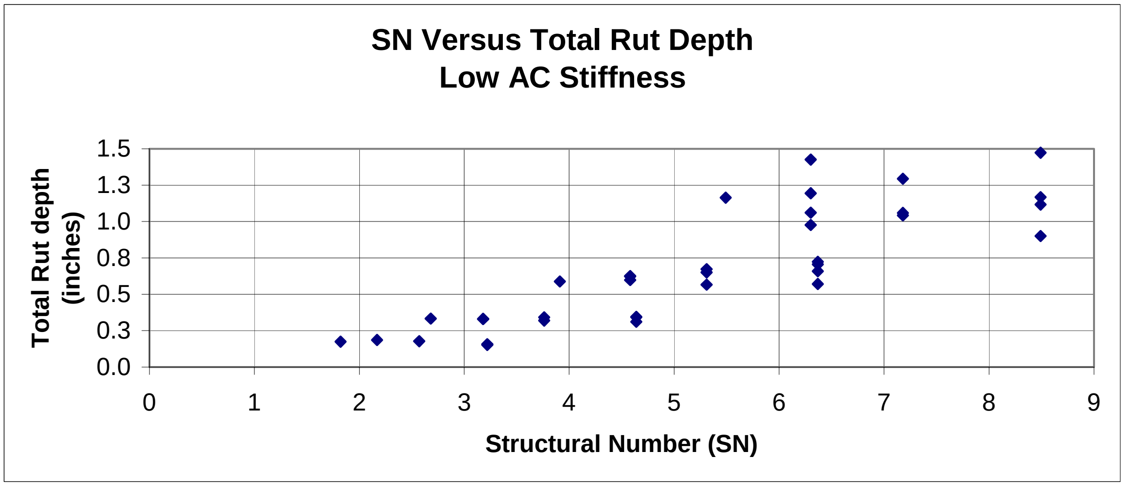
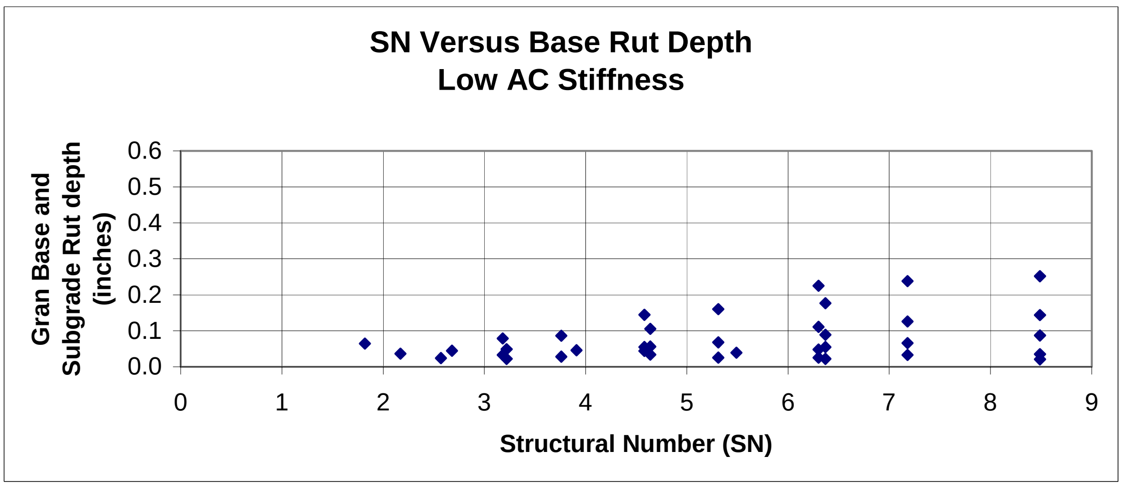


Figure D-166 Average Subgrade Rut Depth versus Subgrade CBR (%) Set 2-CB





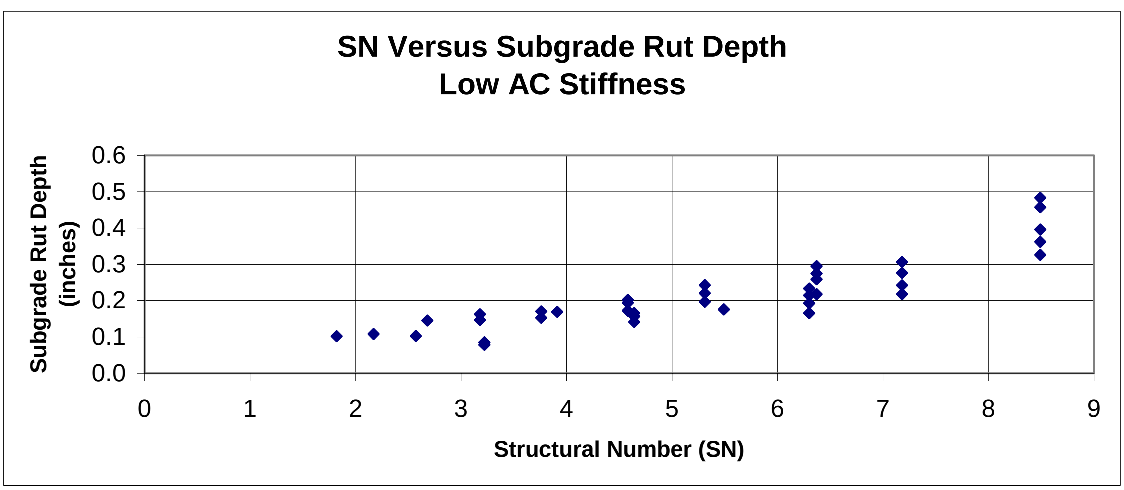
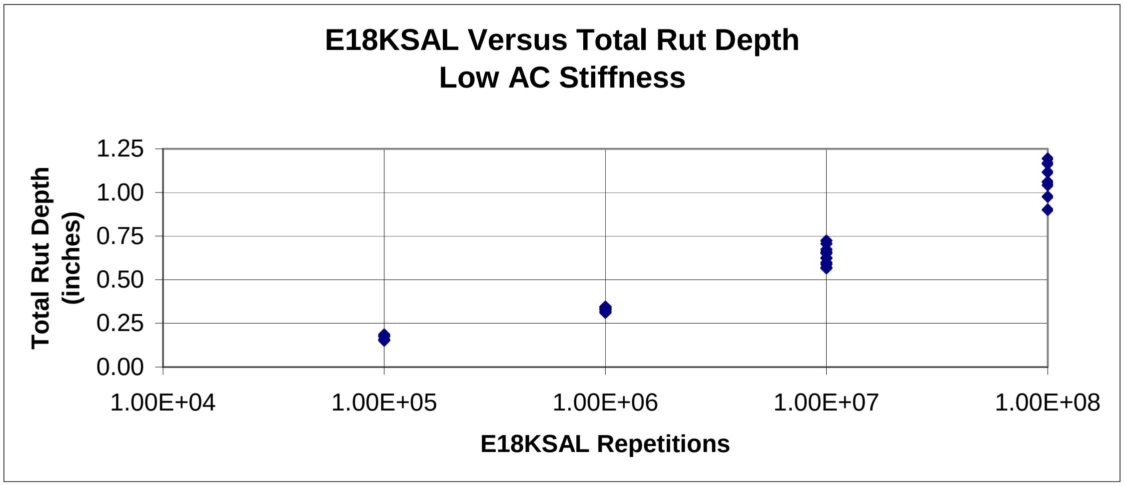
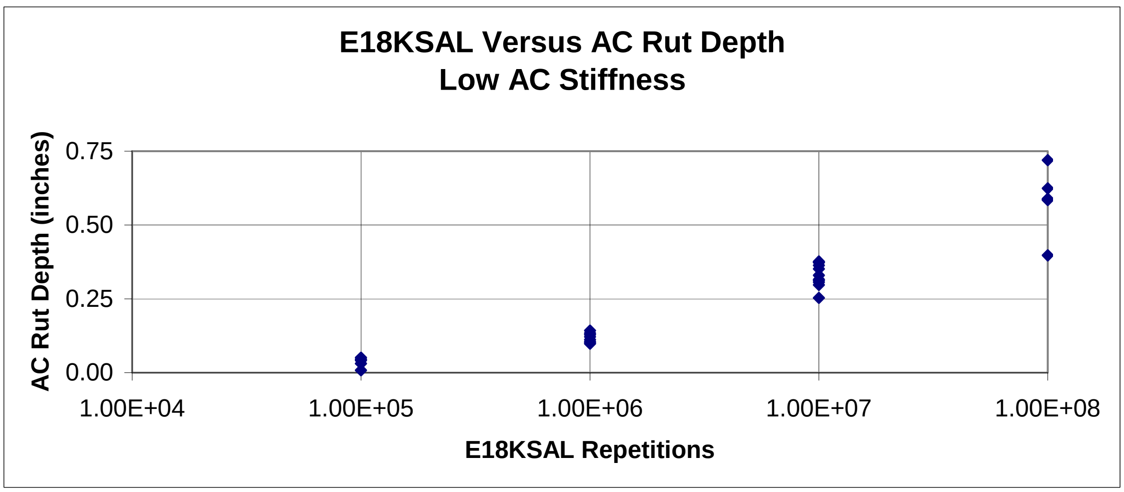


Figure D-167 Rut Depths versus Structural Number Set 2-CB





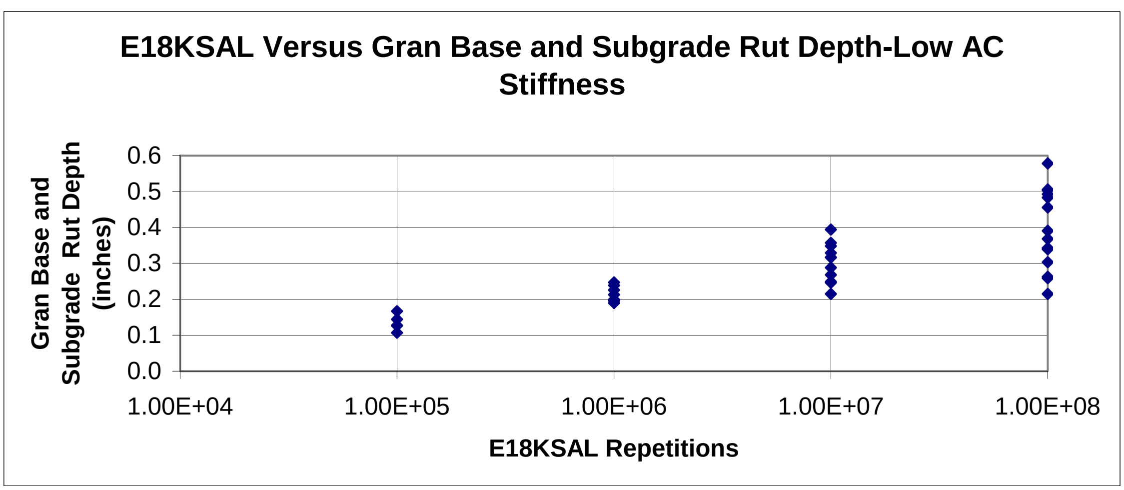
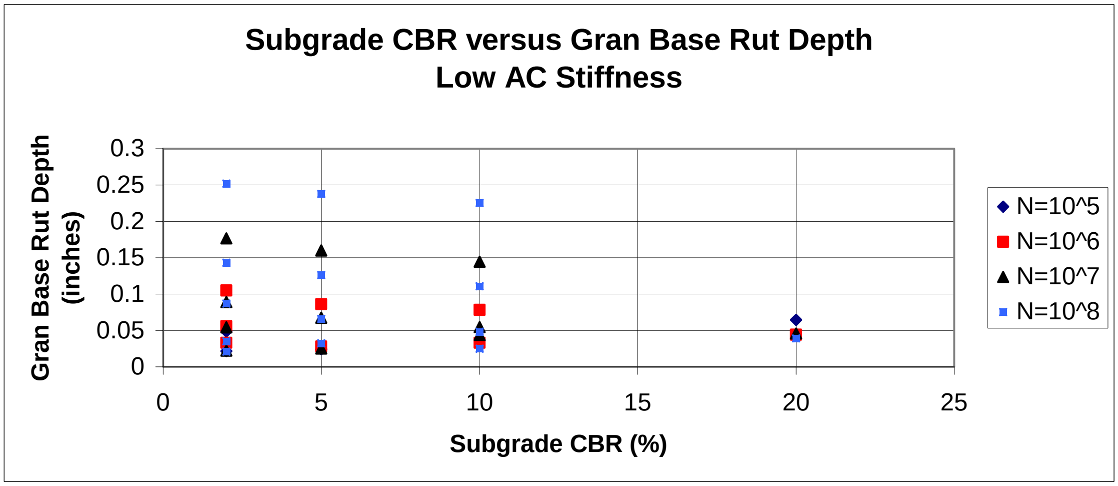


Figure D-168 Rut Depths versus 18KESAL Repetitions Set 2-CB



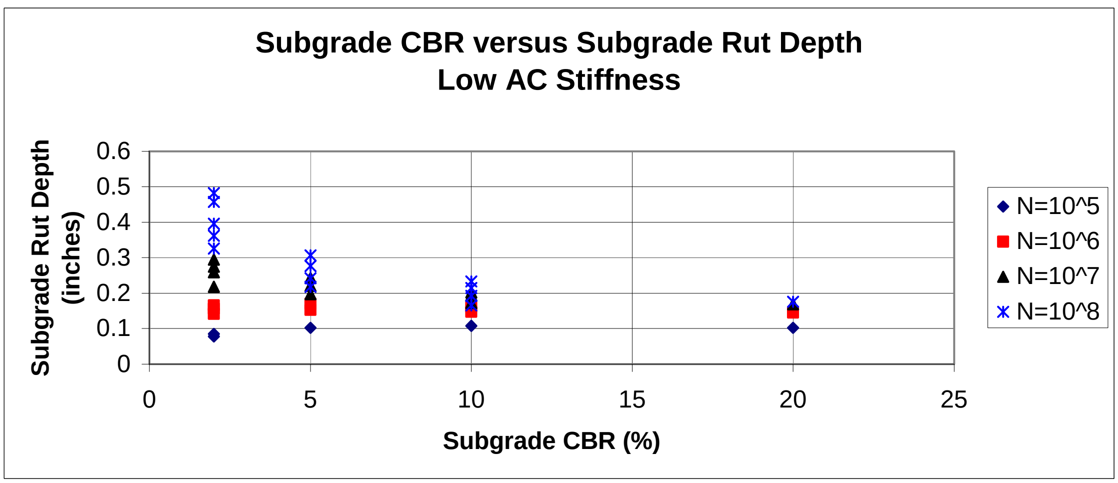


Figure D-169 Base / Subgrade Rut Depths versus Subgrade CBR (All data) Set 2-CB

Table D-77 AASHTO Study Data – Set 3-CB (β_{acr1} = 0.508, β_{acr2} = 0.9, β_{acr3} = 1.2, β_{GB} = 1.75, β_{SG} = 1.75)

				Rut Depth Value			
Hac	***CBRsg***	***N Design***	***SN***	***AC***	***GB***	***SG***	***Total***
2	2	1.00E+05	3.22	0.047	0.066	0.191	0.305
4	2	1.00E+05	3.22	0.070	0.033	0.216	0.318
3	5	1.00E+05	2.57	0.078	0.037	0.207	0.322
2	10	1.00E+05	2.17	0.065	0.053	0.187	0.305
1	20	1.00E+05	1.82	0.012	0.094	0.158	0.264
			Average	***0.054***	***0.057***	***0.192***	***0.303***
2	2	1.00E+06	4.64	0.152	0.117	0.209	0.477
4	2	1.00E+06	4.64	0.199	0.064	0.234	0.497
6	2	1.00E+06	4.64	0.172	0.040	0.258	0.469
2	5	1.00E+06	3.76	0.157	0.096	0.201	0.455
5	5	1.00E+06	3.76	0.187	0.033	0.238	0.458
2	10	1.00E+06	3.18	0.162	0.089	0.181	0.432
4	10	1.00E+06	3.18	0.206	0.039	0.210	0.456
3	20	1.00E+06	2.68	0.219	0.053	0.176	0.448
			Average	***0.182***	***0.066***	***0.213***	***0.461***
2	2	1.00E+07	6.37	0.481	0.169	0.207	0.856
5	2	1.00E+07	6.37	0.577	0.087	0.248	0.912
7	2	1.00E+07	6.37	0.507	0.053	0.269	0.830
10	2	1.00E+07	6.37	0.390	0.022	0.306	0.718
2	5	1.00E+07	5.31	0.486	0.154	0.188	0.828
5	5	1.00E+07	5.31	0.558	0.066	0.216	0.841
8	5	1.00E+07	5.31	0.458	0.025	0.251	0.735
2	10	1.00E+07	4.58	0.472	0.140	0.166	0.778
5	10	1.00E+07	4.58	0.580	0.054	0.194	0.827
6	10	1.00E+07	4.58	0.541	0.044	0.206	0.791
5	20	1.00E+07	3.91	0.575	0.046	0.172	0.792
			Average	***0.511***	***0.078***	***0.220***	***0.810***
2	2	1.00E+08	8.49	0.906	0.216	0.209	1.332
5	2	1.00E+08	8.49	1.820	0.125	0.233	2.178
8	2	1.00E+08	8.49	1.522	0.076	0.260	1.859
12	2	1.00E+08	8.49	0.960	0.031	0.316	1.307
14	2	1.00E+08	8.49	0.611	0.018	0.343	0.973
2	5	1.00E+08	7.18	0.901	0.205	0.160	1.267
5	5	1.00E+08	7.18	1.760	0.110	0.180	2.050
8	5	1.00E+08	7.18	1.462	0.058	0.213	1.733
11	5	1.00E+08	7.18	1.108	0.029	0.244	1.381
2	10	1.00E+08	6.3	0.900	0.195	0.131	1.227
5	10	1.00E+08	6.3	1.726	0.097	0.156	1.980
8	10	1.00E+08	6.3	1.432	0.043	0.180	1.654
10	10	1.00E+08	6.3	1.234	0.022	0.200	1.456
8	20	1.00E+08	5.49	1.461	0.035	0.156	1.651
			Average	***1.272***	***0.090***	***0.213***	***1.575***

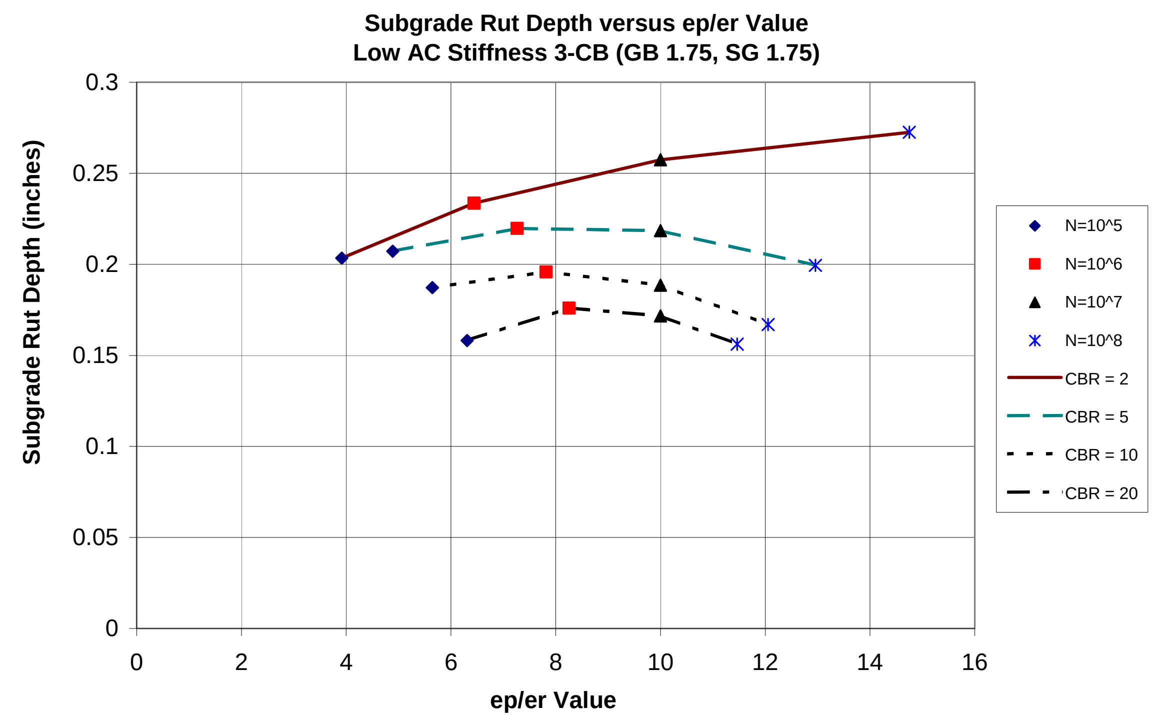


Figure D-170 Subgrade Rut Depth versus ep/er Value Set 3-CB

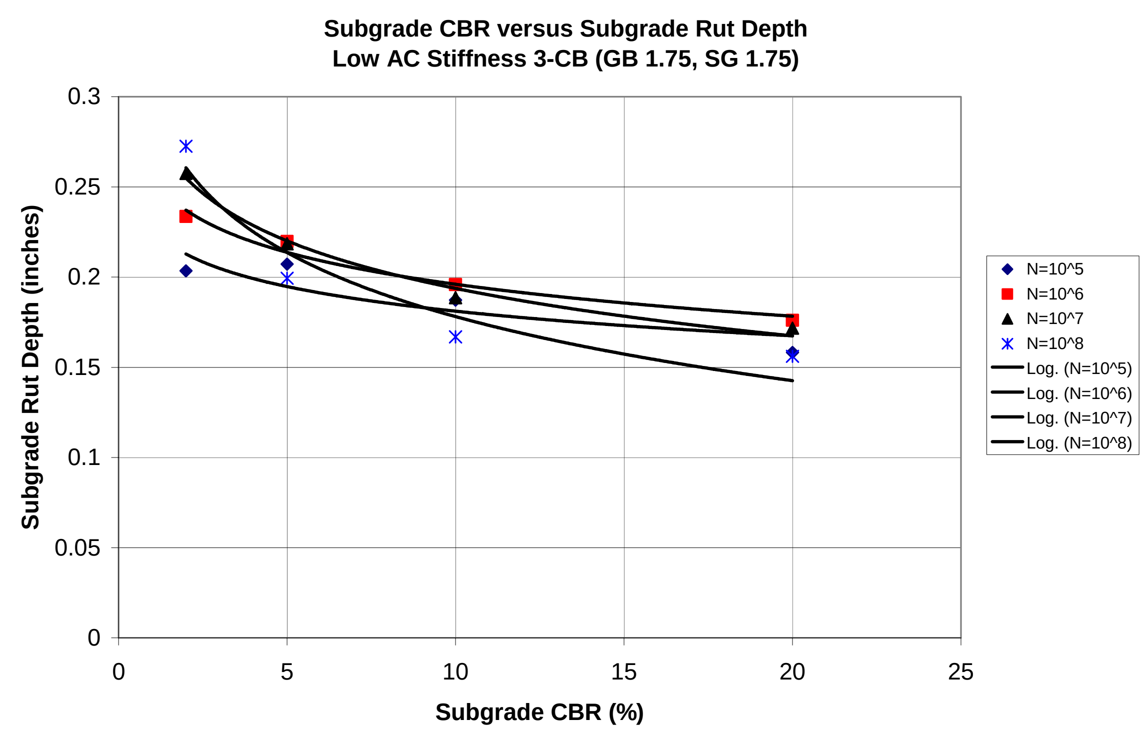
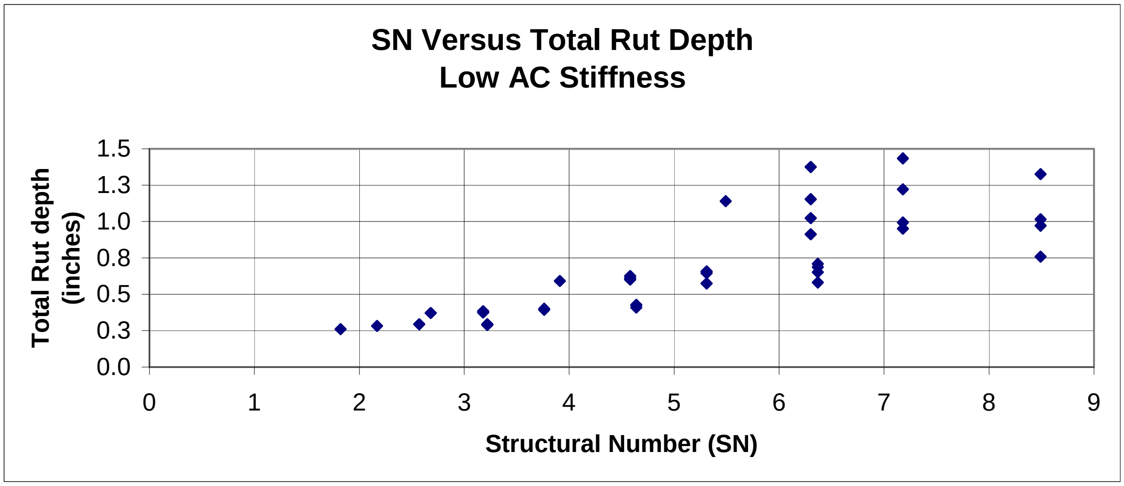
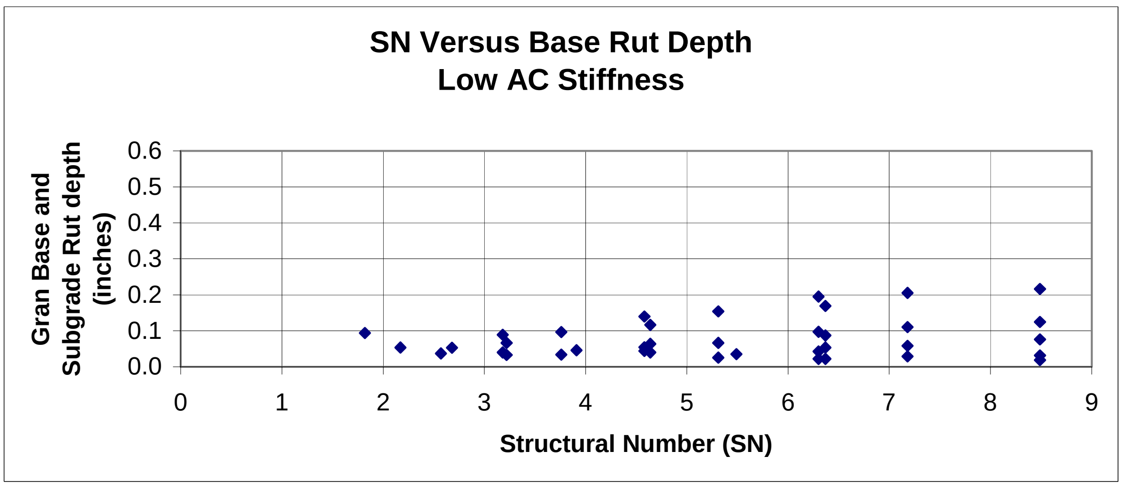


Figure D-171 Average Subgrade Rut Depth versus Subgrade CBR (%) Set 3-CB





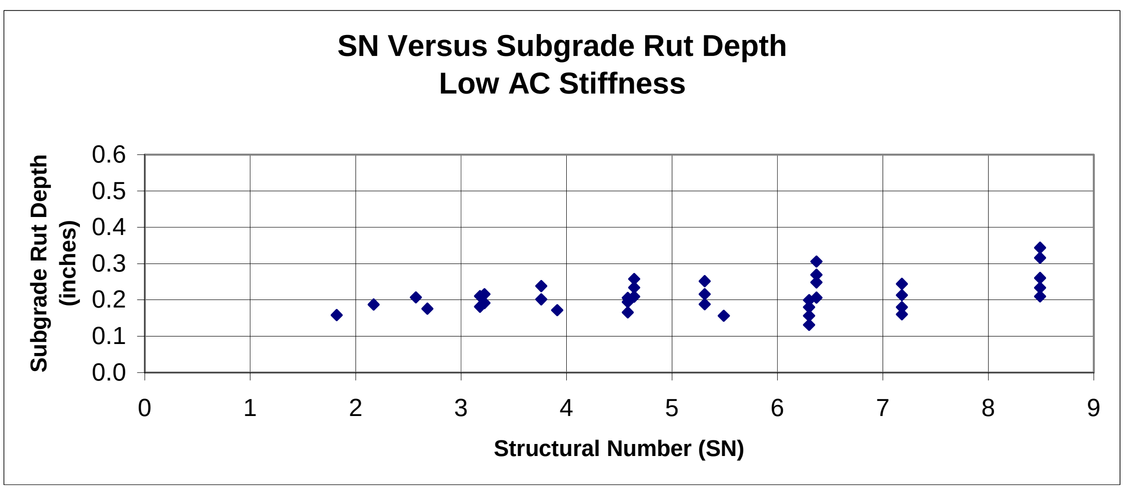
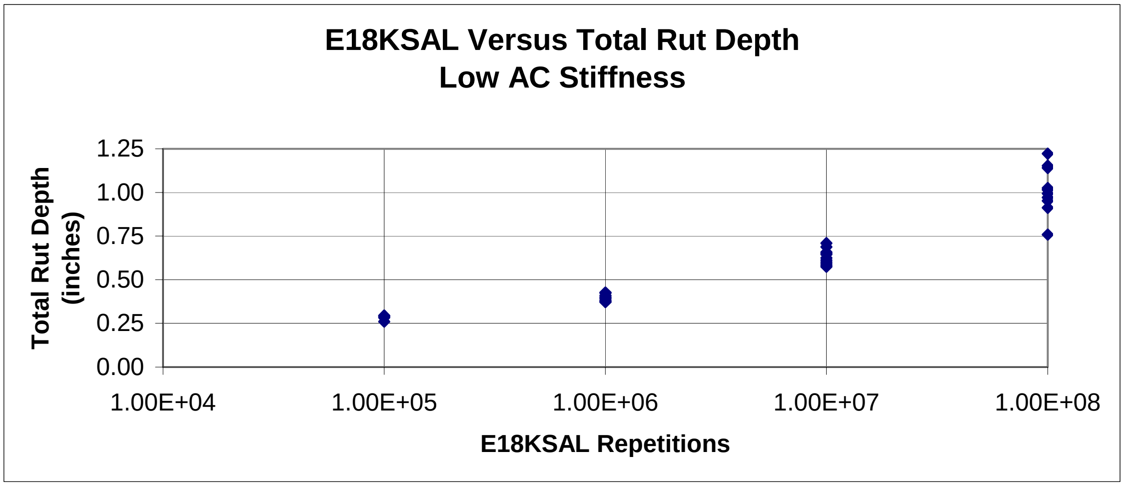
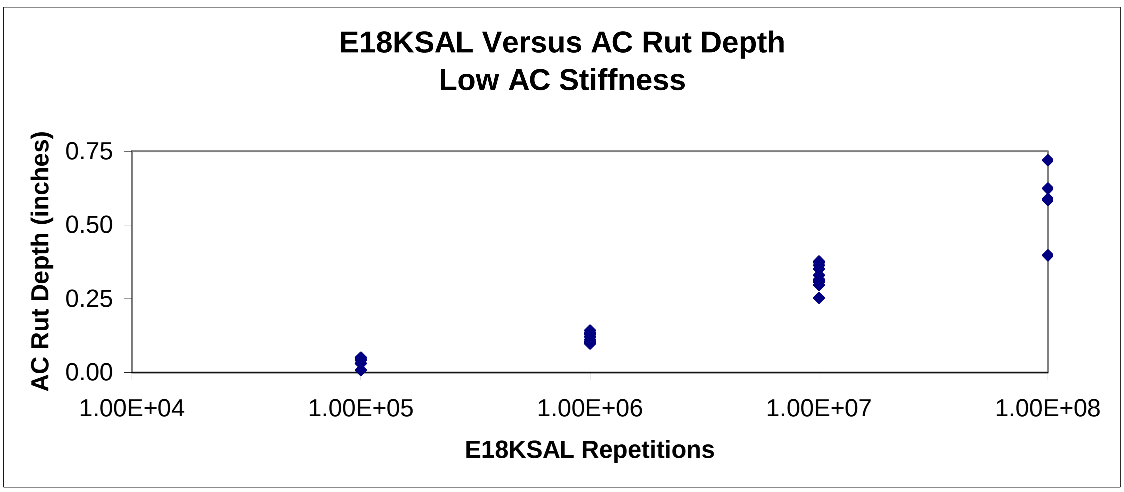


Figure D-172 Rut Depths versus Structural Number Set 3-CB





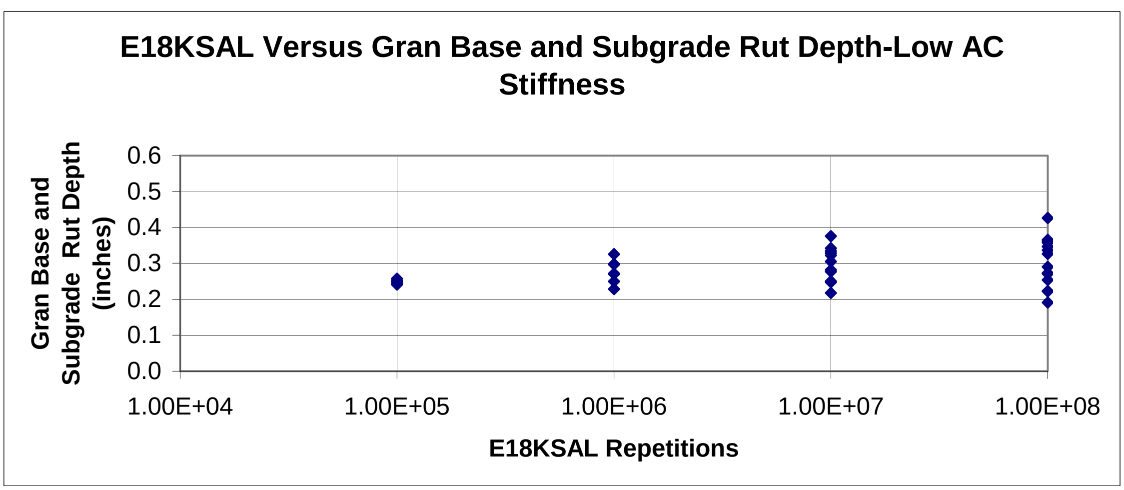
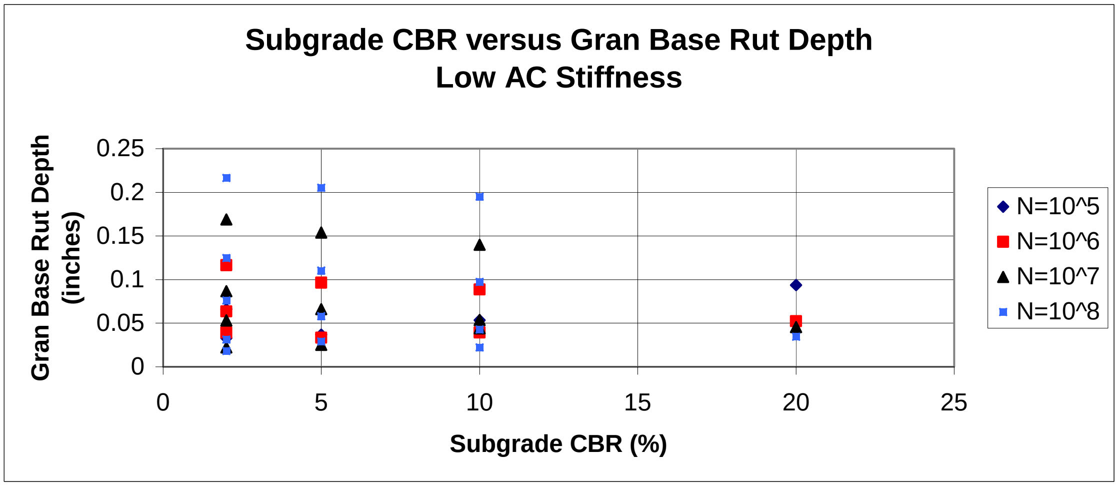


Figure D-173 Rut Depths versus 18KESAL Repetitions Set 3-CB



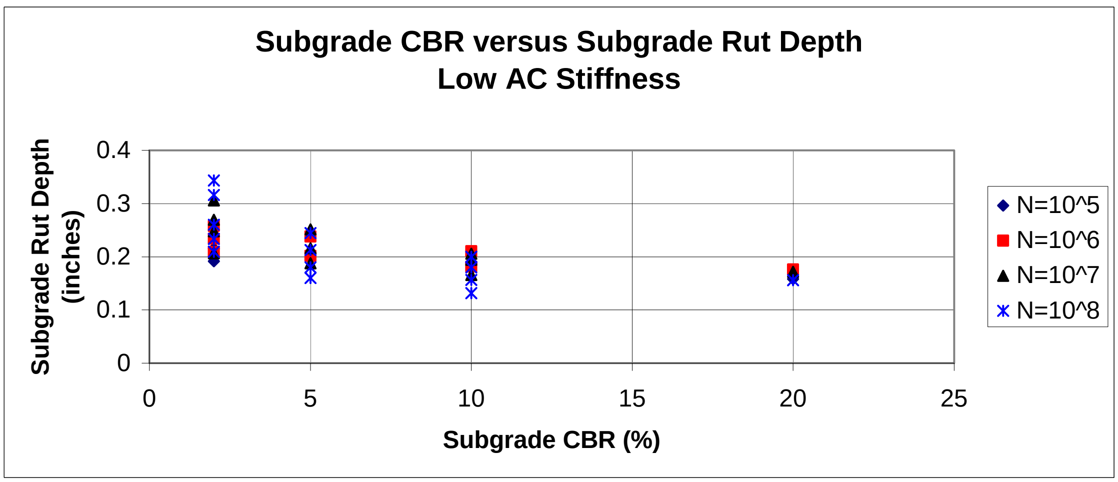


Figure D-174 Base / Subgrade Rut Depths versus Subgrade CBR (All data) Set 3-CB

Table D-78 AASHTO Study Data – Set 4-CB (β_{acr1} = 0.508, β_{acr2} = 0.9, β_{acr3} = 1.2, β_{GB} = 0.19, β_{SG} = 0.19)

				Rut Depth Value			
Hac	***CBRsg***	***N Design***	***SN***	***AC***	***GB***	***SG***	***Total***
2	2	1.00E+05	3.22	0.047	0.057	0.129	0.234
4	2	1.00E+05	3.22	0.070	0.027	0.142	0.239
3	5	1.00E+05	2.57	0.078	0.030	0.153	0.261
2	10	1.00E+05	2.17	0.065	0.044	0.150	0.258
1	20	1.00E+05	1.82	0.012	0.078	0.134	0.224
			Average	***0.054***	***0.047***	***0.142***	***0.243***
2	2	1.00E+06	4.64	0.152	0.111	0.182	0.445
4	2	1.00E+06	4.64	0.199	0.060	0.201	0.461
6	2	1.00E+06	4.64	0.172	0.037	0.216	0.425
2	5	1.00E+06	3.76	0.157	0.092	0.185	0.433
5	5	1.00E+06	3.76	0.187	0.031	0.211	0.428
2	10	1.00E+06	3.18	0.162	0.084	0.172	0.418
4	10	1.00E+06	3.18	0.206	0.036	0.194	0.436
3	20	1.00E+06	2.68	0.219	0.048	0.168	0.436
			Average	***0.182***	***0.062***	***0.191***	***0.435***
2	2	1.00E+07	6.37	0.481	0.174	0.224	0.879
5	2	1.00E+07	6.37	0.577	0.089	0.267	0.933
7	2	1.00E+07	6.37	0.507	0.054	0.286	0.847
10	2	1.00E+07	6.37	0.390	0.022	0.314	0.726
2	5	1.00E+07	5.31	0.486	0.158	0.203	0.847
5	5	1.00E+07	5.31	0.558	0.068	0.229	0.855
8	5	1.00E+07	5.31	0.458	0.026	0.259	0.742
2	10	1.00E+07	4.58	0.472	0.143	0.178	0.793
5	10	1.00E+07	4.58	0.580	0.055	0.204	0.838
6	10	1.00E+07	4.58	0.541	0.044	0.214	0.799
5	20	1.00E+07	3.91	0.575	0.046	0.179	0.800
			Average	***0.511***	***0.080***	***0.232***	***0.824***
2	2	1.00E+08	8.49	0.906	0.236	0.276	1.418
5	2	1.00E+08	8.49	1.820	0.135	0.306	2.262
8	2	1.00E+08	8.49	1.522	0.082	0.338	1.942
12	2	1.00E+08	8.49	0.960	0.034	0.398	1.392
14	2	1.00E+08	8.49	0.611	0.020	0.426	1.057
2	5	1.00E+08	7.18	0.901	0.223	0.197	1.321
5	5	1.00E+08	7.18	1.760	0.119	0.220	2.099
8	5	1.00E+08	7.18	1.462	0.063	0.255	1.780
11	5	1.00E+08	7.18	1.108	0.031	0.287	1.426
2	10	1.00E+08	6.3	0.900	0.212	0.156	1.268
5	10	1.00E+08	6.3	1.726	0.105	0.182	2.014
8	10	1.00E+08	6.3	1.432	0.046	0.206	1.684
10	10	1.00E+08	6.3	1.234	0.024	0.227	1.484
8	20	1.00E+08	5.49	1.461	0.037	0.174	1.672
			Average	***1.272***	***0.098***	***0.261***	***1.630***

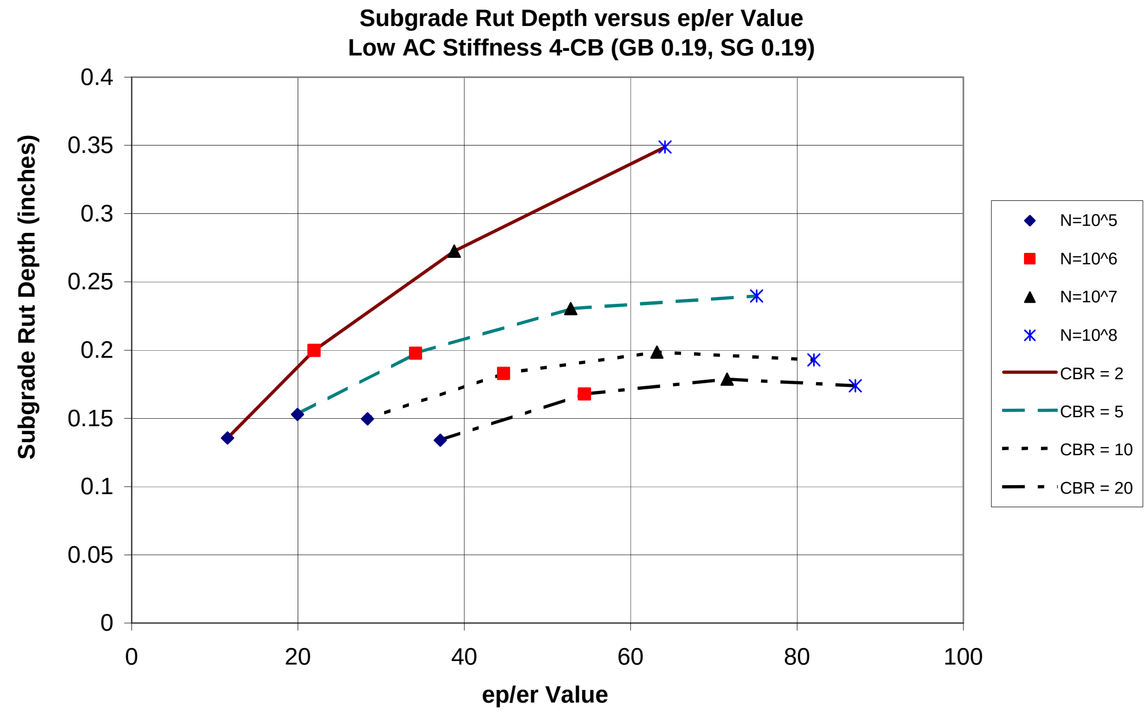


Figure D-175 Subgrade Rut Depth versus ep/er Value Set 4-CB

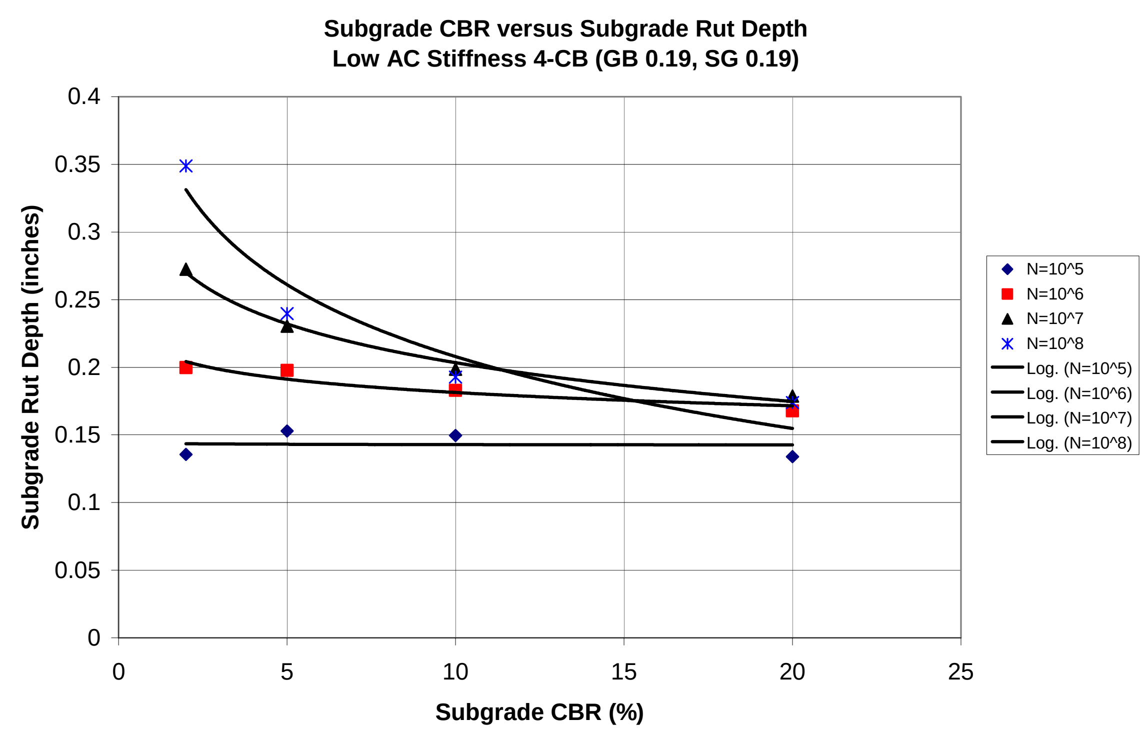
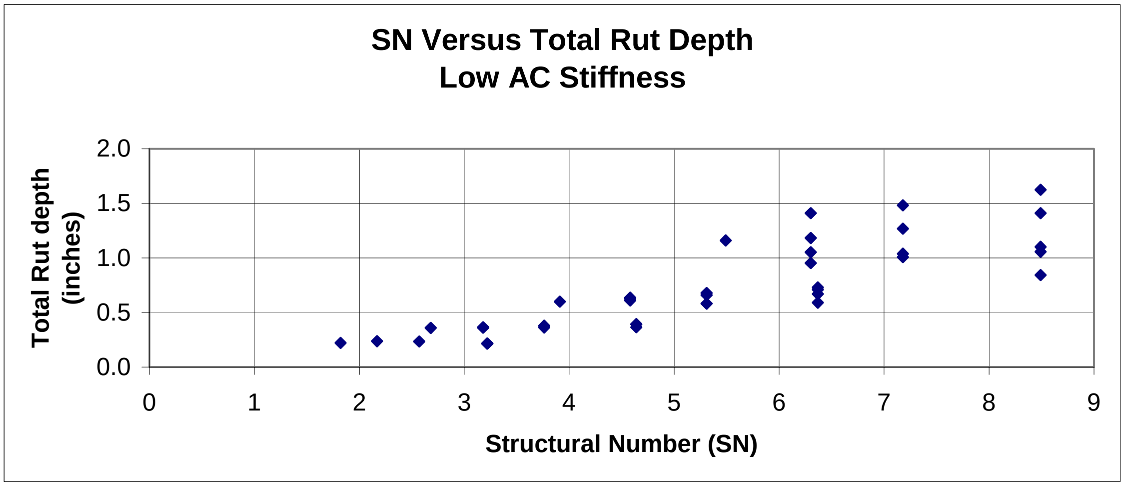
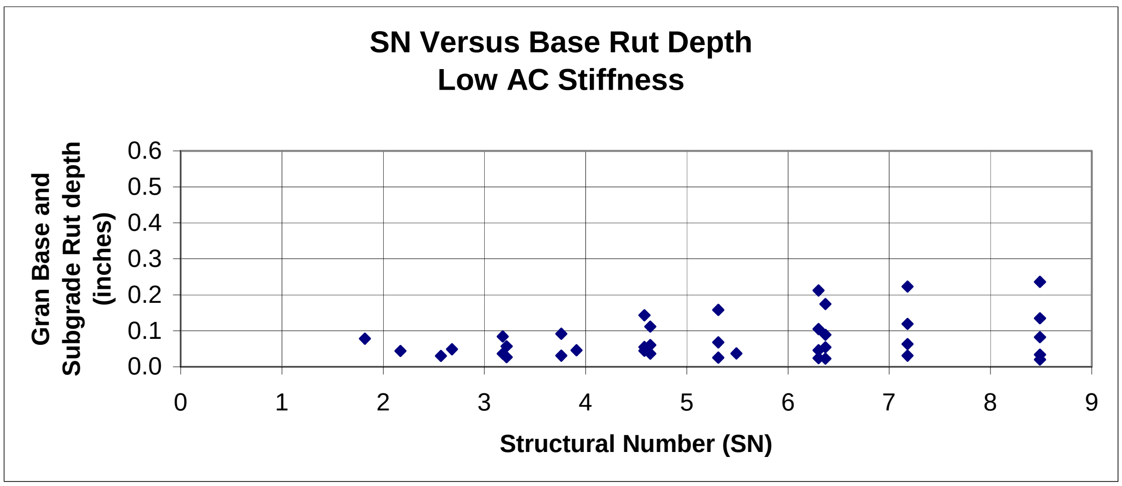


Figure D-176 Average Subgrade Rut Depth versus Subgrade CBR (%) Set 4-CB





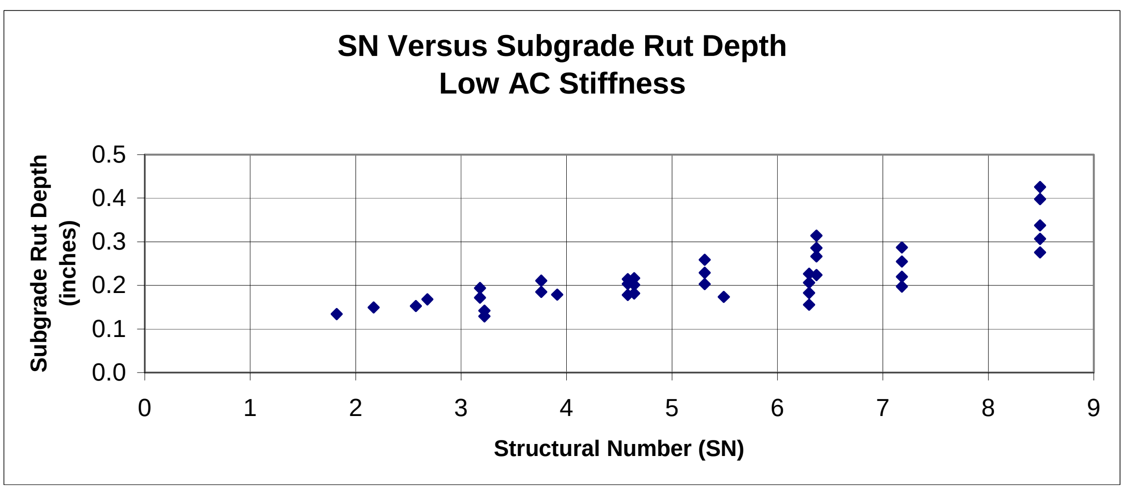
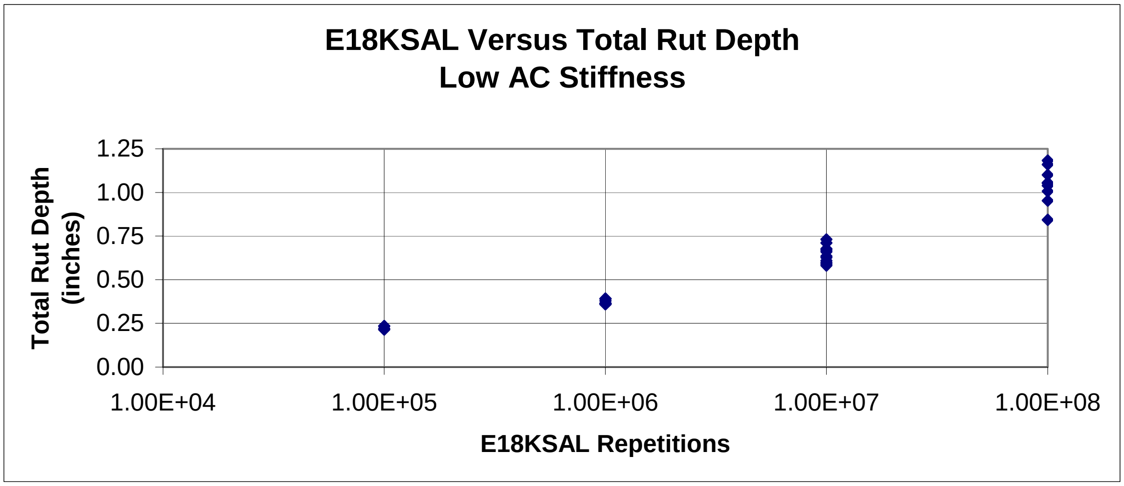
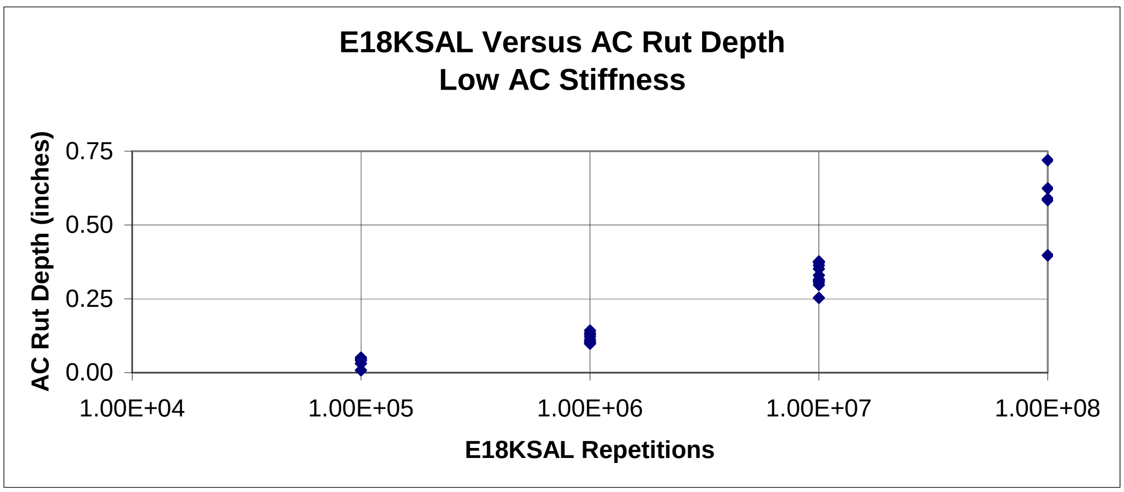


Figure D-177 Rut Depths versus Structural Number Set 4-CB





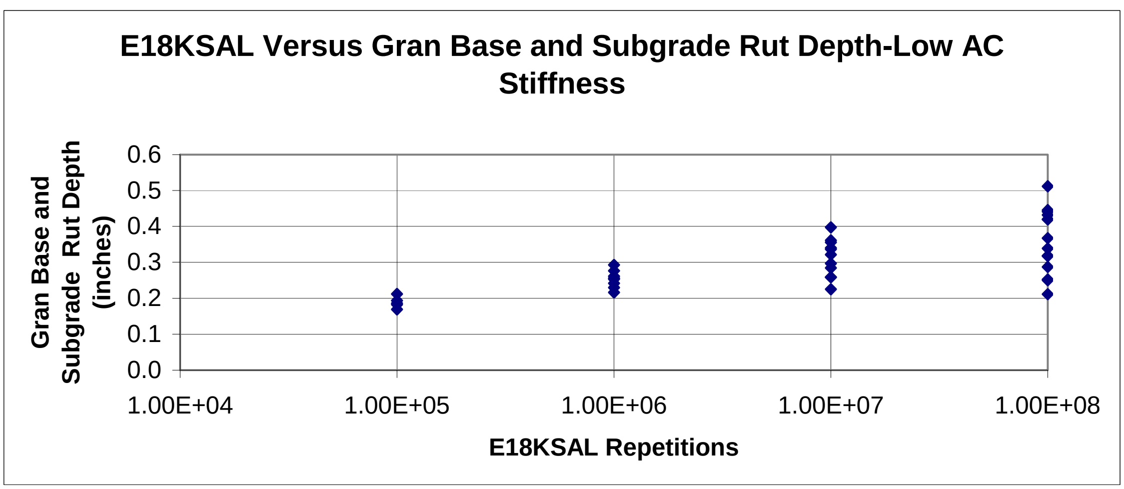
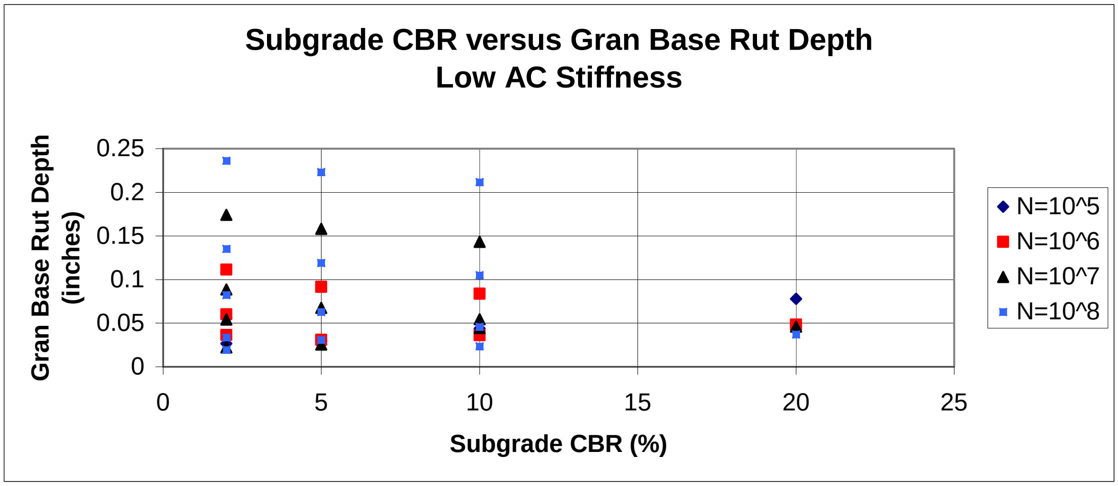


Figure D-178 Rut Depths versus 18KESAL Repetitions Set 4-CB



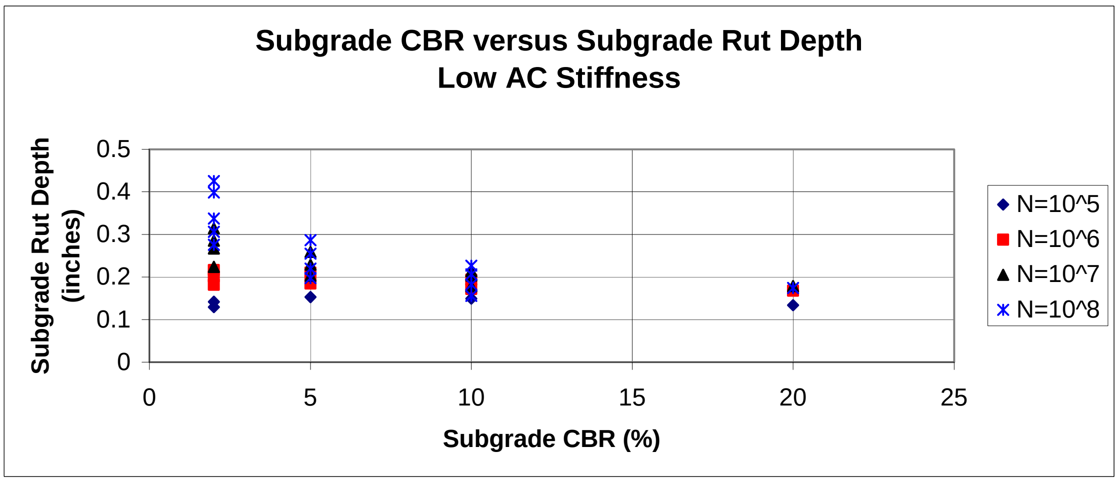


Figure D-179 Base / Subgrade Rut Depths versus Subgrade CBR (All data) Set 4-CB

Table D-79 AASHTO Study Data – Set 5-CB (β_{acr1} = 0.508, β_{acr2} = 0.9, β_{acr3} = 1.2, β_{GB} = 1.65, β_{SG} = 1.65)

				Rut Depth Value			
Hac	***CBRsg***	***N Design***	***SN***	***AC***	***GB***	***SG***	***Total***
2	2	1.00E+05	3.22	0.047	0.075	0.253	0.376
4	2	1.00E+05	3.22	0.070	0.039	0.294	0.402
3	5	1.00E+05	2.57	0.078	0.043	0.260	0.382
2	10	1.00E+05	2.17	0.065	0.063	0.221	0.349
1	20	1.00E+05	1.82	0.012	0.111	0.178	0.302
			Average	***0.054***	***0.066***	***0.241***	***0.362***
2	2	1.00E+06	4.64	0.152	0.122	0.231	0.505
4	2	1.00E+06	4.64	0.199	0.067	0.262	0.528
6	2	1.00E+06	4.64	0.172	0.043	0.297	0.511
2	5	1.00E+06	3.76	0.157	0.102	0.215	0.474
5	5	1.00E+06	3.76	0.187	0.036	0.264	0.486
2	10	1.00E+06	3.18	0.162	0.094	0.189	0.445
4	10	1.00E+06	3.18	0.206	0.042	0.226	0.474
3	20	1.00E+06	2.68	0.219	0.057	0.184	0.460
			Average	***0.182***	***0.070***	***0.233***	***0.486***
2	2	1.00E+07	6.37	0.481	0.167	0.196	0.844
5	2	1.00E+07	6.37	0.577	0.086	0.237	0.901
7	2	1.00E+07	6.37	0.507	0.053	0.262	0.822
10	2	1.00E+07	6.37	0.390	0.022	0.306	0.718
2	5	1.00E+07	5.31	0.486	0.153	0.179	0.818
5	5	1.00E+07	5.31	0.558	0.066	0.209	0.834
8	5	1.00E+07	5.31	0.458	0.026	0.250	0.733
2	10	1.00E+07	4.58	0.472	0.139	0.158	0.769
5	10	1.00E+07	4.58	0.580	0.054	0.190	0.823
6	10	1.00E+07	4.58	0.541	0.045	0.203	0.788
5	20	1.00E+07	3.91	0.575	0.046	0.169	0.789
			Average	***0.511***	***0.078***	***0.215***	***0.804***
2	2	1.00E+08	8.49	0.906	0.205	0.173	1.285
5	2	1.00E+08	8.49	1.820	0.119	0.194	2.133
8	2	1.00E+08	8.49	1.522	0.072	0.220	1.814
12	2	1.00E+08	8.49	0.960	0.030	0.273	1.263
14	2	1.00E+08	8.49	0.611	0.018	0.300	0.929
2	5	1.00E+08	7.18	0.901	0.195	0.139	1.235
5	5	1.00E+08	7.18	1.760	0.105	0.158	2.023
8	5	1.00E+08	7.18	1.462	0.056	0.190	1.708
11	5	1.00E+08	7.18	1.108	0.028	0.221	1.357
2	10	1.00E+08	6.3	0.900	0.186	0.117	1.203
5	10	1.00E+08	6.3	1.726	0.093	0.141	1.961
8	10	1.00E+08	6.3	1.432	0.041	0.165	1.638
10	10	1.00E+08	6.3	1.234	0.021	0.185	1.441
8	20	1.00E+08	5.49	1.461	0.033	0.146	1.640
			Average	***1.272***	***0.086***	***0.187***	***1.545***

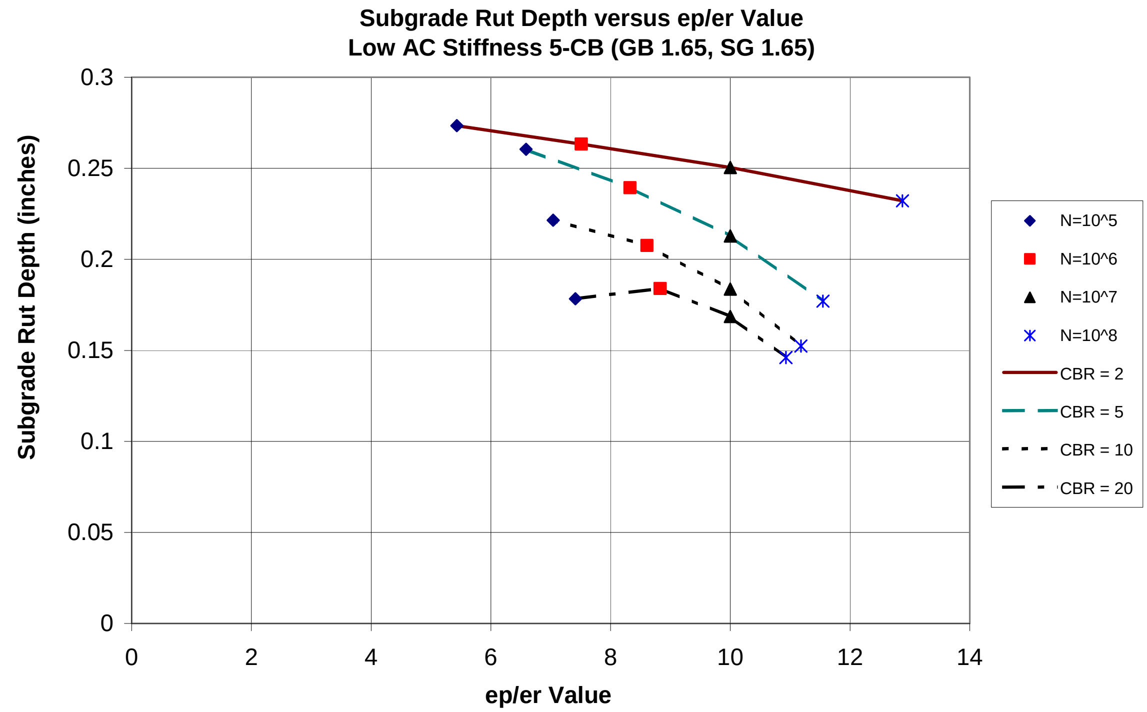


Figure D-180 Subgrade Rut Depth versus ep/er Value Set 5-CB

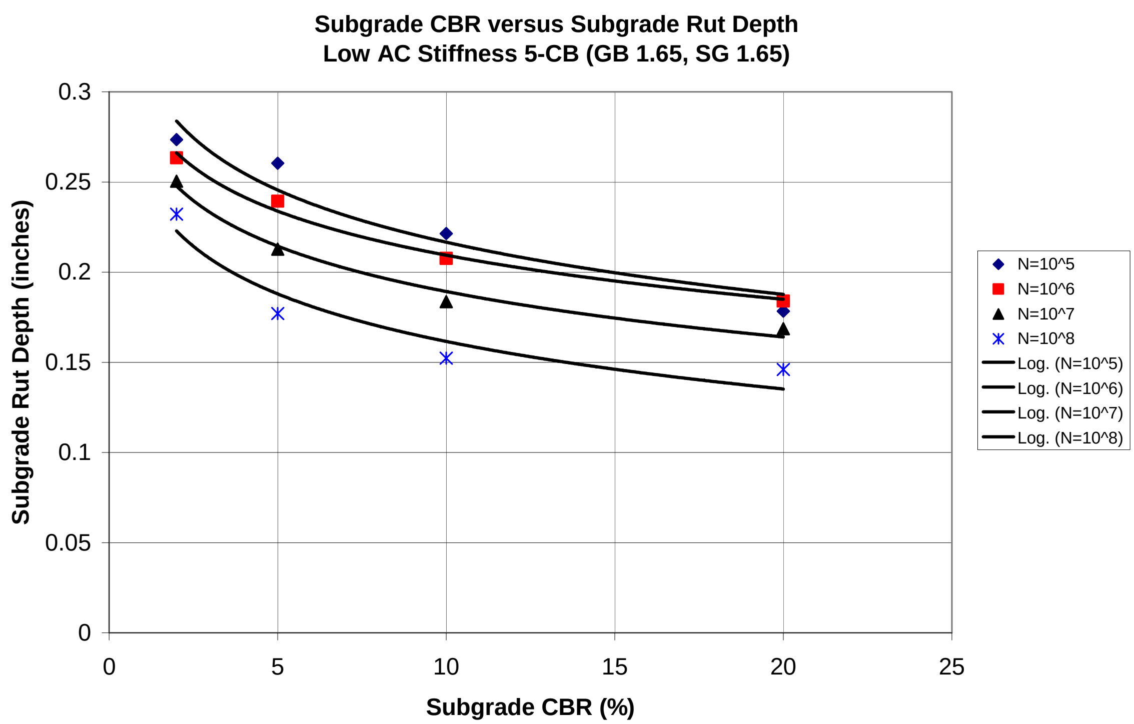
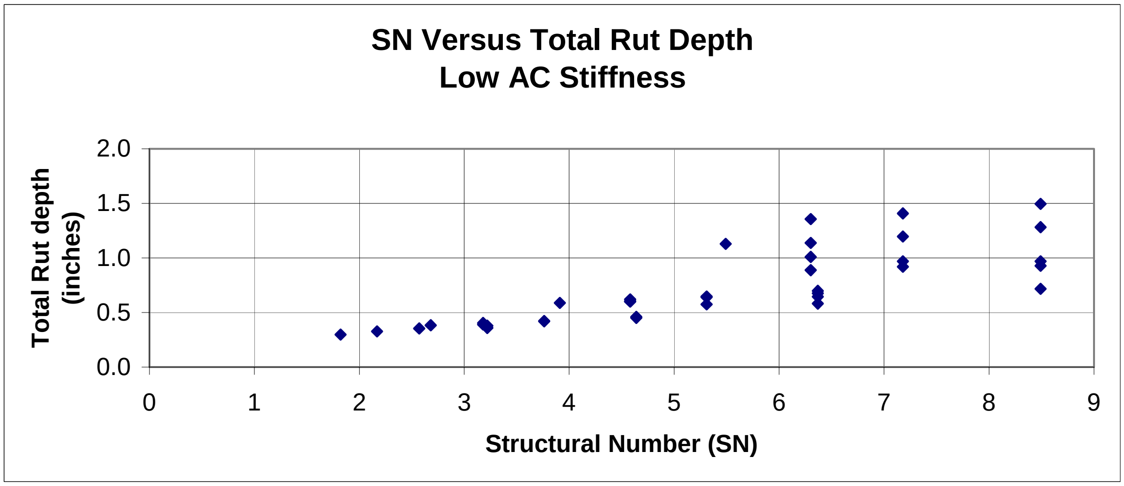
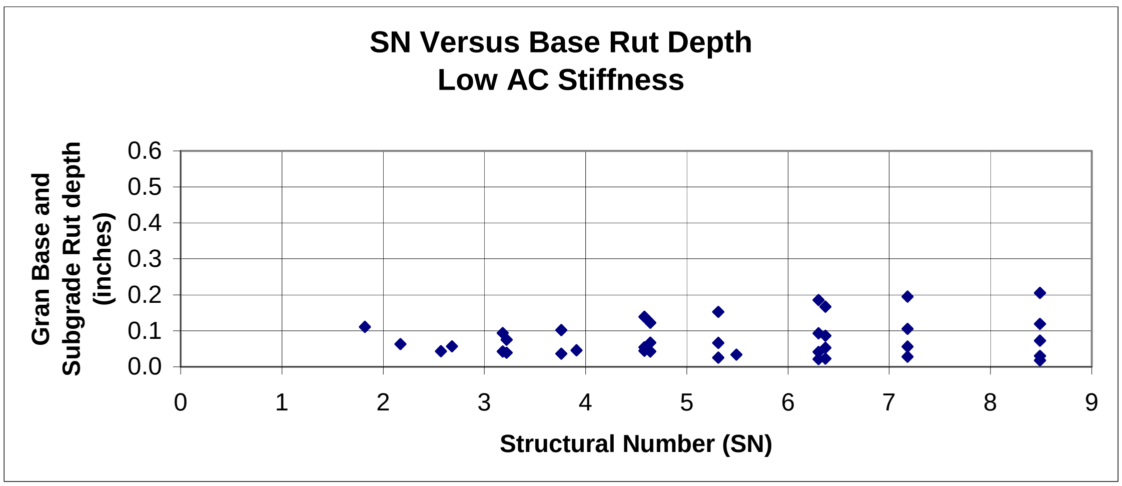


Figure D-181 Average Subgrade Rut Depth versus Subgrade CBR (%) Set 5-CB





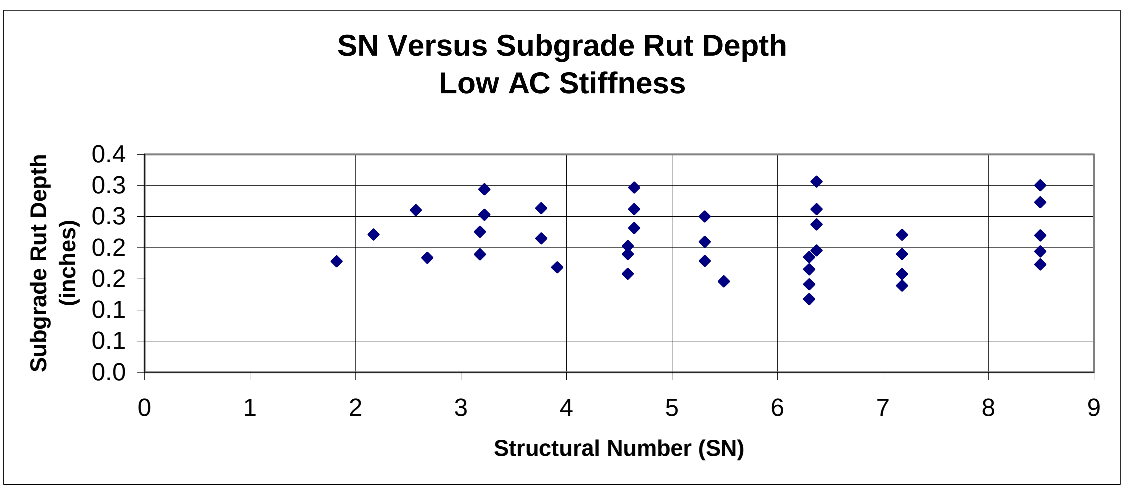
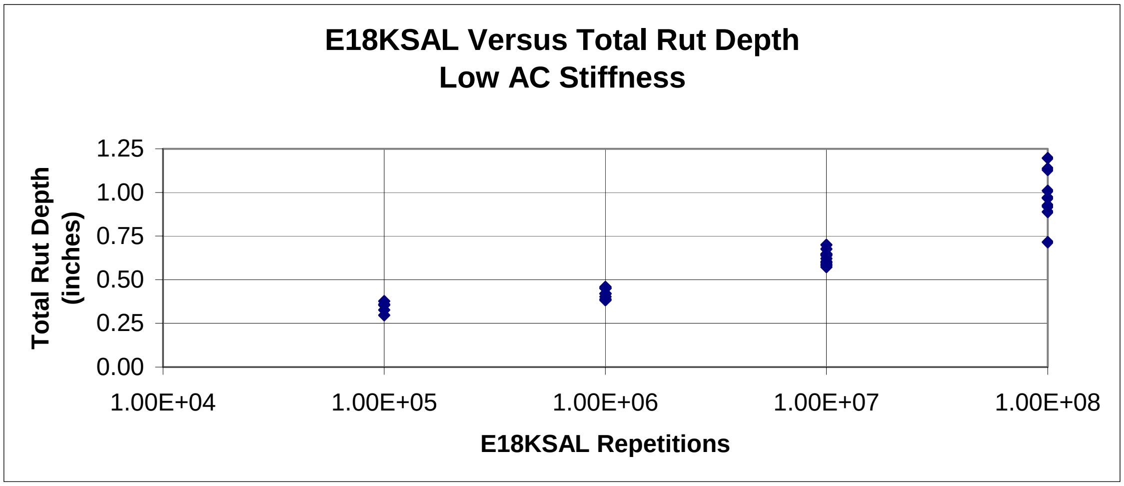
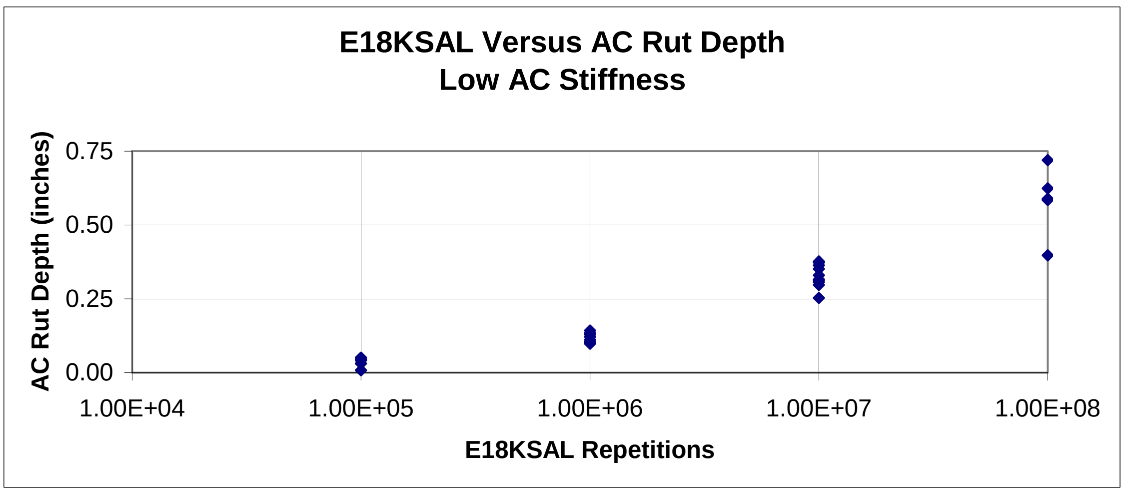


Figure D-182 Rut Depths versus Structural Number Set 5-CB





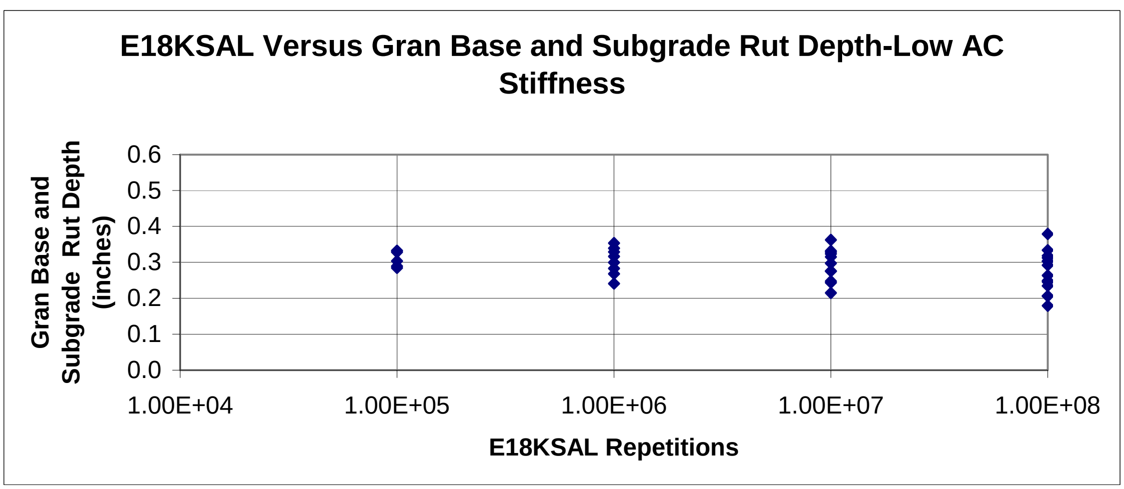
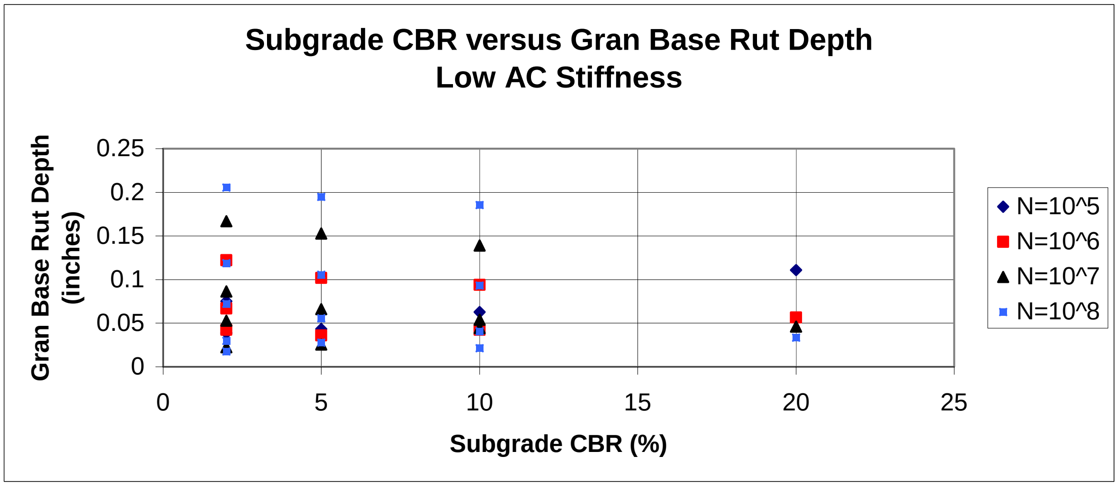


Figure D-183 Rut Depths versus 18KESAL Repetitions Set 5-CB



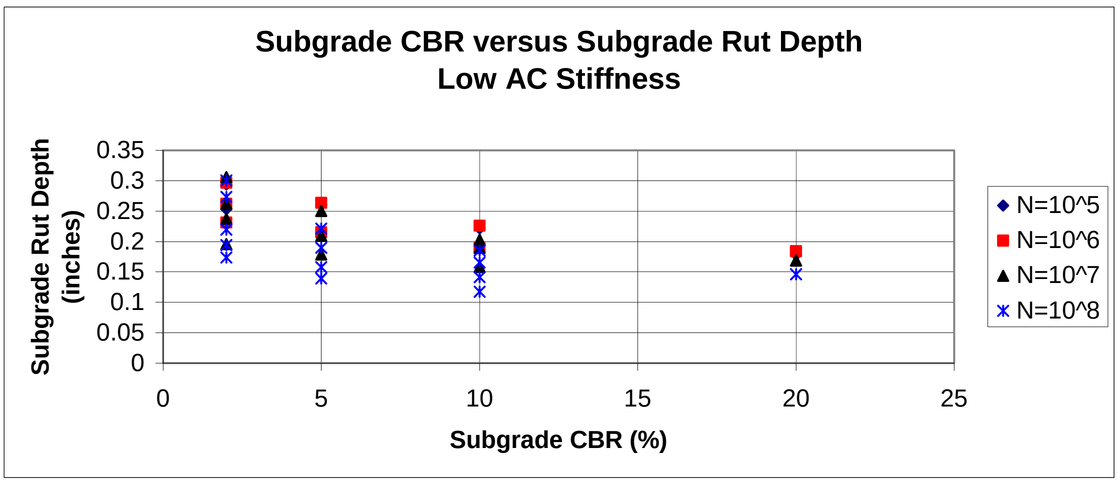


Figure D-184 Base / Subgrade Rut Depths versus Subgrade CBR (All data) Set 5-CB

Table D-80 AASHTO Study Data – Set 6-CB (β_{acr1} = 0.508, β_{acr2} = 0.9, β_{acr3} = 1.2, β_{GB} = 1.7, β_{SG} = 1.7)

				Rut Depth Value			
Hac	***CBRsg***	***N Design***	***SN***	***AC***	***GB***	***SG***	***Total***
2	2	1.00E+05	3.22	0.047	0.069	0.215	0.332
4	2	1.00E+05	3.22	0.070	0.035	0.245	0.350
3	5	1.00E+05	2.57	0.078	0.039	0.227	0.344
2	10	1.00E+05	2.17	0.065	0.057	0.200	0.322
1	20	1.00E+05	1.82	0.012	0.100	0.166	0.278
			Average	***0.054***	***0.060***	***0.211***	***0.325***
2	2	1.00E+06	4.64	0.152	0.118	0.218	0.487
4	2	1.00E+06	4.64	0.199	0.065	0.244	0.508
6	2	1.00E+06	4.64	0.172	0.041	0.272	0.485
2	5	1.00E+06	3.76	0.157	0.098	0.206	0.461
5	5	1.00E+06	3.76	0.187	0.034	0.247	0.468
2	10	1.00E+06	3.18	0.162	0.090	0.184	0.436
4	10	1.00E+06	3.18	0.206	0.040	0.216	0.462
3	20	1.00E+06	2.68	0.219	0.054	0.179	0.452
			Average	***0.182***	***0.068***	***0.221***	***0.470***
2	2	1.00E+07	6.37	0.481	0.167	0.201	0.849
5	2	1.00E+07	6.37	0.577	0.086	0.242	0.905
7	2	1.00E+07	6.37	0.507	0.053	0.265	0.825
10	2	1.00E+07	6.37	0.390	0.022	0.304	0.716
2	5	1.00E+07	5.31	0.486	0.153	0.183	0.822
5	5	1.00E+07	5.31	0.558	0.066	0.212	0.836
8	5	1.00E+07	5.31	0.458	0.025	0.249	0.732
2	10	1.00E+07	4.58	0.472	0.139	0.162	0.773
5	10	1.00E+07	4.58	0.580	0.054	0.191	0.824
6	10	1.00E+07	4.58	0.541	0.044	0.204	0.788
5	20	1.00E+07	3.91	0.575	0.046	0.169	0.790
			Average	***0.511***	***0.078***	***0.217***	***0.805***
2	2	1.00E+08	8.49	0.906	0.211	0.192	1.309
5	2	1.00E+08	8.49	1.820	0.121	0.215	2.156
8	2	1.00E+08	8.49	1.522	0.074	0.241	1.837
12	2	1.00E+08	8.49	0.960	0.030	0.295	1.285
14	2	1.00E+08	8.49	0.611	0.018	0.322	0.951
2	5	1.00E+08	7.18	0.901	0.200	0.150	1.251
5	5	1.00E+08	7.18	1.760	0.108	0.169	2.037
8	5	1.00E+08	7.18	1.462	0.057	0.201	1.720
11	5	1.00E+08	7.18	1.108	0.028	0.233	1.369
2	10	1.00E+08	6.3	0.900	0.190	0.125	1.215
5	10	1.00E+08	6.3	1.726	0.095	0.149	1.970
8	10	1.00E+08	6.3	1.432	0.042	0.173	1.646
10	10	1.00E+08	6.3	1.234	0.022	0.192	1.448
8	20	1.00E+08	5.49	1.461	0.034	0.151	1.646
			Average	***1.272***	***0.088***	***0.201***	***1.560***

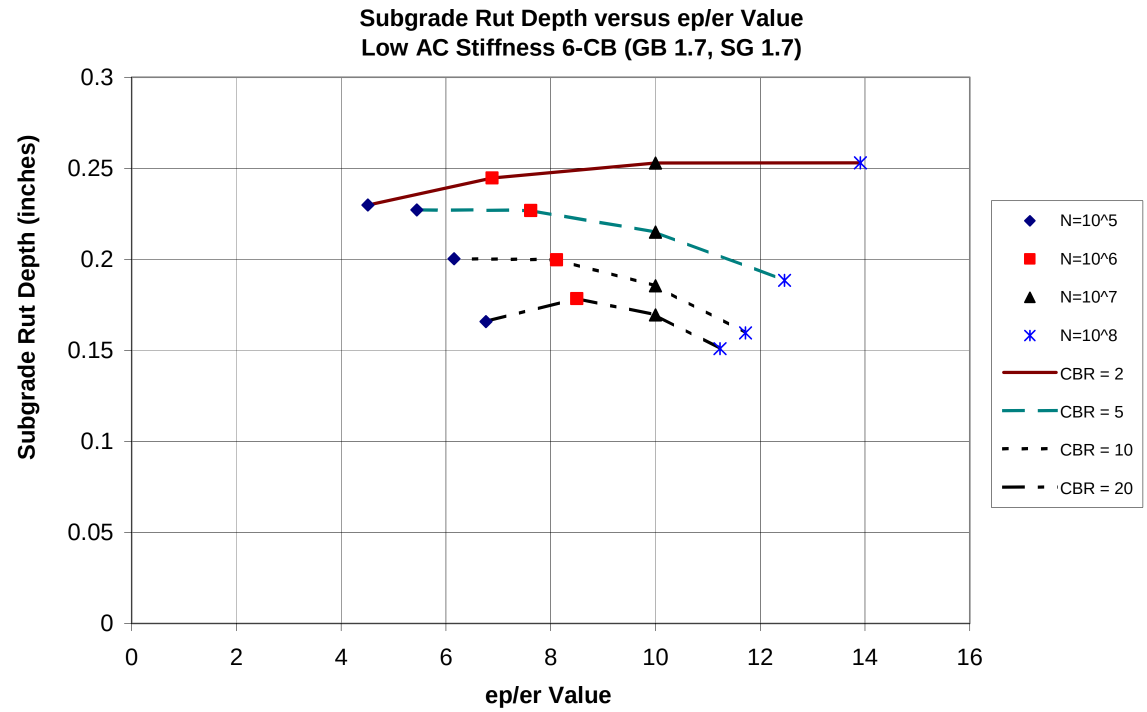


Figure D-185 Subgrade Rut Depth versus ep/er Value Set 6-CB

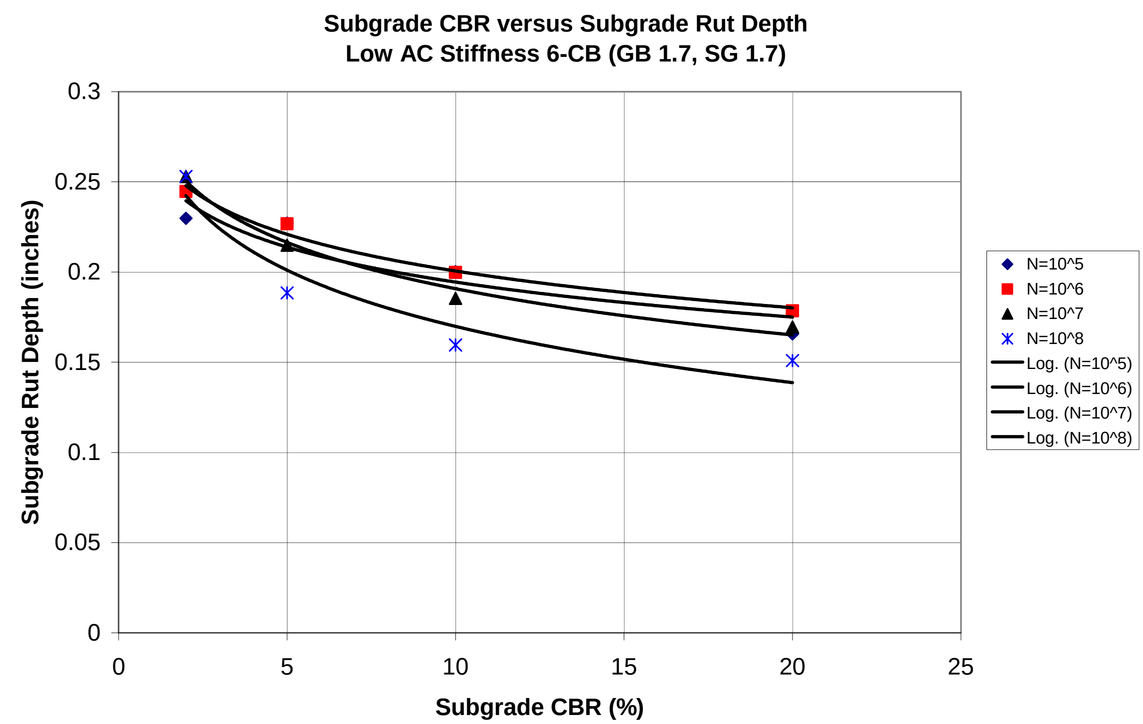
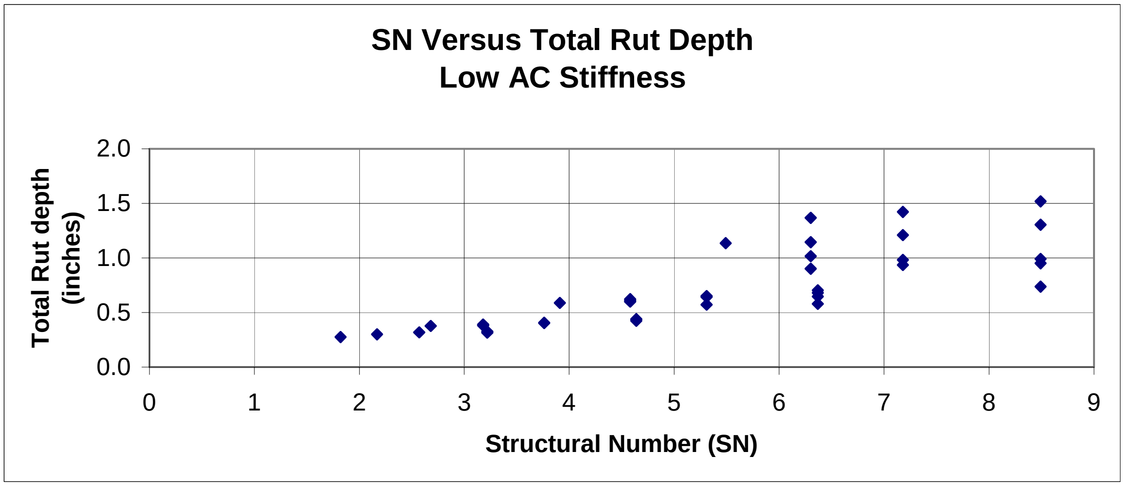
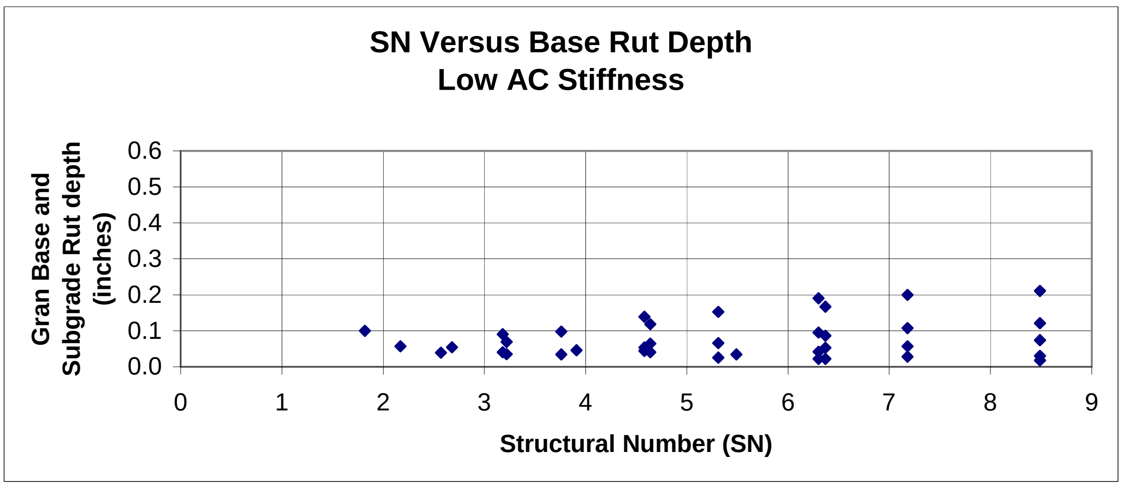


Figure D-186 Average Subgrade Rut Depth versus Subgrade CBR (%) Set 6-CB





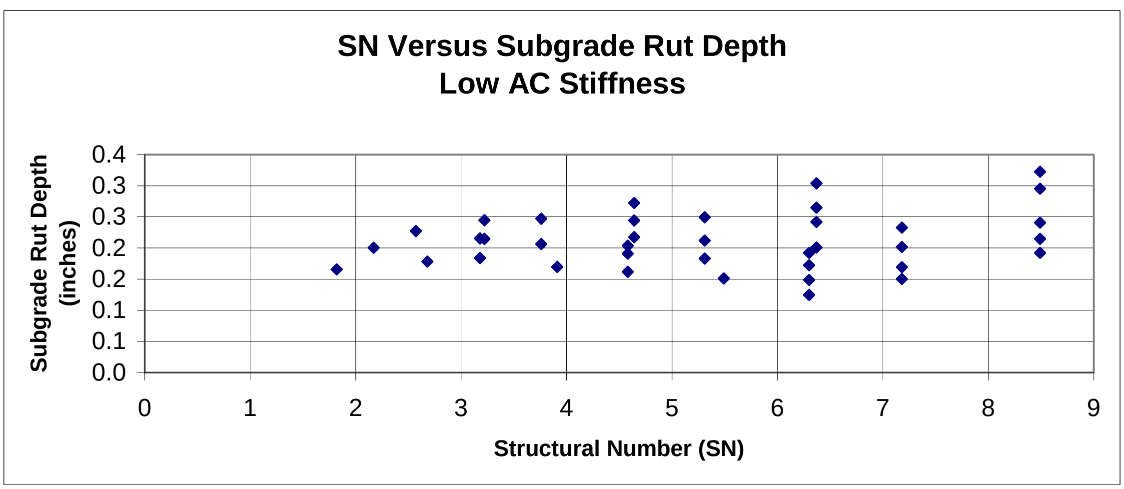
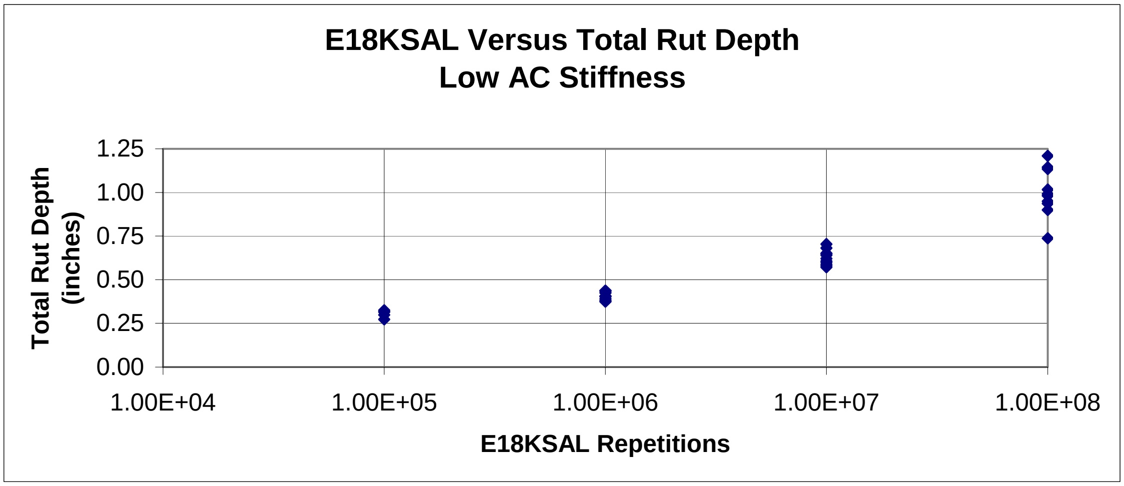
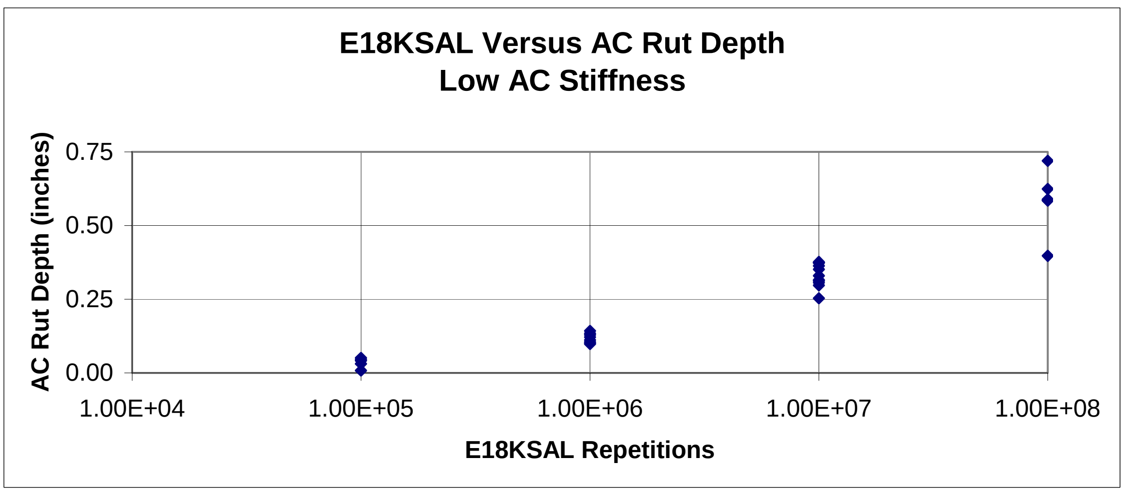


Figure D-187 Rut Depths versus Structural Number Set 6-CB





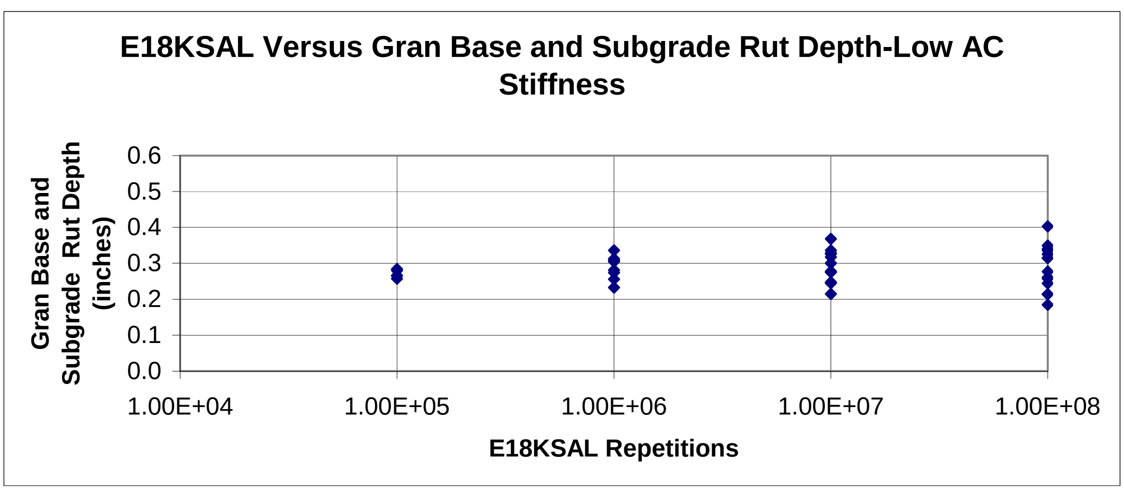
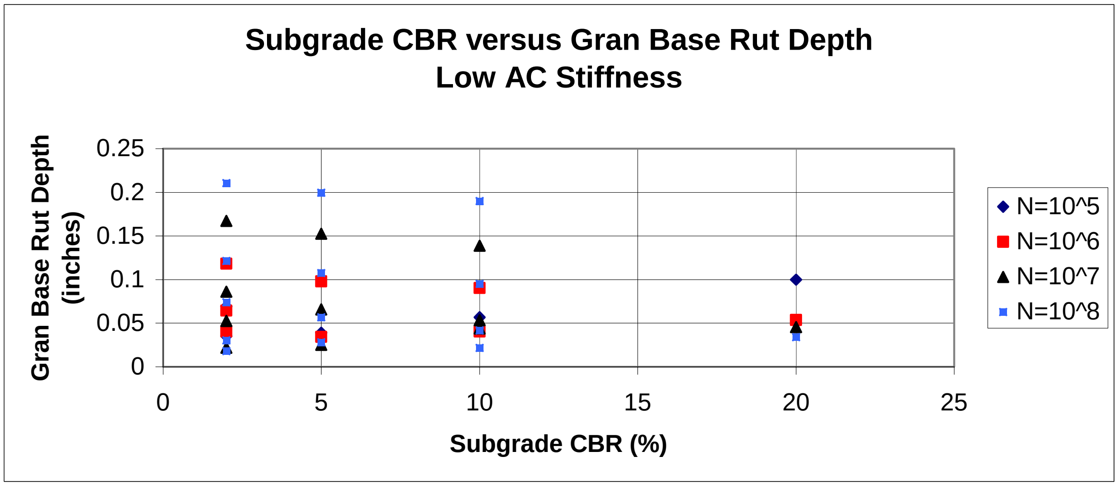


Figure D-188 Rut Depths versus 18KESAL Repetitions Set 6-CB



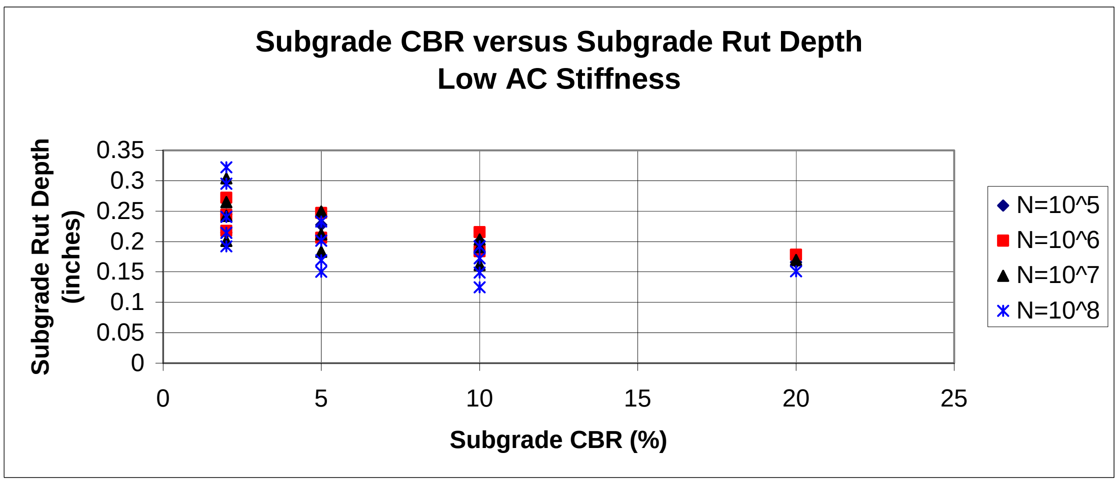


Figure D-189 Base / Subgrade Rut Depths versus Subgrade CBR (All data) Set 6-CB

Table D-81 AASHTO Study Data – Set 7-CB (β_{acr1} = 0.508, β_{acr2} = 0.9, β_{acr3} = 1.2, β_{GB} = 1.75, β_{SG} = 1.71)

				Rut Depth Value			
Hac	***CBRsg***	***N Design***	***SN***	***AC***	***GB***	***SG***	***Total***
2	2	1.00E+05	3.22	0.047	0.069	0.203	0.320
4	2	1.00E+05	3.22	0.070	0.035	0.231	0.335
3	5	1.00E+05	2.57	0.078	0.039	0.217	0.334
2	10	1.00E+05	2.17	0.065	0.056	0.194	0.315
1	20	1.00E+05	1.82	0.012	0.099	0.162	0.273
			Average	***0.054***	***0.060***	***0.201***	***0.315***
2	2	1.00E+06	4.64	0.152	0.120	0.213	0.484
4	2	1.00E+06	4.64	0.199	0.065	0.238	0.503
6	2	1.00E+06	4.64	0.172	0.041	0.264	0.477
2	5	1.00E+06	3.76	0.157	0.099	0.203	0.459
5	5	1.00E+06	3.76	0.187	0.035	0.242	0.463
2	10	1.00E+06	3.18	0.162	0.091	0.182	0.435
4	10	1.00E+06	3.18	0.206	0.041	0.212	0.458
3	20	1.00E+06	2.68	0.219	0.054	0.176	0.450
			Average	***0.182***	***0.068***	***0.216***	***0.466***
2	2	1.00E+07	6.37	0.481	0.171	0.202	0.853
5	2	1.00E+07	6.37	0.577	0.088	0.243	0.908
7	2	1.00E+07	6.37	0.507	0.054	0.265	0.826
10	2	1.00E+07	6.37	0.390	0.023	0.303	0.715
2	5	1.00E+07	5.31	0.486	0.156	0.184	0.826
5	5	1.00E+07	5.31	0.558	0.067	0.212	0.838
8	5	1.00E+07	5.31	0.458	0.026	0.249	0.732
2	10	1.00E+07	4.58	0.472	0.142	0.162	0.776
5	10	1.00E+07	4.58	0.580	0.055	0.191	0.825
6	10	1.00E+07	4.58	0.541	0.045	0.203	0.789
5	20	1.00E+07	3.91	0.575	0.046	0.169	0.790
			Average	***0.511***	***0.079***	***0.217***	***0.807***
2	2	1.00E+08	8.49	0.906	0.217	0.198	1.320
5	2	1.00E+08	8.49	1.820	0.125	0.221	2.166
8	2	1.00E+08	8.49	1.522	0.076	0.247	1.845
12	2	1.00E+08	8.49	0.960	0.031	0.302	1.293
14	2	1.00E+08	8.49	0.611	0.019	0.329	0.958
2	5	1.00E+08	7.18	0.901	0.205	0.153	1.260
5	5	1.00E+08	7.18	1.760	0.111	0.173	2.043
8	5	1.00E+08	7.18	1.462	0.058	0.205	1.725
11	5	1.00E+08	7.18	1.108	0.029	0.236	1.373
2	10	1.00E+08	6.3	0.900	0.195	0.127	1.222
5	10	1.00E+08	6.3	1.726	0.098	0.151	1.975
8	10	1.00E+08	6.3	1.432	0.043	0.174	1.649
10	10	1.00E+08	6.3	1.234	0.022	0.194	1.451
8	20	1.00E+08	5.49	1.461	0.035	0.152	1.648
			Average	***1.272***	***0.090***	***0.204***	***1.566***

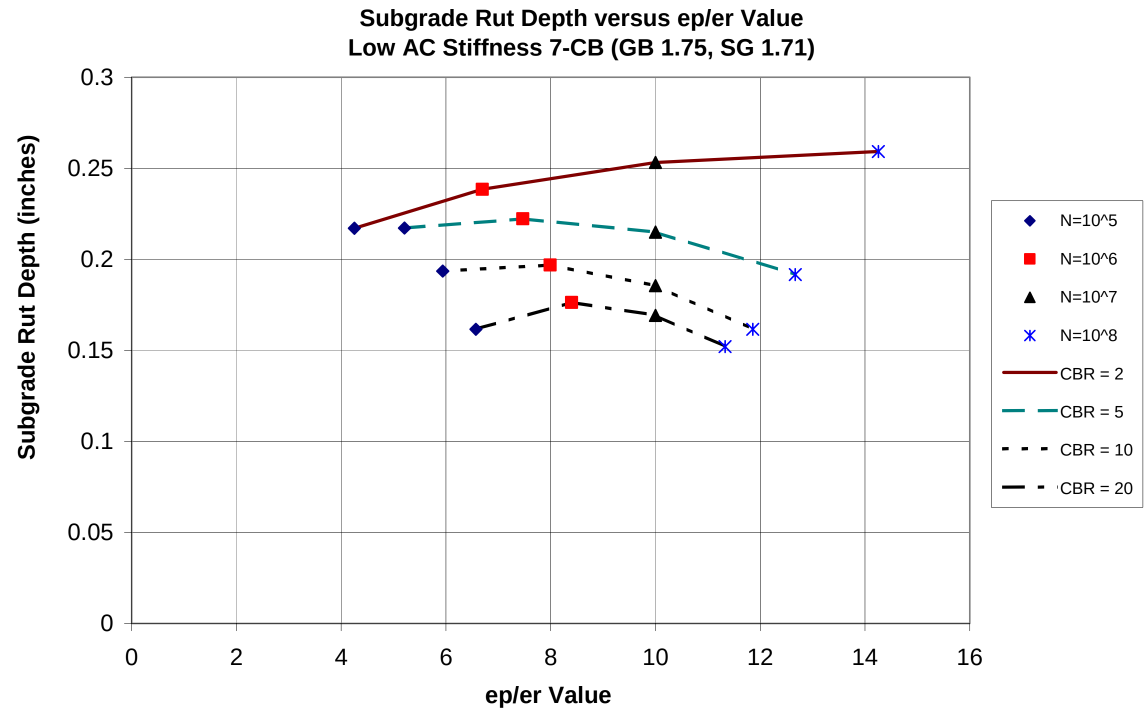


Figure D-190 Subgrade Rut Depth versus ep/er Value Set 7-CB

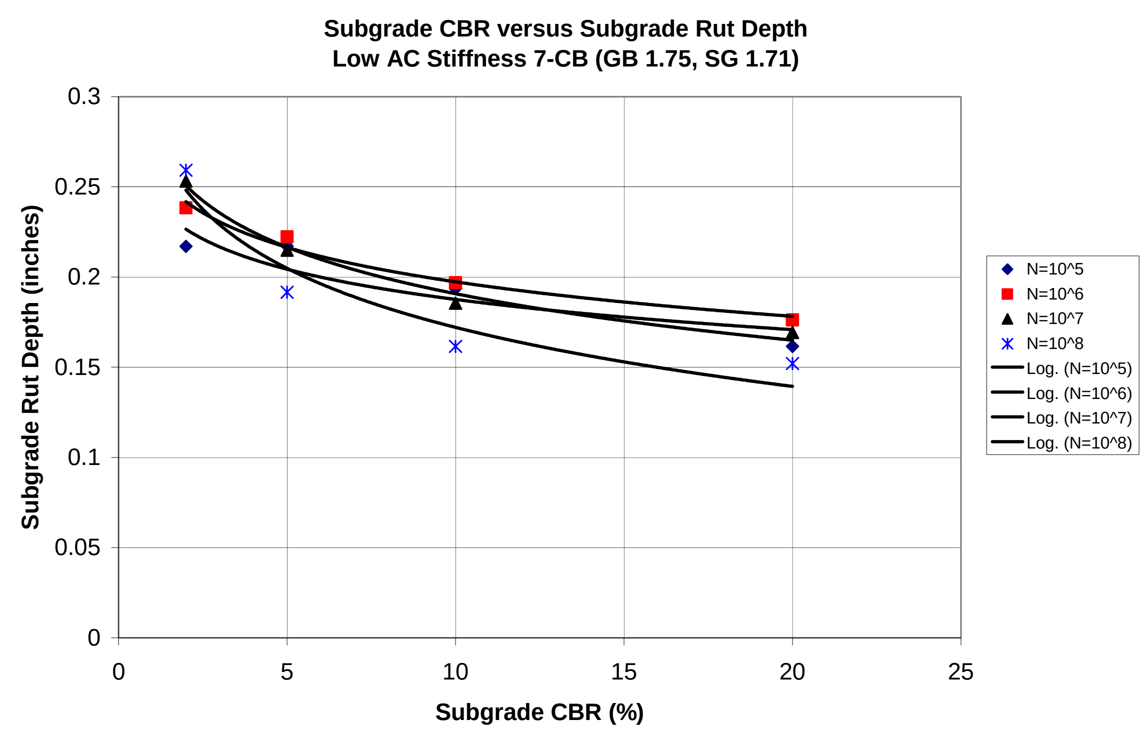
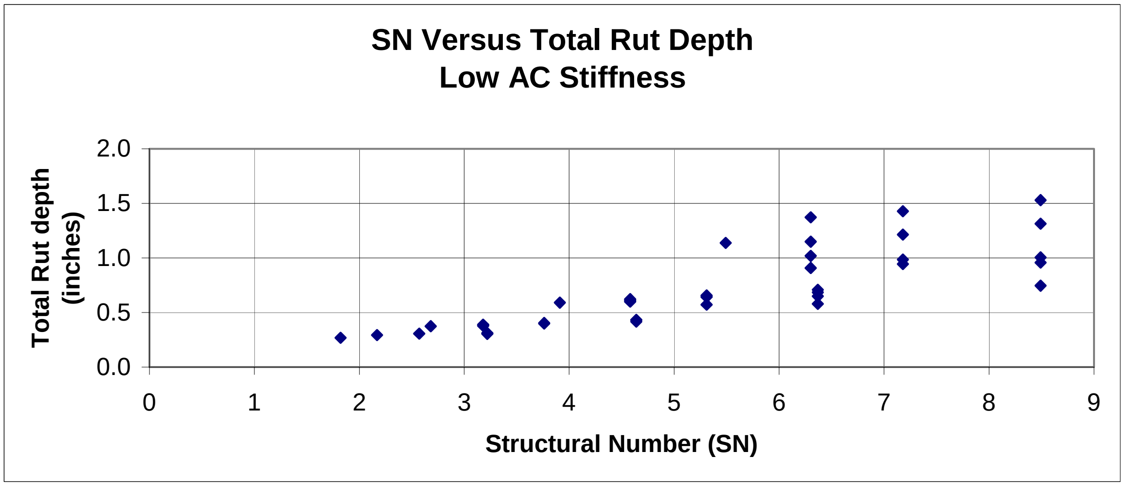
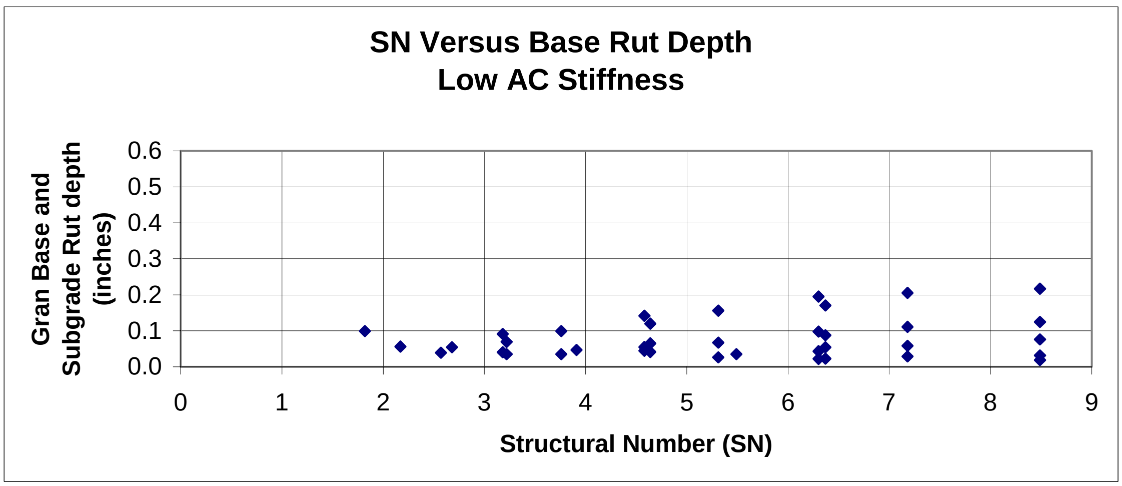


Figure D-191 Average Subgrade Rut Depth versus Subgrade CBR (%) Set 7-CB





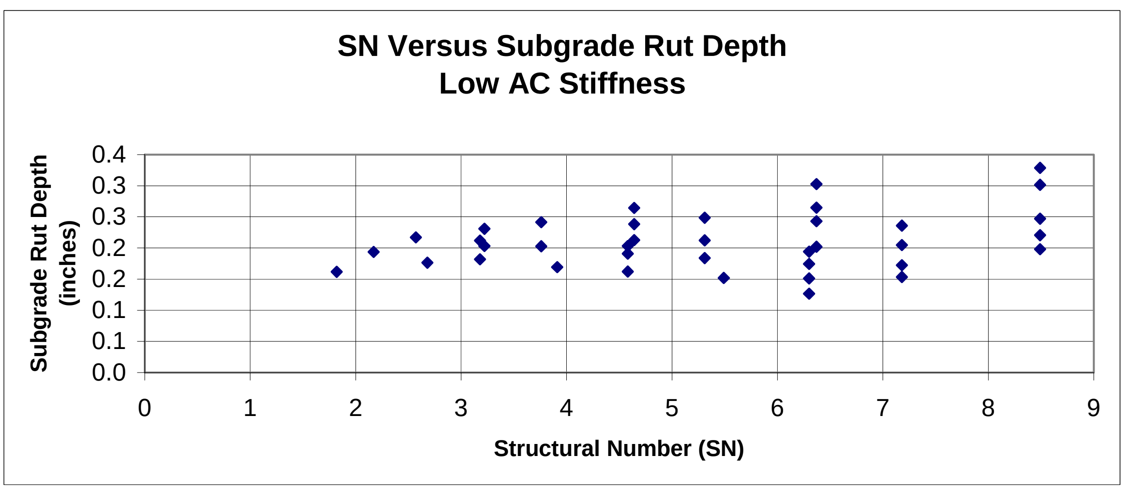
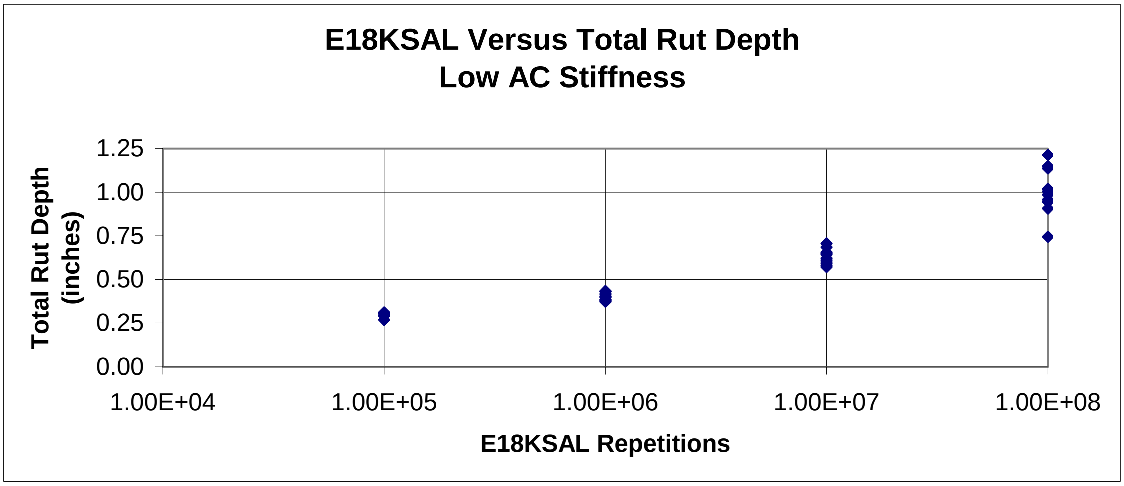
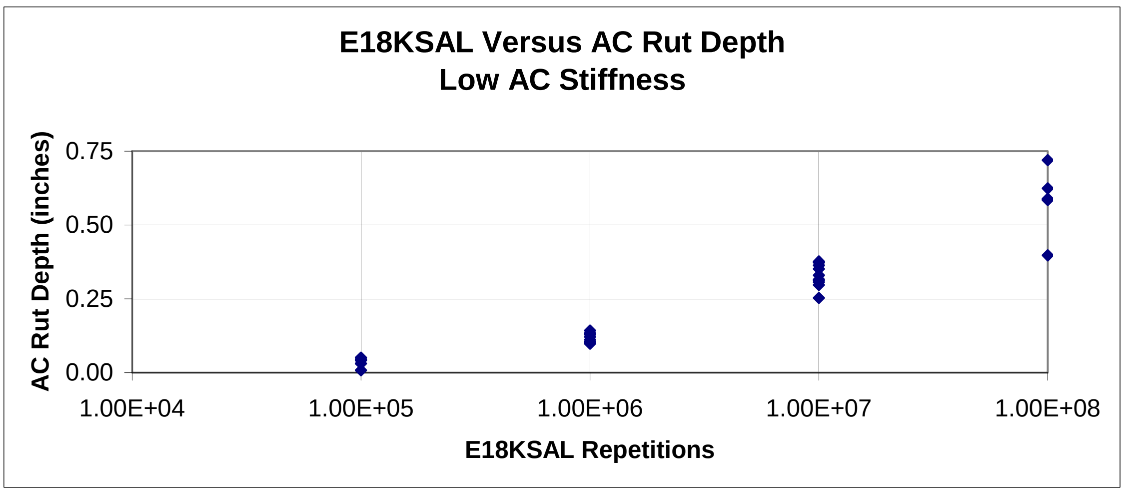


Figure D-192 Rut Depths versus Structural Number Set 7-CB





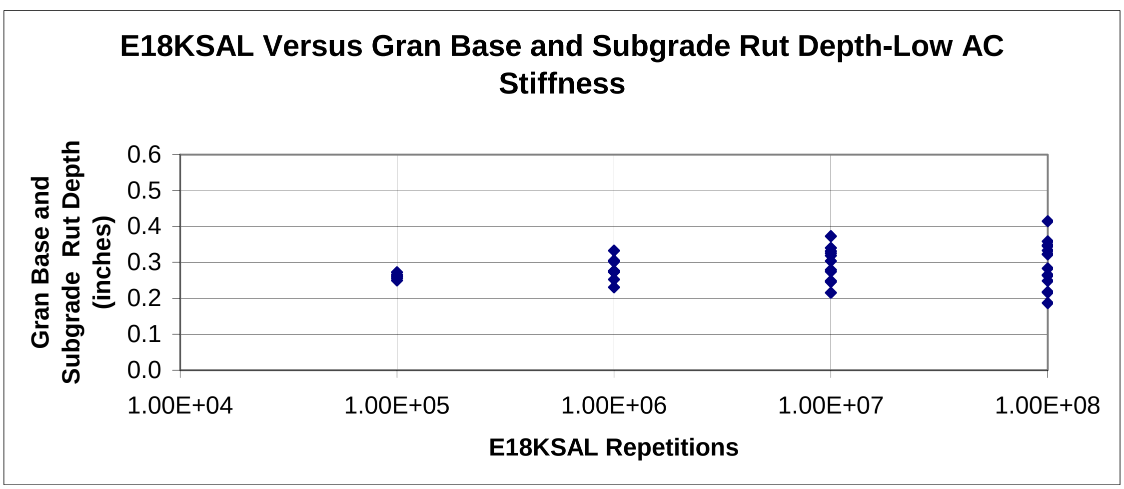
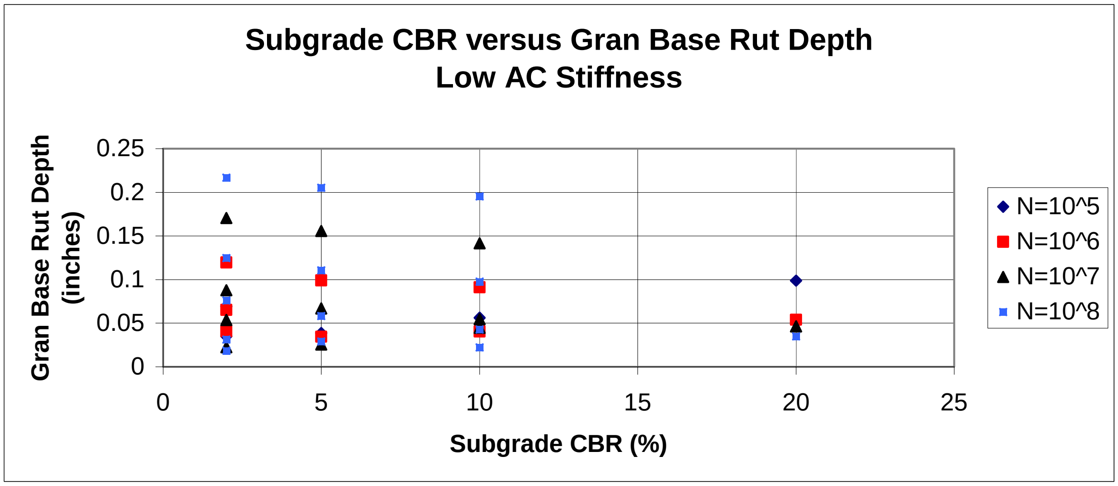


Figure D-193 Rut Depths versus 18KESAL Repetitions Set 7-CB



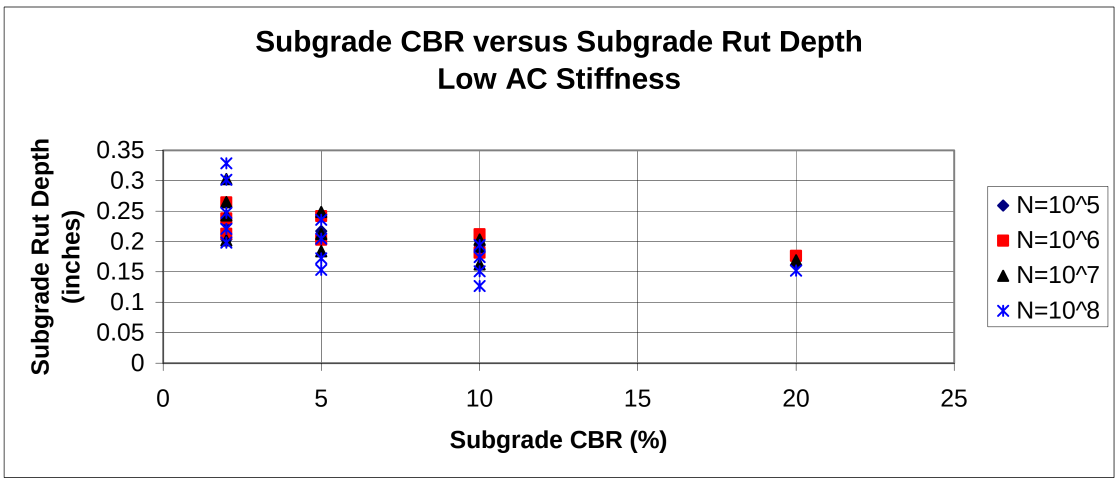


Figure D-194 Base / Subgrade Rut Depths versus Subgrade CBR (All data) Set 7-CB

Table D-82 AASHTO Study Data – Set 8-CB (β_{acr1} = 0.508, β_{acr2} = 0.9, β_{acr3} = 1.2, β_{GB} = 1.05, β_{SG} = 1.35)

				Rut Depth Value			
Hac	***CBRsg***	***N Design***	***SN***	***AC***	***GB***	***SG***	***Total***
2	2	1.00E+05	3.22	0.047	0.067	0.163	0.278
4	2	1.00E+05	3.22	0.070	0.033	0.185	0.288
3	5	1.00E+05	2.57	0.078	0.036	0.209	0.324
2	10	1.00E+05	2.17	0.065	0.053	0.210	0.327
1	20	1.00E+05	1.82	0.012	0.093	0.192	0.297
			Average	***0.054***	***0.056***	***0.192***	***0.303***
2	2	1.00E+06	4.64	0.152	0.119	0.171	0.442
4	2	1.00E+06	4.64	0.199	0.065	0.192	0.456
6	2	1.00E+06	4.64	0.172	0.039	0.213	0.424
2	5	1.00E+06	3.76	0.157	0.099	0.200	0.456
5	5	1.00E+06	3.76	0.187	0.033	0.237	0.458
2	10	1.00E+06	3.18	0.162	0.090	0.203	0.455
4	10	1.00E+06	3.18	0.206	0.039	0.235	0.480
3	20	1.00E+06	2.68	0.219	0.052	0.214	0.485
			Average	***0.182***	***0.067***	***0.208***	***0.457***
2	2	1.00E+07	6.37	0.481	0.172	0.163	0.816
5	2	1.00E+07	6.37	0.577	0.088	0.196	0.862
7	2	1.00E+07	6.37	0.507	0.054	0.214	0.775
10	2	1.00E+07	6.37	0.390	0.022	0.244	0.656
2	5	1.00E+07	5.31	0.486	0.157	0.185	0.828
5	5	1.00E+07	5.31	0.558	0.068	0.212	0.839
8	5	1.00E+07	5.31	0.458	0.025	0.248	0.731
2	10	1.00E+07	4.58	0.472	0.143	0.185	0.800
5	10	1.00E+07	4.58	0.580	0.055	0.216	0.851
6	10	1.00E+07	4.58	0.541	0.044	0.230	0.814
5	20	1.00E+07	3.91	0.575	0.046	0.209	0.829
			Average	***0.511***	***0.080***	***0.209***	***0.800***
2	2	1.00E+08	8.49	0.906	0.221	0.160	1.287
5	2	1.00E+08	8.49	1.820	0.127	0.179	2.126
8	2	1.00E+08	8.49	1.522	0.077	0.200	1.800
12	2	1.00E+08	8.49	0.960	0.032	0.244	1.236
14	2	1.00E+08	8.49	0.611	0.018	0.266	0.895
2	5	1.00E+08	7.18	0.901	0.210	0.156	1.267
5	5	1.00E+08	7.18	1.760	0.113	0.175	2.048
8	5	1.00E+08	7.18	1.462	0.060	0.207	1.729
11	5	1.00E+08	7.18	1.108	0.029	0.239	1.376
2	10	1.00E+08	6.3	0.900	0.200	0.146	1.246
5	10	1.00E+08	6.3	1.726	0.100	0.174	2.000
8	10	1.00E+08	6.3	1.432	0.044	0.200	1.676
10	10	1.00E+08	6.3	1.234	0.022	0.223	1.479
8	20	1.00E+08	5.49	1.461	0.035	0.190	1.686
			Average	***1.272***	***0.092***	***0.197***	***1.561***

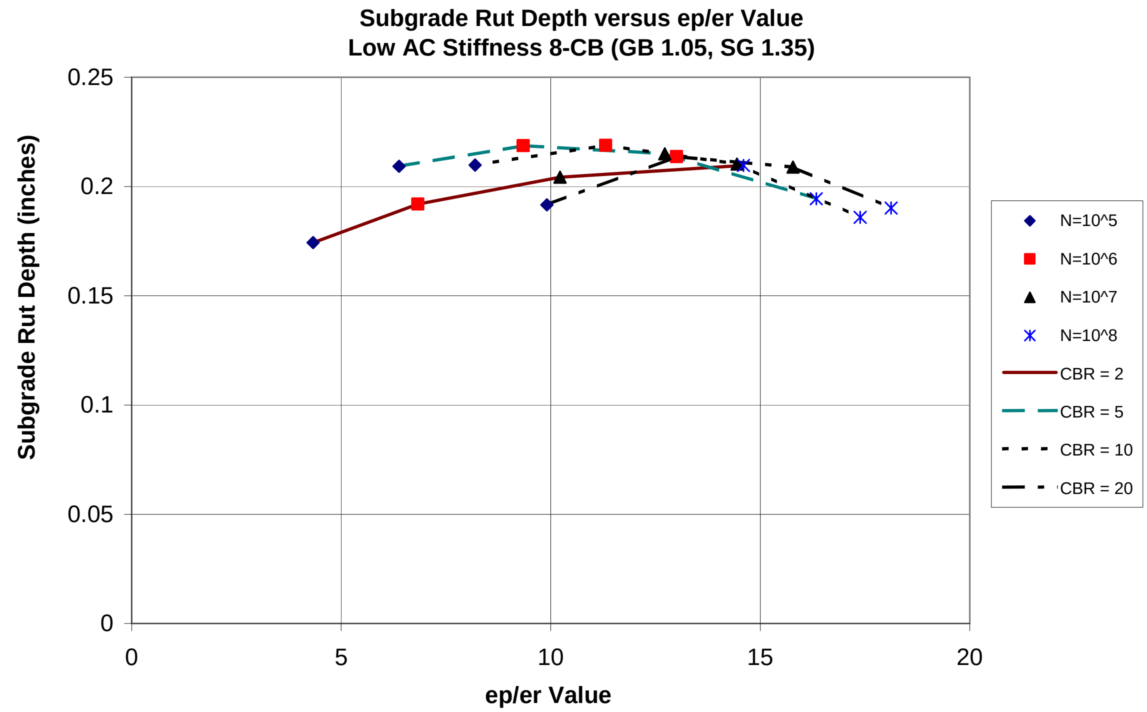


Figure D-195 Subgrade Rut Depth versus ep/er Value Set 8-CB

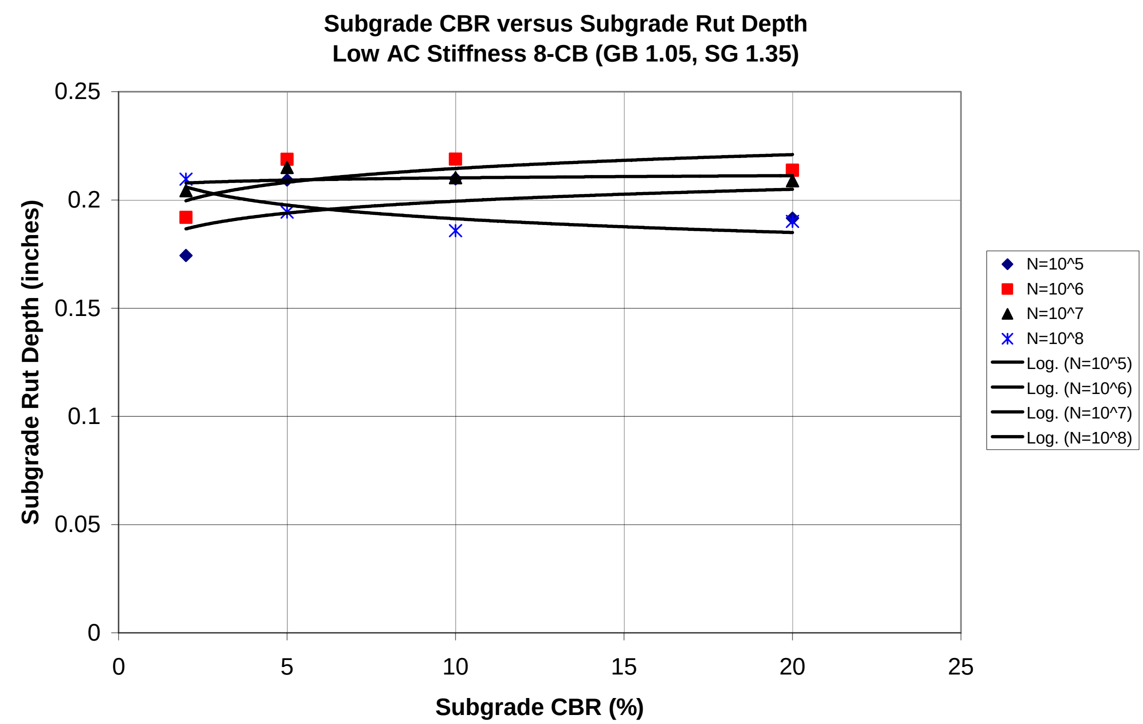
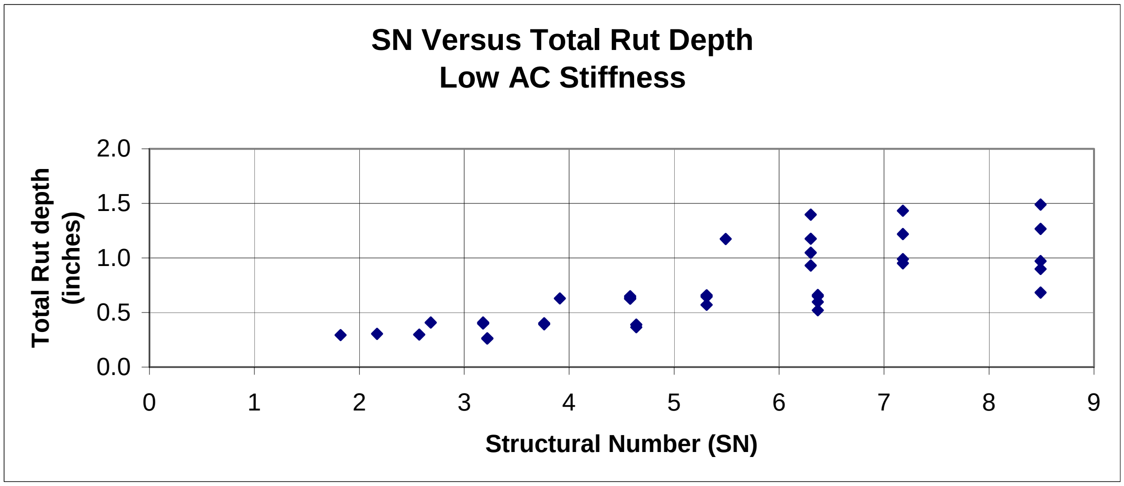
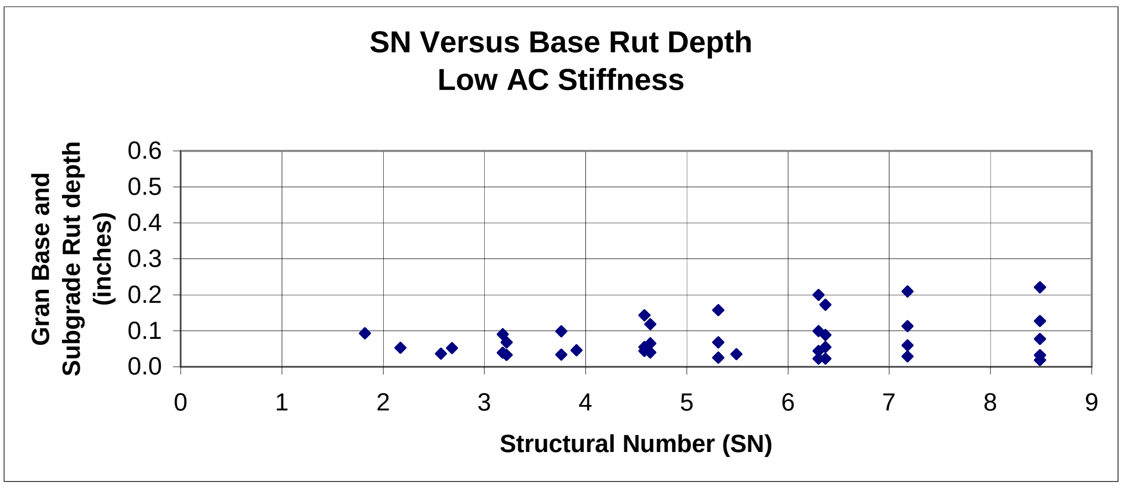


Figure D-196 Average Subgrade Rut Depth versus Subgrade CBR (%) Set 8-CB





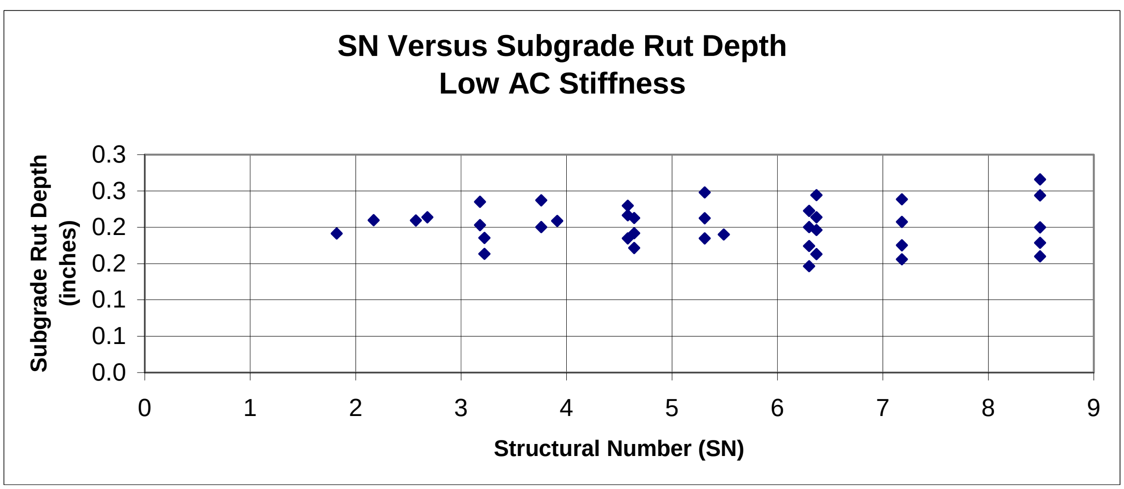
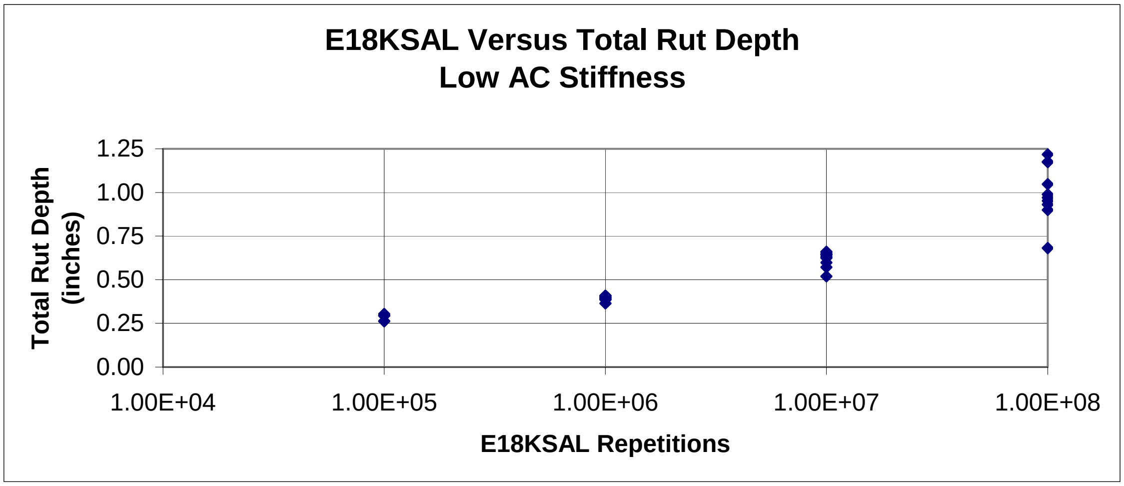
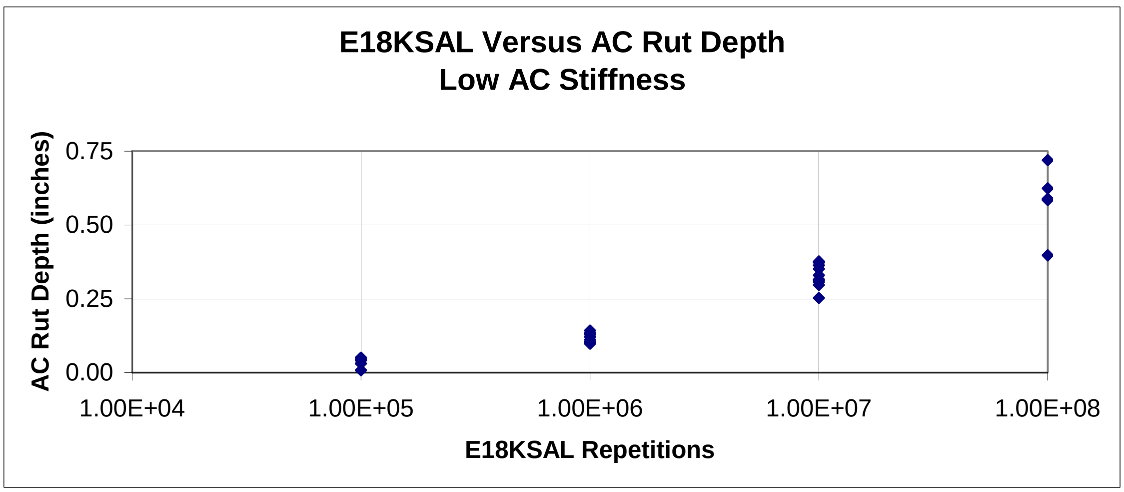


Figure D-197 Rut Depths versus Structural Number Set 8-CB





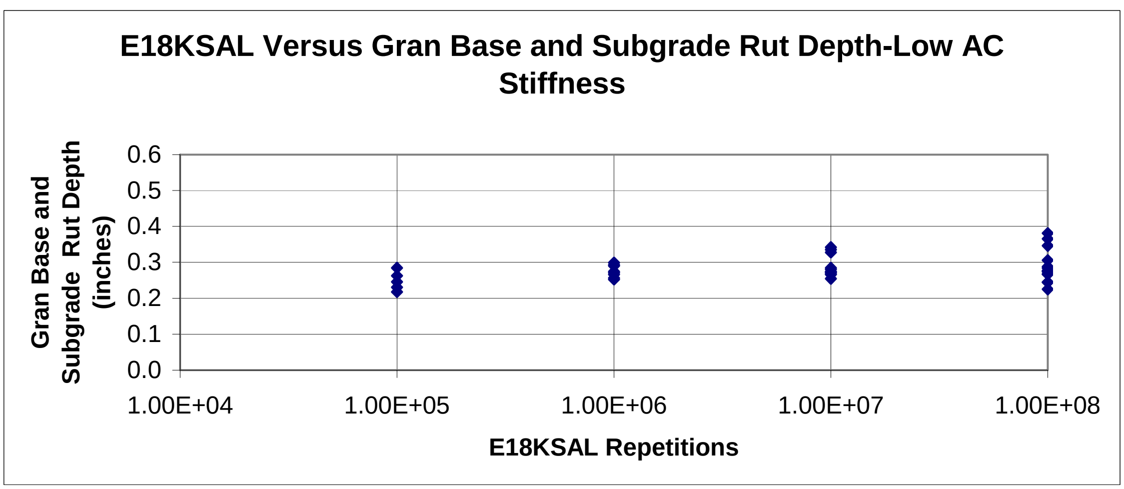
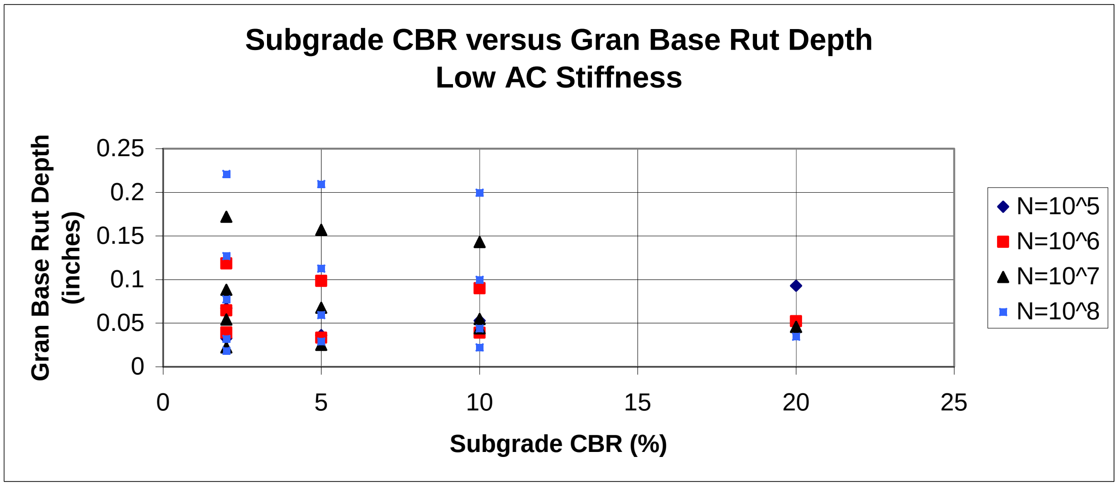


Figure D-198 Rut Depths versus 18KESAL Repetitions Set 8-CB



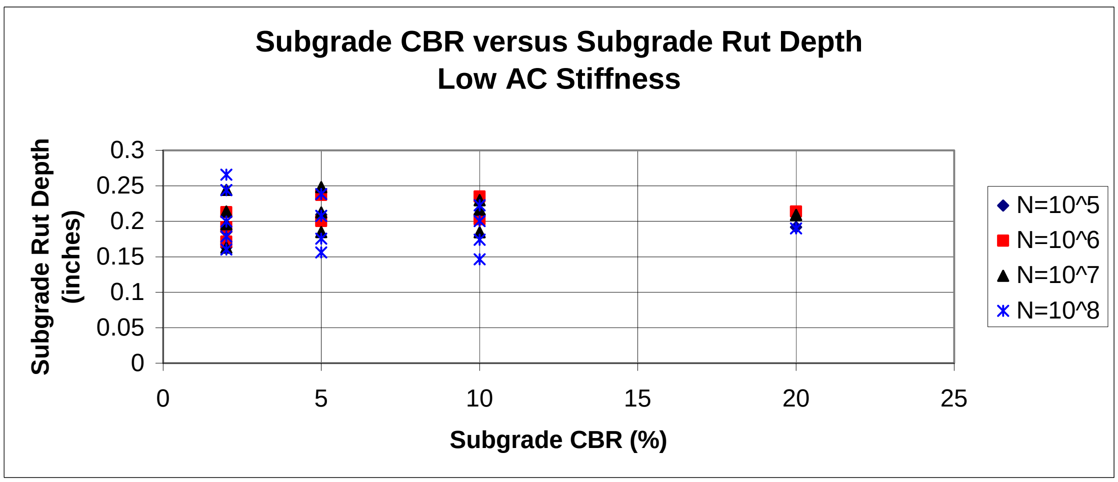


Figure D-199 Base / Subgrade Rut Depths versus Subgrade CBR (All data) Set 8-CB

Table D-83 AASHTO Study Data – Set 9-CB (β_{acr1} = 0.508, β_{acr2} = 0.9, β_{acr3} = 1.2, β_{GB} = 0.60, β_{SG} = 0.93)

				Rut Depth Value			
Hac	***CBRsg***	***N Design***	***SN***	***AC***	***GB***	***SG***	***Total***
2	2	1.00E+05	3.22	0.047	0.066	0.125	0.238
4	2	1.00E+05	3.22	0.070	0.031	0.141	0.242
3	5	1.00E+05	2.57	0.078	0.034	0.191	0.303
2	10	1.00E+05	2.17	0.065	0.050	0.214	0.329
1	20	1.00E+05	1.82	0.012	0.088	0.212	0.313
			Average	***0.054***	***0.054***	***0.177***	***0.285***
2	2	1.00E+06	4.64	0.152	0.119	0.133	0.403
4	2	1.00E+06	4.64	0.199	0.065	0.149	0.413
6	2	1.00E+06	4.64	0.172	0.039	0.165	0.375
2	5	1.00E+06	3.76	0.157	0.099	0.189	0.445
5	5	1.00E+06	3.76	0.187	0.033	0.222	0.442
2	10	1.00E+06	3.18	0.162	0.090	0.214	0.466
4	10	1.00E+06	3.18	0.206	0.038	0.247	0.491
3	20	1.00E+06	2.68	0.219	0.051	0.243	0.513
			Average	***0.182***	***0.067***	***0.195***	***0.444***
2	2	1.00E+07	6.37	0.481	0.176	0.128	0.785
5	2	1.00E+07	6.37	0.577	0.090	0.154	0.821
7	2	1.00E+07	6.37	0.507	0.056	0.168	0.730
10	2	1.00E+07	6.37	0.390	0.022	0.191	0.603
2	5	1.00E+07	5.31	0.486	0.160	0.178	0.825
5	5	1.00E+07	5.31	0.558	0.069	0.205	0.832
8	5	1.00E+07	5.31	0.458	0.025	0.238	0.721
2	10	1.00E+07	4.58	0.472	0.146	0.200	0.818
5	10	1.00E+07	4.58	0.580	0.056	0.233	0.869
6	10	1.00E+07	4.58	0.541	0.044	0.247	0.832
5	20	1.00E+07	3.91	0.575	0.046	0.242	0.863
			Average	***0.511***	***0.081***	***0.199***	***0.791***
2	2	1.00E+08	8.49	0.906	0.229	0.127	1.262
5	2	1.00E+08	8.49	1.820	0.131	0.142	2.093
8	2	1.00E+08	8.49	1.522	0.080	0.159	1.761
12	2	1.00E+08	8.49	0.960	0.033	0.193	1.186
14	2	1.00E+08	8.49	0.611	0.019	0.210	0.840
2	5	1.00E+08	7.18	0.901	0.217	0.154	1.271
5	5	1.00E+08	7.18	1.760	0.116	0.172	2.048
8	5	1.00E+08	7.18	1.462	0.062	0.203	1.727
11	5	1.00E+08	7.18	1.108	0.029	0.233	1.371
2	10	1.00E+08	6.3	0.900	0.206	0.162	1.268
5	10	1.00E+08	6.3	1.726	0.103	0.191	2.021
8	10	1.00E+08	6.3	1.432	0.045	0.220	1.697
10	10	1.00E+08	6.3	1.234	0.023	0.243	1.500
8	20	1.00E+08	5.49	1.461	0.035	0.224	1.720
			Average	***1.272***	***0.095***	***0.188***	***1.555***

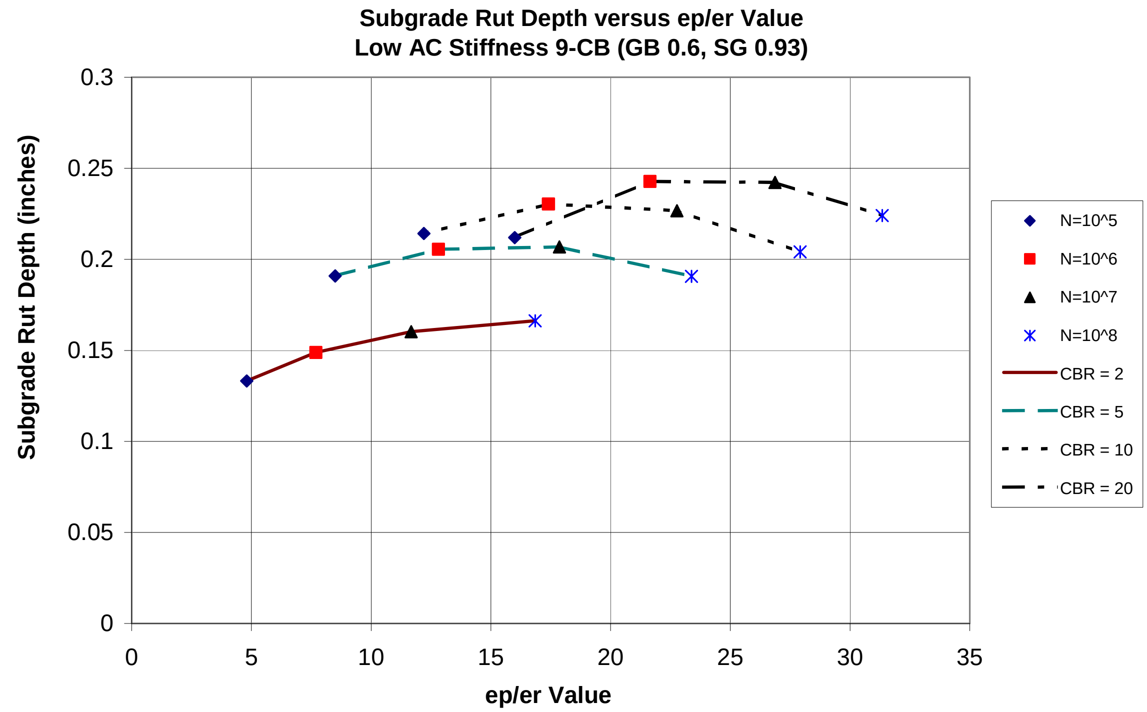


Figure D-200 Subgrade Rut Depth versus ep/er Value Set 9-CB

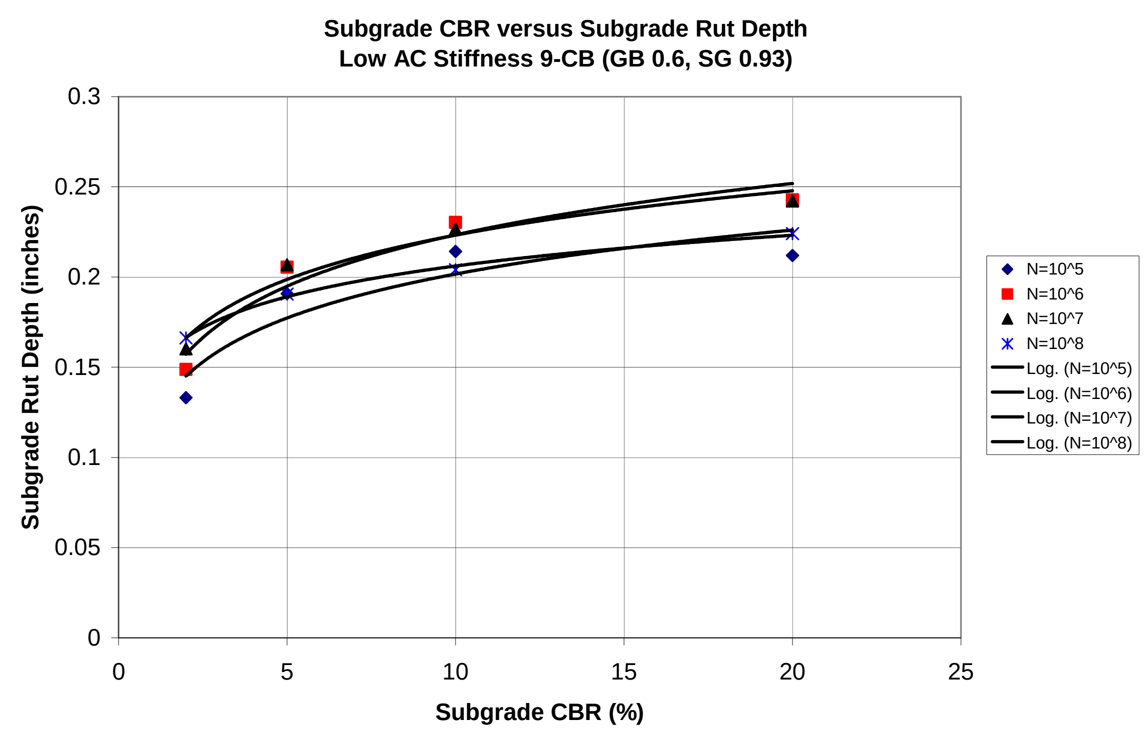
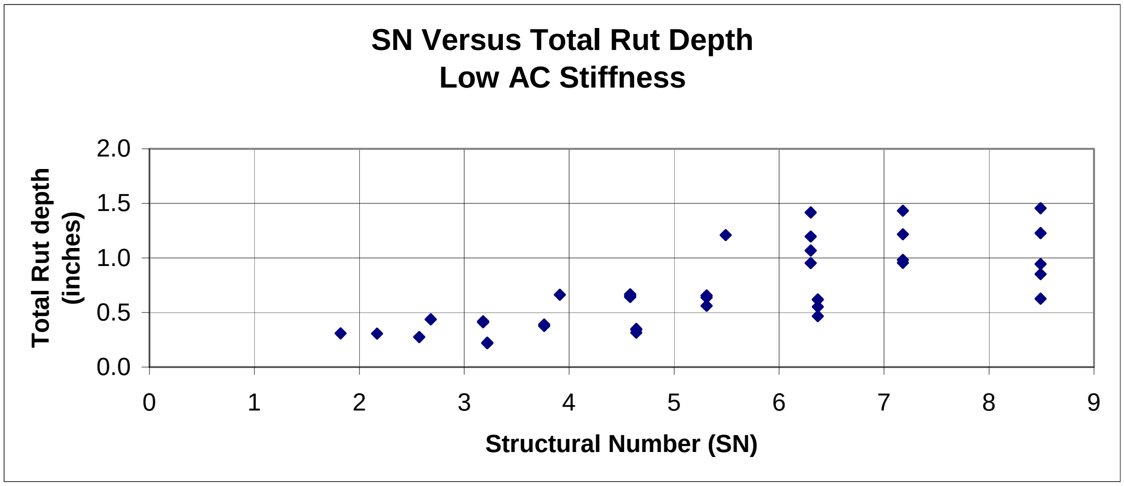
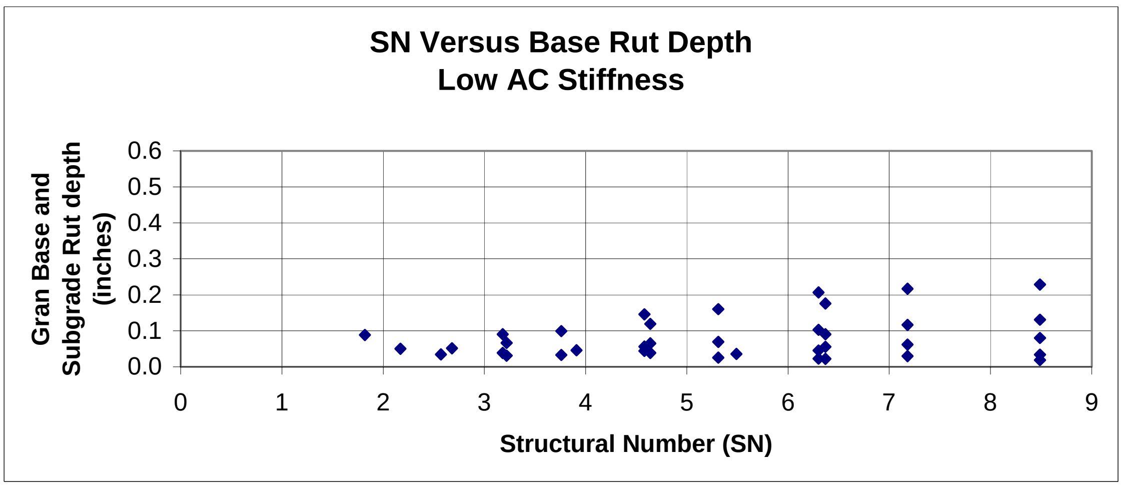


Figure D-201 Average Subgrade Rut Depth versus Subgrade CBR (%) Set 9-CB





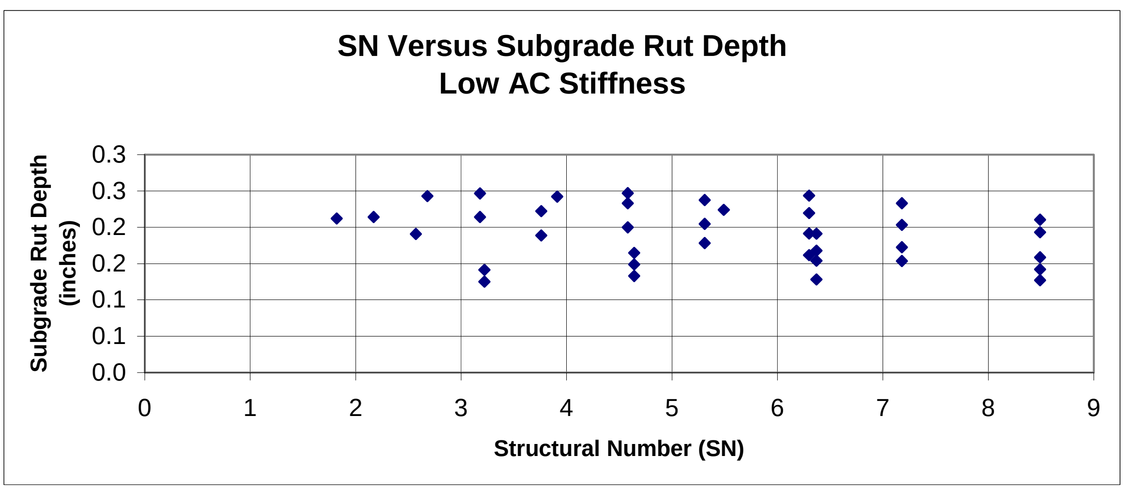
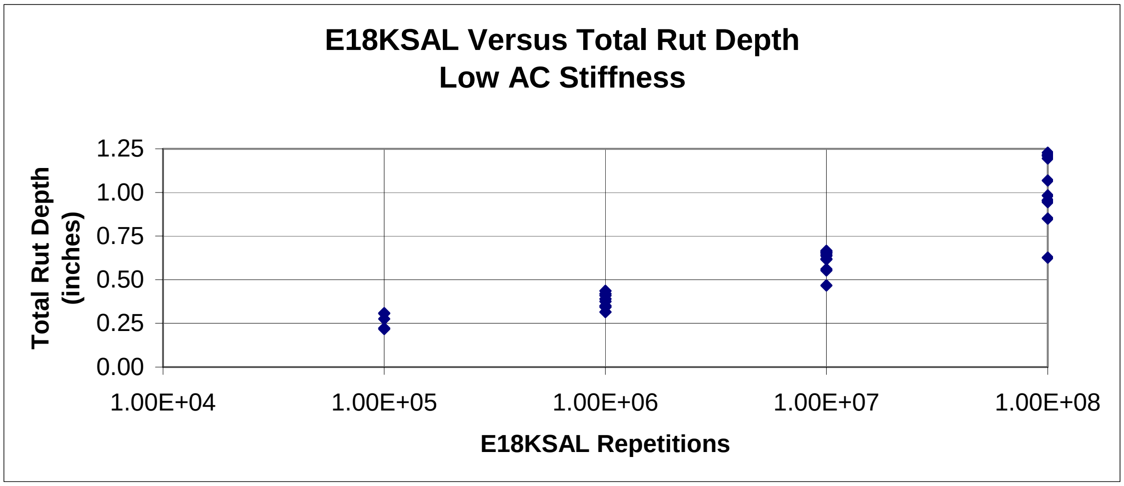
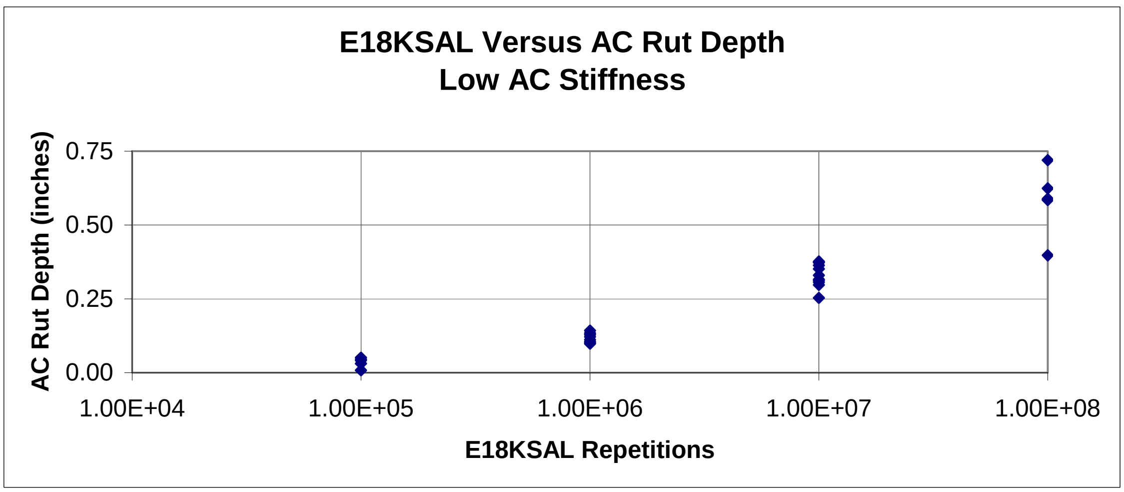


Figure D-202 Rut Depths versus Structural Number Set 9-CB





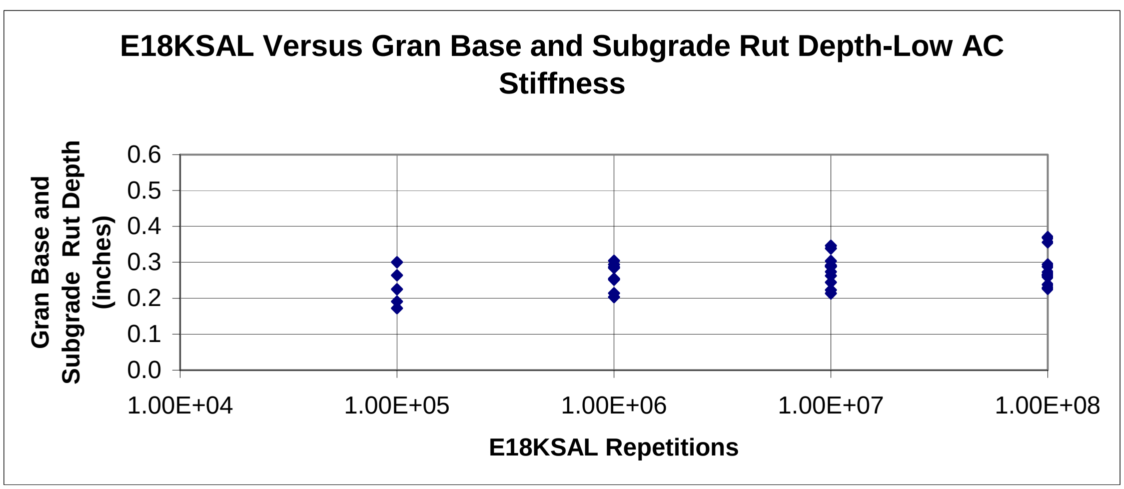
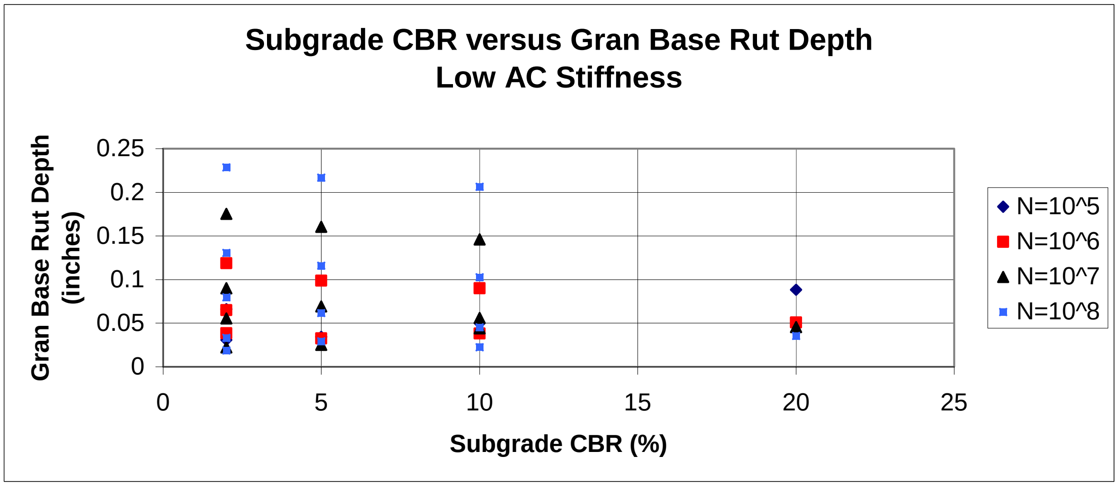


Figure D-203 Rut Depths versus 18KESAL Repetitions Set 9-CB



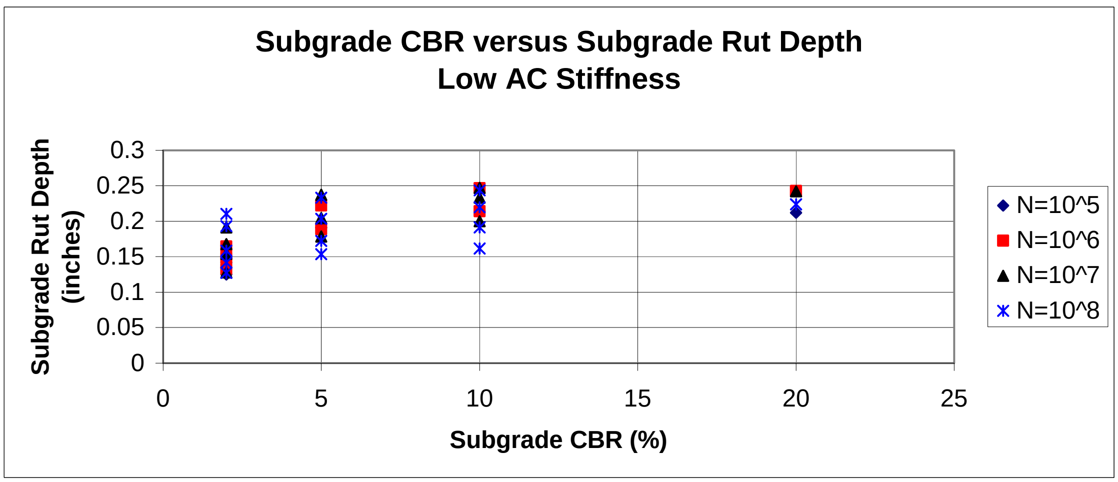


Figure D-204 Base / Subgrade Rut Depths versus Subgrade CBR (All data) Set 9-CB

Table D-84 AASHTO Study Data – Set 10-CB (β_{acr1} = 0.508, β_{acr2} = 0.9, β_{acr3} = 1.2, β_{GB} = 1.14, β_{SG} = 1.51)

				Rut Depth Value			
Hac	***CBRsg***	***N Design***	***SN***	***AC***	***GB***	***SG***	***Total***
2	2	1.00E+05	3.22	0.047	0.063	0.129	0.240
4	2	1.00E+05	3.22	0.070	0.030	0.144	0.244
3	5	1.00E+05	2.57	0.078	0.033	0.178	0.289
2	10	1.00E+05	2.17	0.065	0.048	0.190	0.303
1	20	1.00E+05	1.82	0.012	0.086	0.181	0.279
			Average	***0.054***	***0.052***	***0.165***	***0.271***
2	2	1.00E+06	4.64	0.152	0.117	0.150	0.419
4	2	1.00E+06	4.64	0.199	0.064	0.167	0.431
6	2	1.00E+06	4.64	0.172	0.038	0.183	0.393
2	5	1.00E+06	3.76	0.157	0.097	0.188	0.442
5	5	1.00E+06	3.76	0.187	0.032	0.219	0.438
2	10	1.00E+06	3.18	0.162	0.088	0.198	0.449
4	10	1.00E+06	3.18	0.206	0.038	0.226	0.470
3	20	1.00E+06	2.68	0.219	0.051	0.213	0.483
			Average	***0.182***	***0.066***	***0.193***	***0.440***
2	2	1.00E+07	6.37	0.481	0.176	0.157	0.813
5	2	1.00E+07	6.37	0.577	0.090	0.188	0.855
7	2	1.00E+07	6.37	0.507	0.055	0.203	0.766
10	2	1.00E+07	6.37	0.390	0.022	0.228	0.641
2	5	1.00E+07	5.31	0.486	0.160	0.186	0.832
5	5	1.00E+07	5.31	0.558	0.069	0.212	0.840
8	5	1.00E+07	5.31	0.458	0.026	0.244	0.727
2	10	1.00E+07	4.58	0.472	0.146	0.191	0.809
5	10	1.00E+07	4.58	0.580	0.056	0.221	0.856
6	10	1.00E+07	4.58	0.541	0.044	0.234	0.819
5	20	1.00E+07	3.91	0.575	0.046	0.217	0.838
			Average	***0.511***	***0.081***	***0.207***	***0.800***
2	2	1.00E+08	8.49	0.906	0.232	0.167	1.304
5	2	1.00E+08	8.49	1.820	0.132	0.186	2.138
8	2	1.00E+08	8.49	1.522	0.081	0.206	1.809
12	2	1.00E+08	8.49	0.960	0.034	0.248	1.241
14	2	1.00E+08	8.49	0.611	0.019	0.269	0.899
2	5	1.00E+08	7.18	0.901	0.219	0.166	1.287
5	5	1.00E+08	7.18	1.760	0.117	0.186	2.063
8	5	1.00E+08	7.18	1.462	0.062	0.218	1.743
11	5	1.00E+08	7.18	1.108	0.030	0.249	1.387
2	10	1.00E+08	6.3	0.900	0.209	0.158	1.267
5	10	1.00E+08	6.3	1.726	0.104	0.186	2.017
8	10	1.00E+08	6.3	1.432	0.046	0.213	1.691
10	10	1.00E+08	6.3	1.234	0.023	0.235	1.492
8	20	1.00E+08	5.49	1.461	0.036	0.204	1.700
			Average	***1.272***	***0.096***	***0.207***	***1.574***

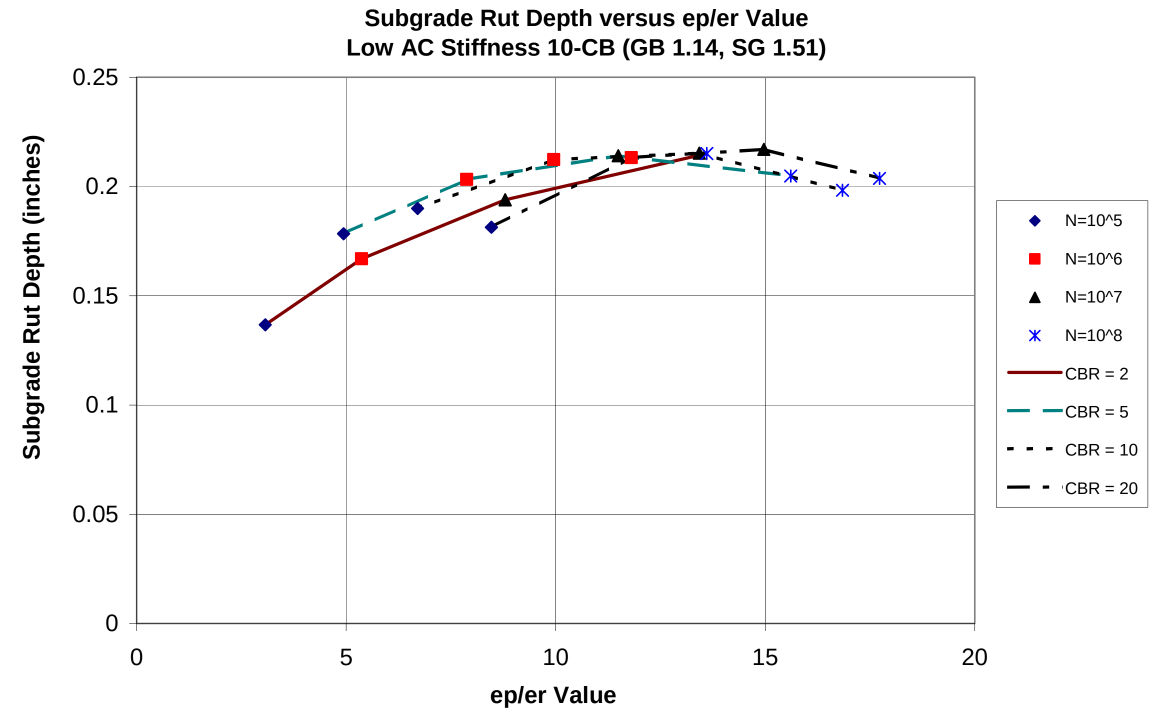


Figure D-205 Subgrade Rut Depth versus ep/er Value Set 10-CB

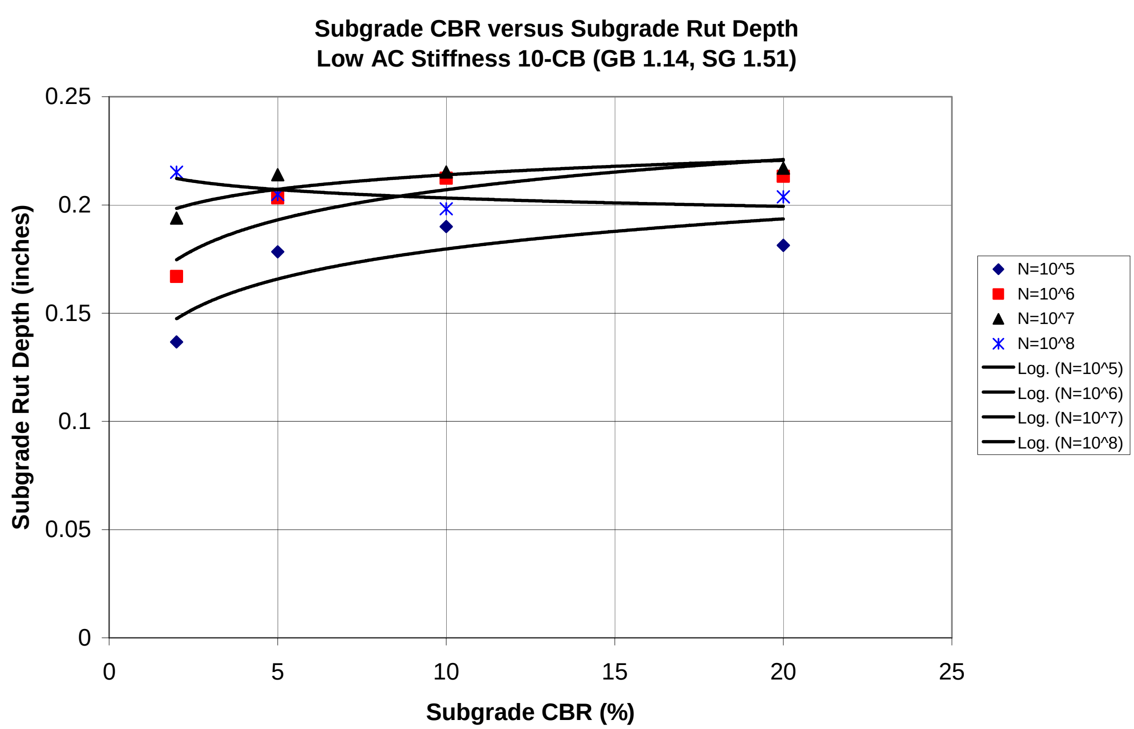
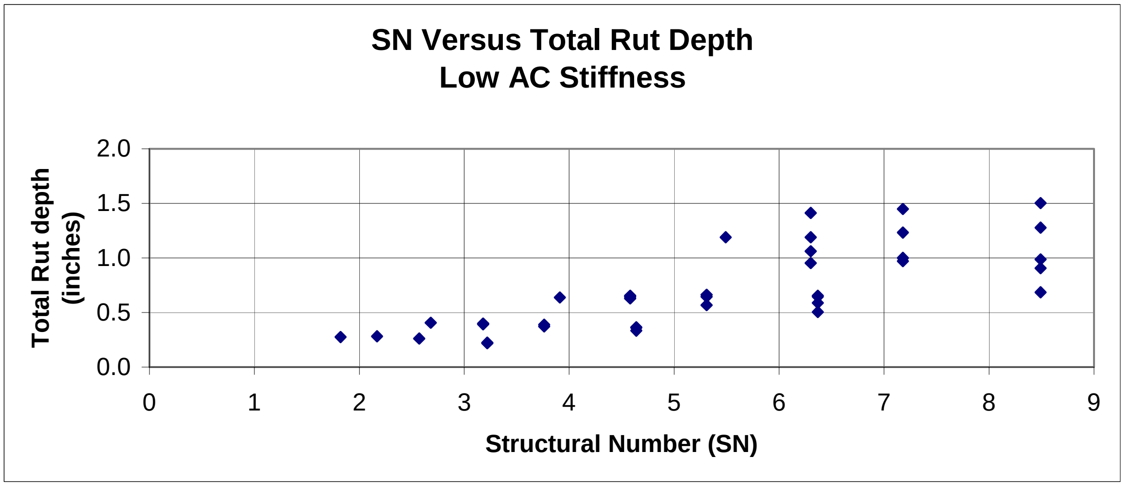
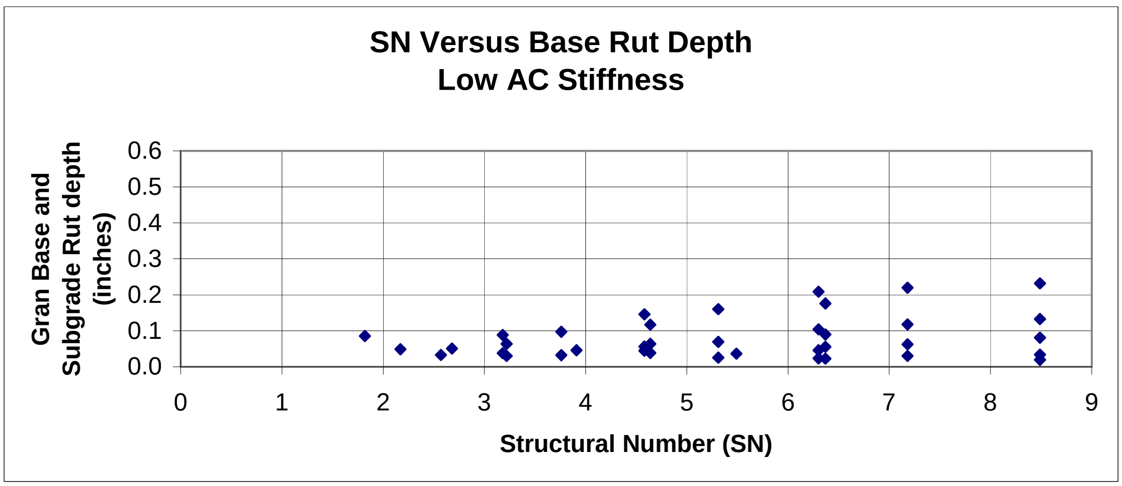


Figure D-206 Average Subgrade Rut Depth versus Subgrade CBR (%) Set 10-CB





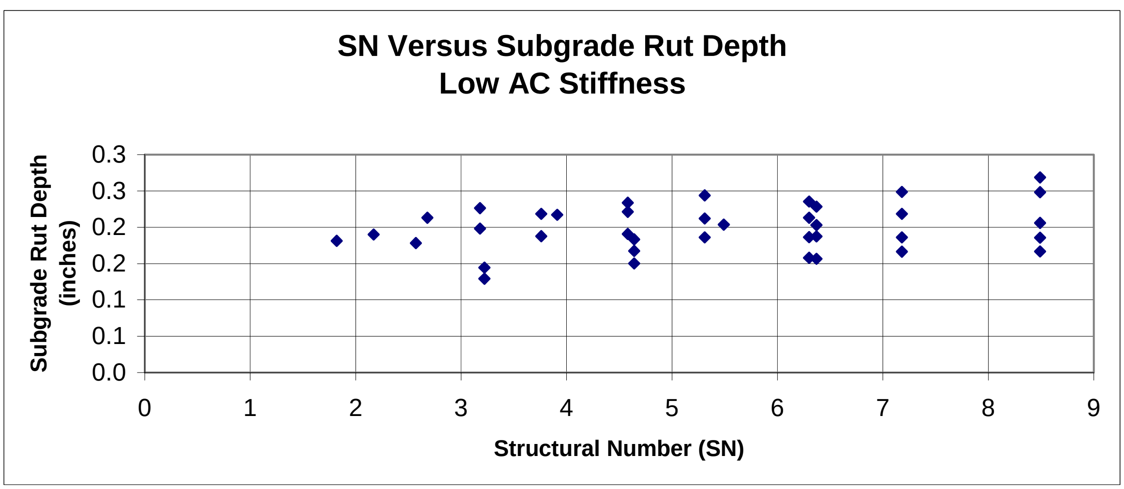
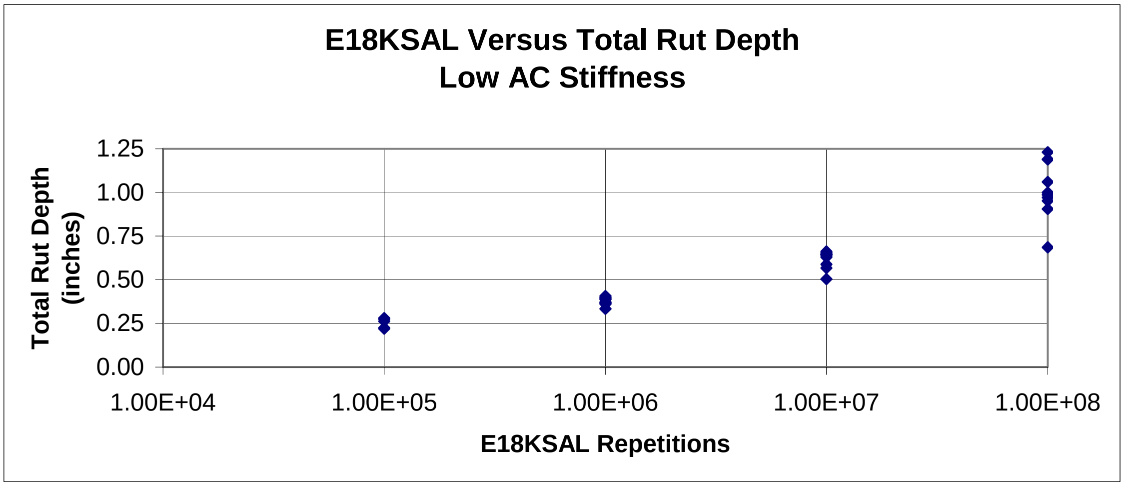
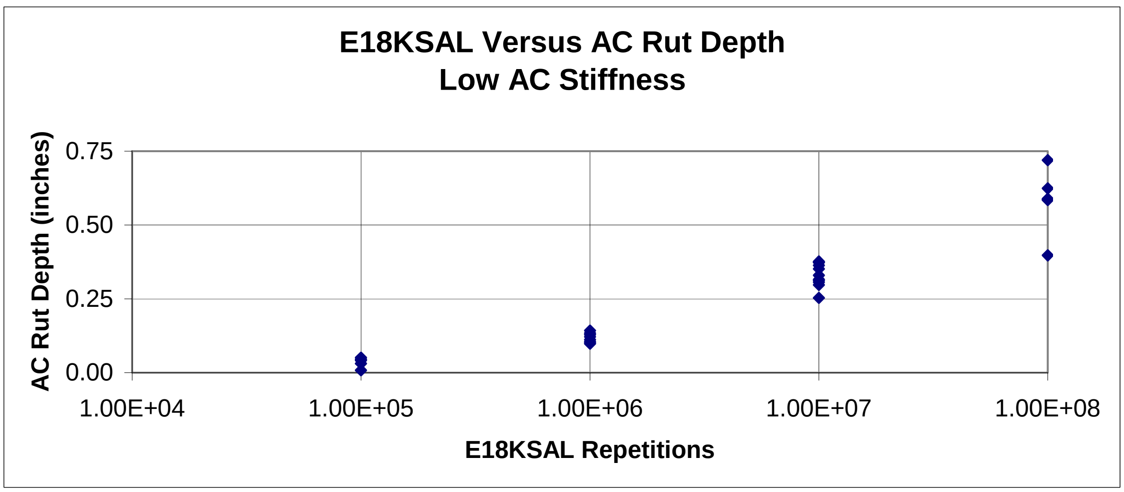


Figure D-207 Rut Depths versus Structural Number Set 10-CB





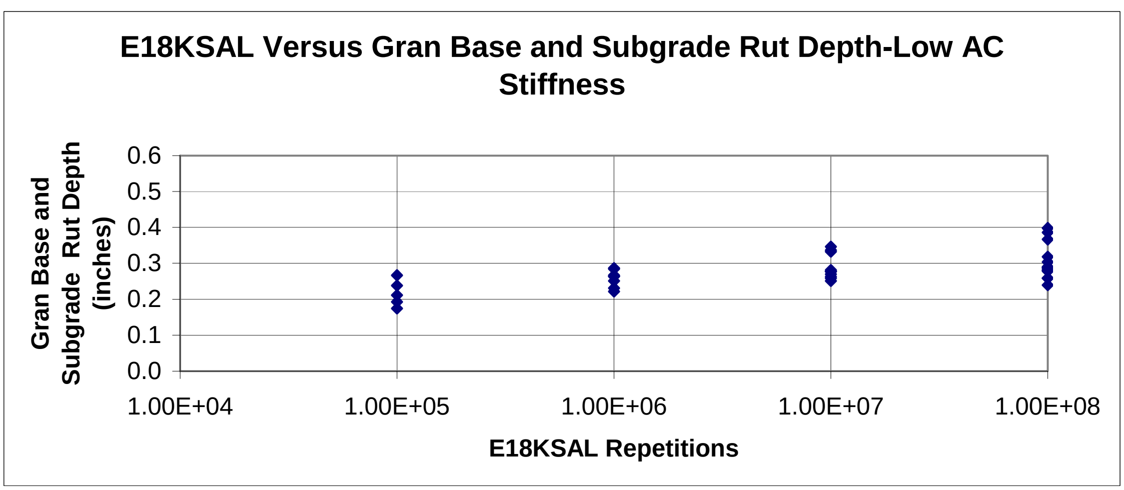
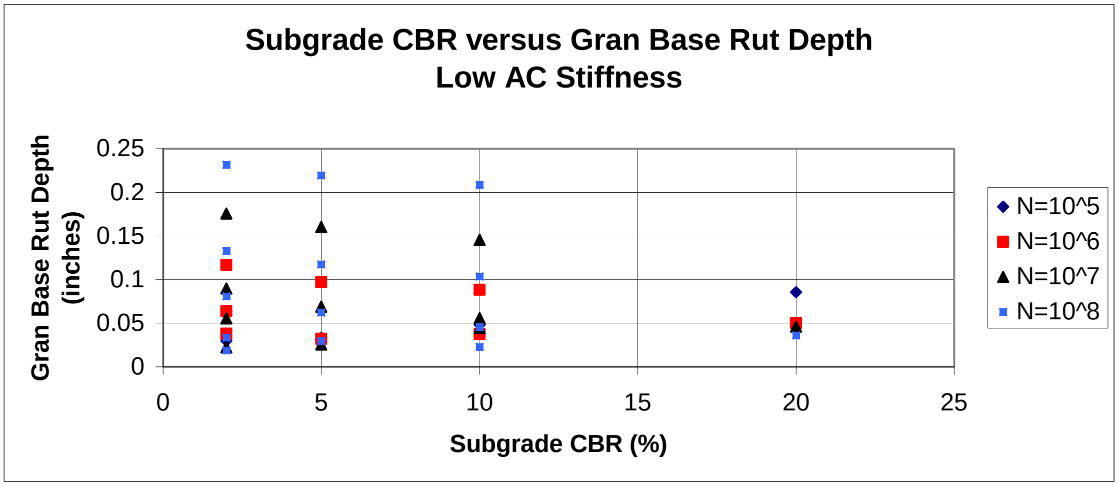


Figure D-208 Rut Depths versus 18KESAL Repetitions Set 10-CB



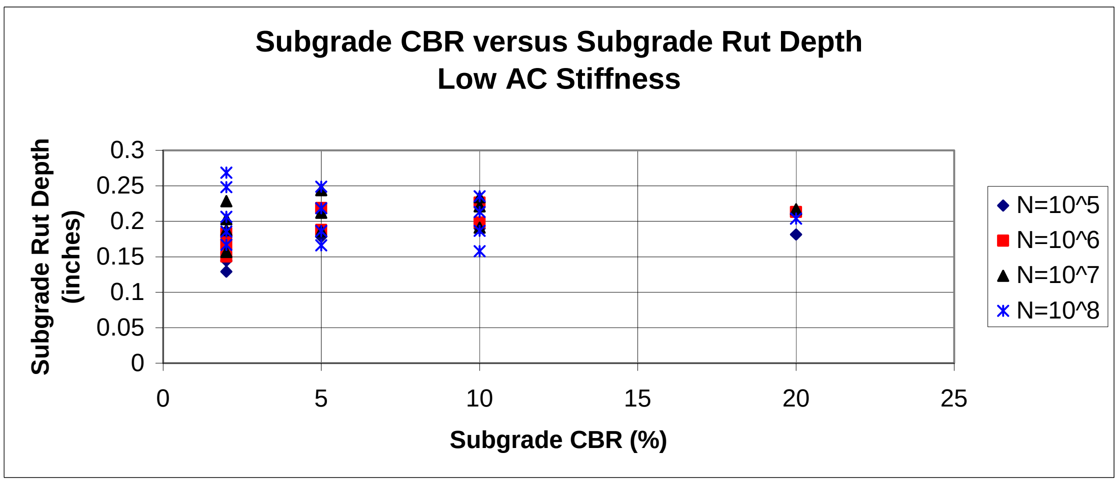


Figure D-209 Base / Subgrade Rut Depths versus Subgrade CBR (All data) Set 10-CB

Table D-85 AASHTO Study Data – Set 11-CB (β_{acr1} = 0.508, β_{acr2} = 0.9, β_{acr3} = 1.2, β_{GB} = 0.24, β_{SG} = 0.33)

				Rut Depth Value			
Hac	***CBRsg***	***N Design***	***SN***	***AC***	***GB***	***SG***	***Total***
2	2	1.00E+05	3.22	0.047	0.060	0.106	0.213
4	2	1.00E+05	3.22	0.070	0.027	0.117	0.214
3	5	1.00E+05	2.57	0.078	0.030	0.156	0.264
2	10	1.00E+05	2.17	0.065	0.044	0.174	0.283
1	20	1.00E+05	1.82	0.012	0.079	0.173	0.264
			Average	***0.054***	***0.048***	***0.145***	***0.248***
2	2	1.00E+06	4.64	0.152	0.114	0.134	0.400
4	2	1.00E+06	4.64	0.199	0.062	0.149	0.410
6	2	1.00E+06	4.64	0.172	0.037	0.162	0.370
2	5	1.00E+06	3.76	0.157	0.095	0.177	0.429
5	5	1.00E+06	3.76	0.187	0.031	0.204	0.422
2	10	1.00E+06	3.18	0.162	0.086	0.194	0.442
4	10	1.00E+06	3.18	0.206	0.036	0.219	0.462
3	20	1.00E+06	2.68	0.219	0.048	0.212	0.480
			Average	***0.182***	***0.064***	***0.181***	***0.427***
2	2	1.00E+07	6.37	0.481	0.176	0.151	0.808
5	2	1.00E+07	6.37	0.577	0.090	0.180	0.847
7	2	1.00E+07	6.37	0.507	0.055	0.194	0.757
10	2	1.00E+07	6.37	0.390	0.022	0.216	0.628
2	5	1.00E+07	5.31	0.486	0.161	0.186	0.833
5	5	1.00E+07	5.31	0.558	0.069	0.211	0.839
8	5	1.00E+07	5.31	0.458	0.025	0.241	0.723
2	10	1.00E+07	4.58	0.472	0.146	0.196	0.814
5	10	1.00E+07	4.58	0.580	0.056	0.225	0.860
6	10	1.00E+07	4.58	0.541	0.044	0.237	0.821
5	20	1.00E+07	3.91	0.575	0.046	0.223	0.844
			Average	***0.511***	***0.081***	***0.205***	***0.798***
2	2	1.00E+08	8.49	0.906	0.237	0.172	1.314
5	2	1.00E+08	8.49	1.820	0.135	0.191	2.146
8	2	1.00E+08	8.49	1.522	0.082	0.211	1.816
12	2	1.00E+08	8.49	0.960	0.034	0.252	1.246
14	2	1.00E+08	8.49	0.611	0.019	0.271	0.901
2	5	1.00E+08	7.18	0.901	0.224	0.175	1.300
5	5	1.00E+08	7.18	1.760	0.120	0.195	2.075
8	5	1.00E+08	7.18	1.462	0.063	0.227	1.753
11	5	1.00E+08	7.18	1.108	0.030	0.257	1.396
2	10	1.00E+08	6.3	0.900	0.213	0.168	1.281
5	10	1.00E+08	6.3	1.726	0.106	0.197	2.029
8	10	1.00E+08	6.3	1.432	0.047	0.224	1.702
10	10	1.00E+08	6.3	1.234	0.023	0.246	1.504
8	20	1.00E+08	5.49	1.461	0.037	0.215	1.712
			Average	***1.272***	***0.098***	***0.214***	***1.584***

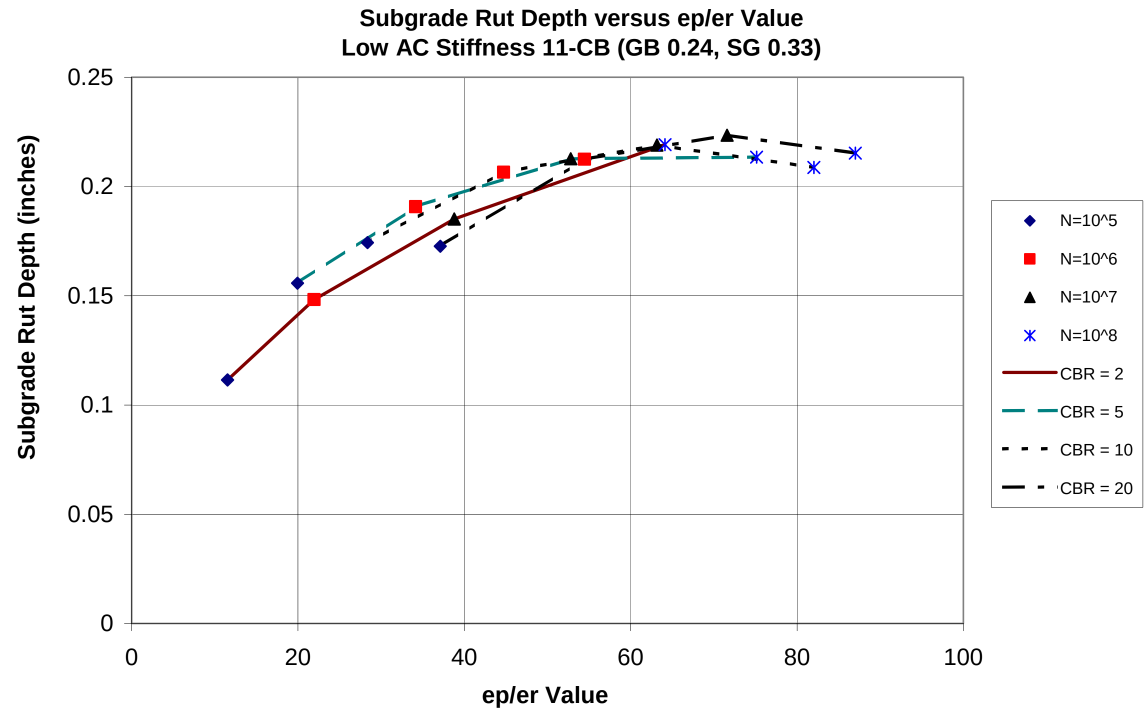


Figure D-210 Subgrade Rut Depth versus ep/er Value Set 11-CB

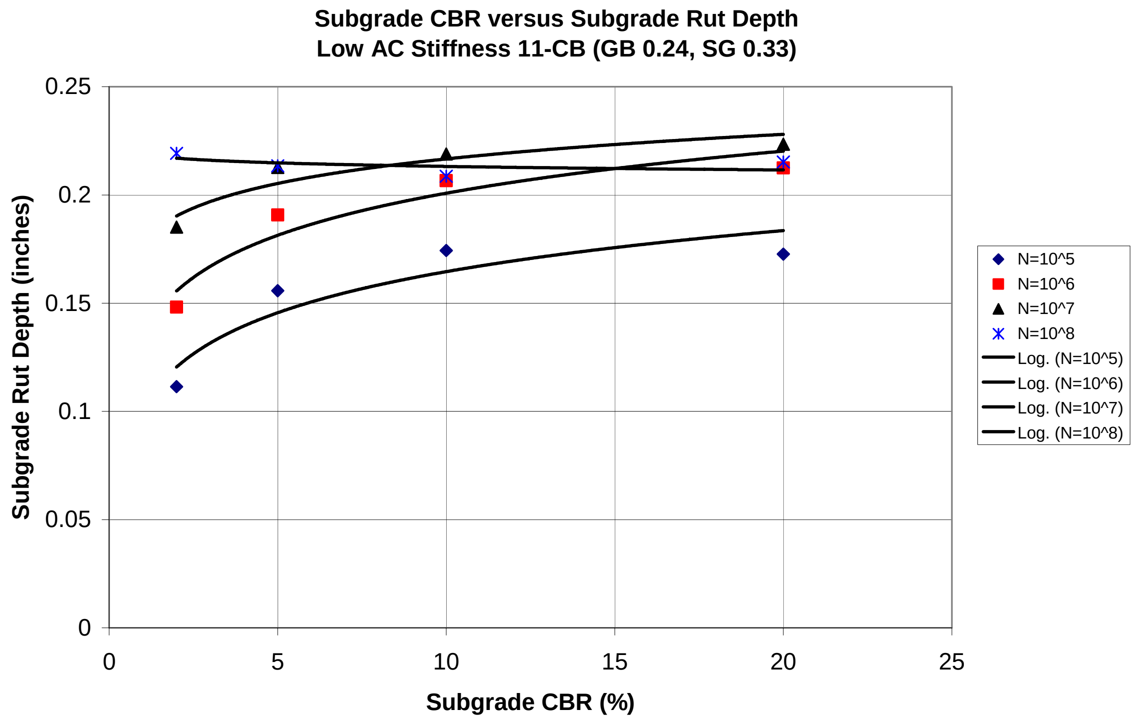
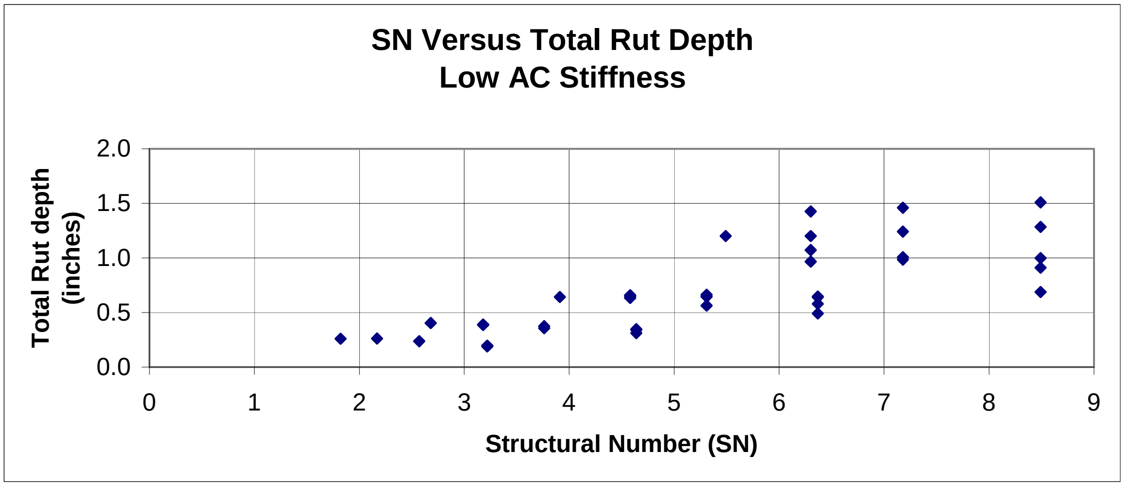
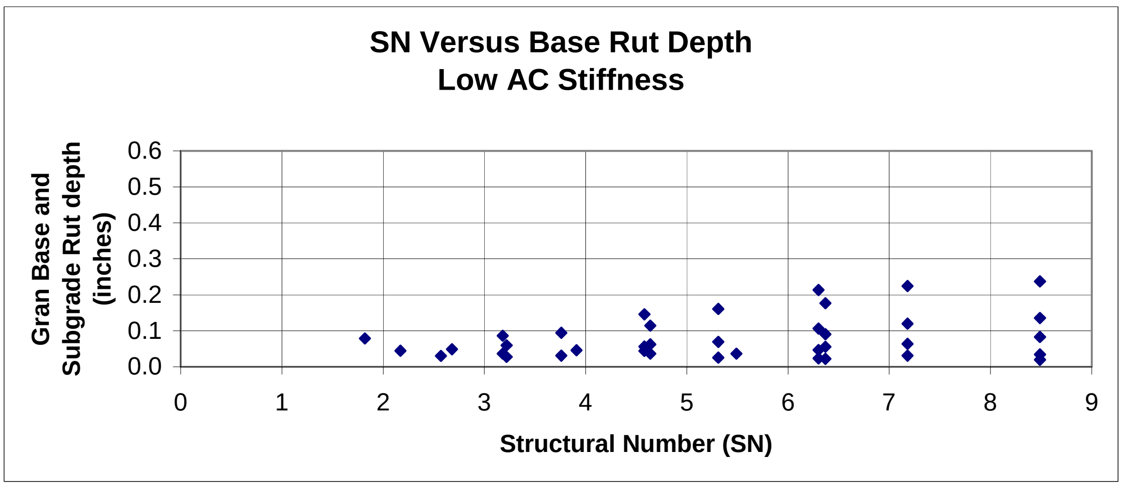


Figure D-211 Average Subgrade Rut Depth versus Subgrade CBR (%) Set 11-CB





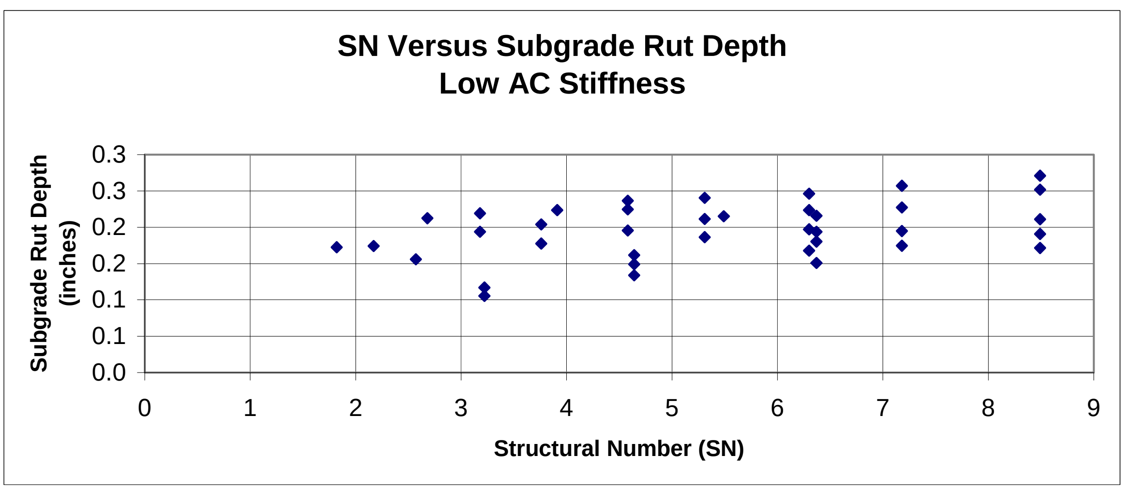
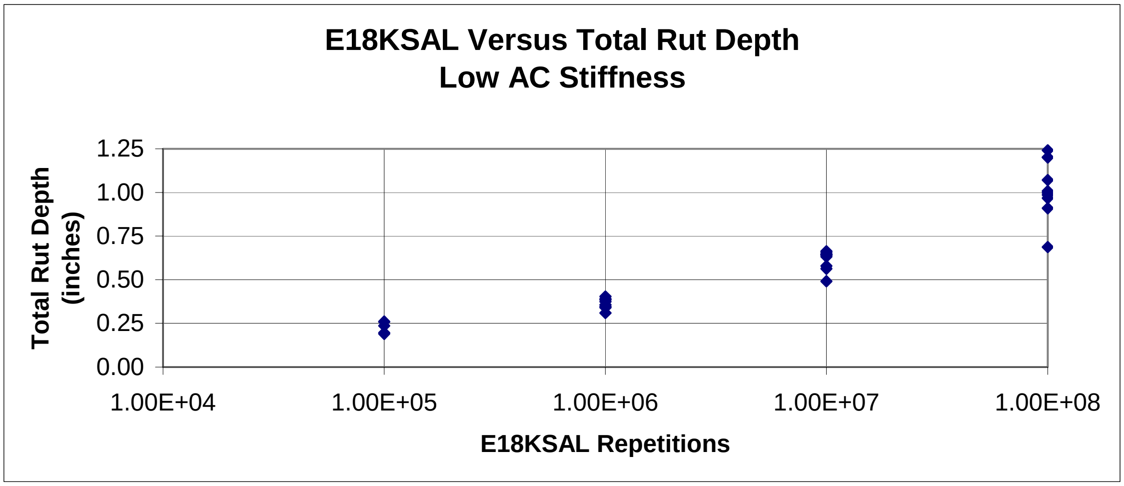
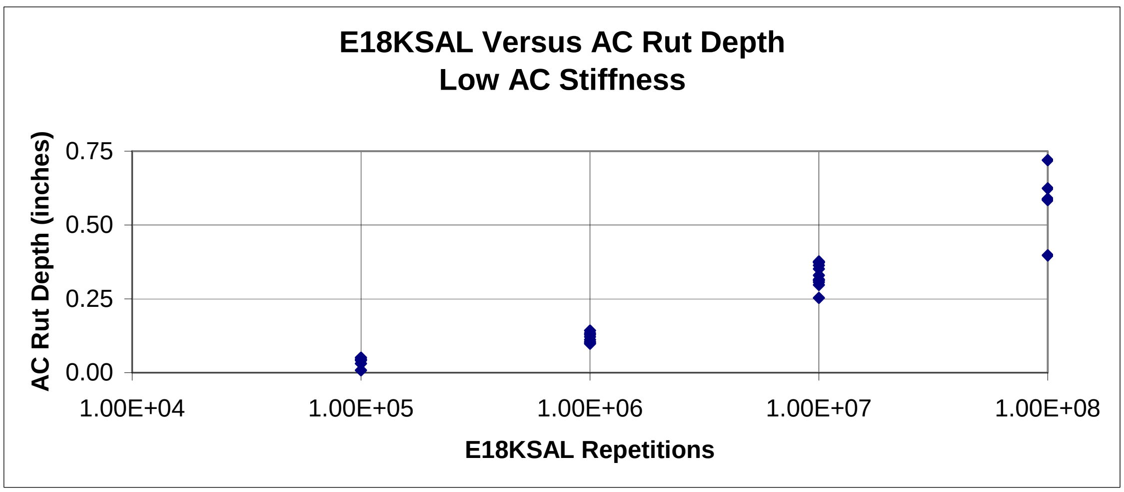


Figure D-212 Rut Depths versus Structural Number Set 11-CB





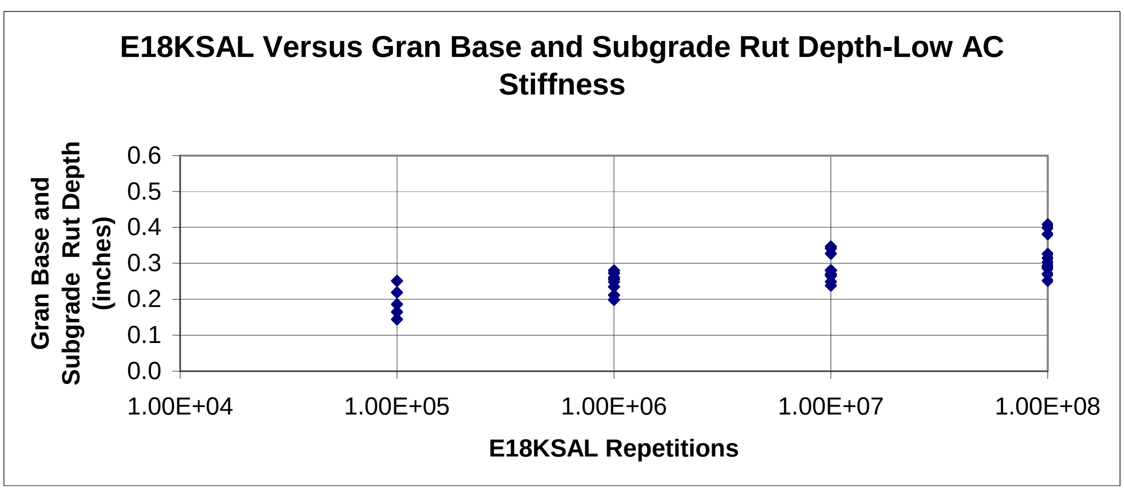
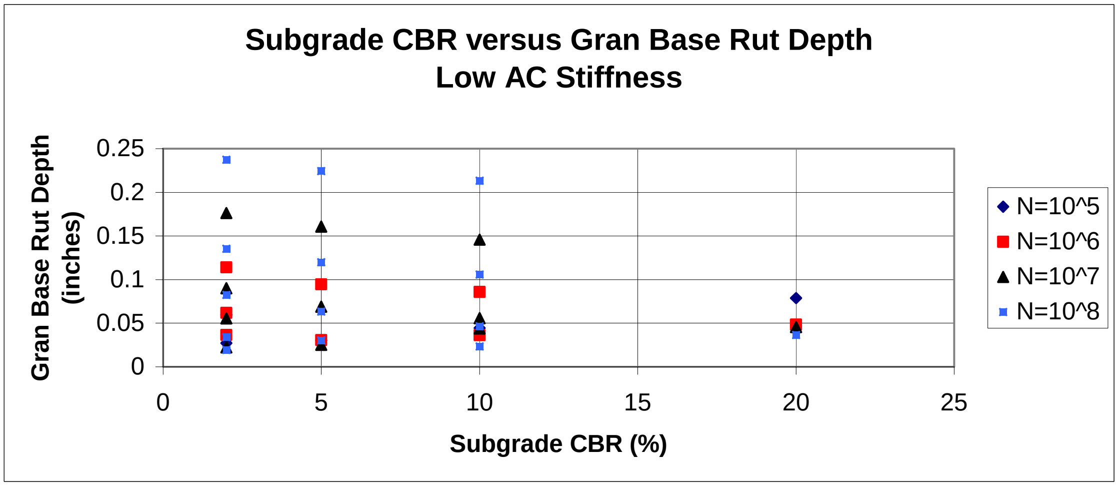


Figure D-213 Rut Depths versus 18KESAL Repetitions Set 11-CB



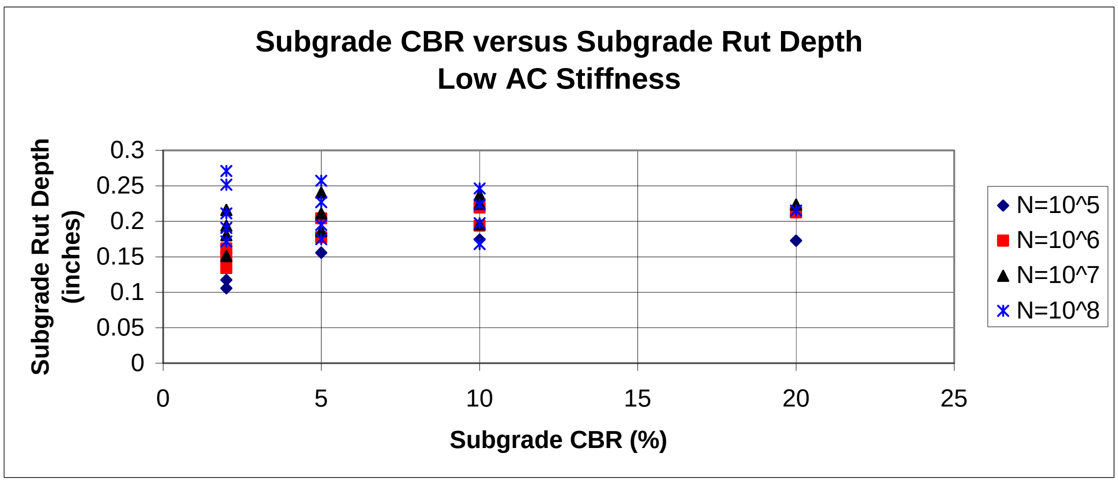


Figure D-214 Base / Subgrade Rut Depths versus Subgrade CBR (All data) Set 11-CB

Table D-86 AASHTO Study Data – Set 8-CB-1 (β_{acr1} = 0.508, β_{acr2} = 0.9, β_{acr3} = 1.2, β_{GB} = 0.40, β_{SG} = 0.74)

				Rut Depth Value			
Hac	***CBRsg***	***N Design***	***SN***	***AC***	***GB***	***SG***	***Total***
2	2	1.00E+05	3.22	0.047	0.067	0.119	0.234
4	2	1.00E+05	3.22	0.070	0.029	0.134	0.233
3	5	1.00E+05	2.57	0.078	0.032	0.179	0.289
2	10	1.00E+05	2.17	0.065	0.047	0.207	0.318
1	20	1.00E+05	1.82	0.012	0.082	0.218	0.312
			Average	***0.054***	***0.051***	***0.171***	***0.277***
2	2	1.00E+06	4.64	0.152	0.121	0.130	0.402
4	2	1.00E+06	4.64	0.199	0.067	0.145	0.411
6	2	1.00E+06	4.64	0.172	0.036	0.160	0.368
2	5	1.00E+06	3.76	0.157	0.102	0.180	0.439
5	5	1.00E+06	3.76	0.187	0.031	0.212	0.429
2	10	1.00E+06	3.18	0.162	0.092	0.210	0.463
4	10	1.00E+06	3.18	0.206	0.036	0.241	0.483
3	20	1.00E+06	2.68	0.219	0.048	0.253	0.521
			Average	***0.182***	***0.067***	***0.191***	***0.440***
2	2	1.00E+07	6.37	0.481	0.180	0.128	0.788
5	2	1.00E+07	6.37	0.577	0.092	0.153	0.823
7	2	1.00E+07	6.37	0.507	0.058	0.167	0.732
10	2	1.00E+07	6.37	0.390	0.021	0.190	0.601
2	5	1.00E+07	5.31	0.486	0.165	0.173	0.824
5	5	1.00E+07	5.31	0.558	0.072	0.198	0.828
8	5	1.00E+07	5.31	0.458	0.024	0.229	0.711
2	10	1.00E+07	4.58	0.472	0.151	0.198	0.822
5	10	1.00E+07	4.58	0.580	0.058	0.231	0.868
6	10	1.00E+07	4.58	0.541	0.042	0.244	0.827
5	20	1.00E+07	3.91	0.575	0.044	0.255	0.874
			Average	***0.511***	***0.082***	***0.197***	***0.791***
2	2	1.00E+08	8.49	0.906	0.235	0.130	1.271
5	2	1.00E+08	8.49	1.820	0.134	0.144	2.098
8	2	1.00E+08	8.49	1.522	0.082	0.161	1.765
12	2	1.00E+08	8.49	0.960	0.035	0.195	1.190
14	2	1.00E+08	8.49	0.611	0.018	0.212	0.842
2	5	1.00E+08	7.18	0.901	0.224	0.151	1.275
5	5	1.00E+08	7.18	1.760	0.119	0.169	2.048
8	5	1.00E+08	7.18	1.462	0.064	0.199	1.725
11	5	1.00E+08	7.18	1.108	0.029	0.228	1.364
2	10	1.00E+08	6.3	0.900	0.213	0.162	1.276
5	10	1.00E+08	6.3	1.726	0.106	0.192	2.024
8	10	1.00E+08	6.3	1.432	0.048	0.219	1.699
10	10	1.00E+08	6.3	1.234	0.022	0.243	1.499
8	20	1.00E+08	5.49	1.461	0.034	0.238	1.733
			Average	***1.272***	***0.097***	***0.189***	***1.558***

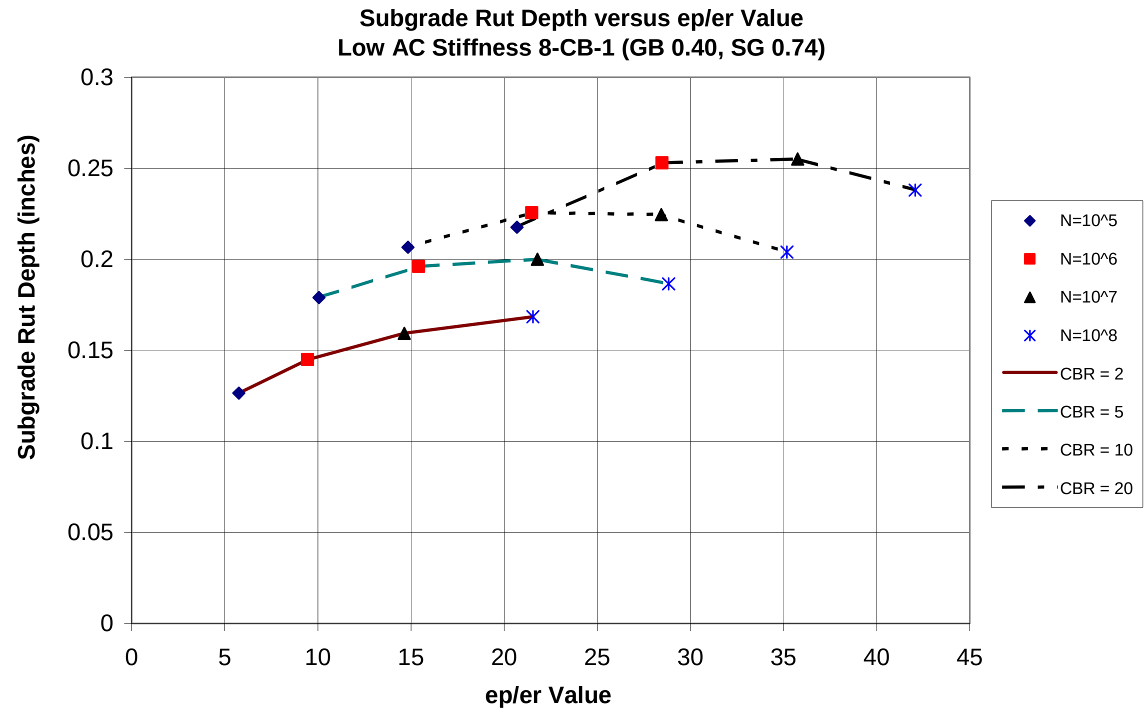


Figure D-215 Subgrade Rut Depth versus ep/er Value Set 8-CB-1

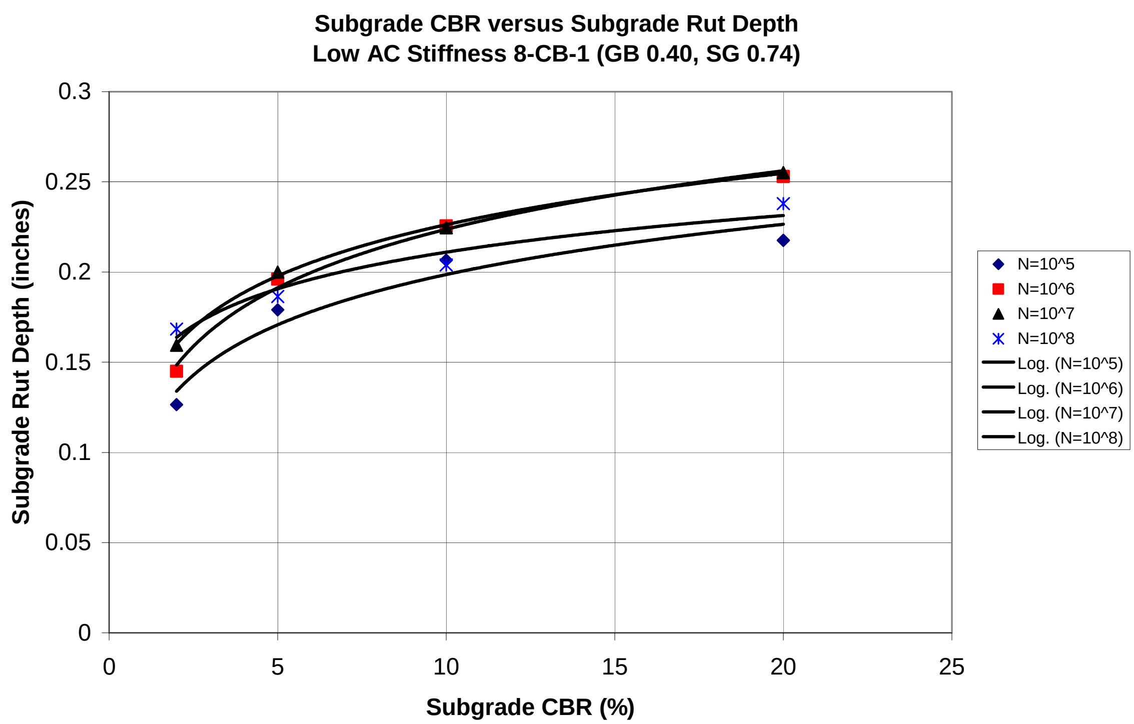
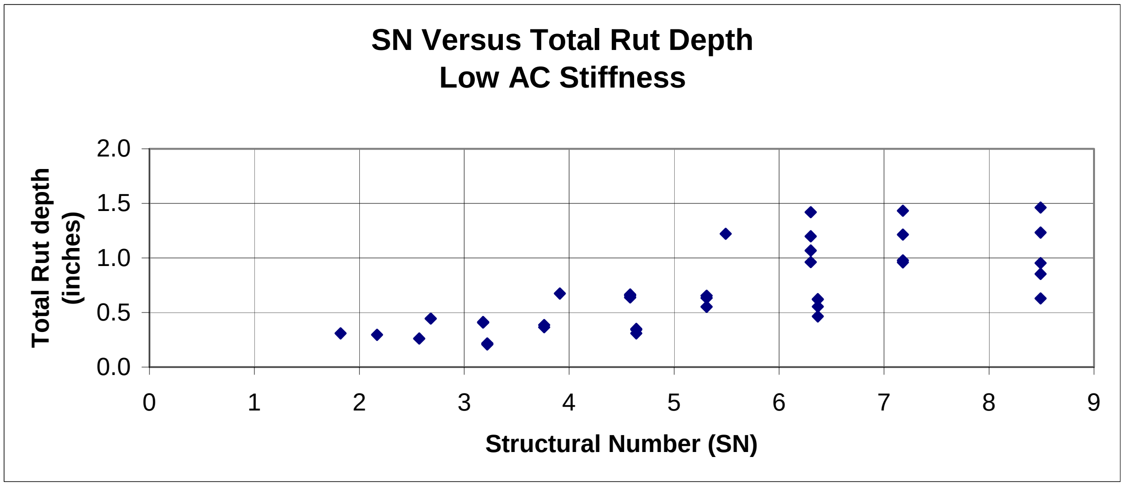
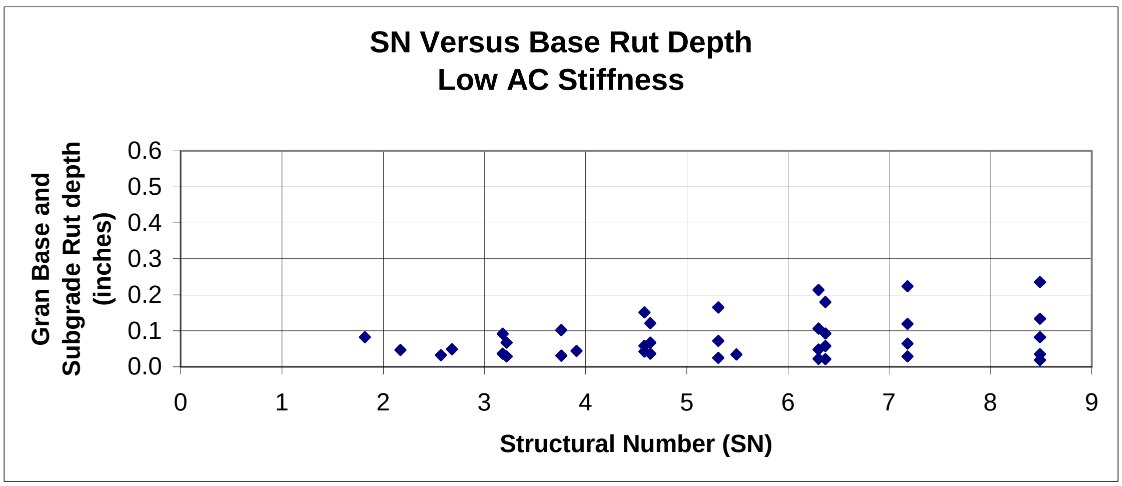


Figure D-216 Average Subgrade Rut Depth versus Subgrade CBR (%) Set 8-CB-1





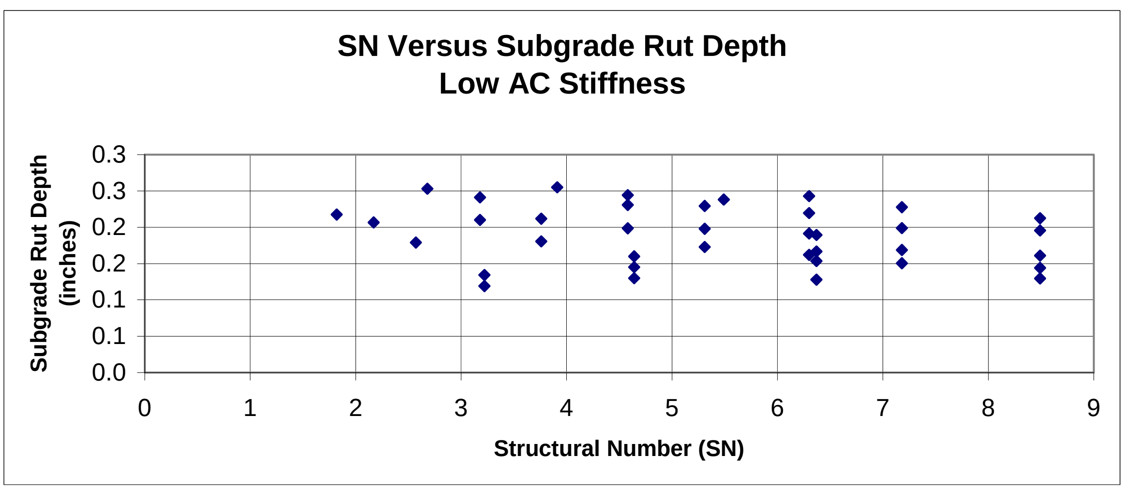
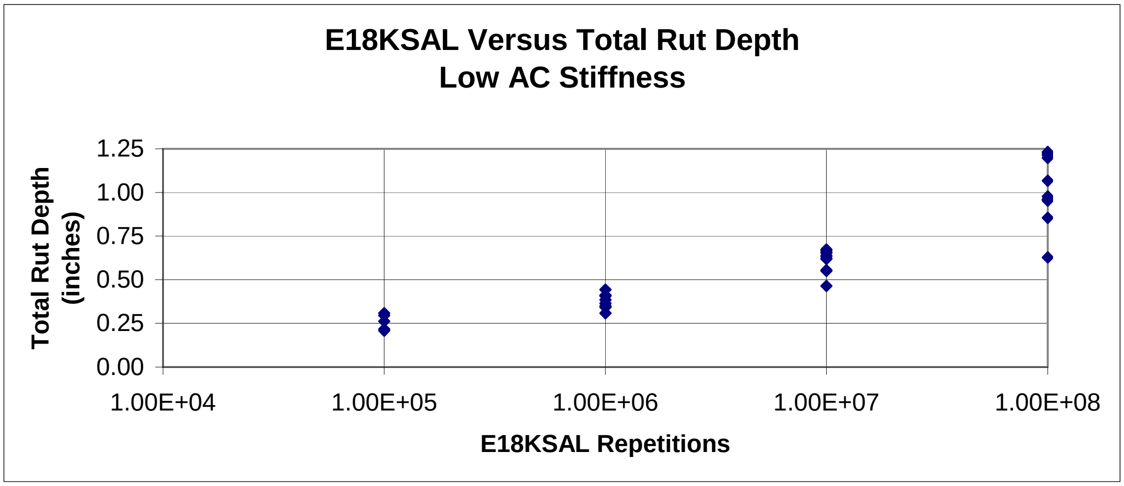
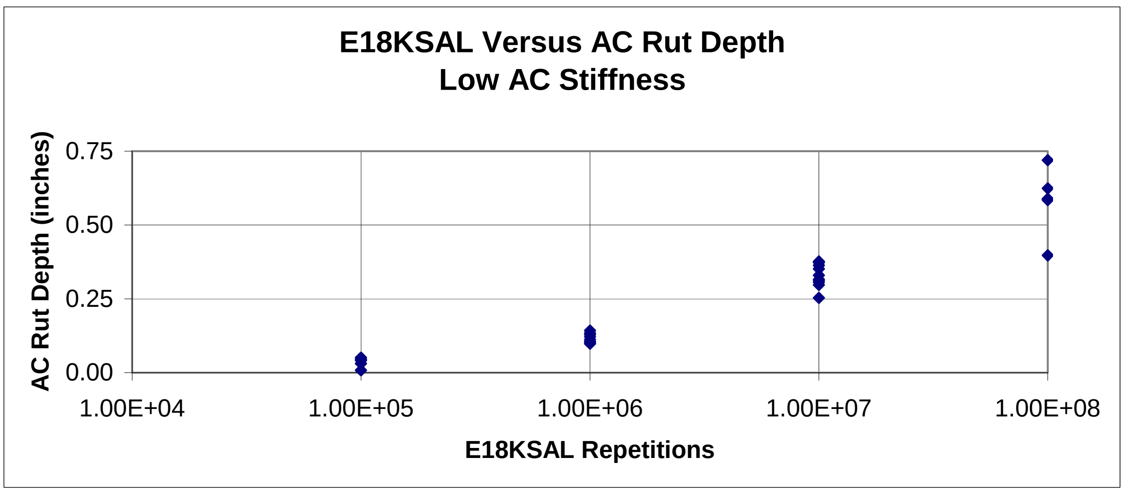


Figure D-217 Rut Depths versus Structural Number Set 8-CB-1





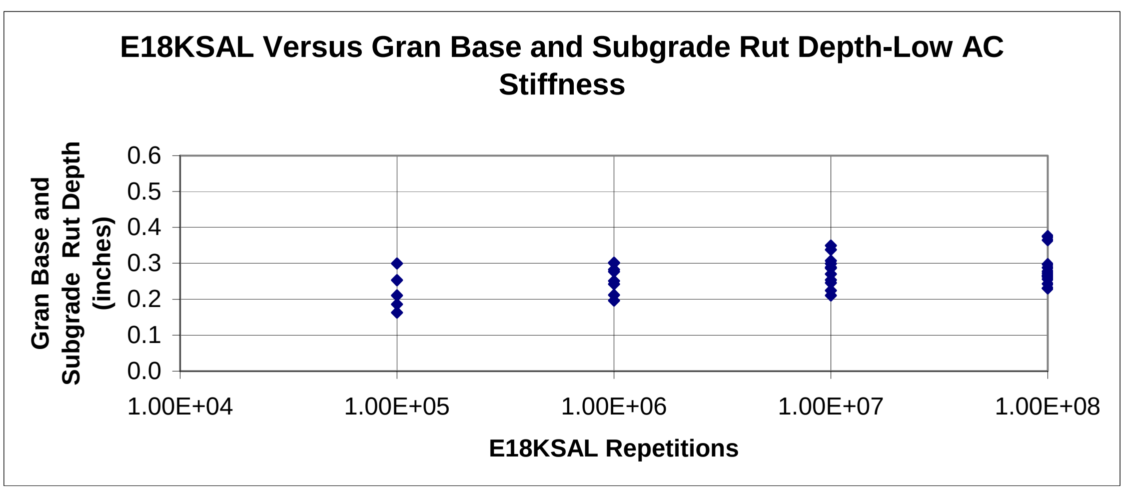
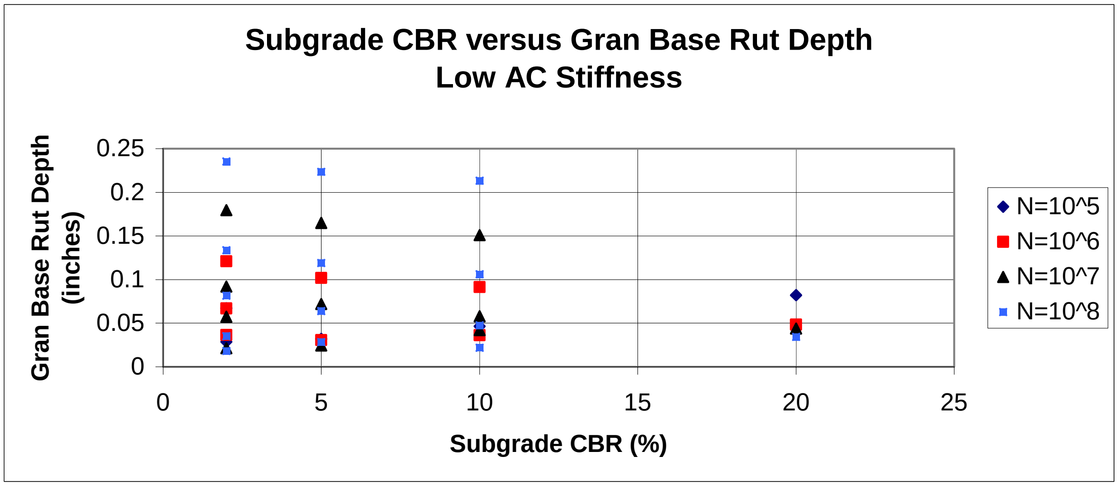


Figure D-218 Rut Depths versus 18KESAL Repetitions Set 8-CB-1



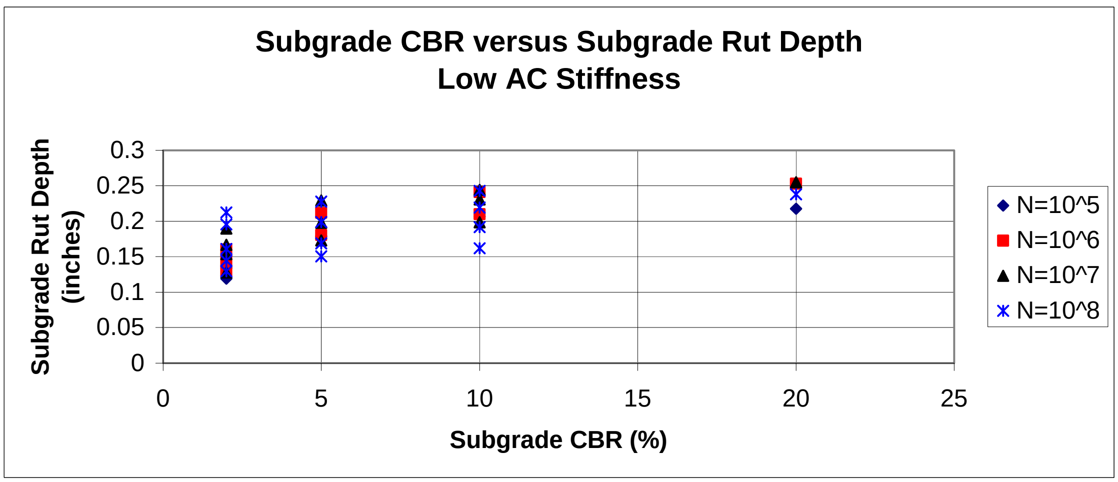


Figure D-219 Base / Subgrade Rut Depths versus Subgrade CBR (All data) Set 8-CB-1

Table D-87 AASHTO Study Data – Set 11-CB-1 (β_{acr1} = 0.508, β_{acr2} = 0.9, β_{acr3} = 1.2, β_{GB} = 0.23, β_{SG} = 0.31)

				Rut Depth Value			
Hac	***CBRsg***	***N Design***	***SN***	***AC***	***GB***	***SG***	***Total***
2	2	1.00E+05	3.22	0.047	0.059	0.135	0.241
4	2	1.00E+05	3.22	0.070	0.028	0.151	0.248
3	5	1.00E+05	2.57	0.078	0.031	0.178	0.286
2	10	1.00E+05	2.17	0.065	0.045	0.186	0.295
1	20	1.00E+05	1.82	0.012	0.080	0.176	0.268
			Average	***0.054***	***0.049***	***0.165***	***0.268***
2	2	1.00E+06	4.64	0.152	0.112	0.156	0.420
4	2	1.00E+06	4.64	0.199	0.061	0.174	0.434
6	2	1.00E+06	4.64	0.172	0.036	0.191	0.399
2	5	1.00E+06	3.76	0.157	0.093	0.189	0.439
5	5	1.00E+06	3.76	0.187	0.031	0.220	0.437
2	10	1.00E+06	3.18	0.162	0.085	0.197	0.444
4	10	1.00E+06	3.18	0.206	0.036	0.225	0.467
3	20	1.00E+06	2.68	0.219	0.048	0.210	0.478
			Average	***0.182***	***0.063***	***0.195***	***0.440***
2	2	1.00E+07	6.37	0.481	0.172	0.162	0.815
5	2	1.00E+07	6.37	0.577	0.088	0.194	0.859
7	2	1.00E+07	6.37	0.507	0.054	0.210	0.771
10	2	1.00E+07	6.37	0.390	0.022	0.236	0.648
2	5	1.00E+07	5.31	0.486	0.156	0.189	0.831
5	5	1.00E+07	5.31	0.558	0.067	0.215	0.841
8	5	1.00E+07	5.31	0.458	0.025	0.247	0.730
2	10	1.00E+07	4.58	0.472	0.142	0.192	0.807
5	10	1.00E+07	4.58	0.580	0.054	0.222	0.856
6	10	1.00E+07	4.58	0.541	0.043	0.235	0.819
5	20	1.00E+07	3.91	0.575	0.045	0.217	0.837
			Average	***0.511***	***0.079***	***0.211***	***0.801***
2	2	1.00E+08	8.49	0.906	0.229	0.172	1.307
5	2	1.00E+08	8.49	1.820	0.131	0.191	2.142
8	2	1.00E+08	8.49	1.522	0.080	0.212	1.815
12	2	1.00E+08	8.49	0.960	0.033	0.256	1.249
14	2	1.00E+08	8.49	0.611	0.019	0.277	0.907
2	5	1.00E+08	7.18	0.901	0.217	0.170	1.288
5	5	1.00E+08	7.18	1.760	0.116	0.190	2.066
8	5	1.00E+08	7.18	1.462	0.061	0.223	1.746
11	5	1.00E+08	7.18	1.108	0.030	0.253	1.391
2	10	1.00E+08	6.3	0.900	0.207	0.161	1.268
5	10	1.00E+08	6.3	1.726	0.103	0.190	2.019
8	10	1.00E+08	6.3	1.432	0.045	0.216	1.693
10	10	1.00E+08	6.3	1.234	0.023	0.239	1.495
8	20	1.00E+08	5.49	1.461	0.036	0.206	1.702
			Average	***1.272***	***0.095***	***0.211***	***1.578***

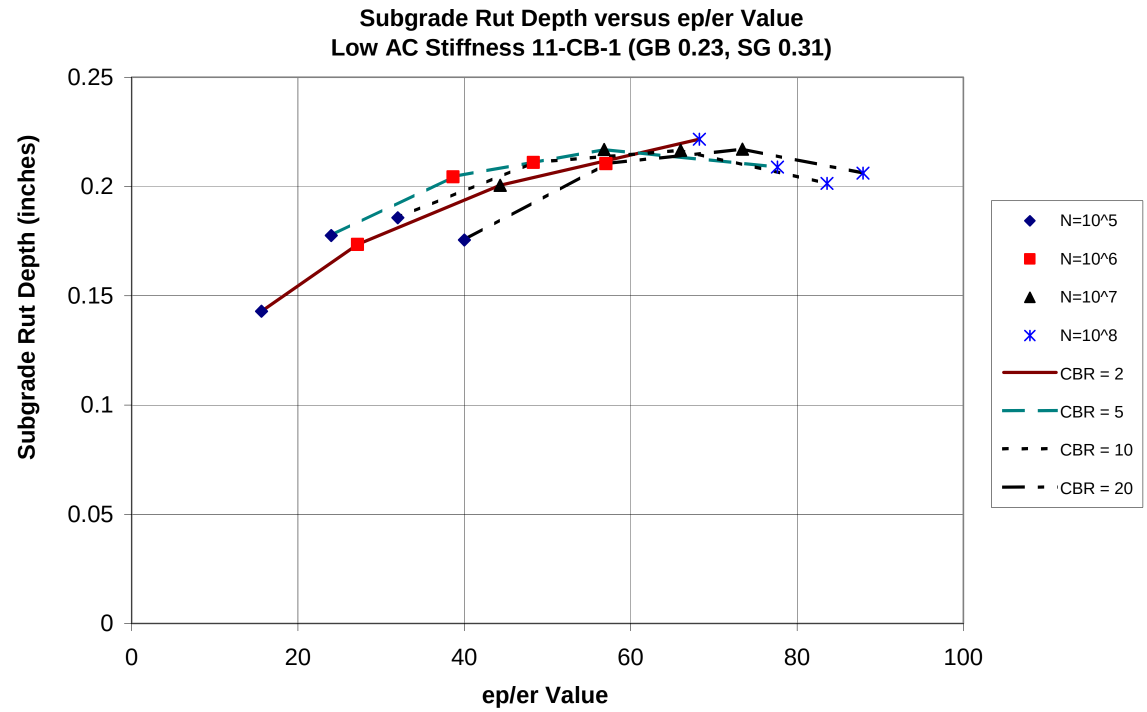


Figure D-220 Subgrade Rut Depth versus ep/er Value Set 11-CB-1

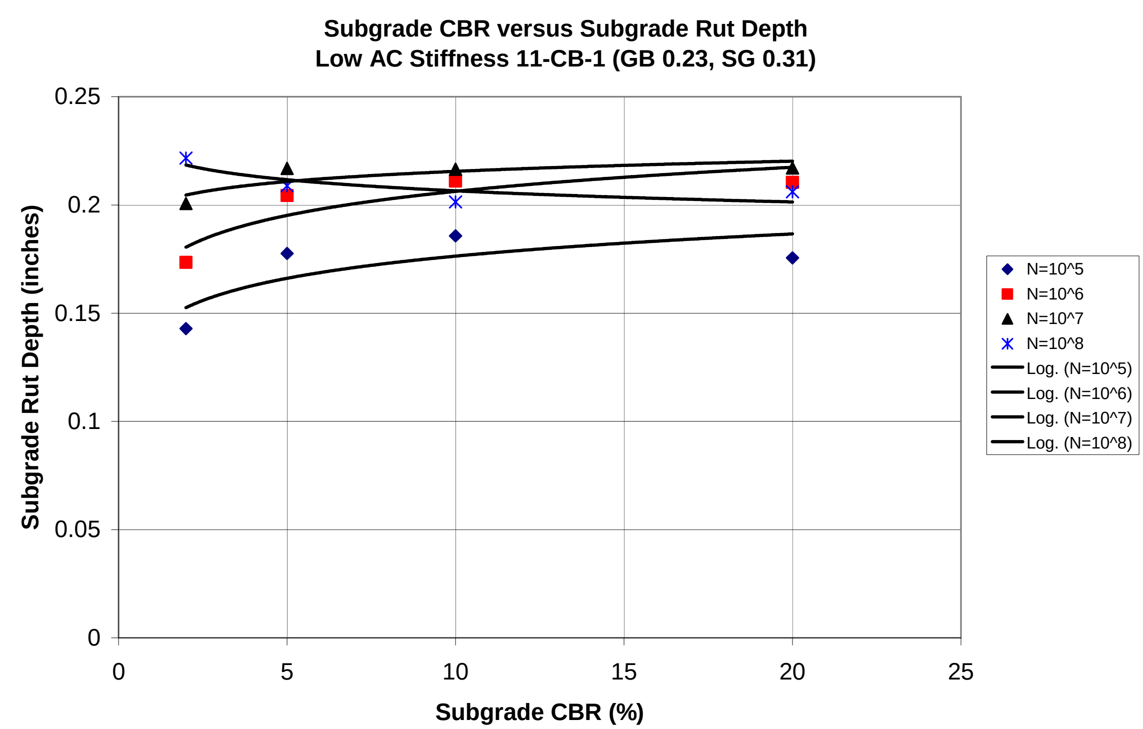
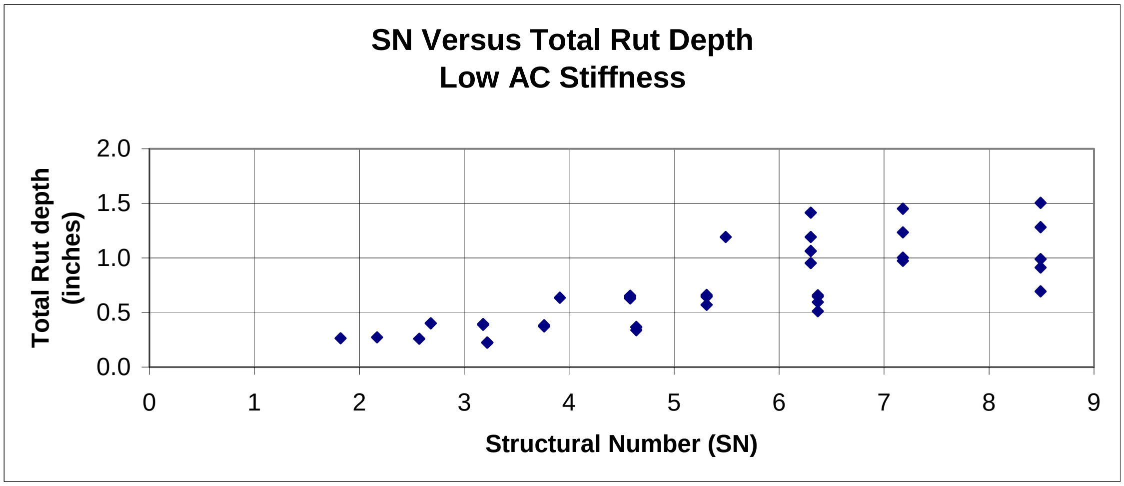
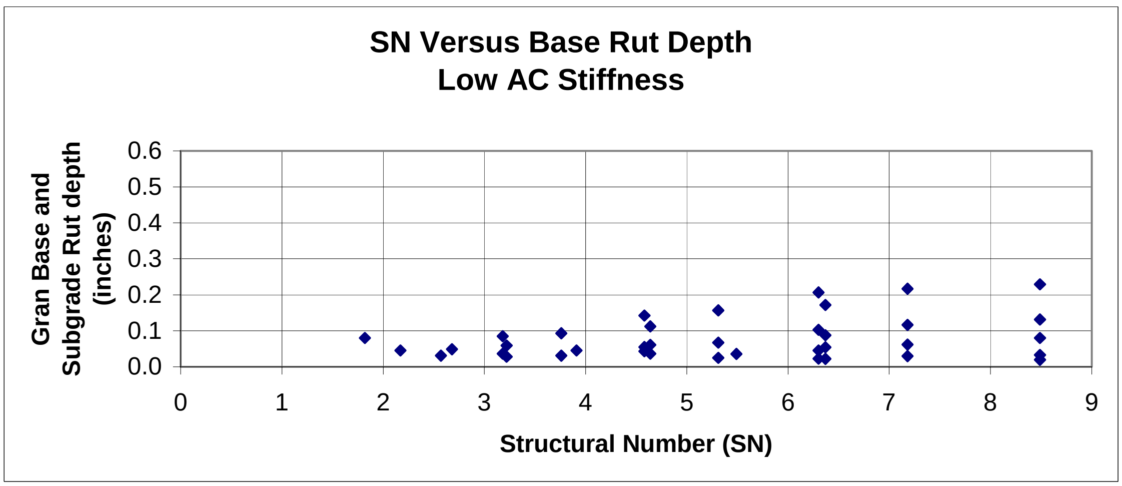


Figure D-221 Average Subgrade Rut Depth versus Subgrade CBR (%) Set 11-CB-1





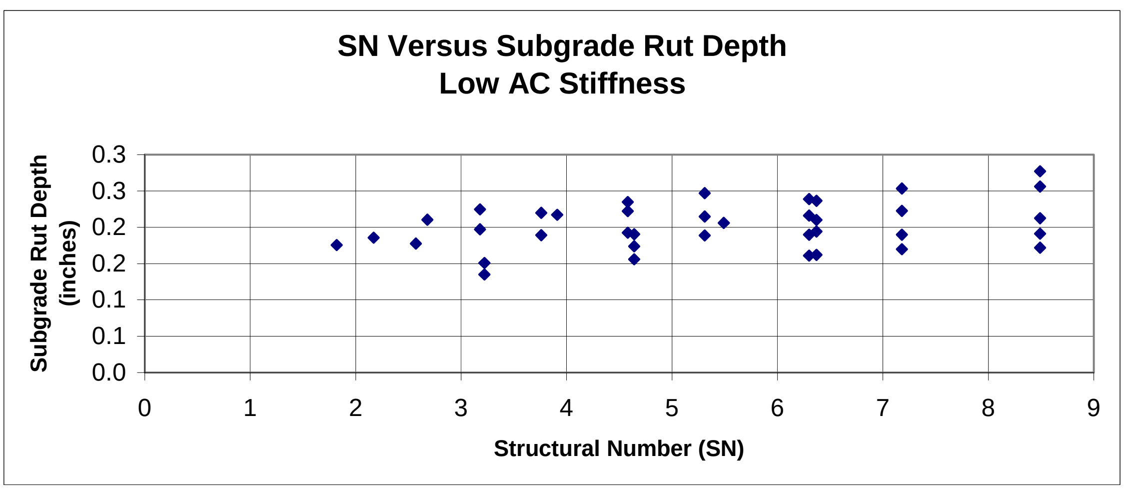
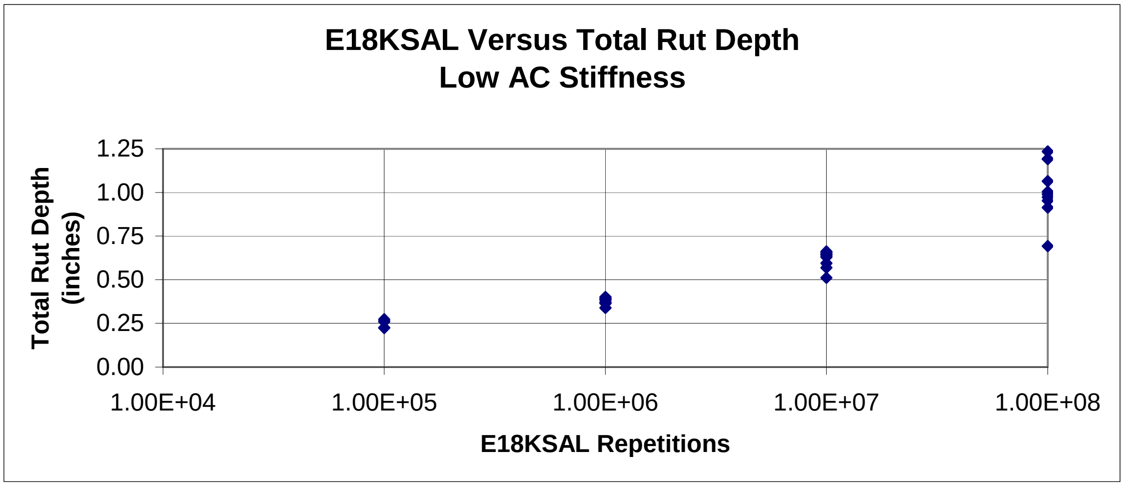
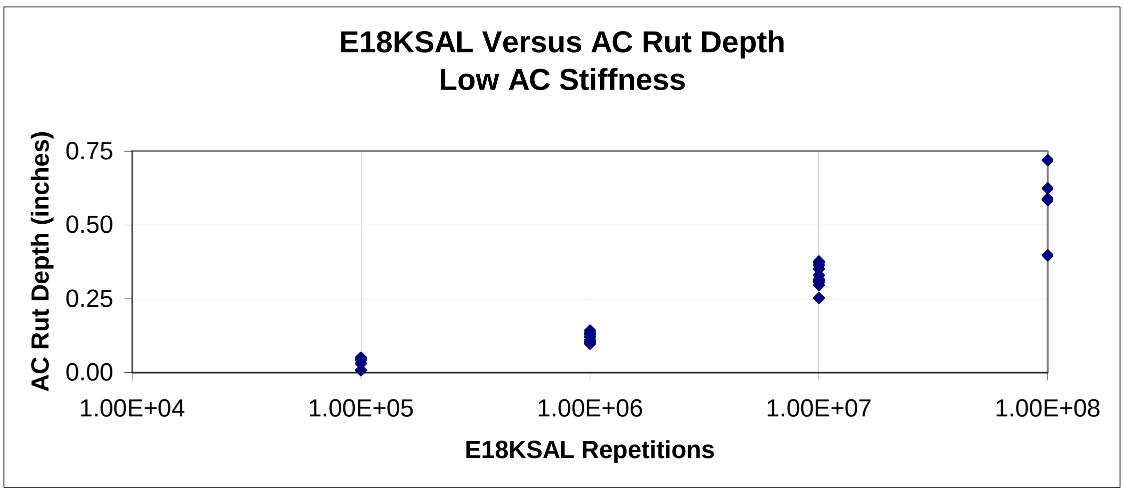


Figure D-222 Rut Depths versus Structural Number Set 11-CB-1





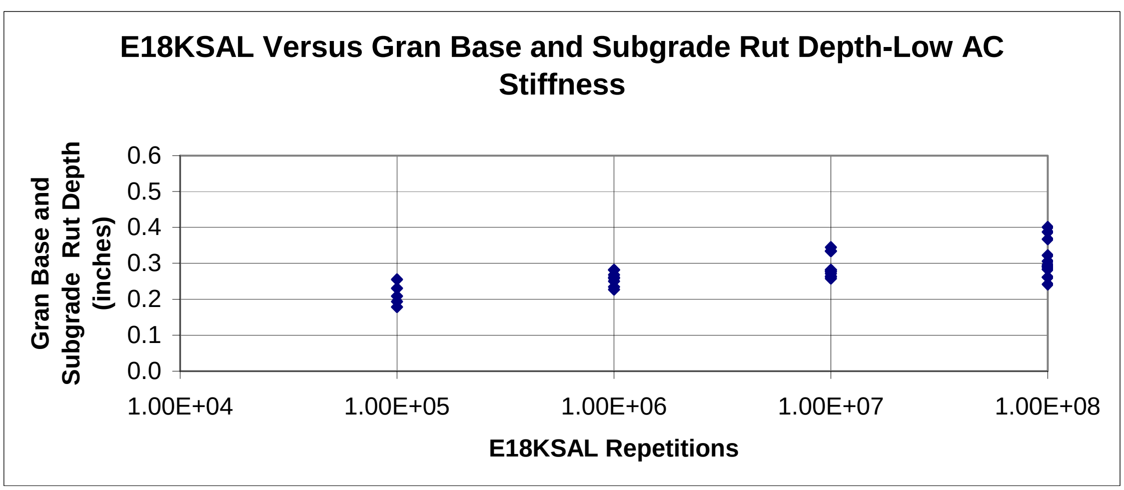
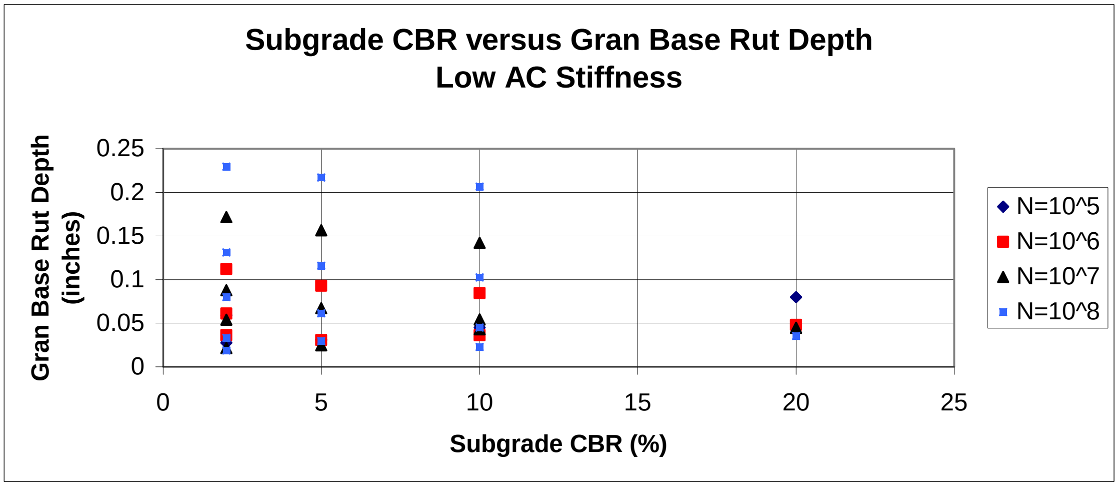


Figure D-223 Rut Depths versus 18KESAL Repetitions Set 11-CB-1



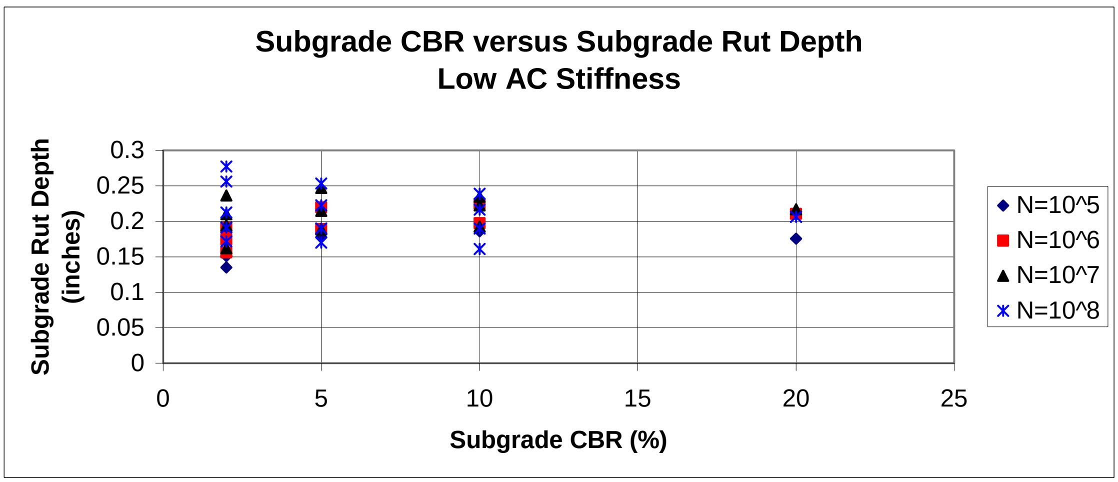


Figure D-224 Base / Subgrade Rut Depths versus Subgrade CBR (All data) Set 11-CB-1

Table D-88 AASHTO Study Data – Set 4-E (β_{acr1} = 0.508, β_{acr2} = 0.9, β_{acr3} = 1.2, β_{GB} = 0.81, β_{SG} = 1.43)

				Rut Depth Value			
Hac	***CBRsg***	***N Design***	***SN***	***AC***	***GB***	***SG***	***Total***
2	2	1.00E+05	3.22	0.047	0.071	0.082	0.200
4	2	1.00E+05	3.22	0.070	0.028	0.089	0.187
3	5	1.00E+05	2.57	0.078	0.031	0.138	0.247
2	10	1.00E+05	2.17	0.065	0.046	0.171	0.281
1	20	1.00E+05	1.82	0.012	0.080	0.191	0.284
			Average	***0.054***	***0.051***	***0.134***	***0.240***
2	2	1.00E+06	4.64	0.152	0.123	0.120	0.394
4	2	1.00E+06	4.64	0.199	0.068	0.133	0.400
6	2	1.00E+06	4.64	0.172	0.036	0.142	0.350
2	5	1.00E+06	3.76	0.157	0.104	0.165	0.426
5	5	1.00E+06	3.76	0.187	0.030	0.188	0.405
2	10	1.00E+06	3.18	0.162	0.093	0.190	0.445
4	10	1.00E+06	3.18	0.206	0.035	0.215	0.456
3	20	1.00E+06	2.68	0.219	0.047	0.229	0.496
			Average	***0.182***	***0.067***	***0.173***	***0.422***
2	2	1.00E+07	6.37	0.481	0.179	0.153	0.814
5	2	1.00E+07	6.37	0.577	0.092	0.183	0.852
7	2	1.00E+07	6.37	0.507	0.058	0.195	0.760
10	2	1.00E+07	6.37	0.390	0.021	0.214	0.624
2	5	1.00E+07	5.31	0.486	0.165	0.180	0.831
5	5	1.00E+07	5.31	0.558	0.072	0.203	0.834
8	5	1.00E+07	5.31	0.458	0.024	0.230	0.711
2	10	1.00E+07	4.58	0.472	0.152	0.191	0.815
5	10	1.00E+07	4.58	0.580	0.058	0.220	0.857
6	10	1.00E+07	4.58	0.541	0.041	0.232	0.813
5	20	1.00E+07	3.91	0.575	0.043	0.236	0.853
			Average	***0.511***	***0.082***	***0.203***	***0.797***
2	2	1.00E+08	8.49	0.906	0.233	0.196	1.335
5	2	1.00E+08	8.49	1.820	0.132	0.218	2.169
8	2	1.00E+08	8.49	1.522	0.081	0.239	1.842
12	2	1.00E+08	8.49	0.960	0.035	0.281	1.276
14	2	1.00E+08	8.49	0.611	0.018	0.300	0.929
2	5	1.00E+08	7.18	0.901	0.222	0.174	1.296
5	5	1.00E+08	7.18	1.760	0.118	0.193	2.071
8	5	1.00E+08	7.18	1.462	0.063	0.225	1.750
11	5	1.00E+08	7.18	1.108	0.028	0.253	1.389
2	10	1.00E+08	6.3	0.900	0.212	0.164	1.276
5	10	1.00E+08	6.3	1.726	0.105	0.193	2.024
8	10	1.00E+08	6.3	1.432	0.047	0.219	1.698
10	10	1.00E+08	6.3	1.234	0.021	0.241	1.496
8	20	1.00E+08	5.49	1.461	0.033	0.224	1.718
			Average	***1.272***	***0.096***	***0.223***	***1.591***

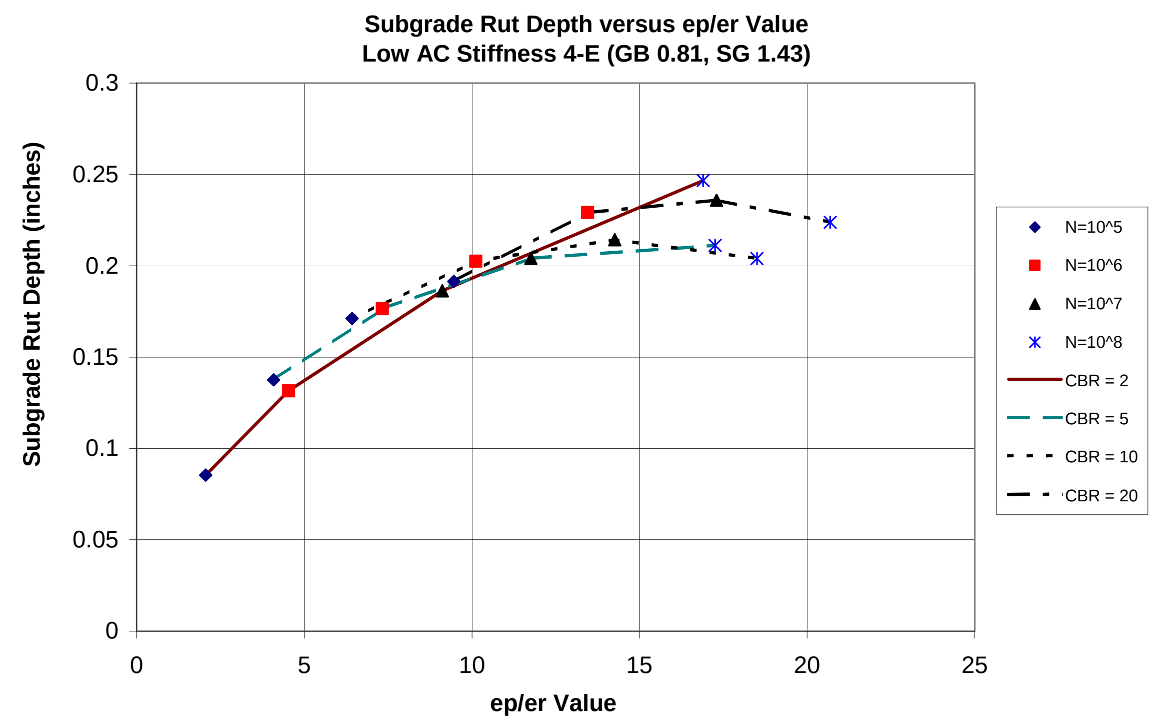


Figure D-225 Subgrade Rut Depth versus ep/er Value Set 4-E

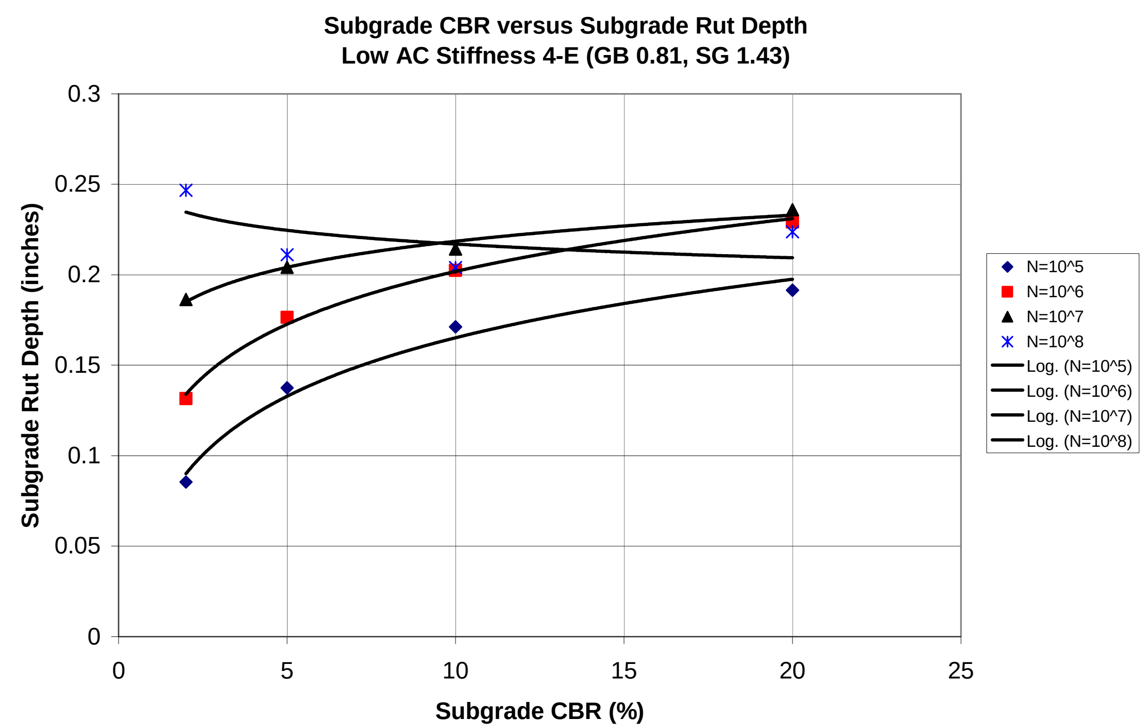
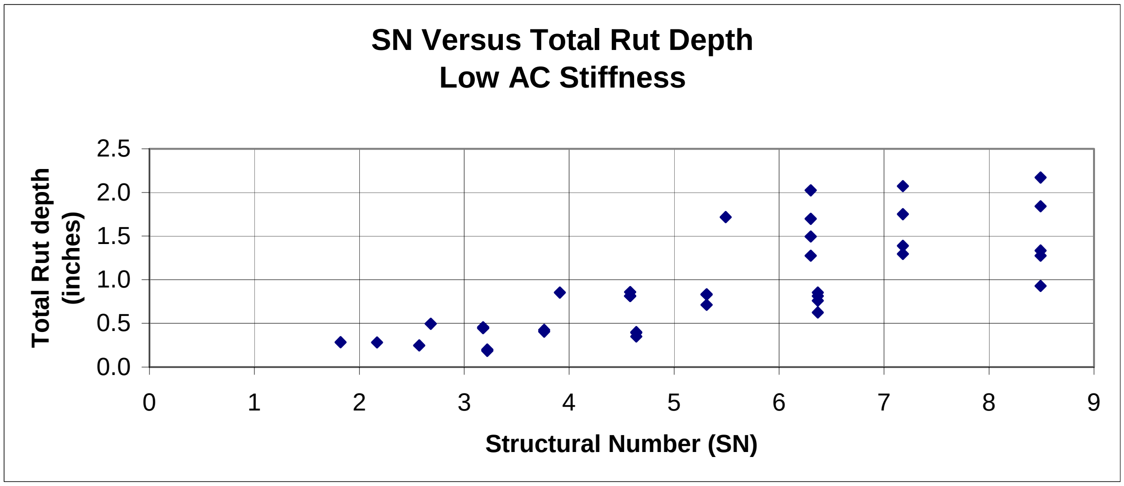
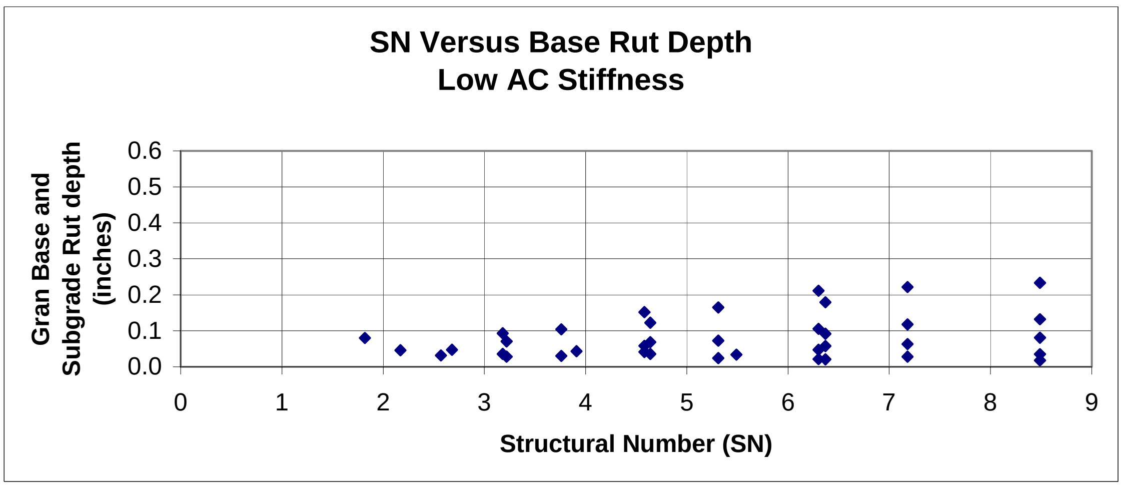


Figure D-226 Average Subgrade Rut Depth versus Subgrade CBR (%) Set 4-E





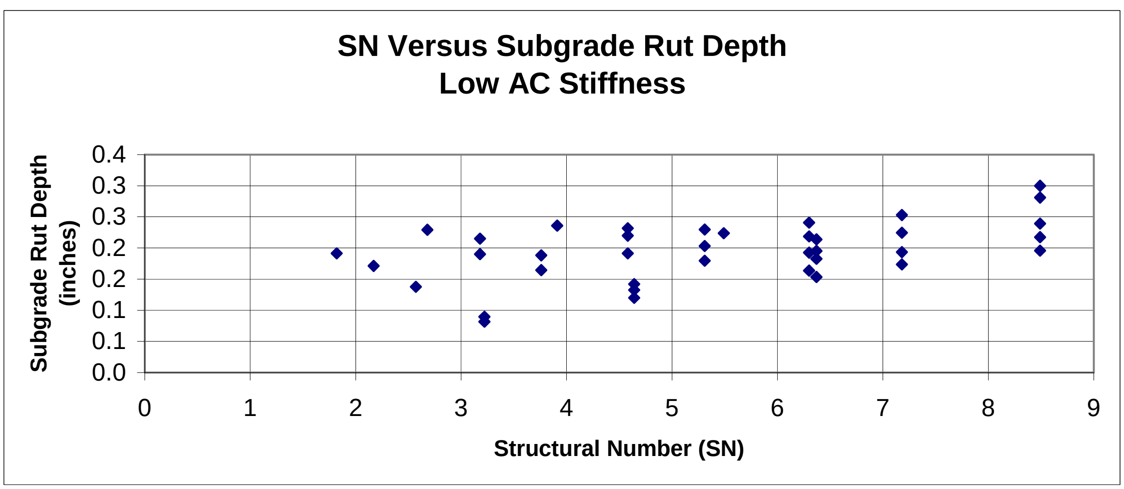
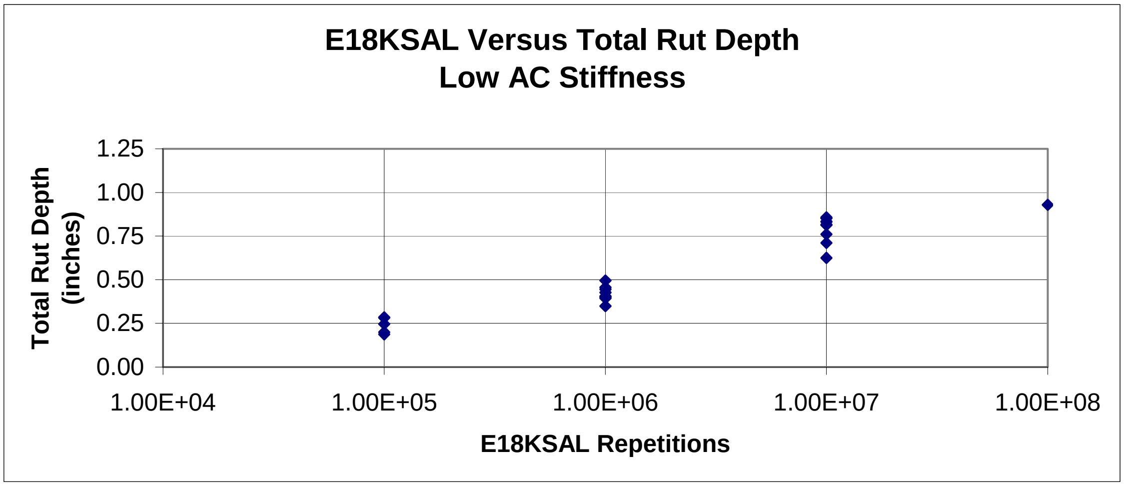
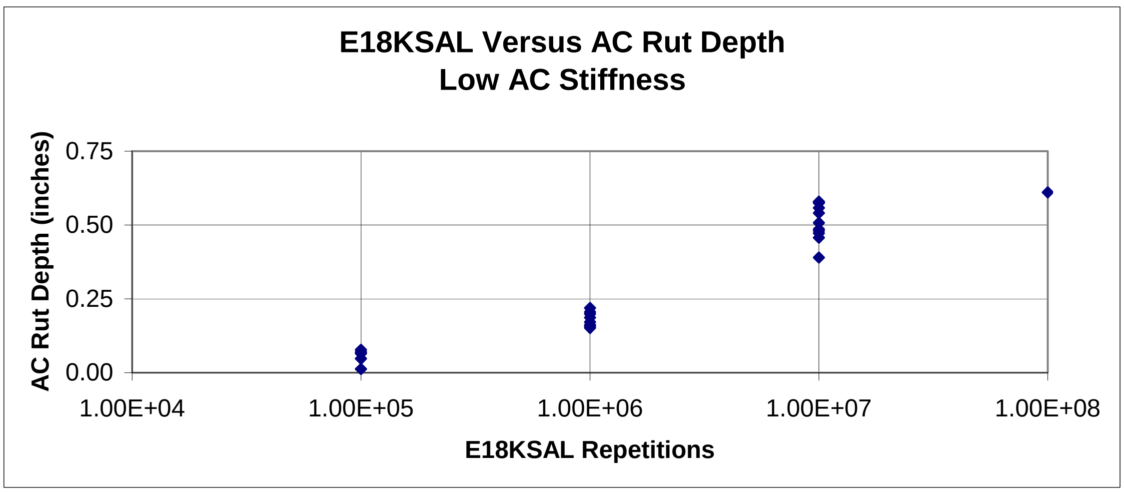


Figure D-227 Rut Depths versus Structural Number Set 4-E





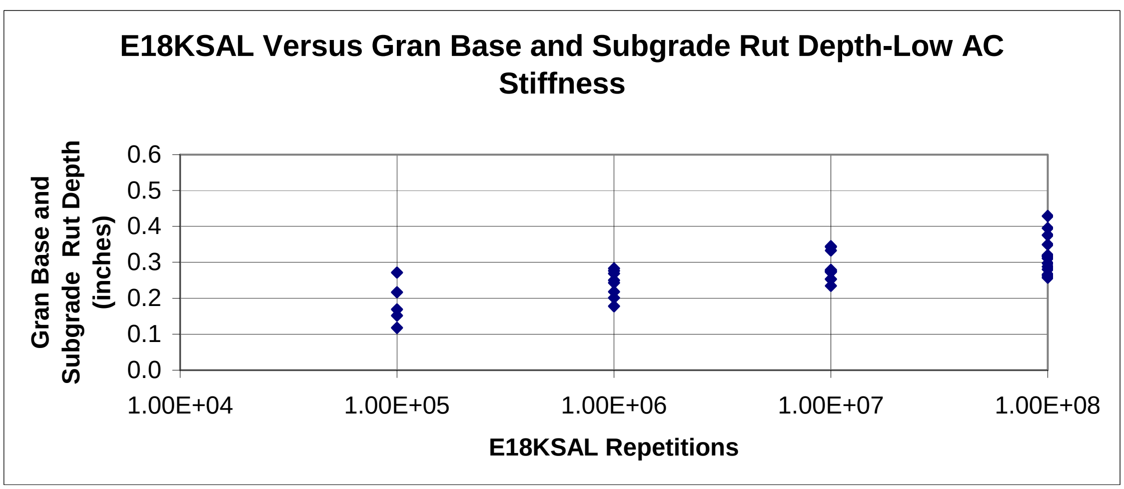
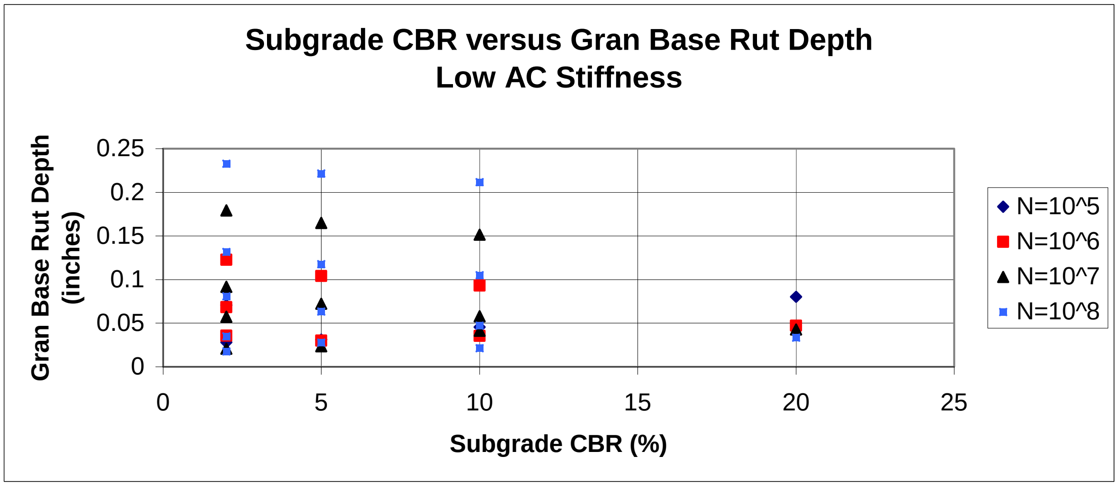


Figure D-228 Rut Depths versus 18KESAL Repetitions Set 4-E



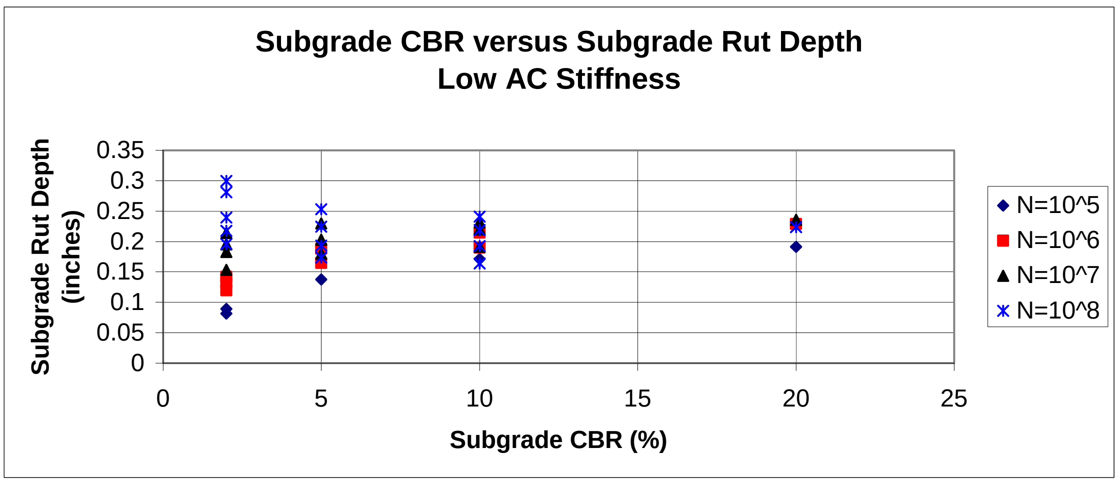


Figure D-229 Base / Subgrade Rut Depths versus Subgrade CBR (All data) Set 4-E

Table D-89 AASHTO Study Data – Set 1-F (β_{acr1} = 0.508, β_{acr2} = 0.9, β_{acr3} = 1.2, β_{GB} = 1.85, β_{SG} = 1.81)

				Rut Depth Value			
Hac	***CBRsg***	***N Design***	***SN***	***AC***	***GB***	***SG***	***Total***
2	2	1.00E+05	3.22	0.047	0.064	0.077	0.188
4	2	1.00E+05	3.22	0.070	0.029	0.083	0.182
3	5	1.00E+05	2.57	0.078	0.032	0.117	0.227
2	10	1.00E+05	2.17	0.065	0.047	0.132	0.244
1	20	1.00E+05	1.82	0.012	0.084	0.129	0.225
			Average	***0.054***	***0.051***	***0.108***	***0.213***
2	2	1.00E+06	4.64	0.152	0.117	0.139	0.407
4	2	1.00E+06	4.64	0.199	0.063	0.153	0.416
6	2	1.00E+06	4.64	0.172	0.038	0.162	0.372
2	5	1.00E+06	3.76	0.157	0.097	0.160	0.414
5	5	1.00E+06	3.76	0.187	0.032	0.180	0.399
2	10	1.00E+06	3.18	0.162	0.088	0.158	0.409
4	10	1.00E+06	3.18	0.206	0.038	0.177	0.421
3	20	1.00E+06	2.68	0.219	0.050	0.161	0.430
			Average	***0.182***	***0.065***	***0.161***	***0.408***
2	2	1.00E+07	6.37	0.481	0.175	0.213	0.869
5	2	1.00E+07	6.37	0.577	0.089	0.253	0.920
7	2	1.00E+07	6.37	0.507	0.055	0.269	0.830
10	2	1.00E+07	6.37	0.390	0.022	0.288	0.701
2	5	1.00E+07	5.31	0.486	0.159	0.193	0.838
5	5	1.00E+07	5.31	0.558	0.068	0.217	0.843
8	5	1.00E+07	5.31	0.458	0.026	0.241	0.724
2	10	1.00E+07	4.58	0.472	0.145	0.169	0.786
5	10	1.00E+07	4.58	0.580	0.055	0.193	0.828
6	10	1.00E+07	4.58	0.541	0.044	0.202	0.787
5	20	1.00E+07	3.91	0.575	0.046	0.171	0.791
			Average	***0.511***	***0.080***	***0.219***	***0.811***
2	2	1.00E+08	8.49	0.906	0.230	0.319	1.455
5	2	1.00E+08	8.49	1.820	0.132	0.354	2.306
8	2	1.00E+08	8.49	1.522	0.080	0.388	1.990
12	2	1.00E+08	8.49	0.960	0.033	0.448	1.440
14	2	1.00E+08	8.49	0.611	0.019	0.472	1.103
2	5	1.00E+08	7.18	0.901	0.218	0.202	1.321
5	5	1.00E+08	7.18	1.760	0.116	0.225	2.101
8	5	1.00E+08	7.18	1.462	0.061	0.258	1.782
11	5	1.00E+08	7.18	1.108	0.030	0.288	1.427
2	10	1.00E+08	6.3	0.900	0.207	0.152	1.259
5	10	1.00E+08	6.3	1.726	0.103	0.177	2.006
8	10	1.00E+08	6.3	1.432	0.045	0.200	1.676
10	10	1.00E+08	6.3	1.234	0.023	0.219	1.476
8	20	1.00E+08	5.49	1.461	0.036	0.165	1.662
			Average	***1.272***	***0.095***	***0.276***	***1.643***

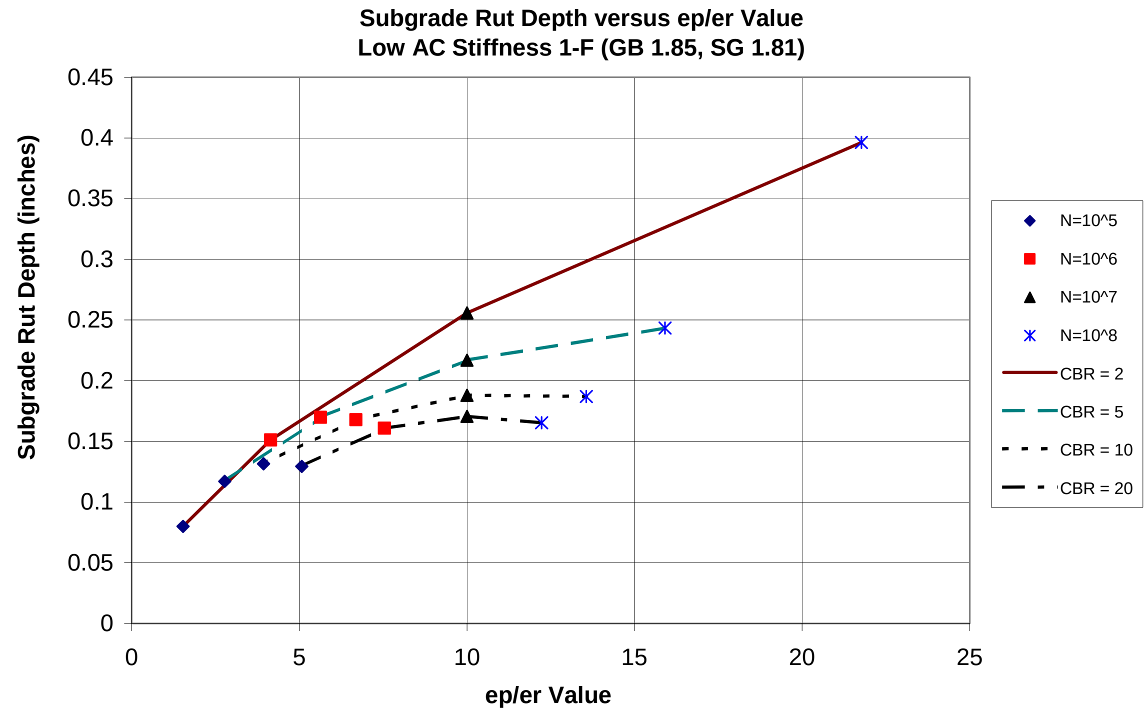


Figure D-230 Subgrade Rut Depth versus ep/er Value Set 1-F

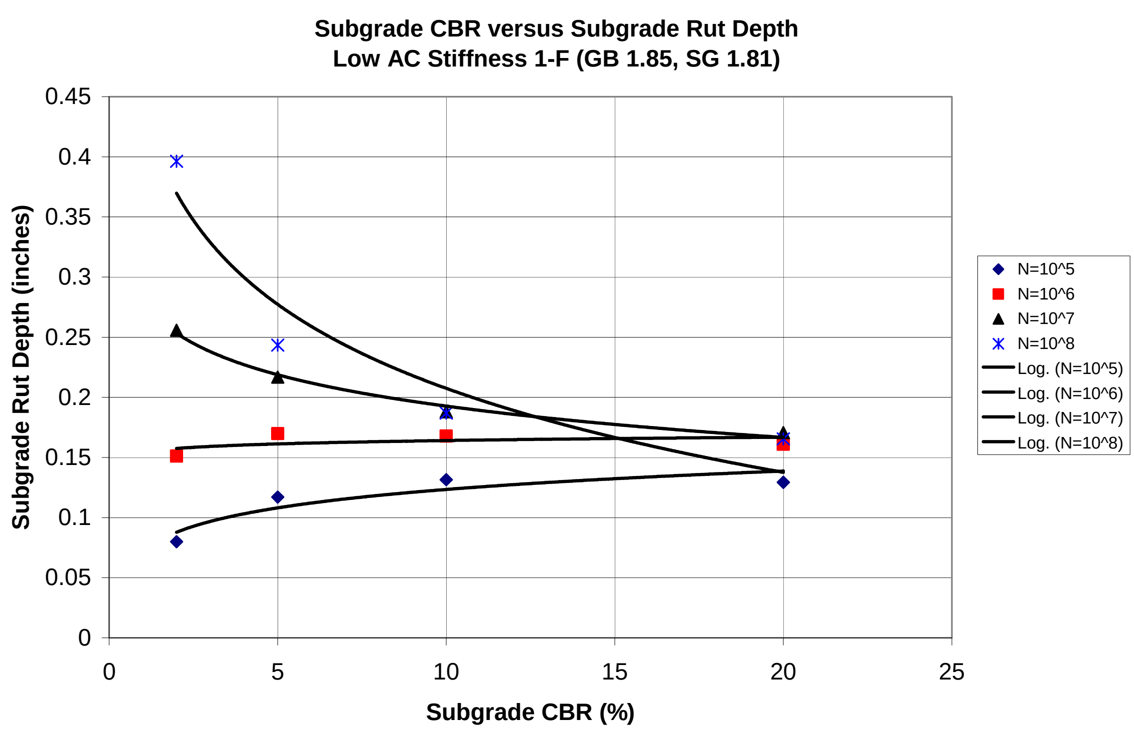
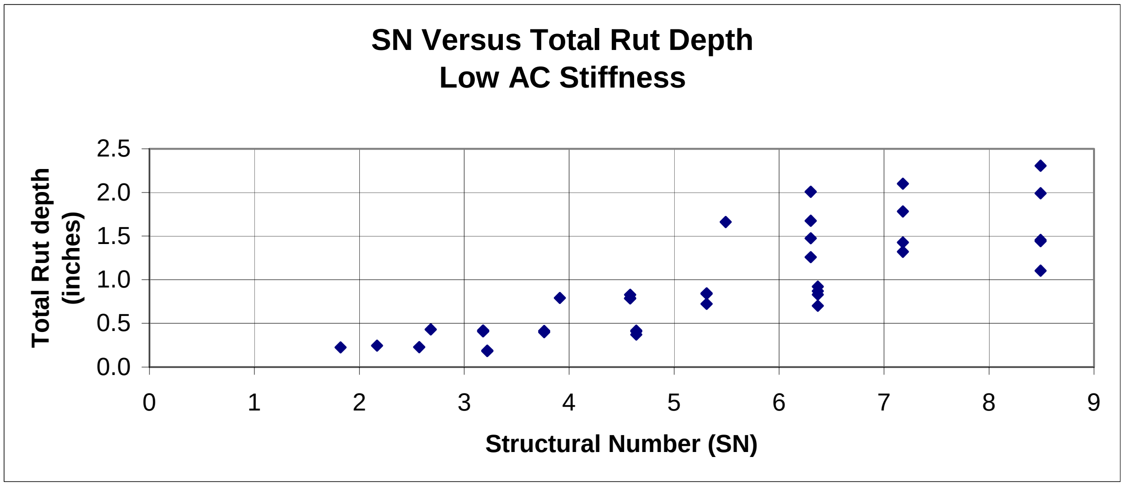
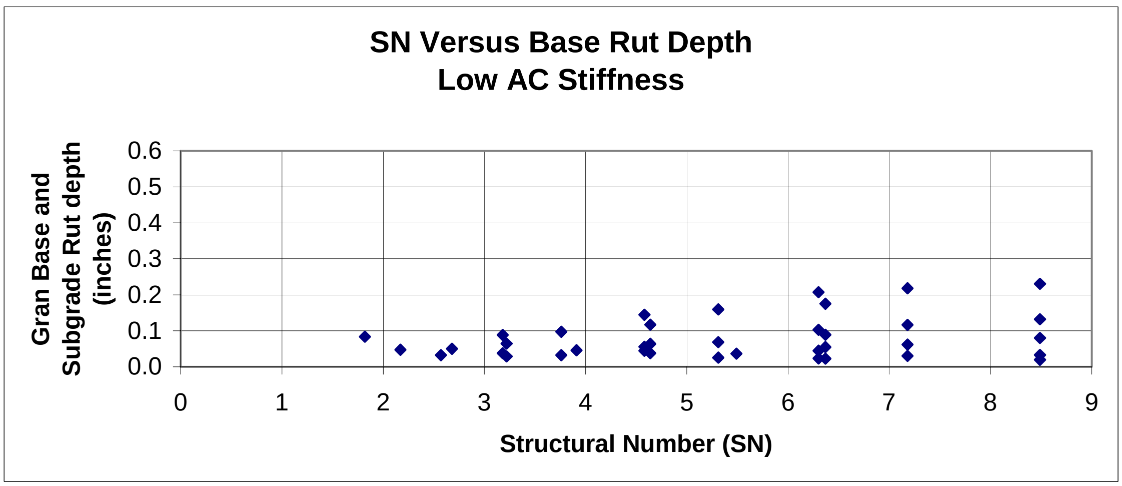


Figure D-231 Average Subgrade Rut Depth versus Subgrade CBR (%) Set 1-F





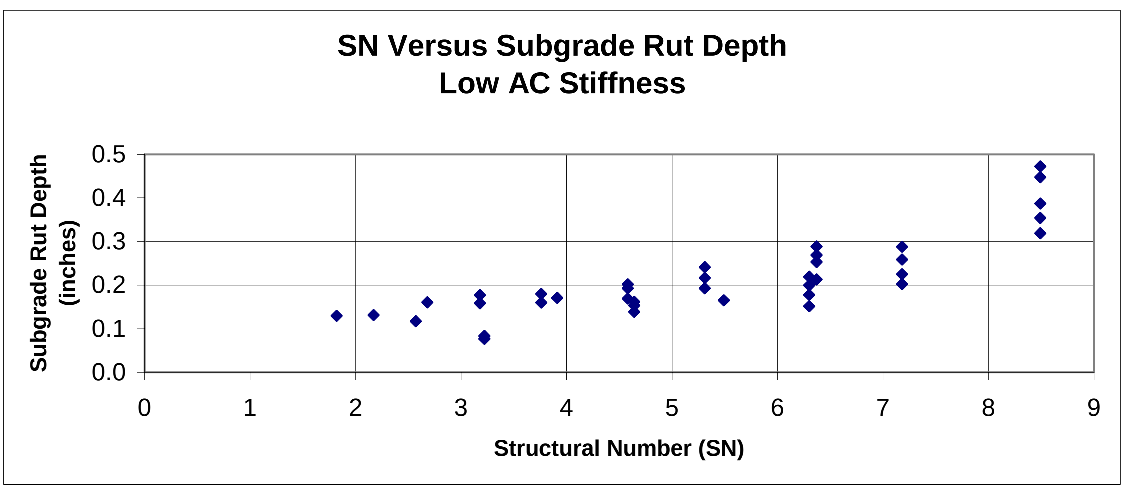
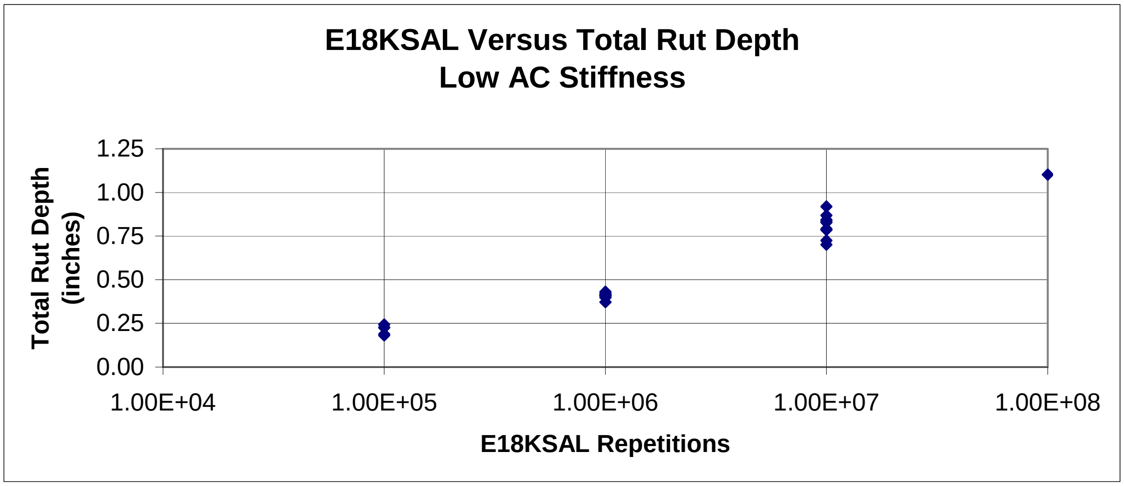
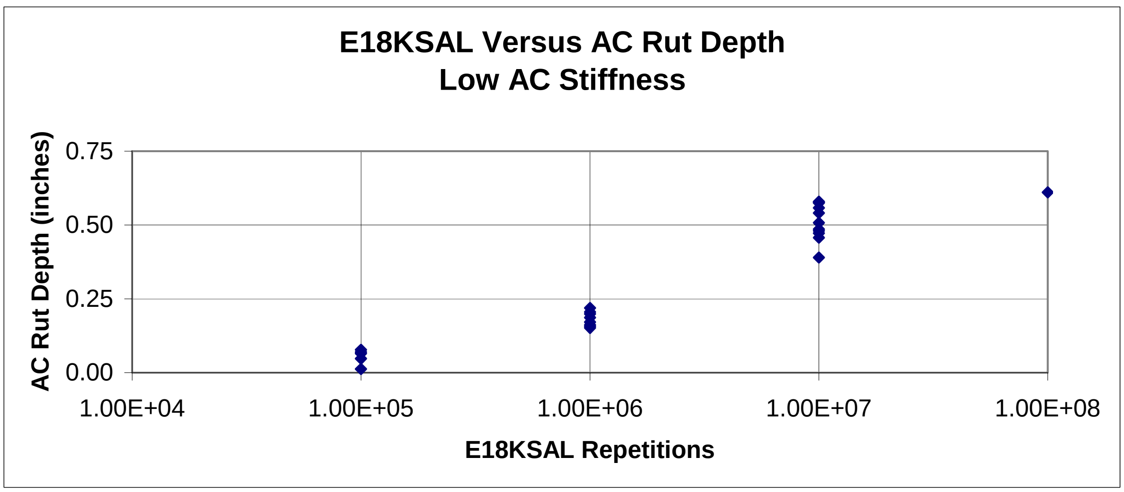


Figure D-232 Rut Depths versus Structural Number Set 1-F





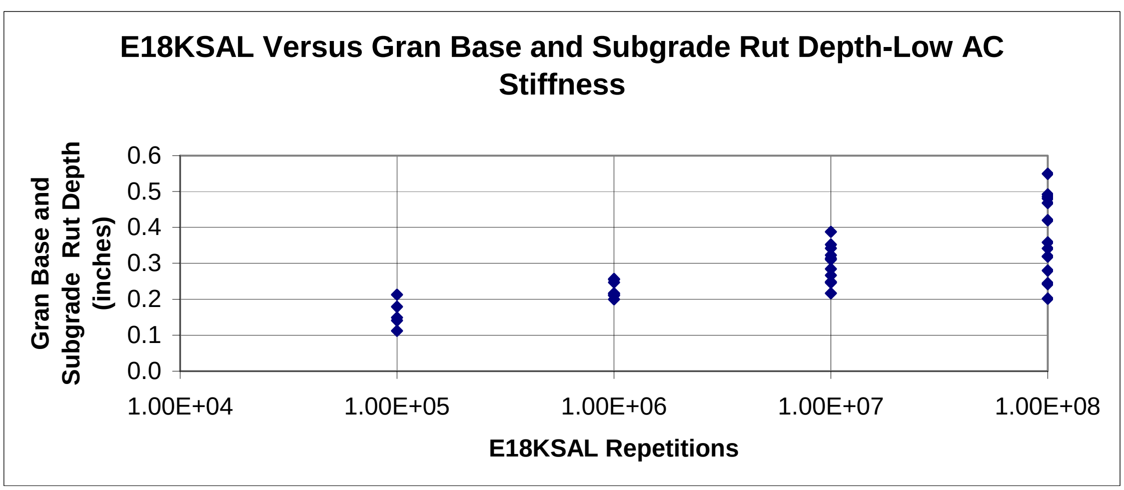
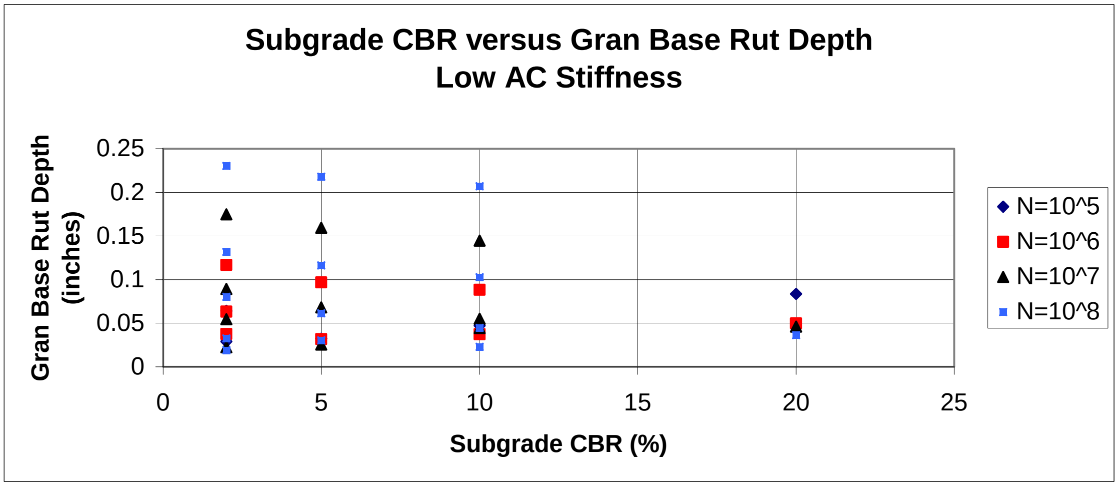


Figure D-233 Rut Depths versus 18KESAL Repetitions Set 1-F



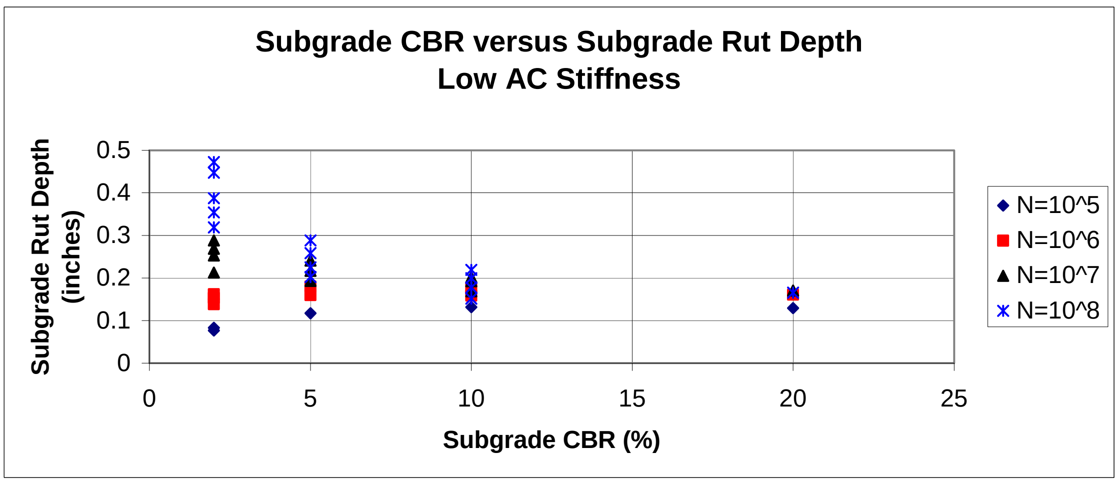


Figure D-234 Base / Subgrade Rut Depths versus Subgrade CBR (All data) Set 1-F

Table D-90 AASHTO Study Data – Set 2-F (β_{acr1} = 0.508, β_{acr2} = 0.9, β_{acr3} = 1.2, β_{GB} = 1.82, β_{SG} = 1.79)

				Rut Depth Value			
Hac	***CBRsg***	***N Design***	***SN***	***AC***	***GB***	***SG***	***Total***
2	2	1.00E+05	3.22	0.047	0.066	0.122	0.235
4	2	1.00E+05	3.22	0.070	0.031	0.134	0.235
3	5	1.00E+05	2.57	0.078	0.035	0.156	0.269
2	10	1.00E+05	2.17	0.065	0.051	0.158	0.273
1	20	1.00E+05	1.82	0.012	0.089	0.144	0.246
			Average	***0.054***	***0.054***	***0.142***	***0.251***
2	2	1.00E+06	4.64	0.152	0.118	0.171	0.440
4	2	1.00E+06	4.64	0.199	0.064	0.190	0.453
6	2	1.00E+06	4.64	0.172	0.039	0.204	0.415
2	5	1.00E+06	3.76	0.157	0.098	0.180	0.435
5	5	1.00E+06	3.76	0.187	0.033	0.207	0.427
2	10	1.00E+06	3.18	0.162	0.090	0.170	0.422
4	10	1.00E+06	3.18	0.206	0.039	0.193	0.438
3	20	1.00E+06	2.68	0.219	0.052	0.169	0.440
			Average	***0.182***	***0.066***	***0.186***	***0.434***
2	2	1.00E+07	6.37	0.481	0.174	0.211	0.865
5	2	1.00E+07	6.37	0.577	0.089	0.251	0.918
7	2	1.00E+07	6.37	0.507	0.054	0.269	0.831
10	2	1.00E+07	6.37	0.390	0.023	0.296	0.708
2	5	1.00E+07	5.31	0.486	0.158	0.191	0.836
5	5	1.00E+07	5.31	0.558	0.068	0.217	0.843
8	5	1.00E+07	5.31	0.458	0.026	0.246	0.730
2	10	1.00E+07	4.58	0.472	0.144	0.168	0.784
5	10	1.00E+07	4.58	0.580	0.055	0.194	0.829
6	10	1.00E+07	4.58	0.541	0.045	0.205	0.790
5	20	1.00E+07	3.91	0.575	0.046	0.172	0.793
			Average	***0.511***	***0.080***	***0.220***	***0.811***
2	2	1.00E+08	8.49	0.906	0.226	0.260	1.391
5	2	1.00E+08	8.49	1.820	0.130	0.289	2.239
8	2	1.00E+08	8.49	1.522	0.079	0.318	1.919
12	2	1.00E+08	8.49	0.960	0.032	0.375	1.367
14	2	1.00E+08	8.49	0.611	0.019	0.401	1.032
2	5	1.00E+08	7.18	0.901	0.214	0.181	1.296
5	5	1.00E+08	7.18	1.760	0.114	0.202	2.076
8	5	1.00E+08	7.18	1.462	0.060	0.235	1.758
11	5	1.00E+08	7.18	1.108	0.030	0.265	1.404
2	10	1.00E+08	6.3	0.900	0.203	0.142	1.246
5	10	1.00E+08	6.3	1.726	0.101	0.167	1.995
8	10	1.00E+08	6.3	1.432	0.044	0.190	1.666
10	10	1.00E+08	6.3	1.234	0.023	0.210	1.467
8	20	1.00E+08	5.49	1.461	0.036	0.161	1.658
			Average	***1.272***	***0.094***	***0.243***	***1.608***

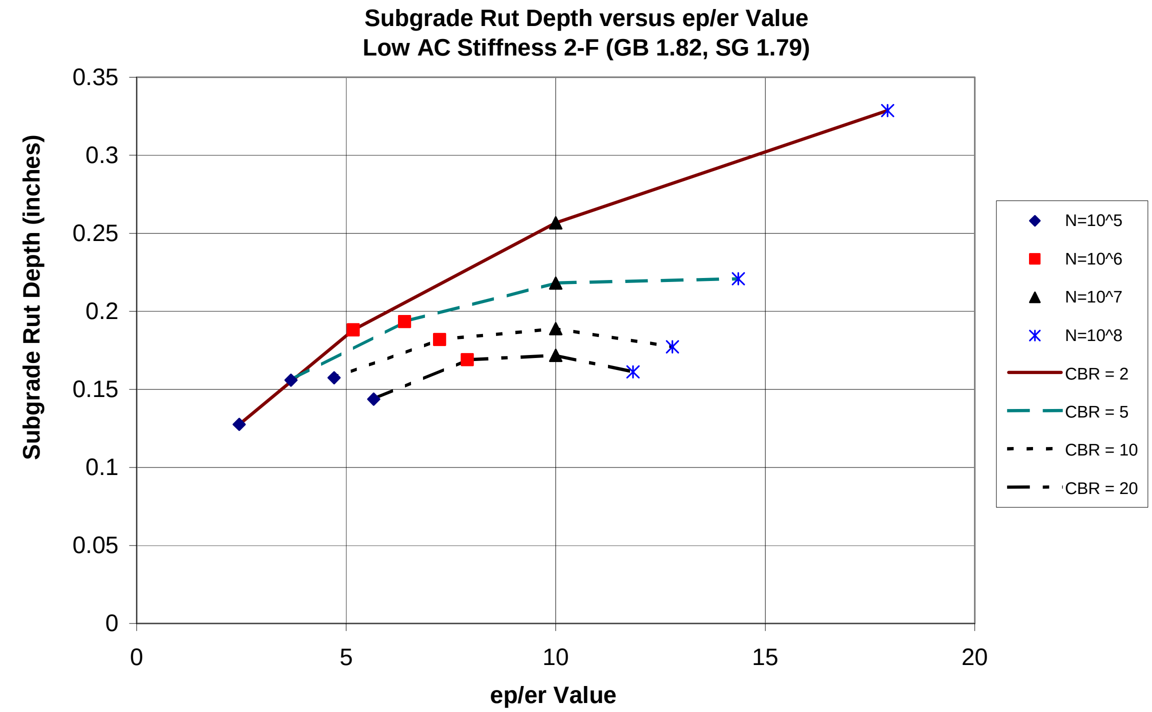


Figure D-235 Subgrade Rut Depth versus ep/er Value Set 2-F

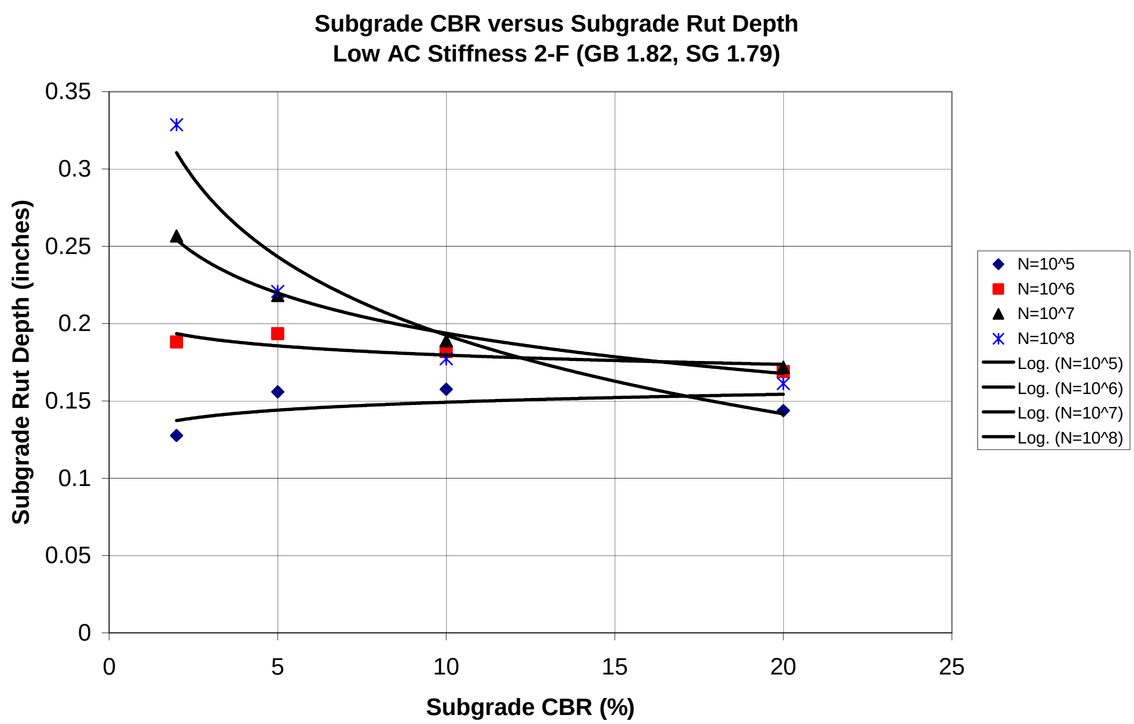
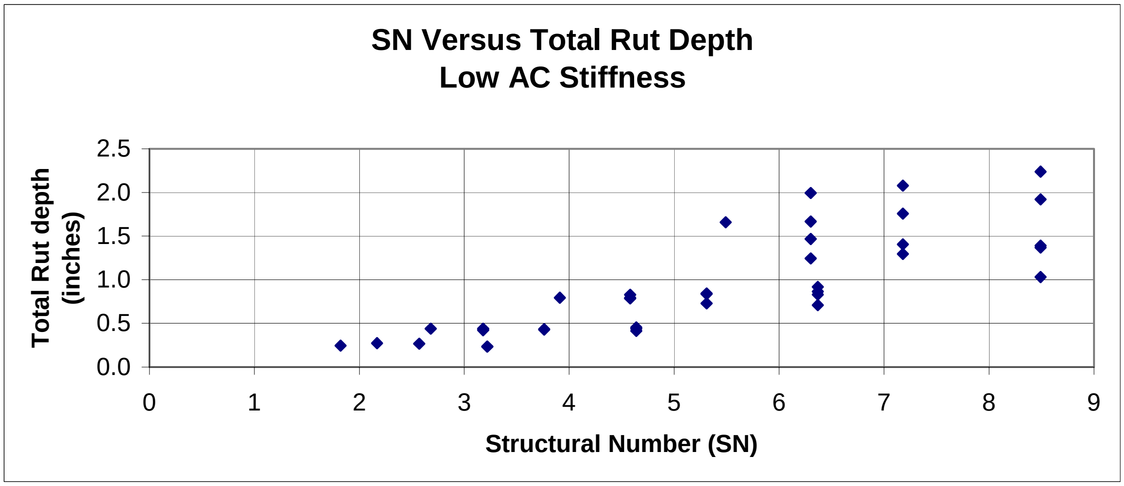
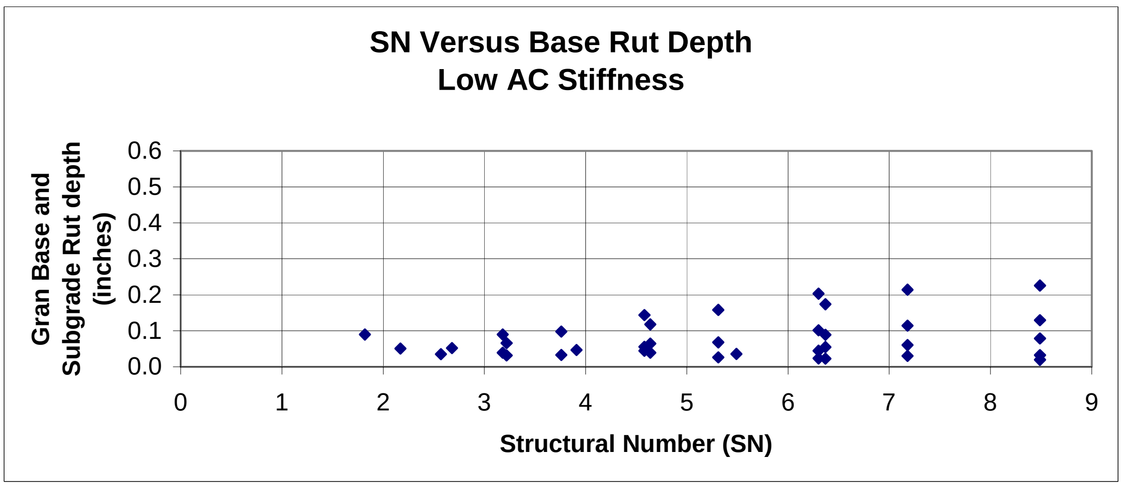


Figure D-236 Average Subgrade Rut Depth versus Subgrade CBR (%) Set 2-F





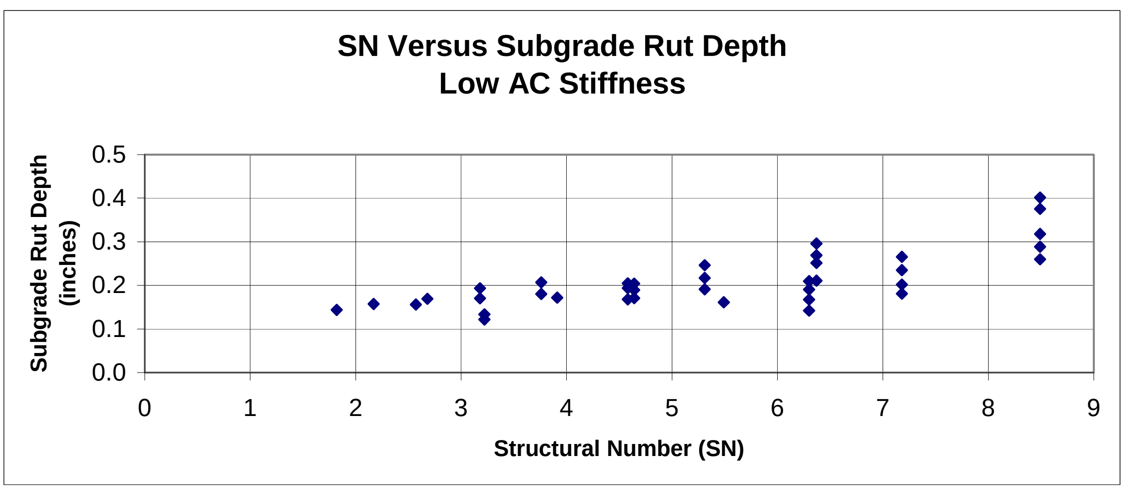
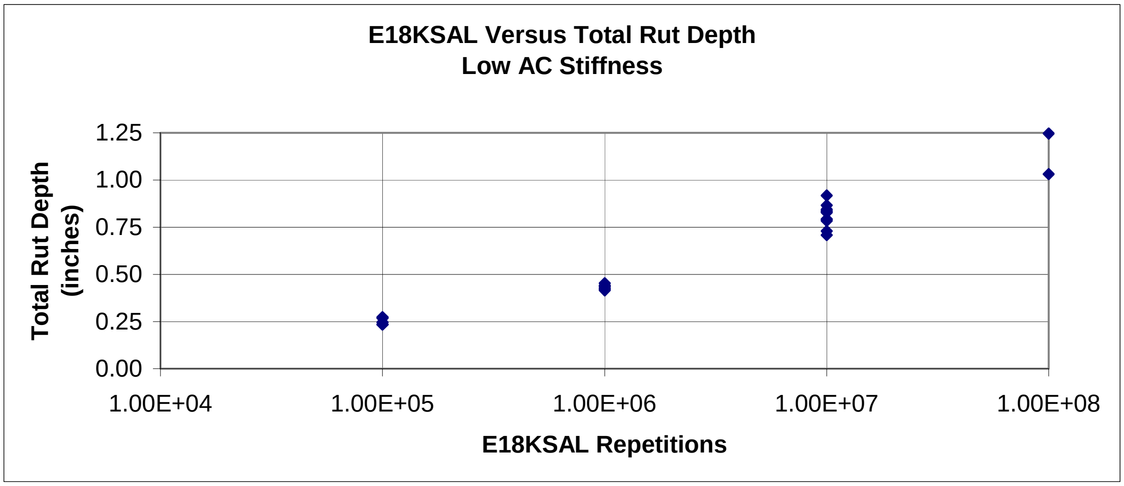
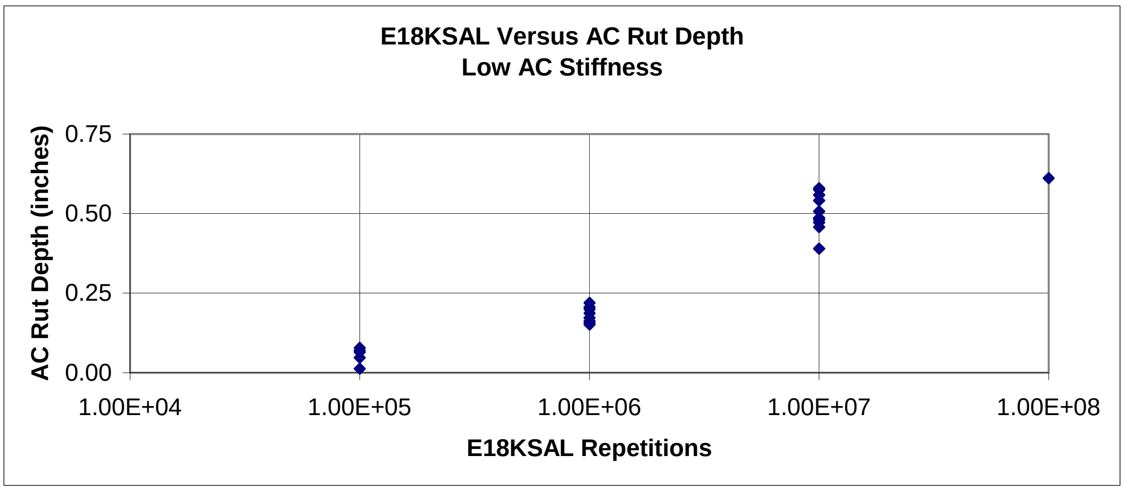


Figure D-237 Rut Depths versus Structural Number Set 2-F





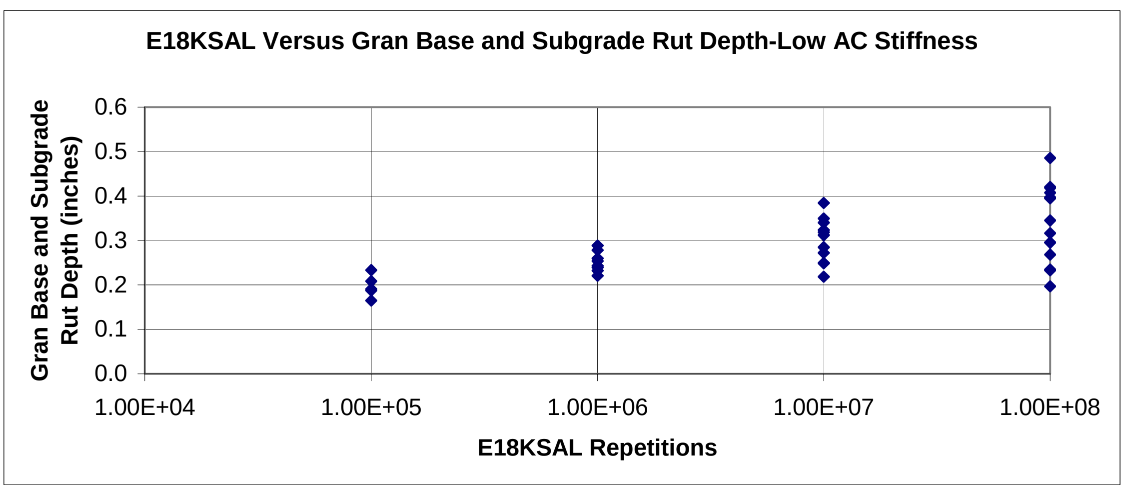
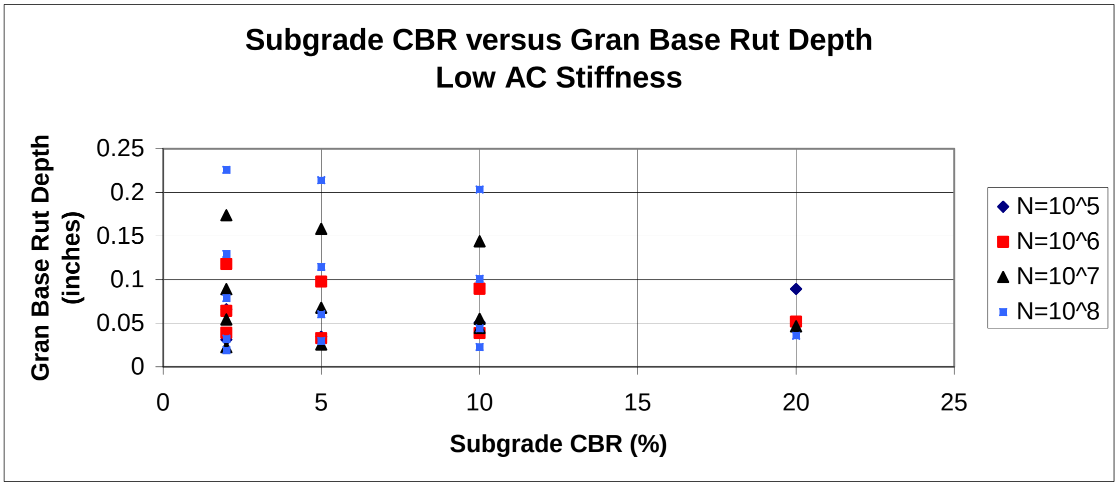


Figure D-238 Rut Depths versus 18KESAL Repetitions Set 2-F



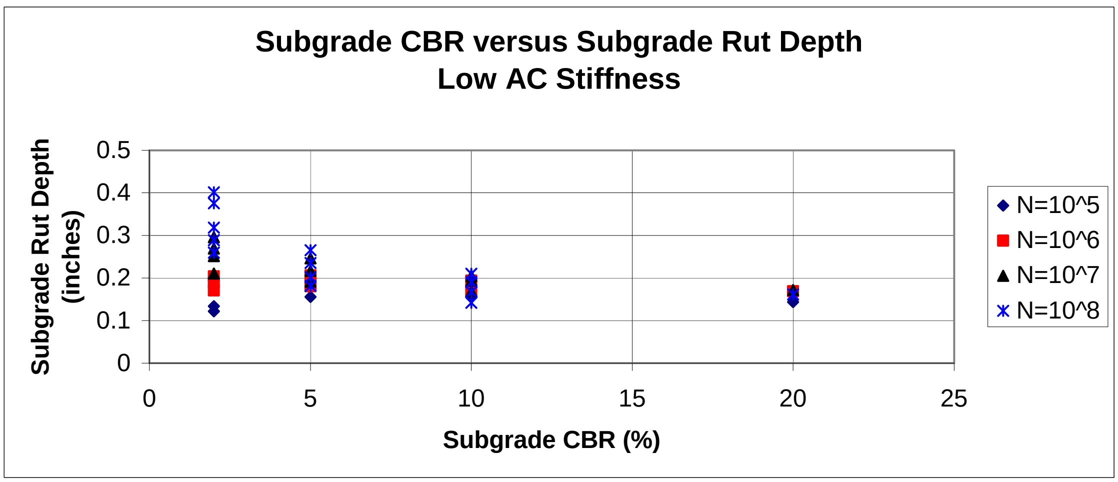


Figure D-239 Base / Subgrade Rut Depths versus Subgrade CBR (All data) Set 2-F

Table D-91 AASHTO Study Data – Set 3-F (β_{acr1} = 0.508, β_{acr2} = 0.9, β_{acr3} = 1.2, β_{GB} = 1.80, β_{SG} = 1.76)

				Rut Depth Value			
Hac	***CBRsg***	***N Design***	***SN***	***AC***	***GB***	***SG***	***Total***
2	2	1.00E+05	3.22	0.047	0.067	0.166	0.281
4	2	1.00E+05	3.22	0.070	0.033	0.186	0.289
3	5	1.00E+05	2.57	0.078	0.037	0.190	0.304
2	10	1.00E+05	2.17	0.065	0.053	0.178	0.296
1	20	1.00E+05	1.82	0.012	0.094	0.153	0.260
			Average	***0.054***	***0.057***	***0.175***	***0.286***
2	2	1.00E+06	4.64	0.152	0.119	0.197	0.467
4	2	1.00E+06	4.64	0.199	0.065	0.219	0.483
6	2	1.00E+06	4.64	0.172	0.040	0.239	0.451
2	5	1.00E+06	3.76	0.157	0.098	0.194	0.450
5	5	1.00E+06	3.76	0.187	0.034	0.228	0.448
2	10	1.00E+06	3.18	0.162	0.090	0.178	0.430
4	10	1.00E+06	3.18	0.206	0.040	0.205	0.450
3	20	1.00E+06	2.68	0.219	0.053	0.174	0.446
			Average	***0.182***	***0.067***	***0.204***	***0.453***
2	2	1.00E+07	6.37	0.481	0.173	0.208	0.861
5	2	1.00E+07	6.37	0.577	0.089	0.248	0.914
7	2	1.00E+07	6.37	0.507	0.054	0.268	0.830
10	2	1.00E+07	6.37	0.390	0.023	0.302	0.714
2	5	1.00E+07	5.31	0.486	0.158	0.189	0.832
5	5	1.00E+07	5.31	0.558	0.068	0.216	0.842
8	5	1.00E+07	5.31	0.458	0.026	0.249	0.733
2	10	1.00E+07	4.58	0.472	0.143	0.166	0.782
5	10	1.00E+07	4.58	0.580	0.055	0.194	0.828
6	10	1.00E+07	4.58	0.541	0.045	0.205	0.791
5	20	1.00E+07	3.91	0.575	0.047	0.171	0.793
			Average	***0.511***	***0.080***	***0.220***	***0.811***
2	2	1.00E+08	8.49	0.906	0.223	0.223	1.352
5	2	1.00E+08	8.49	1.820	0.128	0.249	2.197
8	2	1.00E+08	8.49	1.522	0.078	0.276	1.876
12	2	1.00E+08	8.49	0.960	0.032	0.332	1.323
14	2	1.00E+08	8.49	0.611	0.019	0.359	0.988
2	5	1.00E+08	7.18	0.901	0.211	0.166	1.278
5	5	1.00E+08	7.18	1.760	0.113	0.186	2.059
8	5	1.00E+08	7.18	1.462	0.060	0.219	1.741
11	5	1.00E+08	7.18	1.108	0.030	0.250	1.388
2	10	1.00E+08	6.3	0.900	0.201	0.134	1.235
5	10	1.00E+08	6.3	1.726	0.100	0.159	1.986
8	10	1.00E+08	6.3	1.432	0.044	0.183	1.658
10	10	1.00E+08	6.3	1.234	0.023	0.202	1.459
8	20	1.00E+08	5.49	1.461	0.036	0.157	1.654
			Average	***1.272***	***0.093***	***0.221***	***1.585***

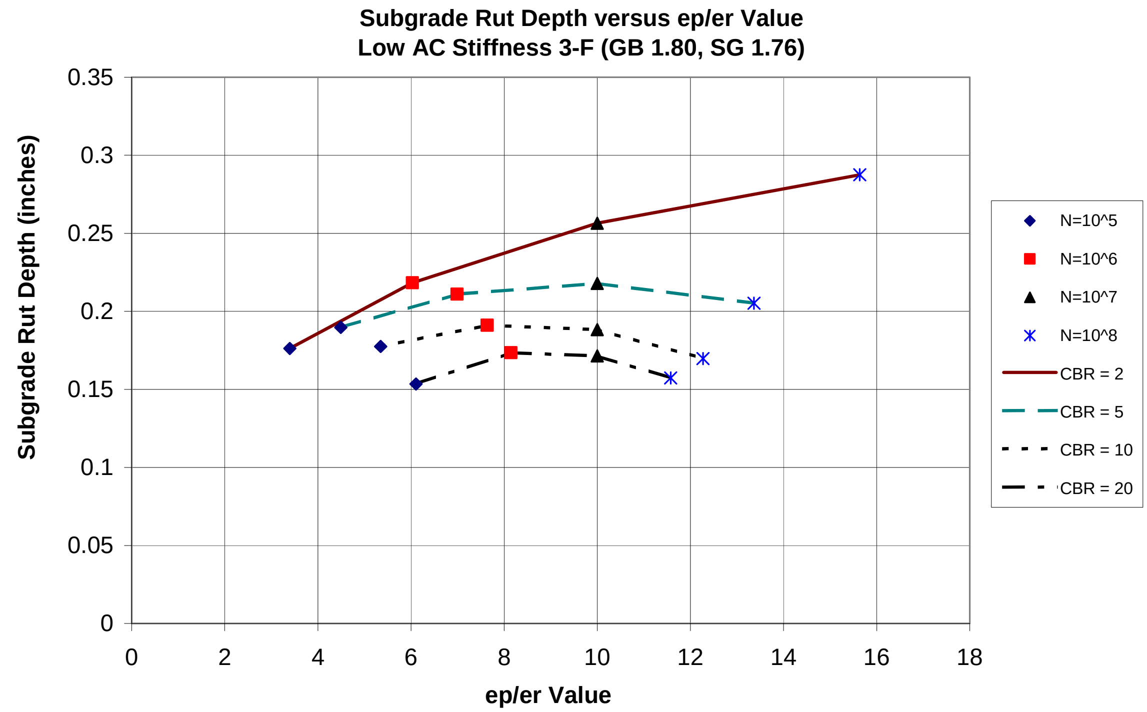


Figure D-240 Subgrade Rut Depth versus ep/er Value Set 3-F

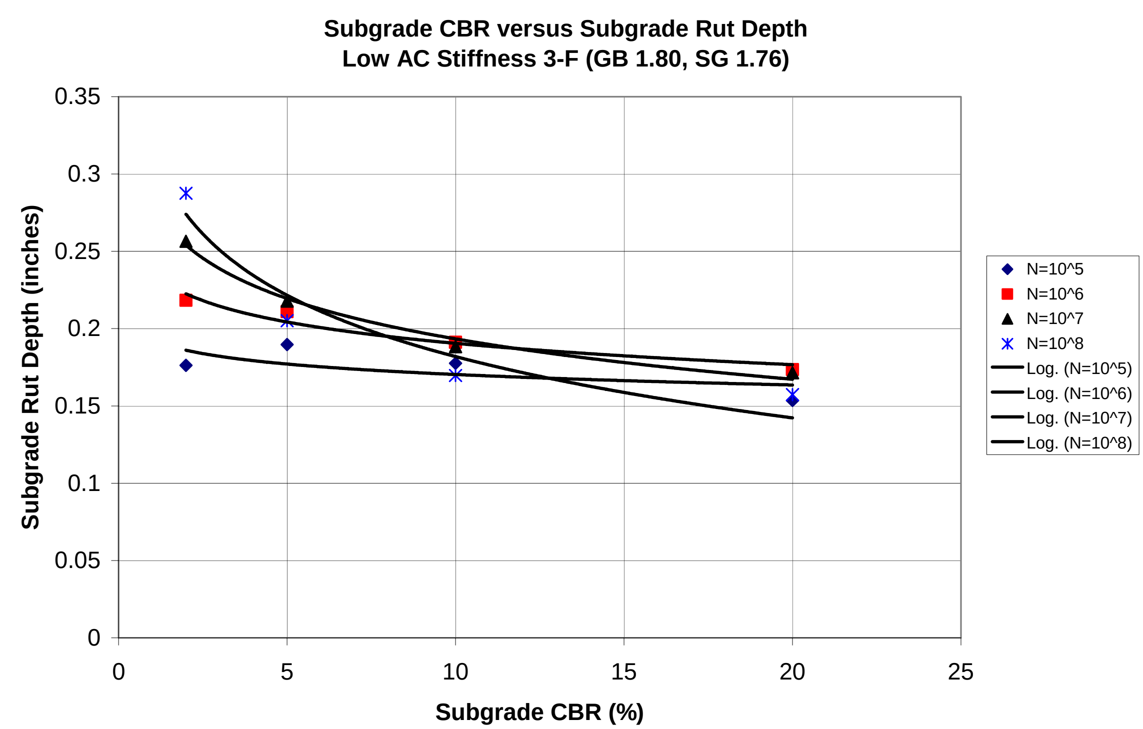
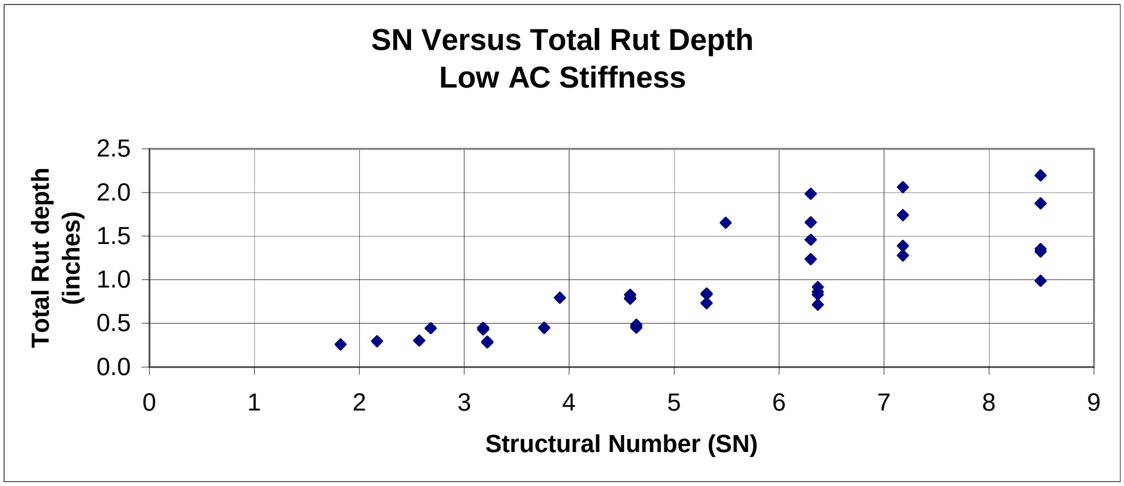
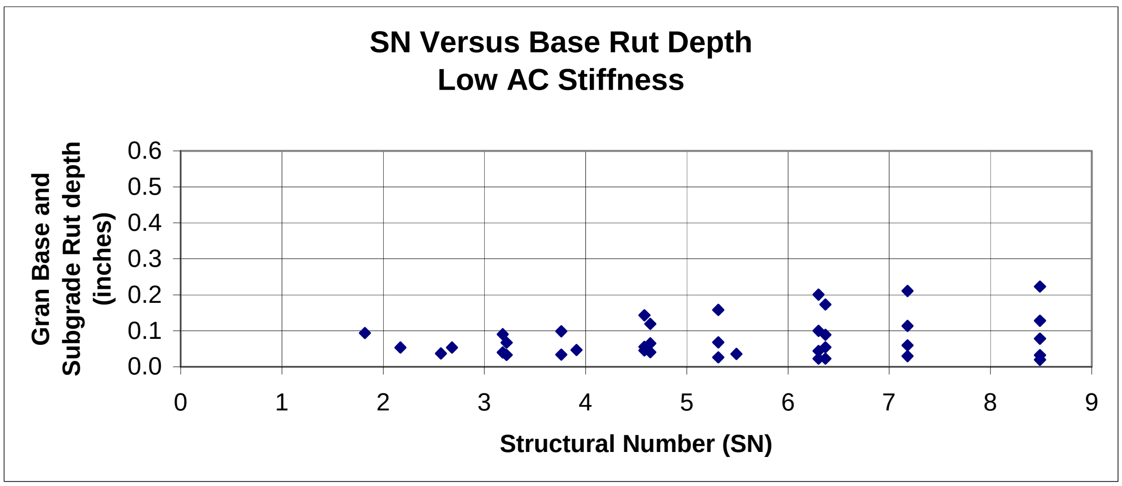


Figure D-241 Average Subgrade Rut Depth versus Subgrade CBR (%) Set 3-F





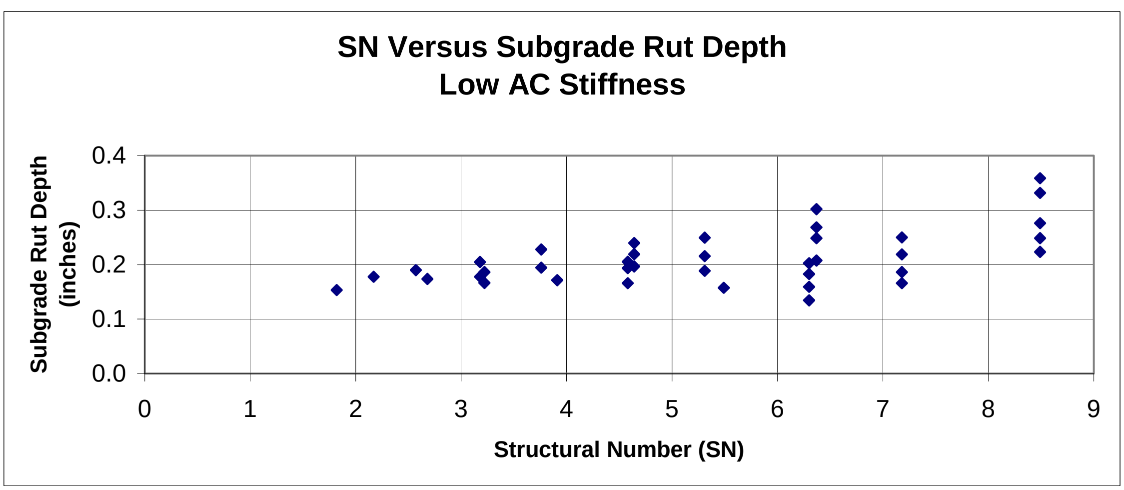
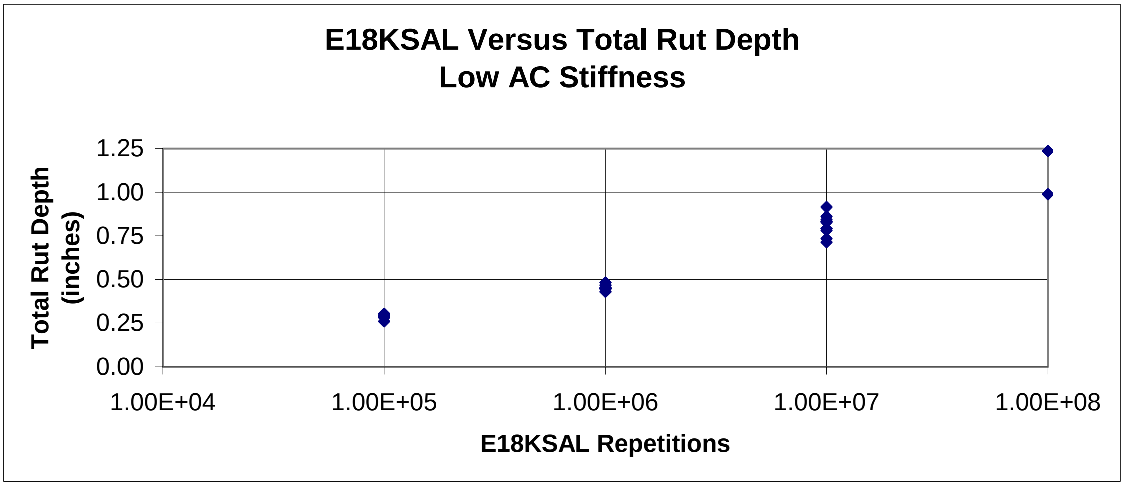
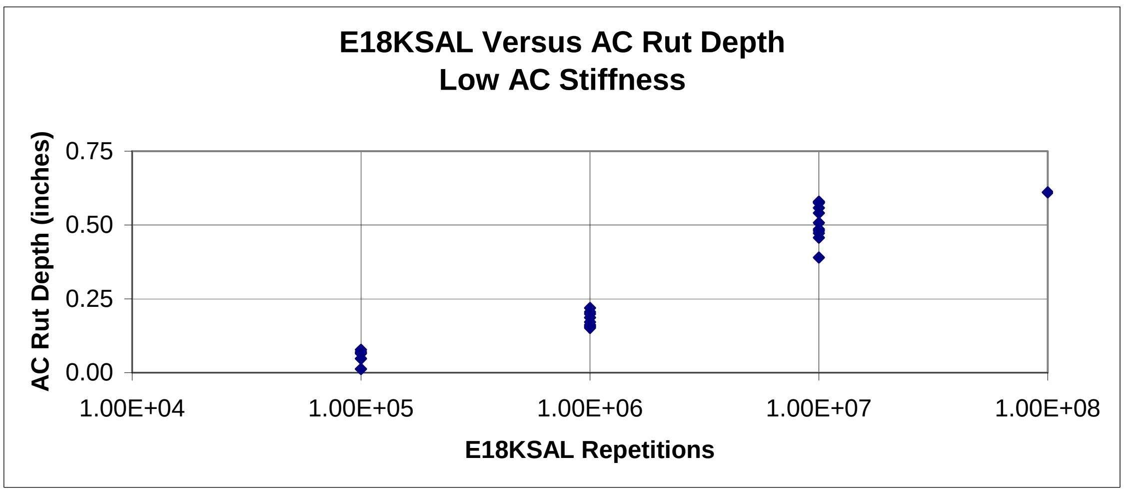


Figure D-242 Rut Depths versus Structural Number Set 3-F





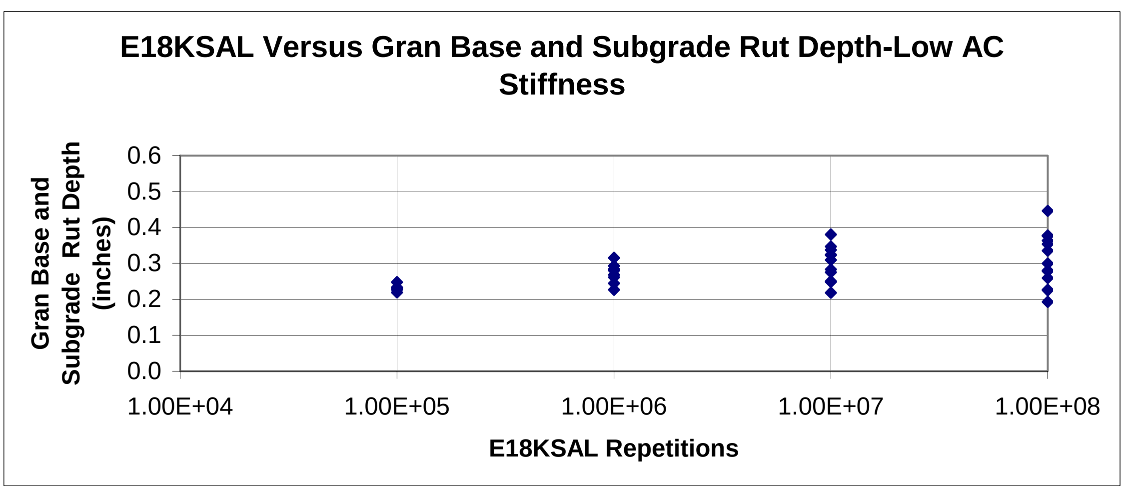
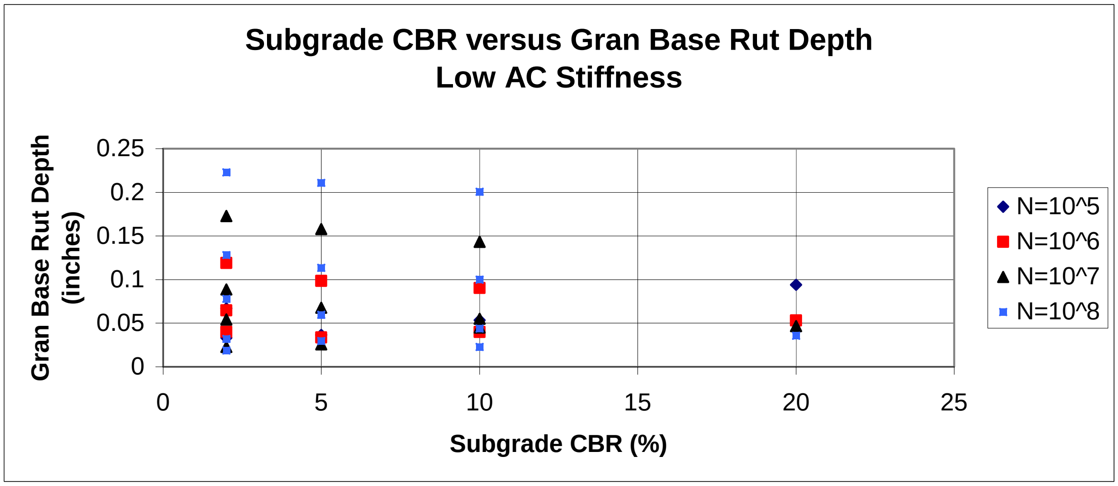


Figure D-243 Rut Depths versus 18KESAL Repetitions Set 3-F



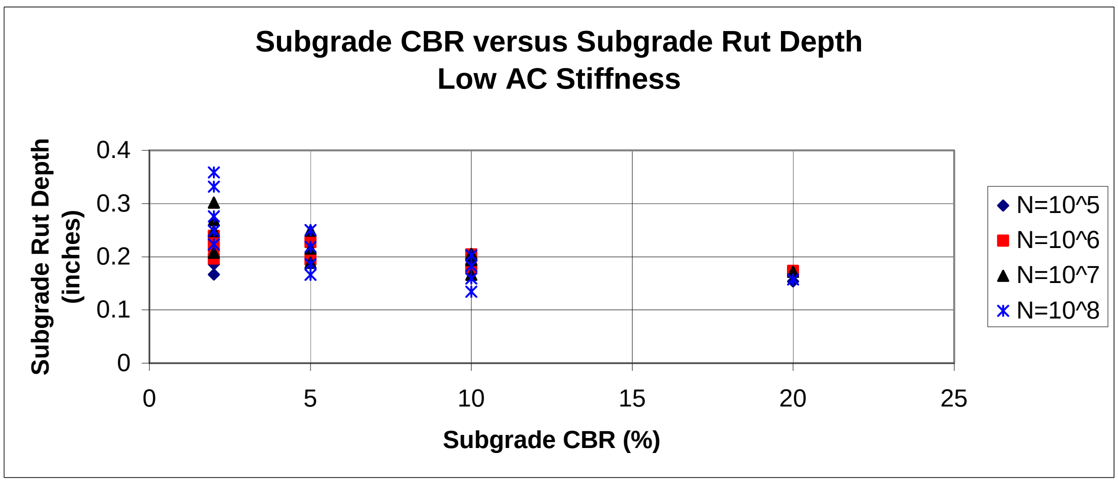


Figure D-244 Base / Subgrade Rut Depths versus Subgrade CBR (All data) Set 3-F

Table D-92 AASHTO Study Data – Set 4-F (β_{acr1} = 0.508, β_{acr2} = 0.9, β_{acr3} = 1.2, β_{GB} = 1.78, β_{SG} = 1.74)

				Rut Depth Value			
Hac	***CBRsg***	***N Design***	***SN***	***AC***	***GB***	***SG***	***Total***
2	2	1.00E+05	3.22	0.047	0.067	0.190	0.305
4	2	1.00E+05	3.22	0.070	0.034	0.214	0.318
3	5	1.00E+05	2.57	0.078	0.037	0.206	0.321
2	10	1.00E+05	2.17	0.065	0.054	0.186	0.305
1	20	1.00E+05	1.82	0.012	0.095	0.157	0.265
			Average	***0.054***	***0.058***	***0.191***	***0.303***
2	2	1.00E+06	4.64	0.152	0.119	0.208	0.478
4	2	1.00E+06	4.64	0.199	0.065	0.232	0.496
6	2	1.00E+06	4.64	0.172	0.040	0.256	0.468
2	5	1.00E+06	3.76	0.157	0.098	0.200	0.455
5	5	1.00E+06	3.76	0.187	0.034	0.237	0.458
2	10	1.00E+06	3.18	0.162	0.090	0.180	0.432
4	10	1.00E+06	3.18	0.206	0.040	0.209	0.455
3	20	1.00E+06	2.68	0.219	0.053	0.175	0.448
			Average	***0.182***	***0.067***	***0.212***	***0.461***
2	2	1.00E+07	6.37	0.481	0.172	0.205	0.858
5	2	1.00E+07	6.37	0.577	0.088	0.247	0.912
7	2	1.00E+07	6.37	0.507	0.054	0.268	0.829
10	2	1.00E+07	6.37	0.390	0.023	0.304	0.717
2	5	1.00E+07	5.31	0.486	0.156	0.187	0.829
5	5	1.00E+07	5.31	0.558	0.067	0.215	0.841
8	5	1.00E+07	5.31	0.458	0.026	0.250	0.734
2	10	1.00E+07	4.58	0.472	0.142	0.165	0.779
5	10	1.00E+07	4.58	0.580	0.055	0.193	0.827
6	10	1.00E+07	4.58	0.541	0.045	0.205	0.790
5	20	1.00E+07	3.91	0.575	0.046	0.171	0.792
			Average	***0.511***	***0.079***	***0.219***	***0.810***
2	2	1.00E+08	8.49	0.906	0.220	0.208	1.334
5	2	1.00E+08	8.49	1.820	0.127	0.232	2.179
8	2	1.00E+08	8.49	1.522	0.077	0.259	1.859
12	2	1.00E+08	8.49	0.960	0.032	0.314	1.306
14	2	1.00E+08	8.49	0.611	0.019	0.341	0.971
2	5	1.00E+08	7.18	0.901	0.209	0.159	1.269
5	5	1.00E+08	7.18	1.760	0.112	0.179	2.051
8	5	1.00E+08	7.18	1.462	0.059	0.212	1.733
11	5	1.00E+08	7.18	1.108	0.029	0.243	1.380
2	10	1.00E+08	6.3	0.900	0.198	0.131	1.229
5	10	1.00E+08	6.3	1.726	0.099	0.155	1.981
8	10	1.00E+08	6.3	1.432	0.043	0.179	1.654
10	10	1.00E+08	6.3	1.234	0.023	0.199	1.455
8	20	1.00E+08	5.49	1.461	0.035	0.155	1.651
			Average	***1.272***	***0.092***	***0.212***	***1.575***

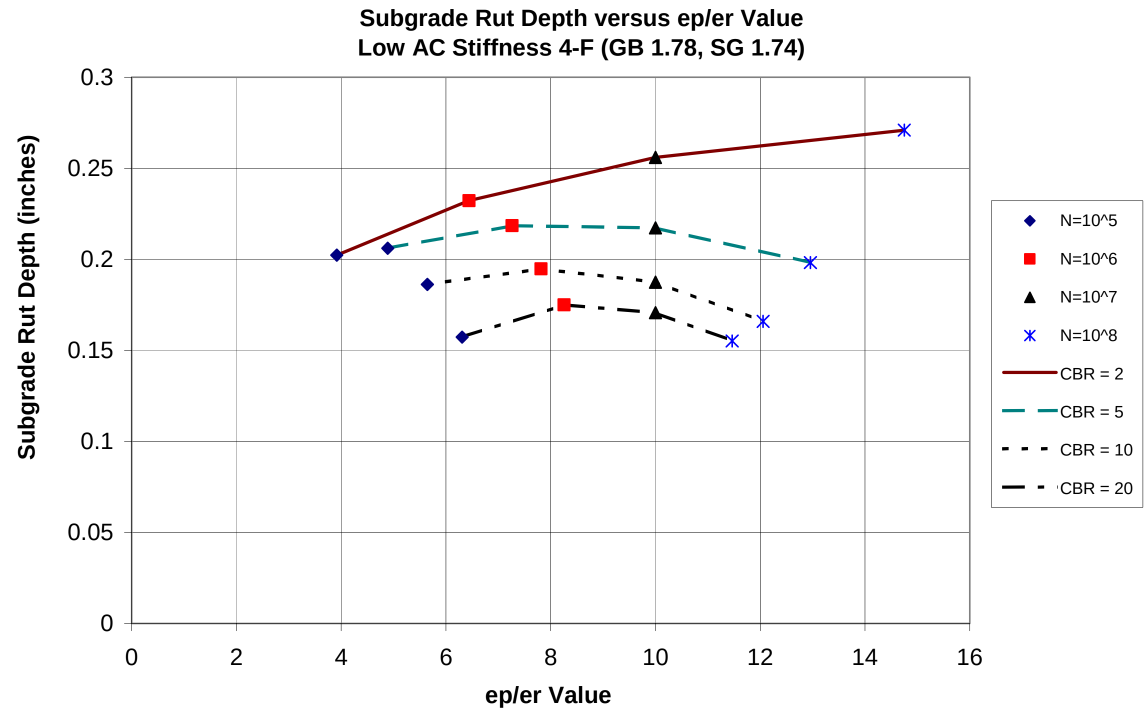


Figure D-245 Subgrade Rut Depth versus ep/er Value Set 4-F

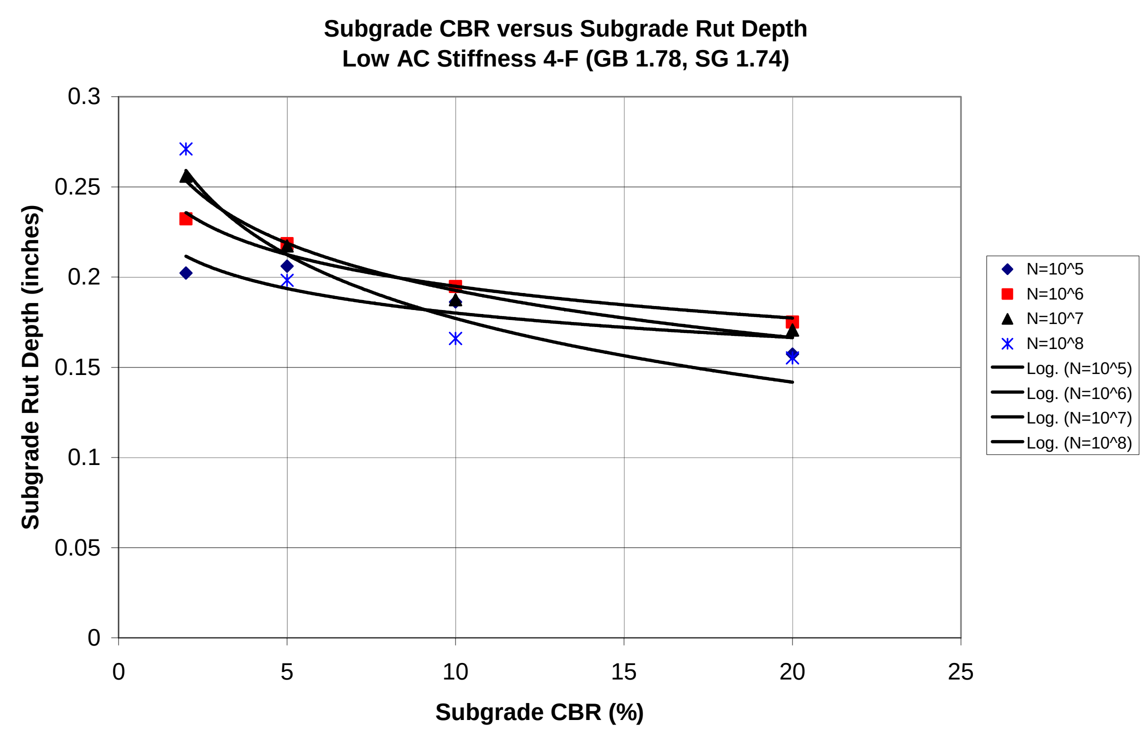
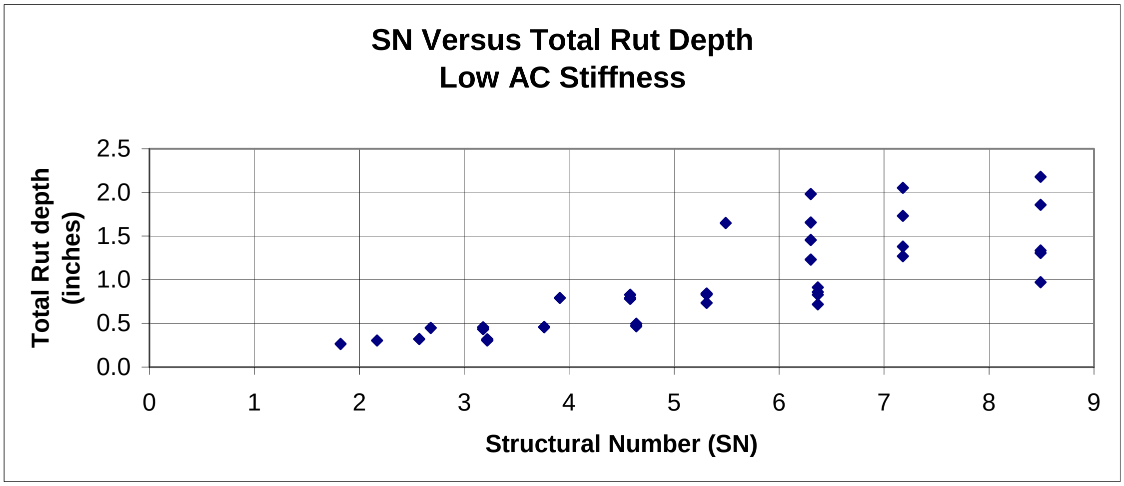
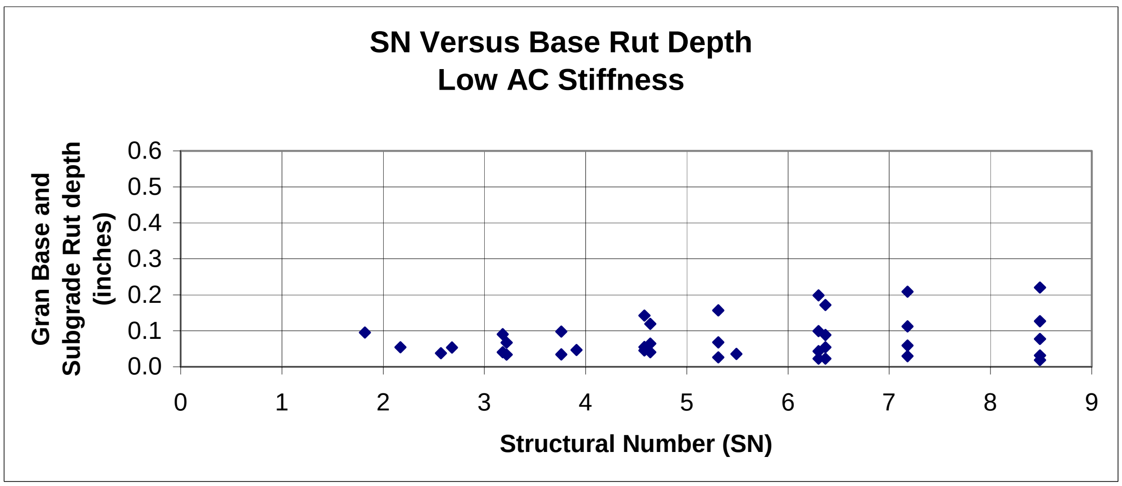


Figure D-246 Average Subgrade Rut Depth versus Subgrade CBR (%) Set 4-F





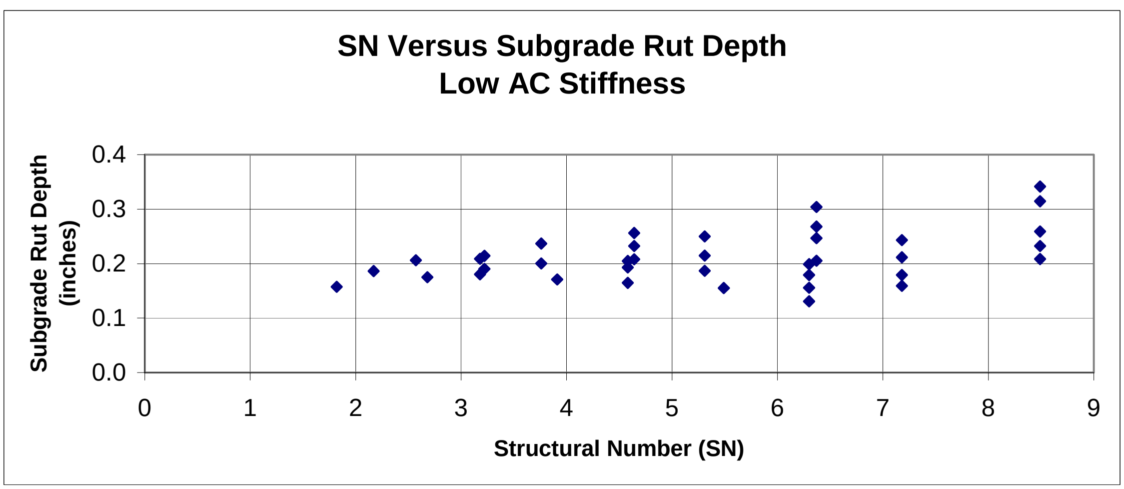
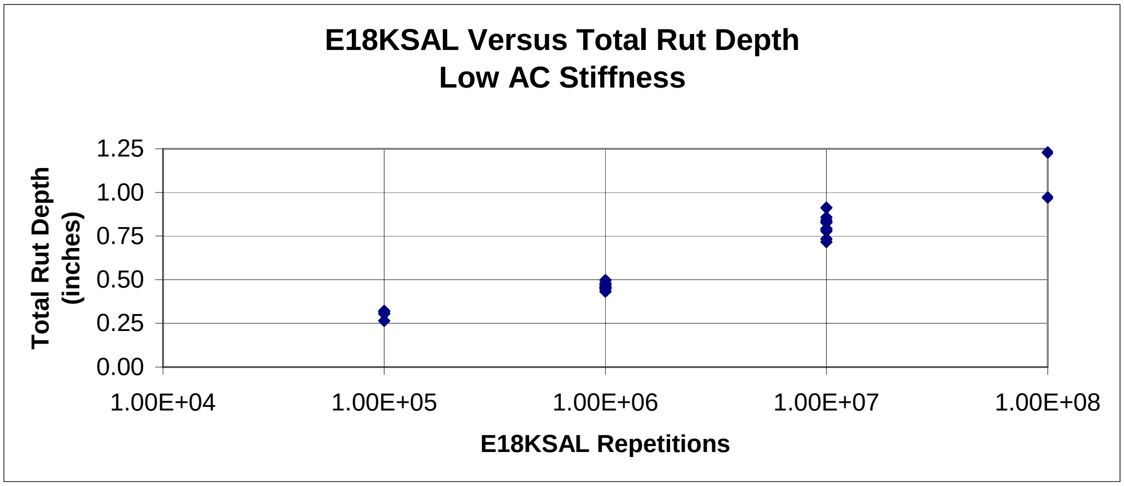
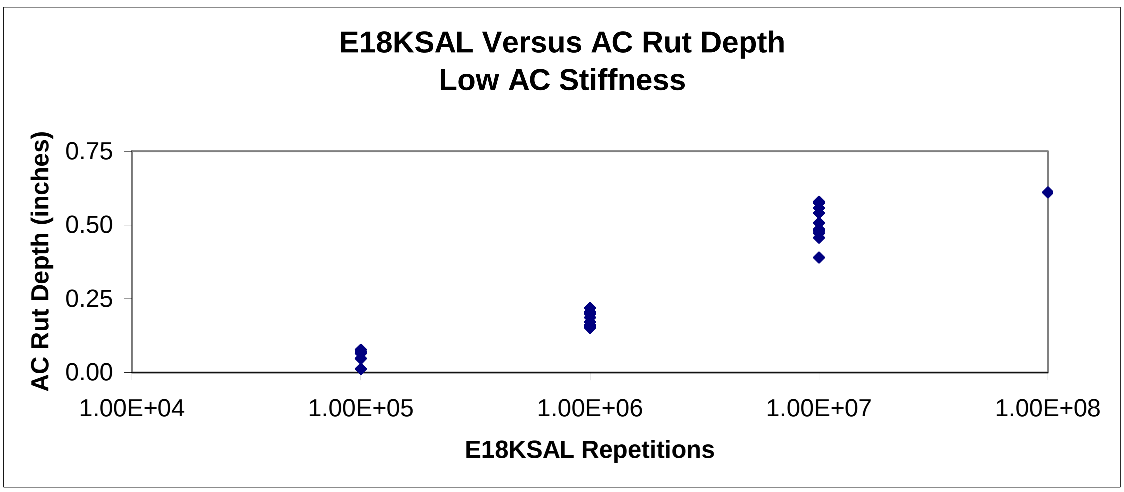


Figure D-247 Rut Depths versus Structural Number Set 4-F





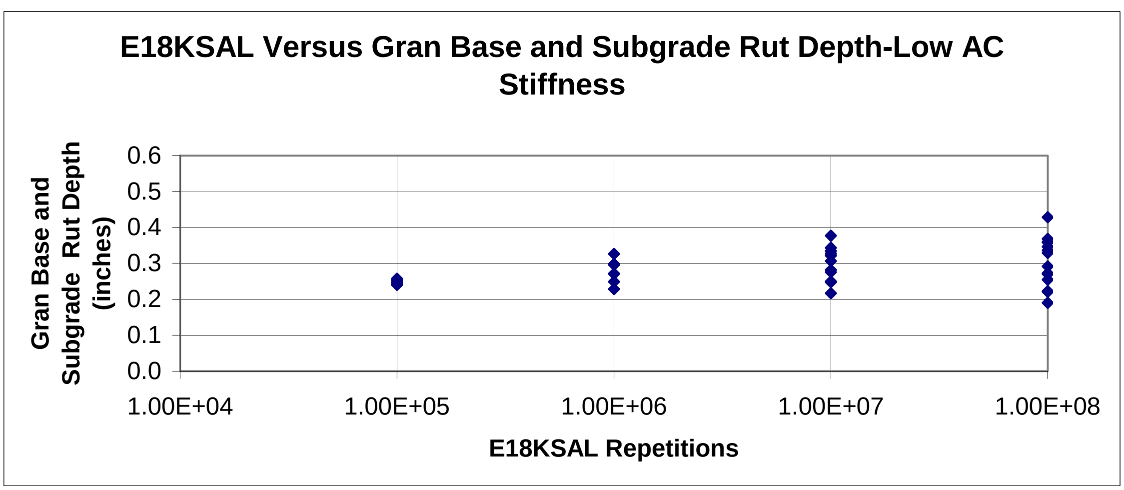
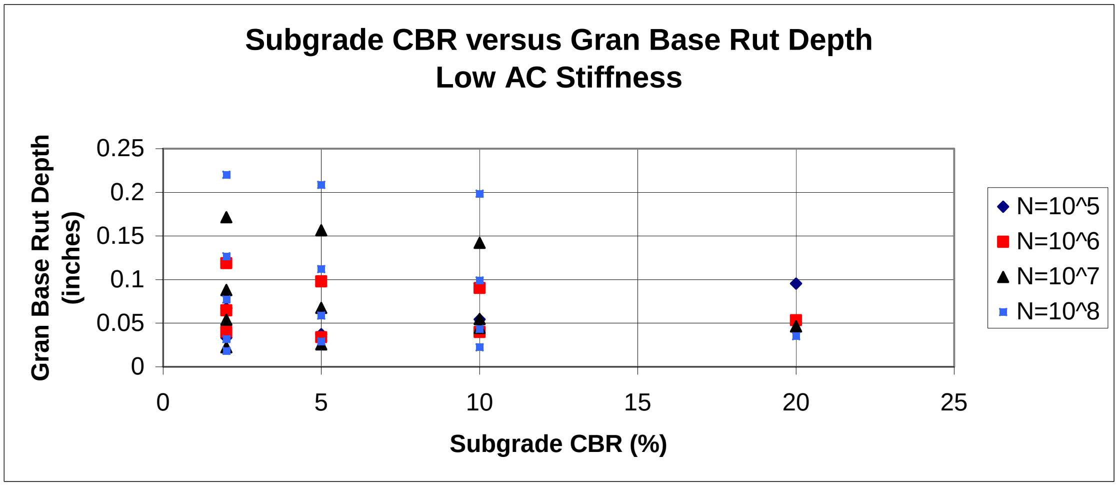


Figure D-248 Rut Depths versus 18KESAL Repetitions Set 4-F



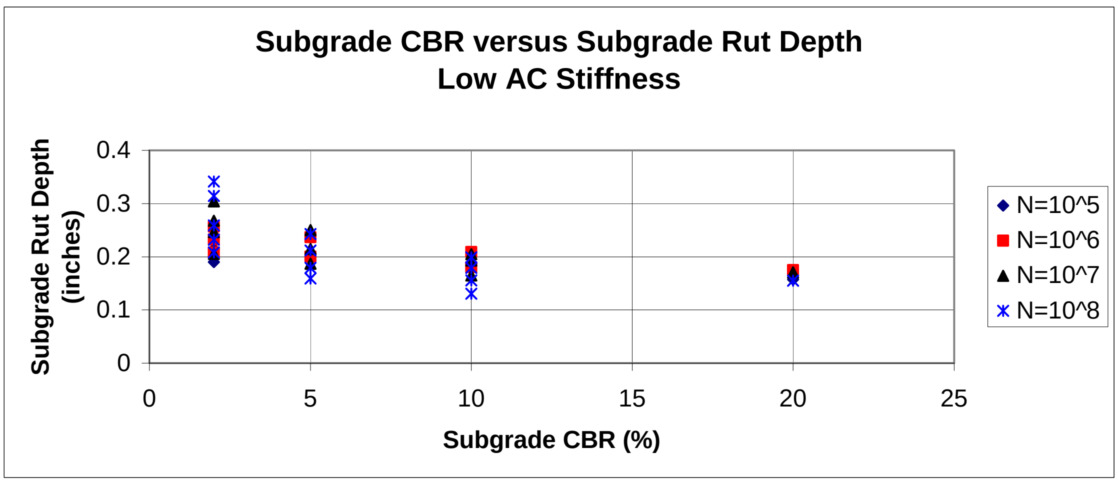


Figure D-249 Base / Subgrade Rut Depths versus Subgrade CBR (All data) Set 4-F

Table D-93 AASHTO Study Data – Set 1-G (β_{acr1} = 0.508, β_{acr2} = 0.9, β_{acr3} = 1.2, β_{GB} = 5.70, β_{SG} = 19.40)

				Rut Depth Value			
Hac	***CBRsg***	***N Design***	***SN***	***AC***	***GB***	***SG***	***Total***
2	2	1.00E+05	3.22	0.047	0.068	0.099	0.215
4	2	1.00E+05	3.22	0.070	0.023	0.113	0.206
3	5	1.00E+05	2.57	0.078	0.026	0.163	0.266
2	10	1.00E+05	2.17	0.065	0.038	0.213	0.316
1	20	1.00E+05	1.82	0.012	0.067	0.266	0.345
			Average	***0.054***	***0.044***	***0.171***	***0.269***
2	2	1.00E+06	4.64	0.152	0.123	0.099	0.374
4	2	1.00E+06	4.64	0.199	0.070	0.113	0.382
6	2	1.00E+06	4.64	0.172	0.031	0.124	0.327
2	5	1.00E+06	3.76	0.157	0.107	0.159	0.423
5	5	1.00E+06	3.76	0.187	0.026	0.188	0.401
2	10	1.00E+06	3.18	0.162	0.093	0.215	0.470
4	10	1.00E+06	3.18	0.206	0.030	0.248	0.485
3	20	1.00E+06	2.68	0.219	0.040	0.316	0.576
			Average	***0.182***	***0.065***	***0.183***	***0.430***
2	2	1.00E+07	6.37	0.481	0.184	0.091	0.756
5	2	1.00E+07	6.37	0.577	0.095	0.111	0.783
7	2	1.00E+07	6.37	0.507	0.061	0.120	0.689
10	2	1.00E+07	6.37	0.390	0.018	0.138	0.546
2	5	1.00E+07	5.31	0.486	0.172	0.149	0.807
5	5	1.00E+07	5.31	0.558	0.077	0.171	0.806
8	5	1.00E+07	5.31	0.458	0.021	0.200	0.679
2	10	1.00E+07	4.58	0.472	0.159	0.204	0.835
5	10	1.00E+07	4.58	0.580	0.061	0.237	0.877
6	10	1.00E+07	4.58	0.541	0.036	0.252	0.829
5	20	1.00E+07	3.91	0.575	0.038	0.322	0.935
			Average	***0.511***	***0.084***	***0.181***	***0.776***
2	2	1.00E+08	8.49	0.906	0.245	0.087	1.238
5	2	1.00E+08	8.49	1.820	0.137	0.097	2.054
8	2	1.00E+08	8.49	1.522	0.084	0.109	1.715
12	2	1.00E+08	8.49	0.960	0.039	0.134	1.133
14	2	1.00E+08	8.49	0.611	0.016	0.146	0.773
2	5	1.00E+08	7.18	0.901	0.234	0.128	1.263
5	5	1.00E+08	7.18	1.760	0.124	0.144	2.027
8	5	1.00E+08	7.18	1.462	0.068	0.169	1.699
11	5	1.00E+08	7.18	1.108	0.025	0.194	1.327
2	10	1.00E+08	6.3	0.900	0.225	0.167	1.292
5	10	1.00E+08	6.3	1.726	0.112	0.196	2.035
8	10	1.00E+08	6.3	1.432	0.052	0.225	1.709
10	10	1.00E+08	6.3	1.234	0.019	0.250	1.504
8	20	1.00E+08	5.49	1.461	0.030	0.305	1.795
			Average	***1.272***	***0.101***	***0.168***	***1.540***

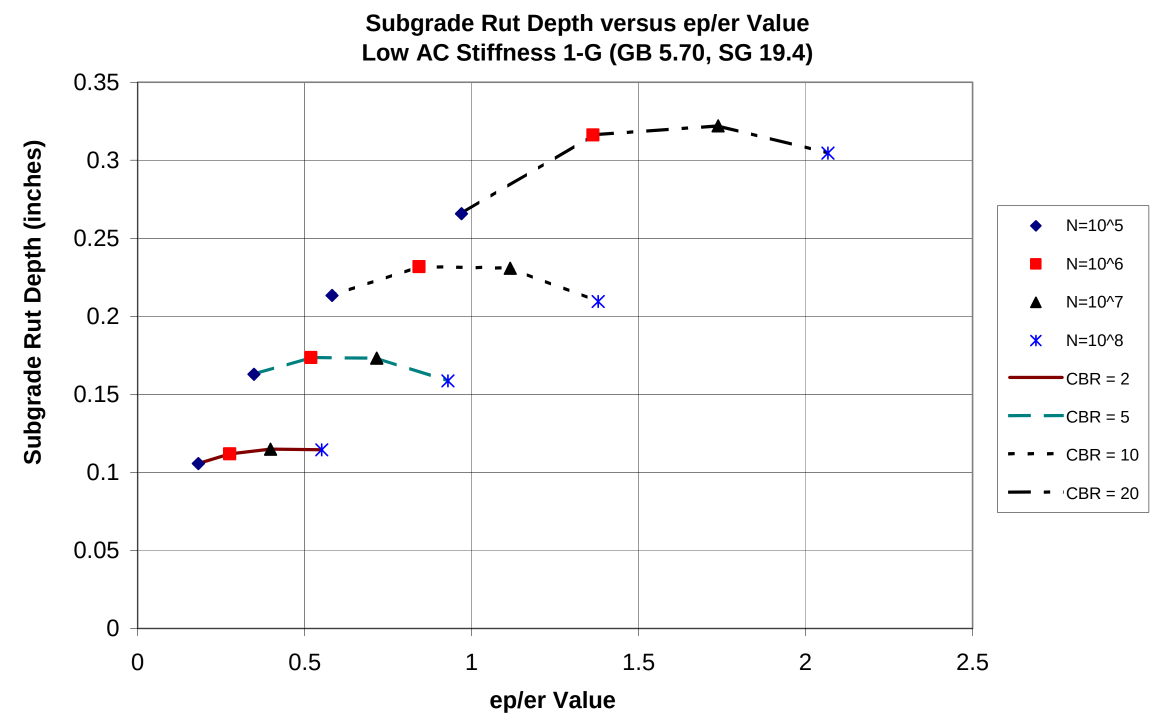


Figure D-250 Subgrade Rut Depth versus ep/er Value Set 1-G

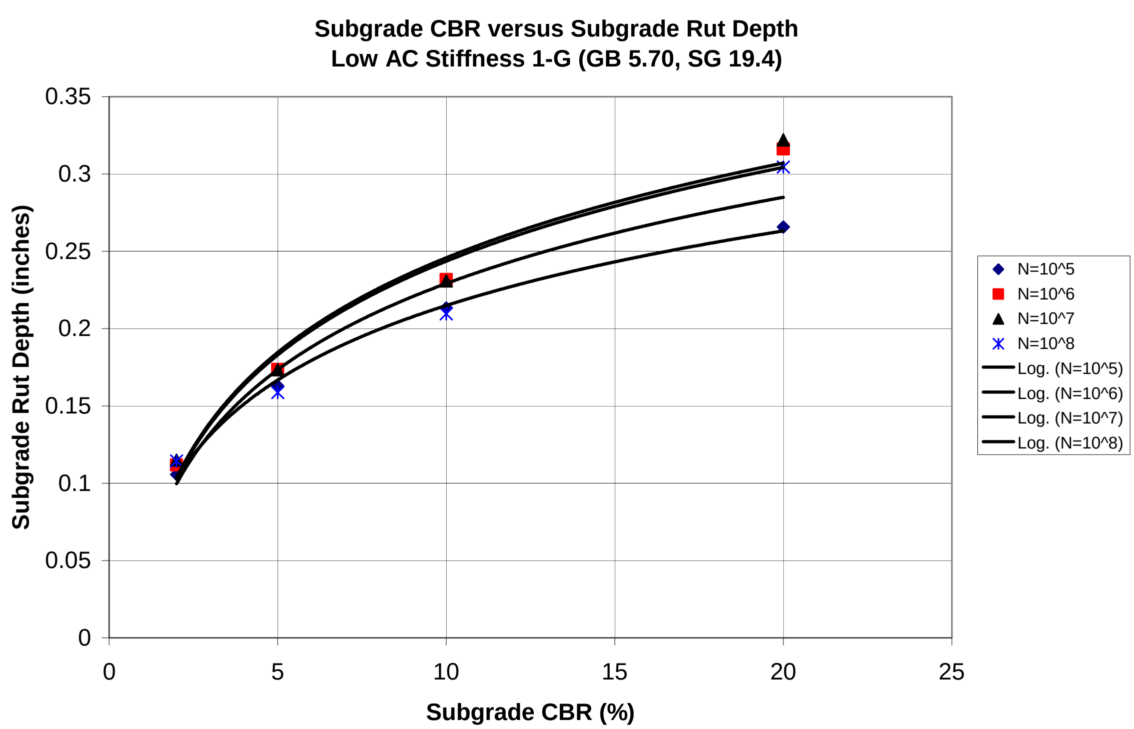
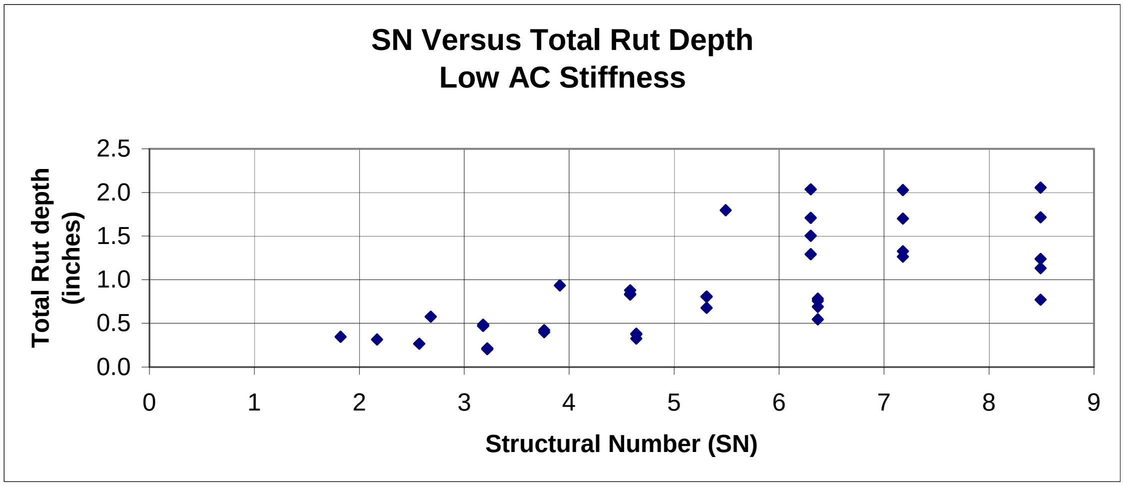
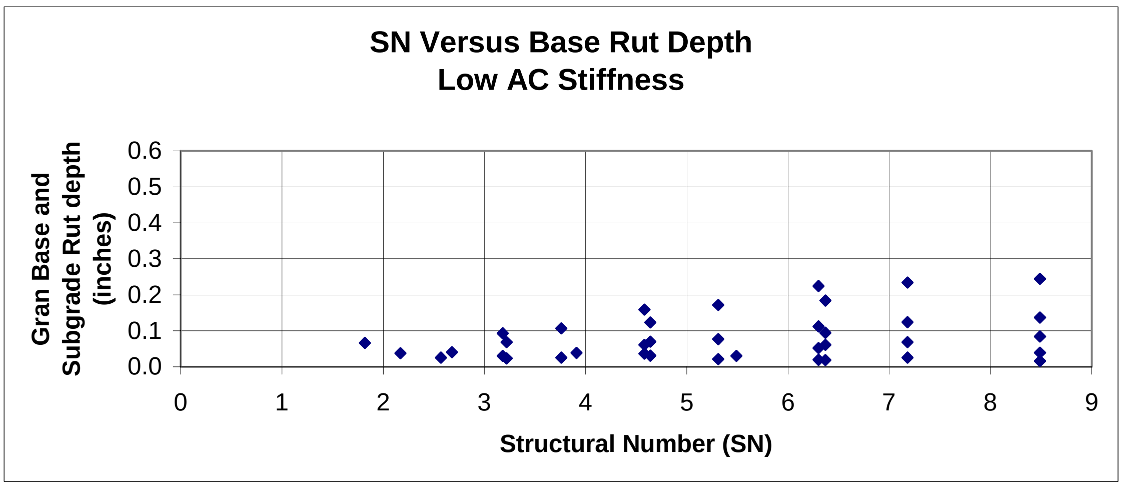


Figure D-251 Average Subgrade Rut Depth versus Subgrade CBR (%) Set 1-G





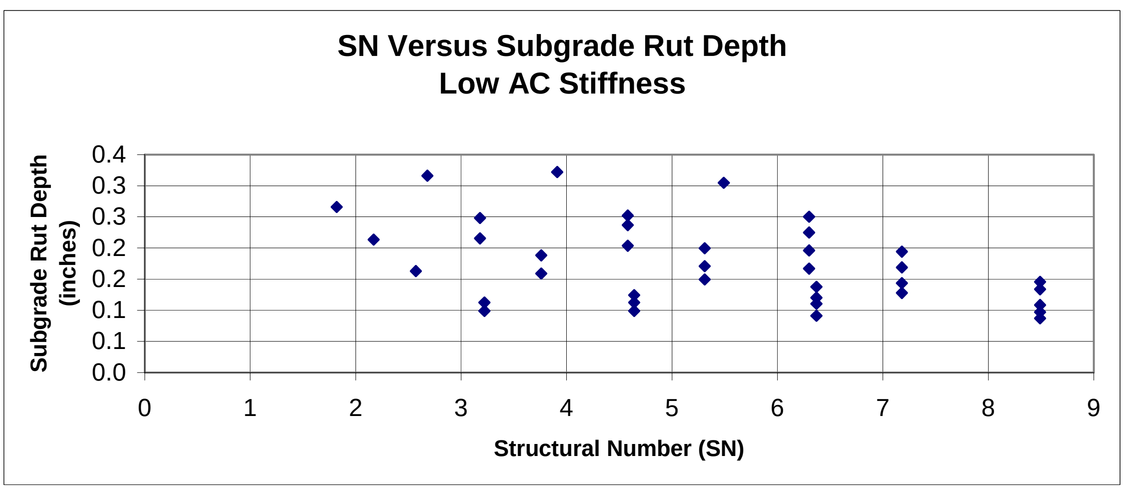
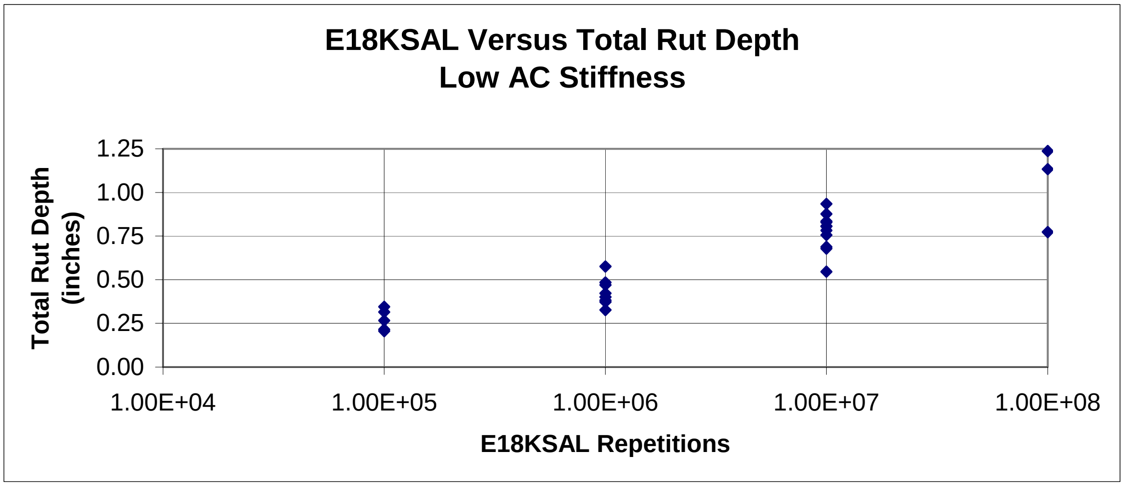
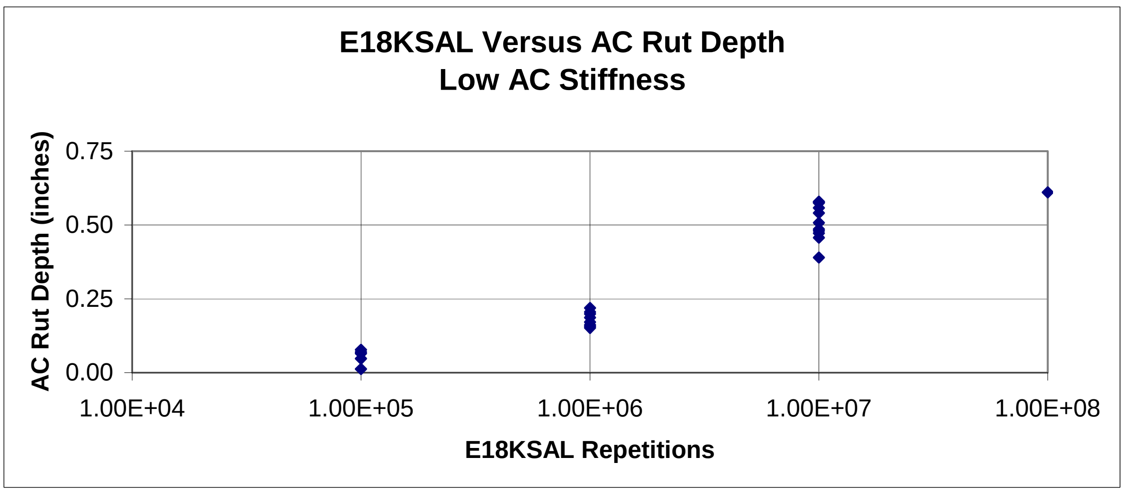


Figure D-252 Rut Depths versus Structural Number Set 1-G





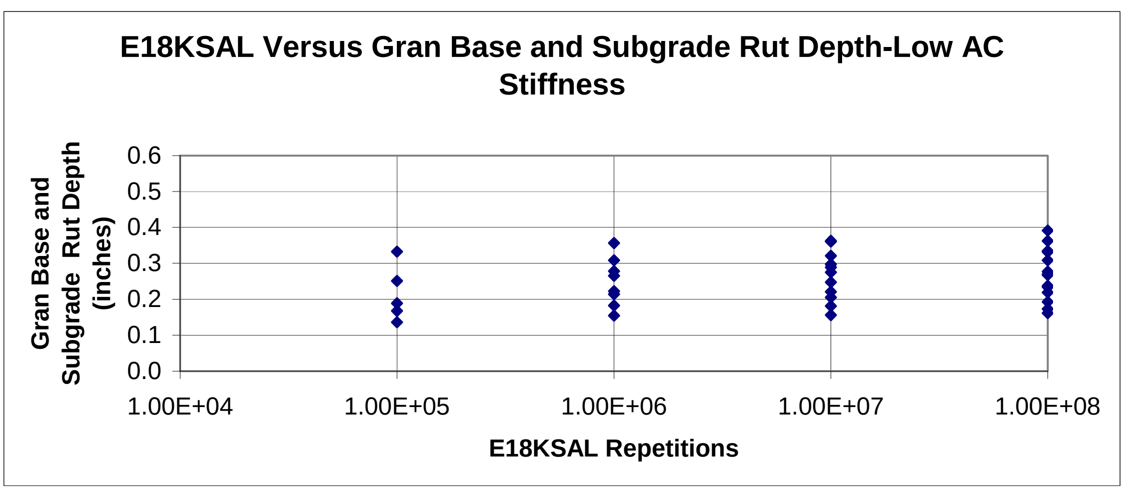
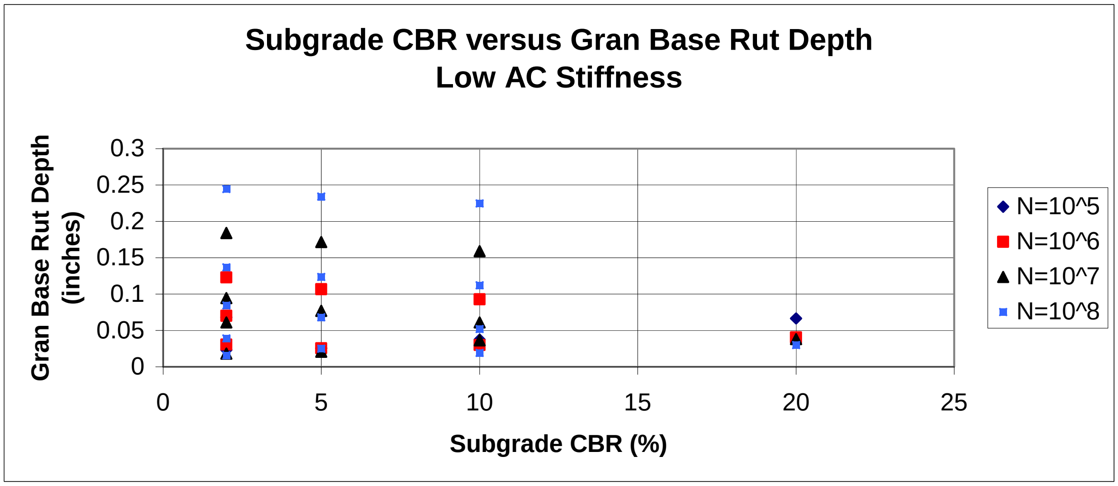


Figure D-253 Rut Depths versus 18KESAL Repetitions Set 1-G



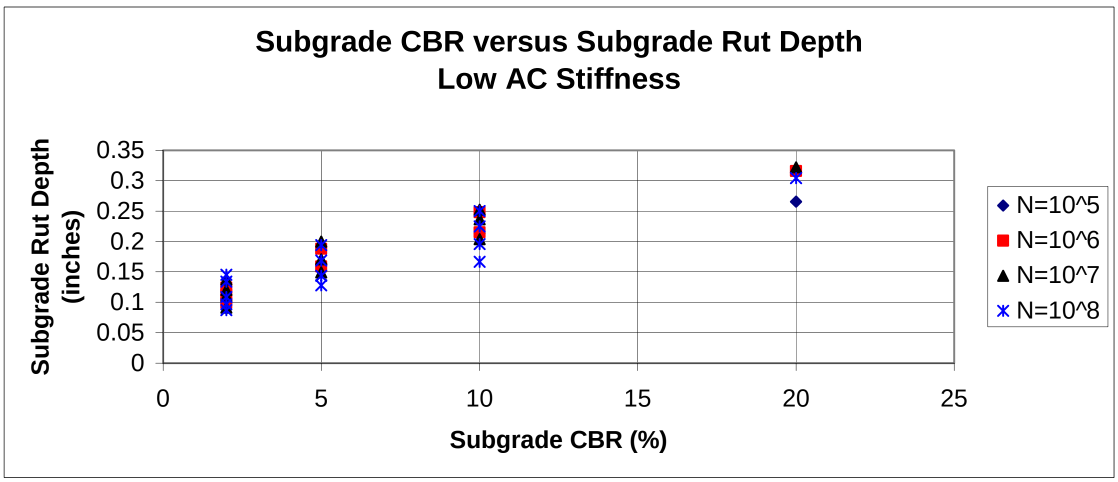


Figure D-254 Base / Subgrade Rut Depths versus Subgrade CBR (All data) Set 1-G

Table D-94 AASHTO Study Data – Set 2-G (β_{acr1} = 0.508, β_{acr2} = 0.9, β_{acr3} = 1.2, β_{GB} = 5.75, β_{SG} = 19.6)

				Rut Depth Value			
Hac	**CBRsg**	**N Design**	**SN**	**AC**	**GB**	**SG**	**Total**
2	2	1.00E+05	3.22	0.047	0.069	0.082	0.199
4	2	1.00E+05	3.22	0.070	0.023	0.094	0.187
3	5	1.00E+05	2.57	0.078	0.025	0.147	0.250
2	10	1.00E+05	2.17	0.065	0.037	0.200	0.302
1	20	1.00E+05	1.82	0.012	0.066	0.259	0.337
			Average	***0.054***	***0.044***	***0.156***	***0.255***
2	2	1.00E+06	4.64	0.152	0.124	0.092	0.367
4	2	1.00E+06	4.64	0.199	0.070	0.102	0.371
6	2	1.00E+06	4.64	0.172	0.030	0.114	0.316
2	5	1.00E+06	3.76	0.157	0.108	0.153	0.417
5	5	1.00E+06	3.76	0.187	0.026	0.178	0.391
2	10	1.00E+06	3.18	0.162	0.093	0.212	0.467
4	10	1.00E+06	3.18	0.206	0.030	0.241	0.478
3	20	1.00E+06	2.68	0.219	0.040	0.312	0.571
			Average	***0.182***	***0.065***	***0.175***	***0.422***
2	2	1.00E+07	6.37	0.481	0.186	0.092	0.759
5	2	1.00E+07	6.37	0.577	0.095	0.110	0.783
7	2	1.00E+07	6.37	0.507	0.062	0.120	0.688
10	2	1.00E+07	6.37	0.390	0.018	0.135	0.543
2	5	1.00E+07	5.31	0.486	0.173	0.151	0.809
5	5	1.00E+07	5.31	0.558	0.078	0.172	0.809
8	5	1.00E+07	5.31	0.458	0.021	0.198	0.677
2	10	1.00E+07	4.58	0.472	0.160	0.206	0.838
5	10	1.00E+07	4.58	0.580	0.062	0.237	0.878
6	10	1.00E+07	4.58	0.541	0.037	0.251	0.828
5	20	1.00E+07	3.91	0.575	0.038	0.323	0.936
			Average	***0.511***	***0.084***	***0.181***	***0.777***
2	2	1.00E+08	8.49	0.906	0.247	0.094	1.247
5	2	1.00E+08	8.49	1.820	0.138	0.106	2.064
8	2	1.00E+08	8.49	1.522	0.085	0.118	1.725
12	2	1.00E+08	8.49	0.960	0.040	0.141	1.141
14	2	1.00E+08	8.49	0.611	0.016	0.155	0.782
2	5	1.00E+08	7.18	0.901	0.236	0.133	1.271
5	5	1.00E+08	7.18	1.760	0.125	0.149	2.034
8	5	1.00E+08	7.18	1.462	0.069	0.176	1.708
11	5	1.00E+08	7.18	1.108	0.025	0.200	1.333
2	10	1.00E+08	6.3	0.900	0.227	0.171	1.298
5	10	1.00E+08	6.3	1.726	0.113	0.202	2.042
8	10	1.00E+08	6.3	1.432	0.052	0.231	1.715
10	10	1.00E+08	6.3	1.234	0.020	0.255	1.508
8	20	1.00E+08	5.49	1.461	0.030	0.310	1.801
			Average	***1.272***	***0.102***	***0.174***	***1.548***

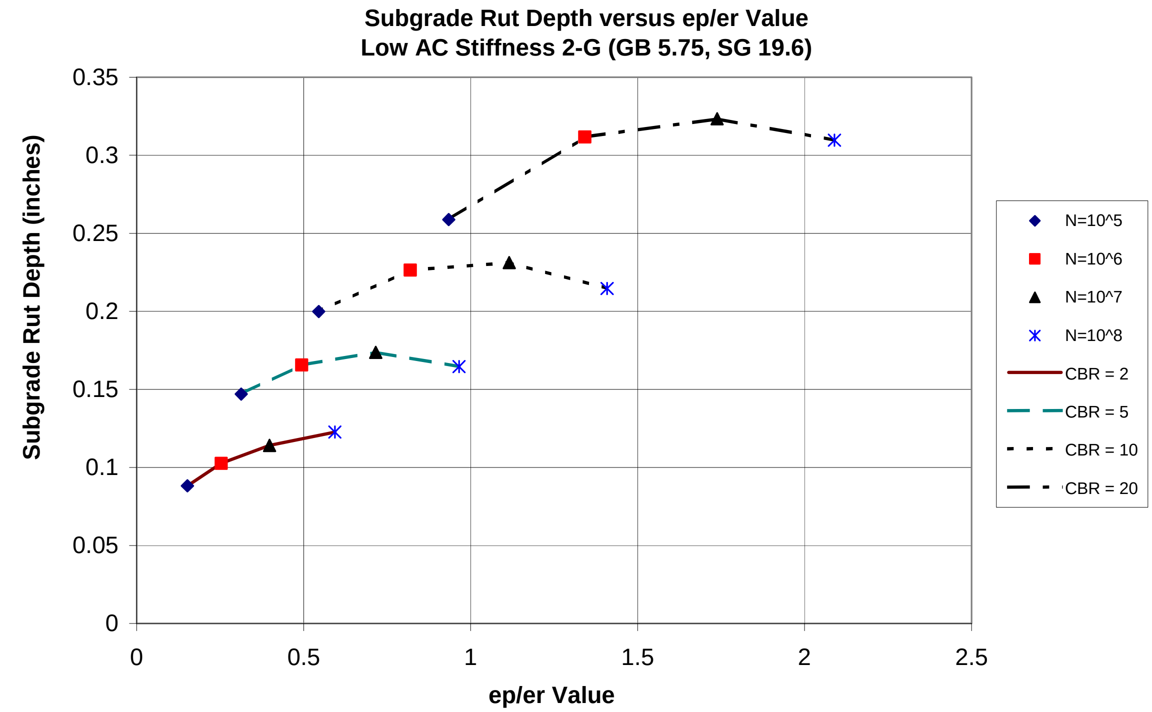


Figure D-255 Subgrade Rut Depth versus ep/er Value Set 2-G

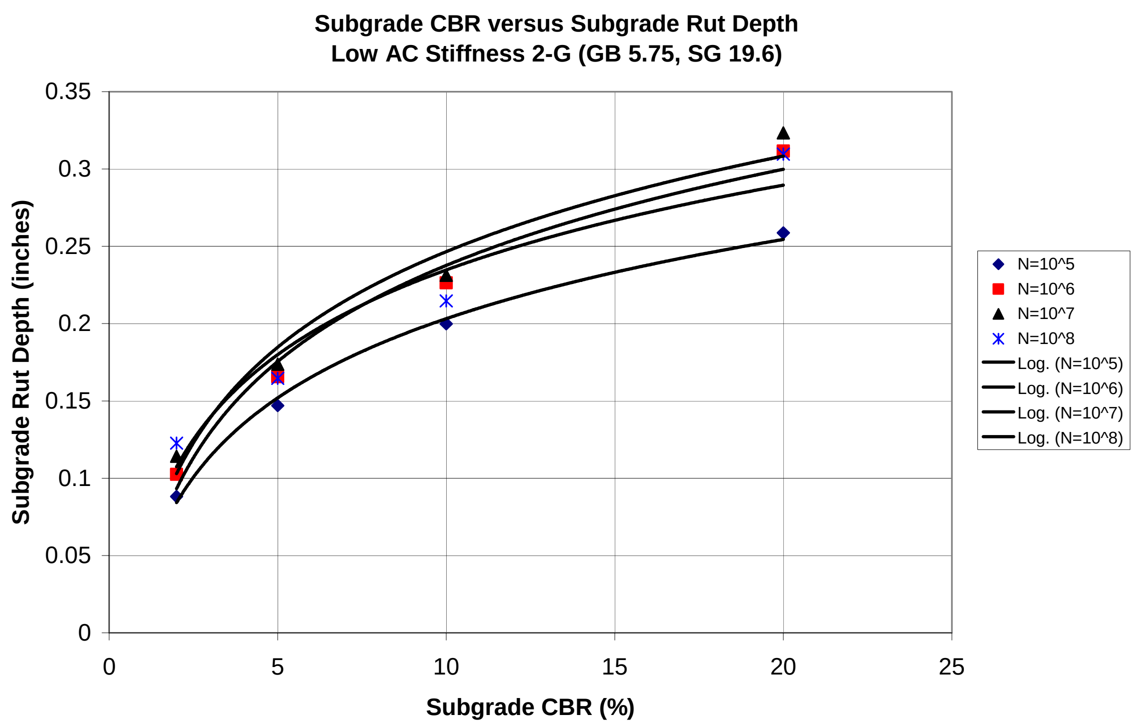
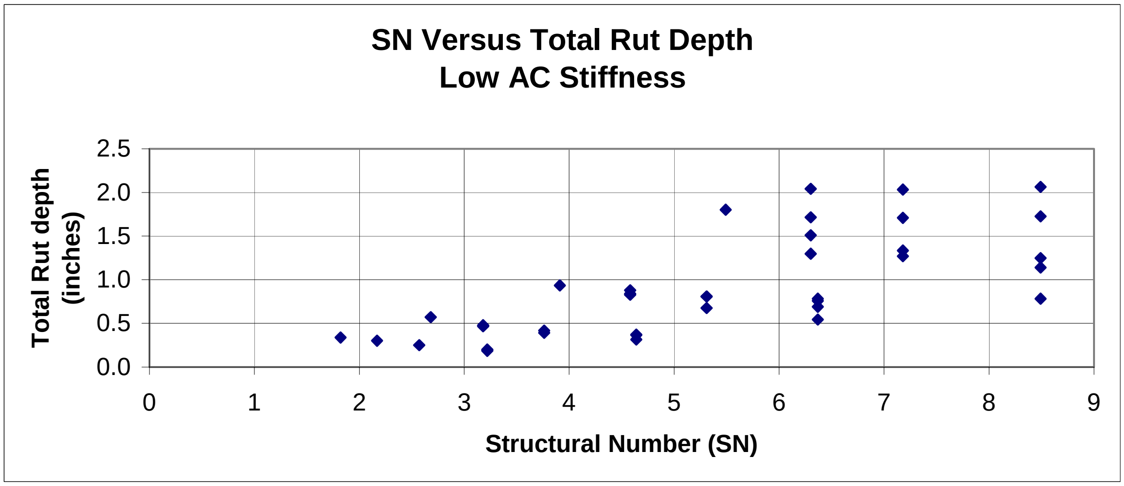
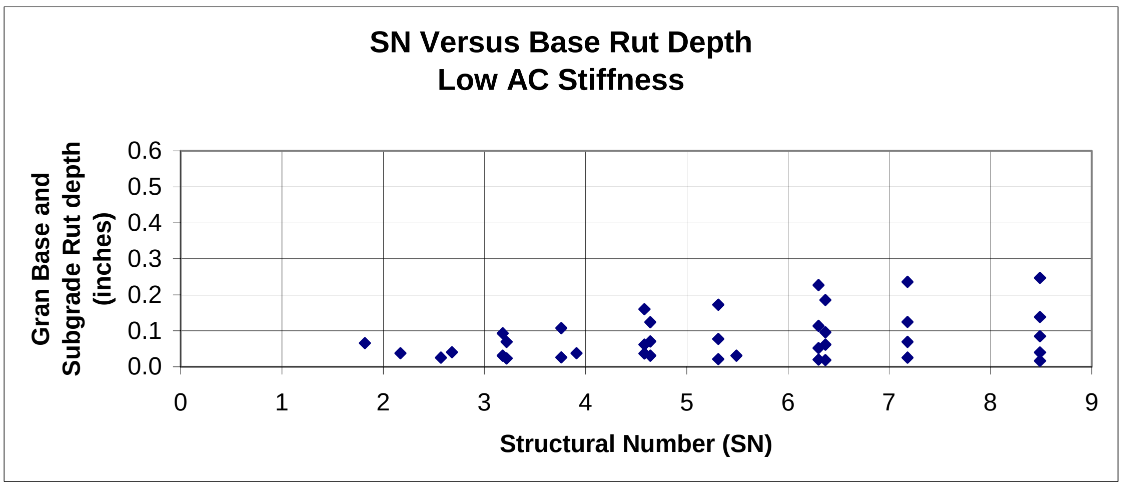


Figure D-256 Average Subgrade Rut Depth versus Subgrade CBR (%) Set 2-G





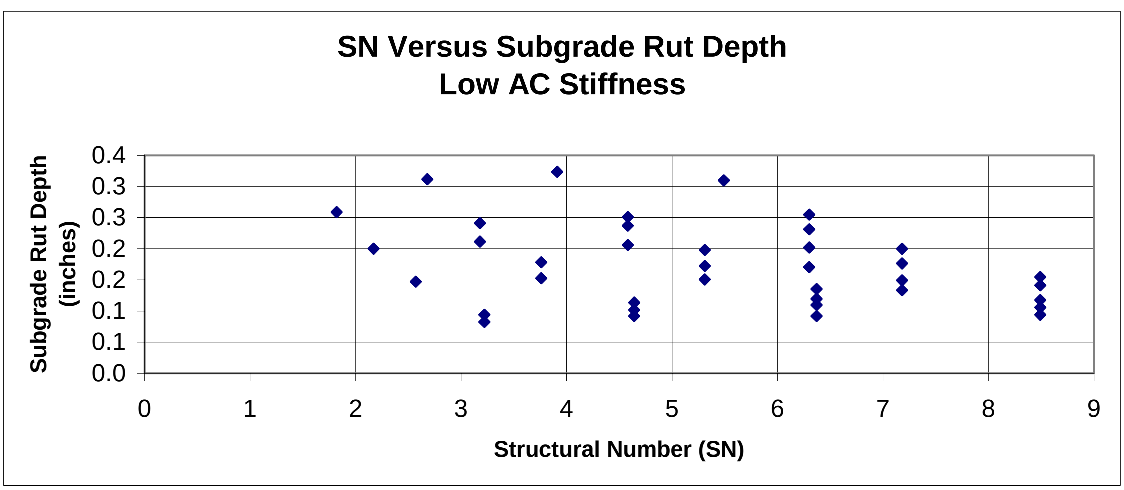
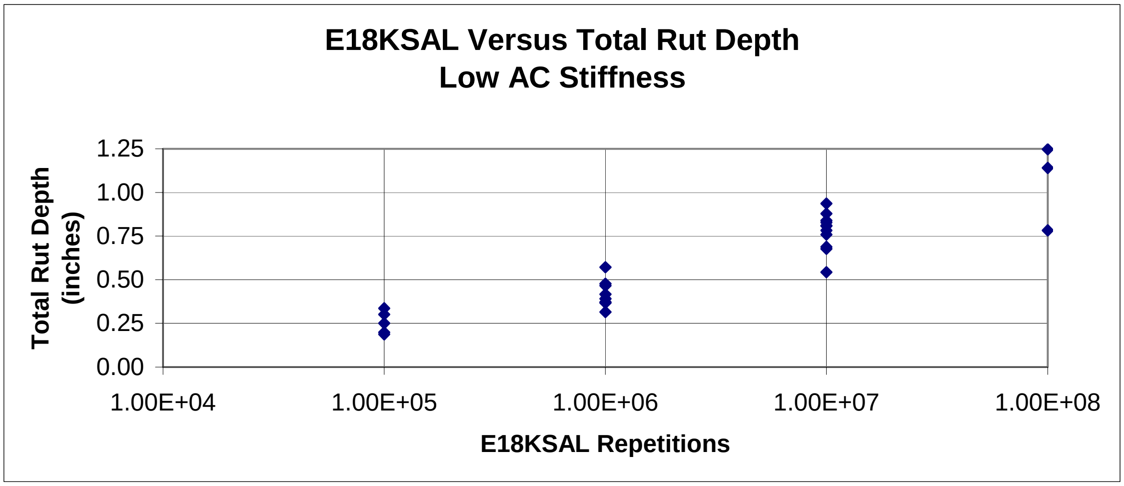
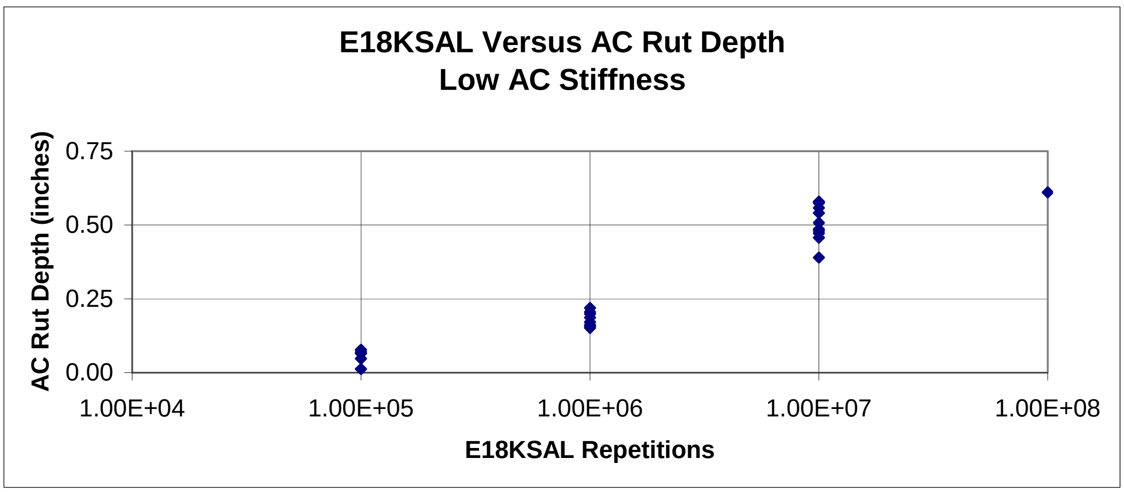


Figure D-257 Rut Depths versus Structural Number Set 2-G





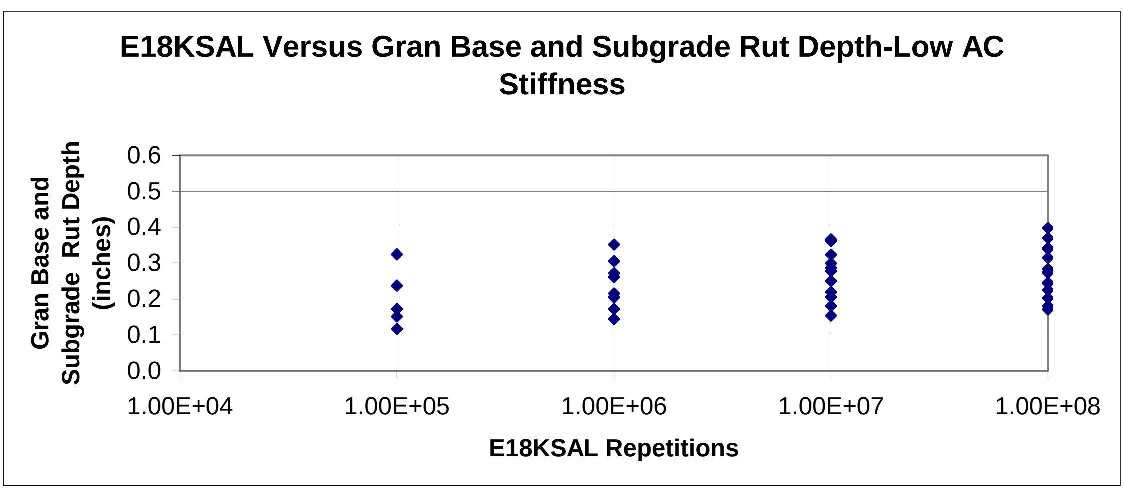
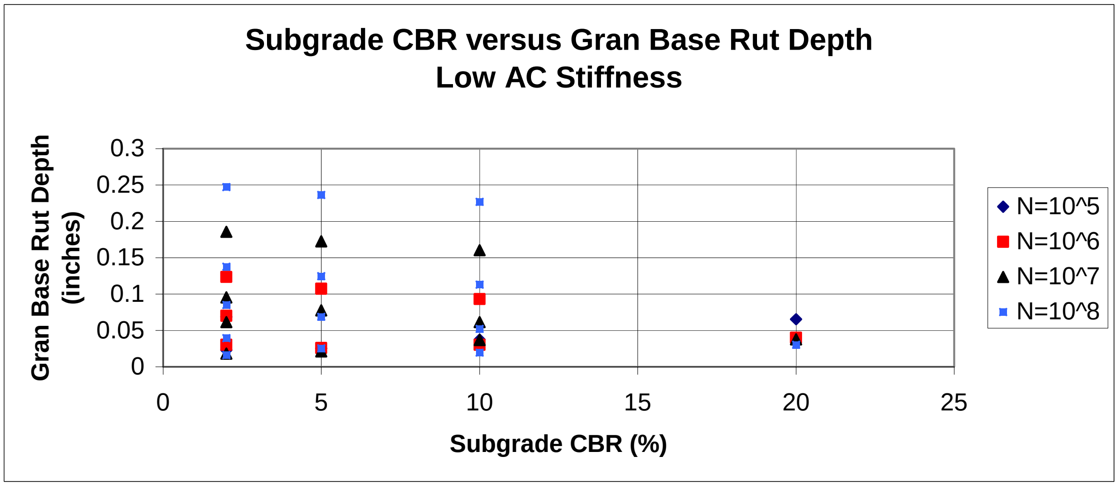


Figure D-258 Rut Depths versus 18KESAL Repetitions Set 2-G



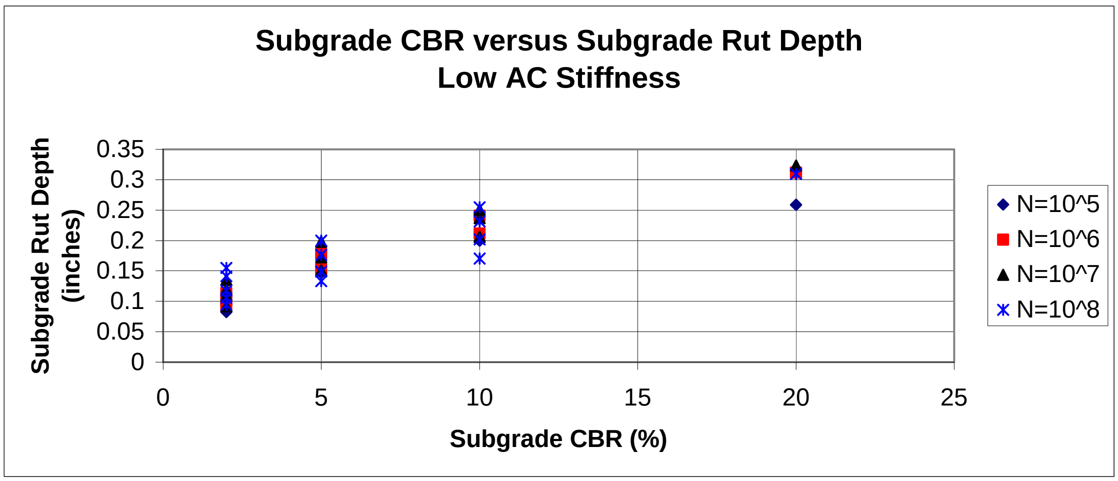


Figure D-259 Base / Subgrade Rut Depths versus Subgrade CBR (All data) Set 2-G

Table D-95 AASHTO Study Data – Set 3-G (β_{acr1} = 0.508, β_{acr2} = 0.9, β_{acr3} = 1.2, β_{GB} = 5.05, β_{SG} = 17.1)

				Rut Depth Value			
Hac	***CBRsg***	***N Design***	***SN***	***AC***	***GB***	***SG***	***Total***
2	2	1.00E+05	3.22	0.047	0.085	0.149	0.282
4	2	1.00E+05	3.22	0.070	0.031	0.183	0.283
3	5	1.00E+05	2.57	0.078	0.034	0.236	0.348
2	10	1.00E+05	2.17	0.065	0.050	0.279	0.393
1	20	1.00E+05	1.82	0.012	0.088	0.327	0.427
			Average	***0.054***	***0.058***	***0.235***	***0.347***
2	2	1.00E+06	4.64	0.152	0.132	0.115	0.398
4	2	1.00E+06	4.64	0.199	0.076	0.132	0.407
6	2	1.00E+06	4.64	0.172	0.034	0.156	0.362
2	5	1.00E+06	3.76	0.157	0.116	0.174	0.447
5	5	1.00E+06	3.76	0.187	0.029	0.221	0.437
2	10	1.00E+06	3.18	0.162	0.102	0.227	0.491
4	10	1.00E+06	3.18	0.206	0.034	0.275	0.516
3	20	1.00E+06	2.68	0.219	0.045	0.335	0.600
			Average	***0.182***	***0.071***	***0.204***	***0.457***
2	2	1.00E+07	6.37	0.481	0.178	0.082	0.741
5	2	1.00E+07	6.37	0.577	0.092	0.103	0.772
7	2	1.00E+07	6.37	0.507	0.060	0.115	0.681
10	2	1.00E+07	6.37	0.390	0.018	0.139	0.547
2	5	1.00E+07	5.31	0.486	0.167	0.135	0.788
5	5	1.00E+07	5.31	0.558	0.075	0.161	0.794
8	5	1.00E+07	5.31	0.458	0.021	0.195	0.673
2	10	1.00E+07	4.58	0.472	0.156	0.185	0.812
5	10	1.00E+07	4.58	0.580	0.060	0.224	0.863
6	10	1.00E+07	4.58	0.541	0.036	0.239	0.816
5	20	1.00E+07	3.91	0.575	0.038	0.304	0.917
			Average	***0.511***	***0.082***	***0.171***	***0.764***
2	2	1.00E+08	8.49	0.906	0.219	0.063	1.188
5	2	1.00E+08	8.49	1.820	0.123	0.072	2.015
8	2	1.00E+08	8.49	1.522	0.076	0.084	1.682
12	2	1.00E+08	8.49	0.960	0.035	0.106	1.101
14	2	1.00E+08	8.49	0.611	0.015	0.118	0.744
2	5	1.00E+08	7.18	0.901	0.210	0.099	1.210
5	5	1.00E+08	7.18	1.760	0.112	0.113	1.984
8	5	1.00E+08	7.18	1.462	0.062	0.137	1.661
11	5	1.00E+08	7.18	1.108	0.023	0.162	1.293
2	10	1.00E+08	6.3	0.900	0.203	0.133	1.236
5	10	1.00E+08	6.3	1.726	0.102	0.162	1.990
8	10	1.00E+08	6.3	1.432	0.047	0.190	1.669
10	10	1.00E+08	6.3	1.234	0.018	0.214	1.465
8	20	1.00E+08	5.49	1.461	0.028	0.263	1.752
			Average	***1.272***	***0.091***	***0.137***	***1.499***

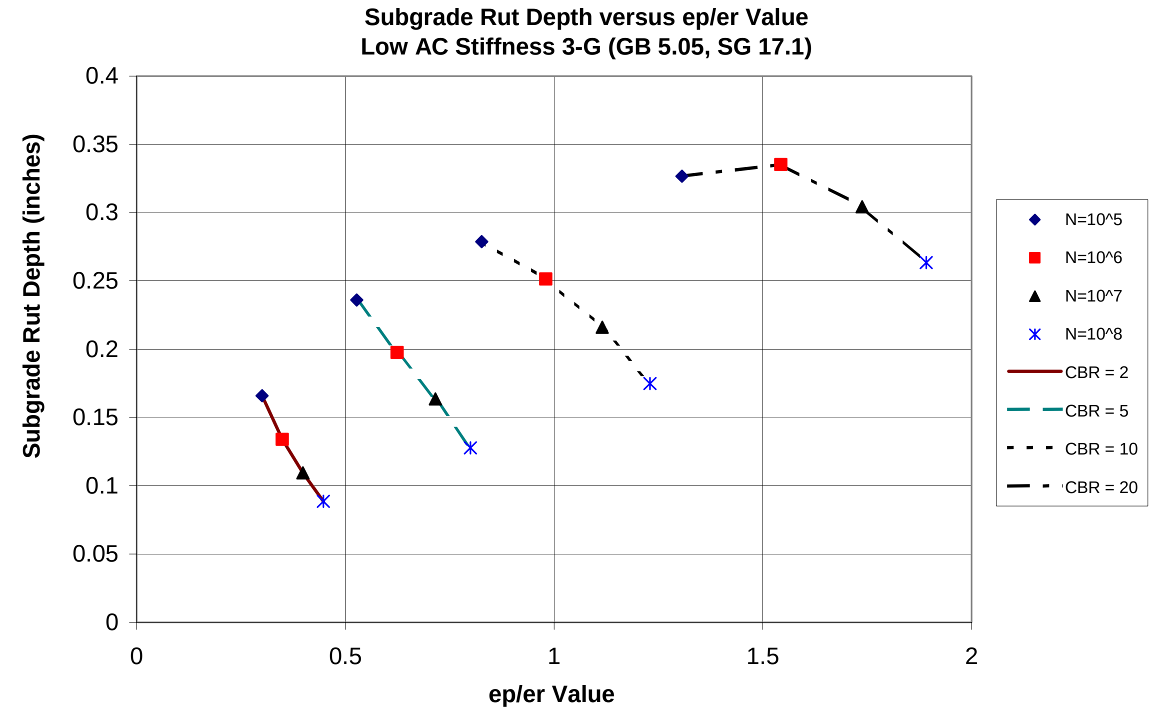


Figure D-260 Subgrade Rut Depth versus ep/er Value Set 3-G

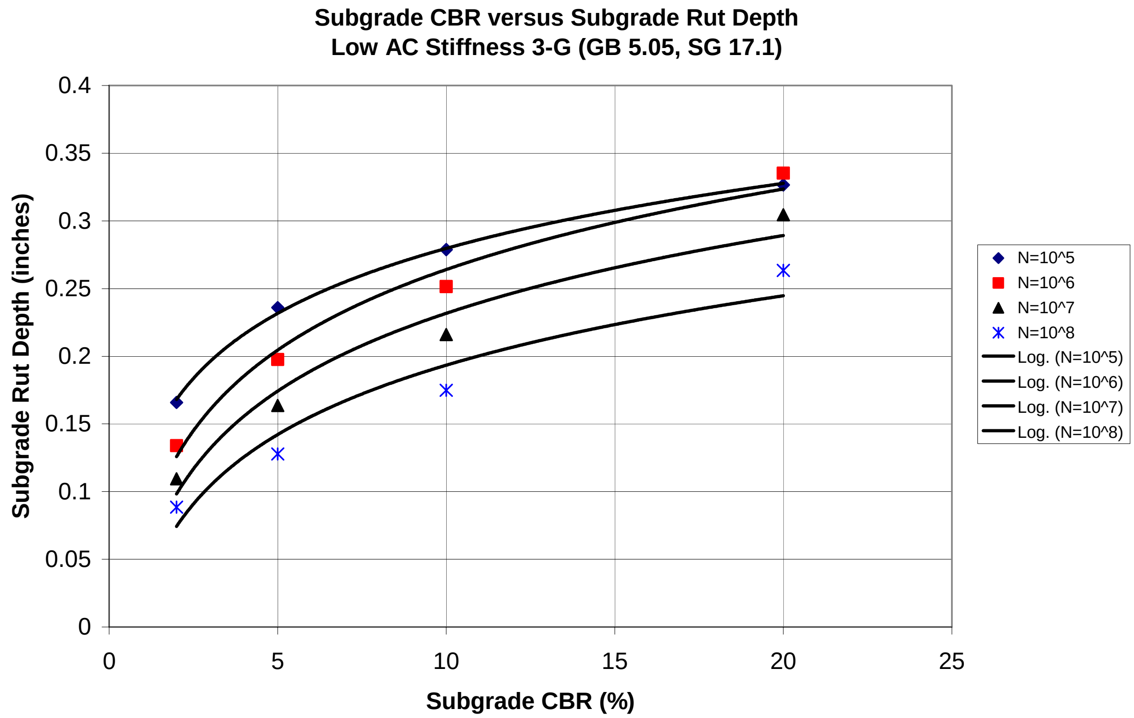
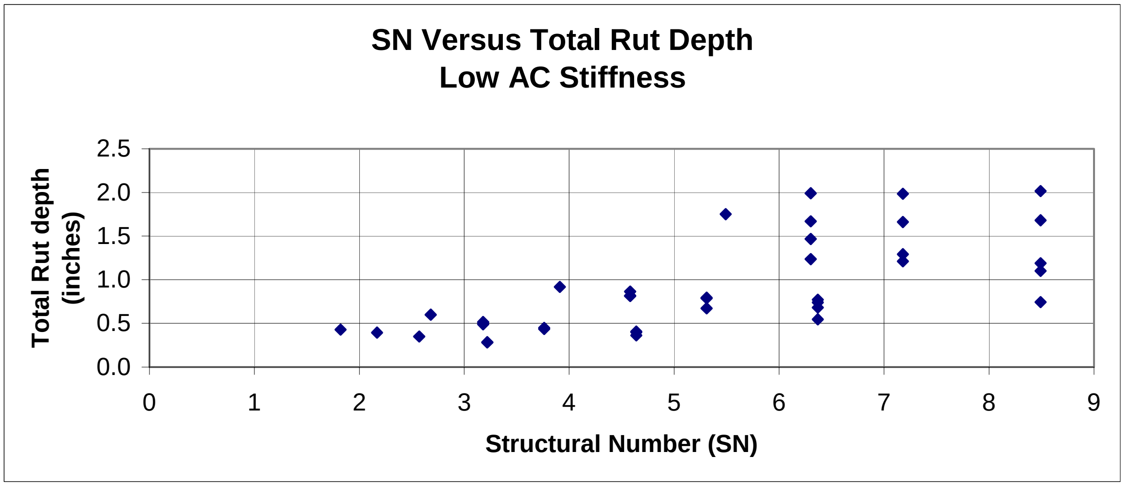
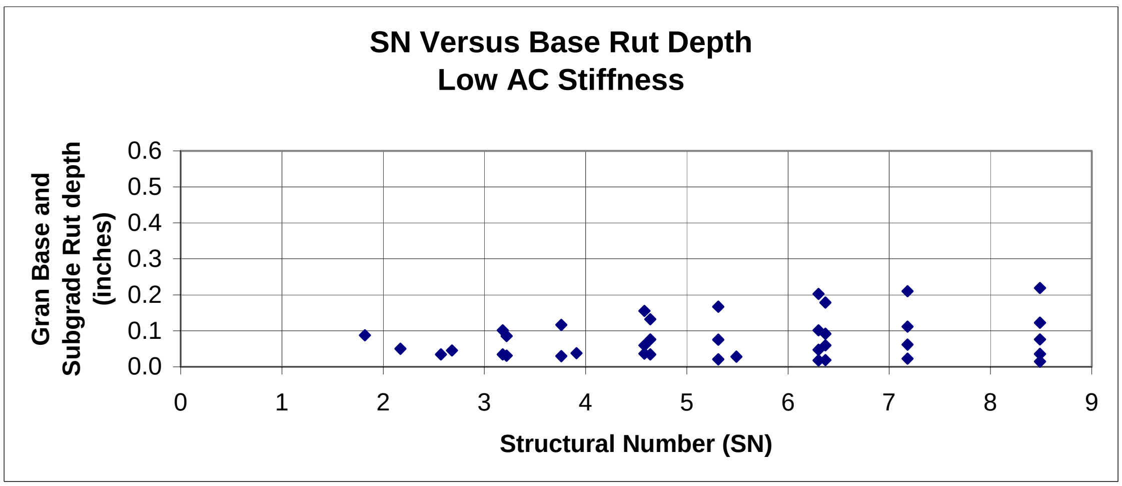


Figure D-261 Average Subgrade Rut Depth versus Subgrade CBR (%) Set 3-G





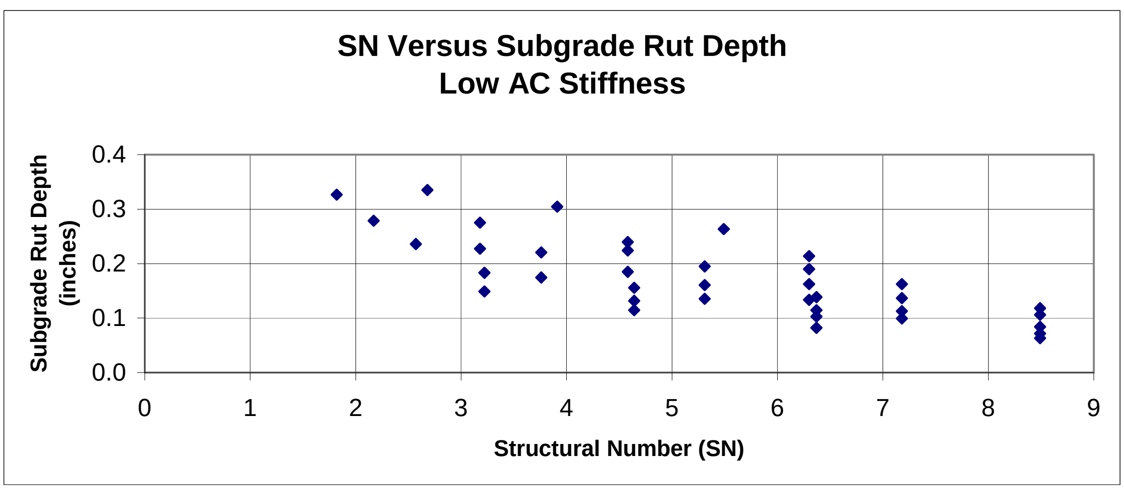
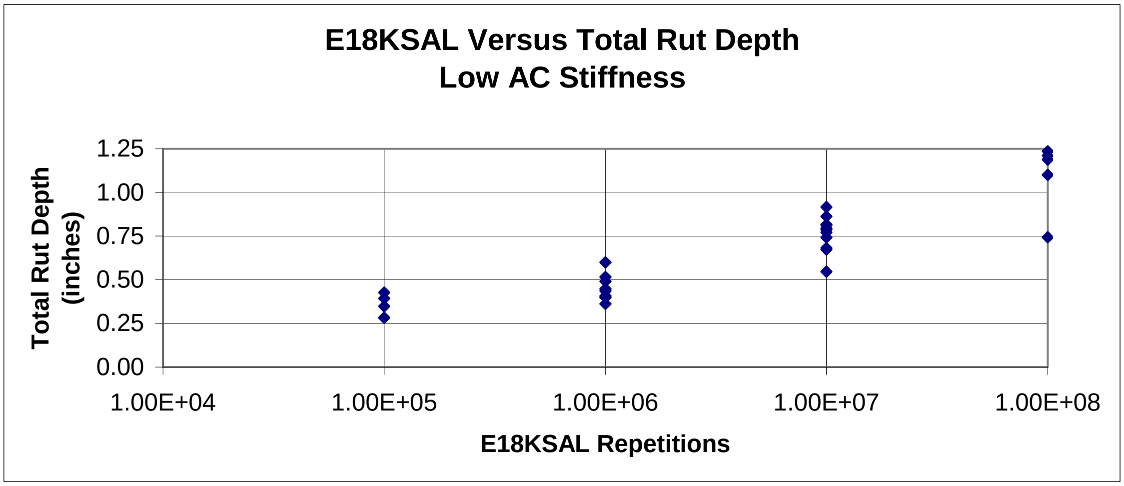
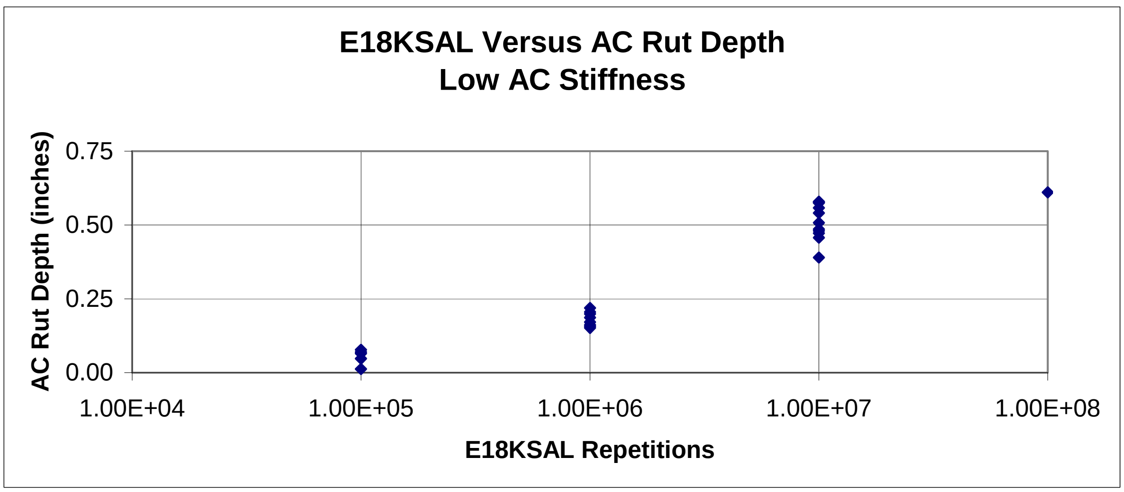


Figure D-262 Rut Depths versus Structural Number Set 3-G





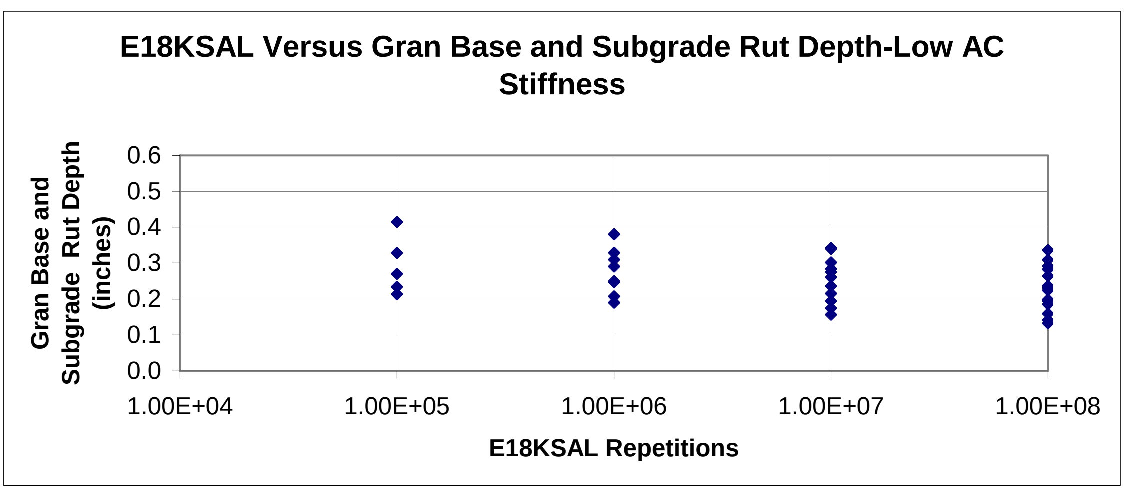
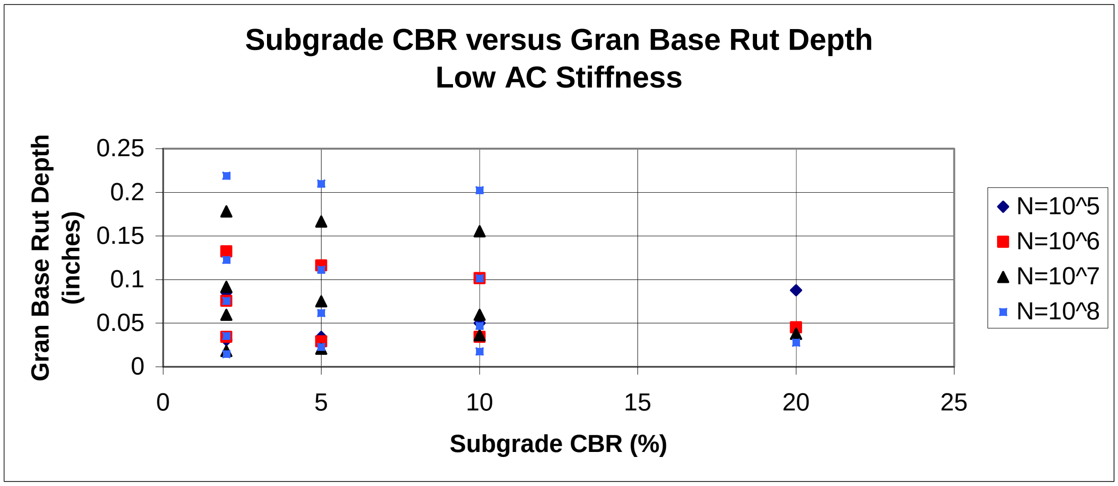


Figure D-263 Rut Depths versus 18KESAL Repetitions Set 3-G



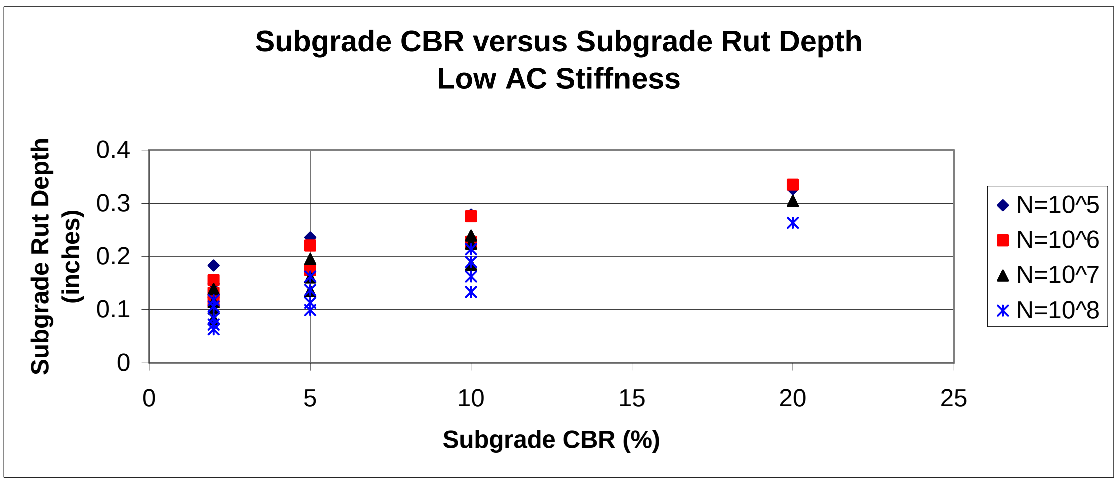


Figure D-264 Base / Subgrade Rut Depths versus Subgrade CBR (All data) Set 3-G

Table D-96 AASHTO Study Data – Set 4-G (β_{acr1} = 0.508, β_{acr2} = 0.9, β_{acr3} = 1.2, β_{GB} = 2.8, β_{SG} = 5.25)

				Rut Depth Value			
Hac	***CBRsg***	***N Design***	***SN***	***AC***	***GB***	***SG***	***Total***
2	2	1.00E+05	3.22	0.047	0.086	0.229	0.363
4	2	1.00E+05	3.22	0.070	0.038	0.280	0.388
3	5	1.00E+05	2.57	0.078	0.042	0.287	0.407
2	10	1.00E+05	2.17	0.065	0.062	0.278	0.404
1	20	1.00E+05	1.82	0.012	0.109	0.262	0.384
			Average	***0.054***	***0.067***	***0.267***	***0.389***
2	2	1.00E+06	4.64	0.152	0.130	0.175	0.457
4	2	1.00E+06	4.64	0.199	0.073	0.203	0.475
6	2	1.00E+06	4.64	0.172	0.040	0.238	0.450
2	5	1.00E+06	3.76	0.157	0.111	0.205	0.474
5	5	1.00E+06	3.76	0.187	0.034	0.261	0.482
2	10	1.00E+06	3.18	0.162	0.100	0.218	0.480
4	10	1.00E+06	3.18	0.206	0.040	0.266	0.512
3	20	1.00E+06	2.68	0.219	0.053	0.260	0.533
			Average	***0.182***	***0.073***	***0.229***	***0.483***
2	2	1.00E+07	6.37	0.481	0.171	0.127	0.779
5	2	1.00E+07	6.37	0.577	0.088	0.157	0.823
7	2	1.00E+07	6.37	0.507	0.056	0.177	0.740
10	2	1.00E+07	6.37	0.390	0.020	0.214	0.624
2	5	1.00E+07	5.31	0.486	0.158	0.155	0.799
5	5	1.00E+07	5.31	0.558	0.070	0.185	0.814
8	5	1.00E+07	5.31	0.458	0.024	0.227	0.709
2	10	1.00E+07	4.58	0.472	0.146	0.171	0.789
5	10	1.00E+07	4.58	0.580	0.057	0.209	0.845
6	10	1.00E+07	4.58	0.541	0.041	0.225	0.807
5	20	1.00E+07	3.91	0.575	0.042	0.230	0.847
			Average	***0.511***	***0.079***	***0.189***	***0.780***
2	2	1.00E+08	8.49	0.906	0.205	0.098	1.209
5	2	1.00E+08	8.49	1.820	0.117	0.111	2.048
8	2	1.00E+08	8.49	1.522	0.072	0.128	1.722
12	2	1.00E+08	8.49	0.960	0.032	0.164	1.155
14	2	1.00E+08	8.49	0.611	0.016	0.183	0.810
2	5	1.00E+08	7.18	0.901	0.196	0.112	1.209
5	5	1.00E+08	7.18	1.760	0.105	0.129	1.994
8	5	1.00E+08	7.18	1.462	0.057	0.157	1.676
11	5	1.00E+08	7.18	1.108	0.025	0.185	1.318
2	10	1.00E+08	6.3	0.900	0.188	0.121	1.210
5	10	1.00E+08	6.3	1.726	0.095	0.148	1.969
8	10	1.00E+08	6.3	1.432	0.043	0.174	1.649
10	10	1.00E+08	6.3	1.234	0.019	0.197	1.450
8	20	1.00E+08	5.49	1.461	0.030	0.194	1.685
			Average	***1.272***	***0.086***	***0.150***	***1.507***

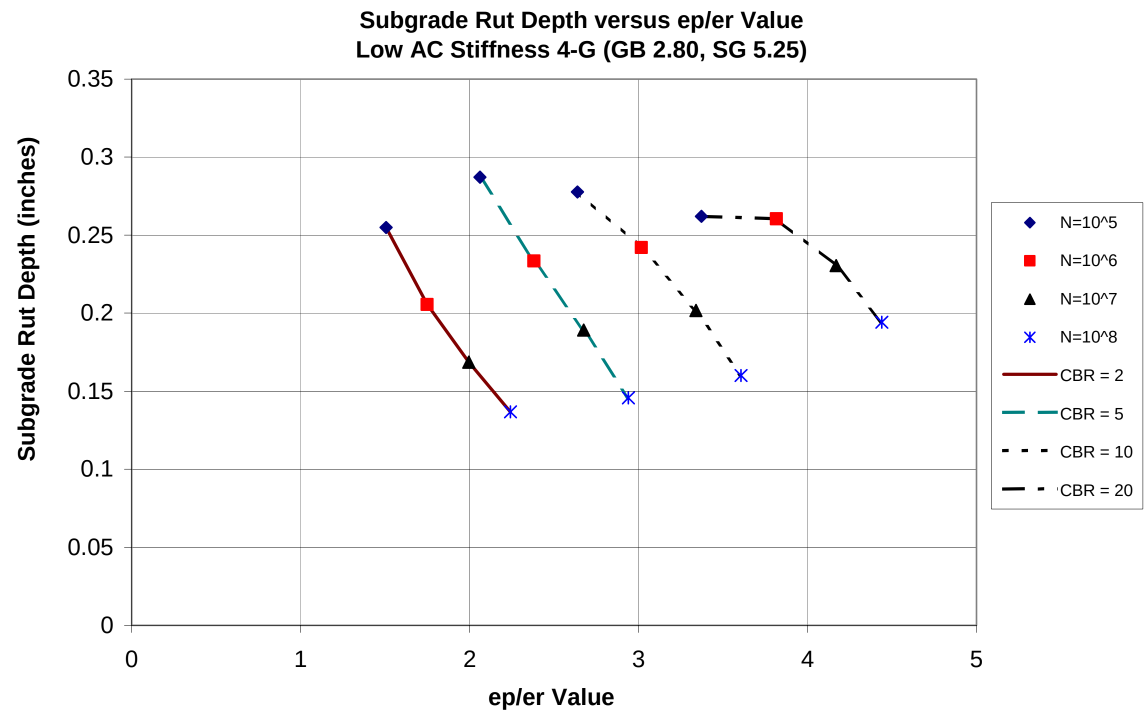


Figure D-265 Subgrade Rut Depth versus ep/er Value Set 4-G

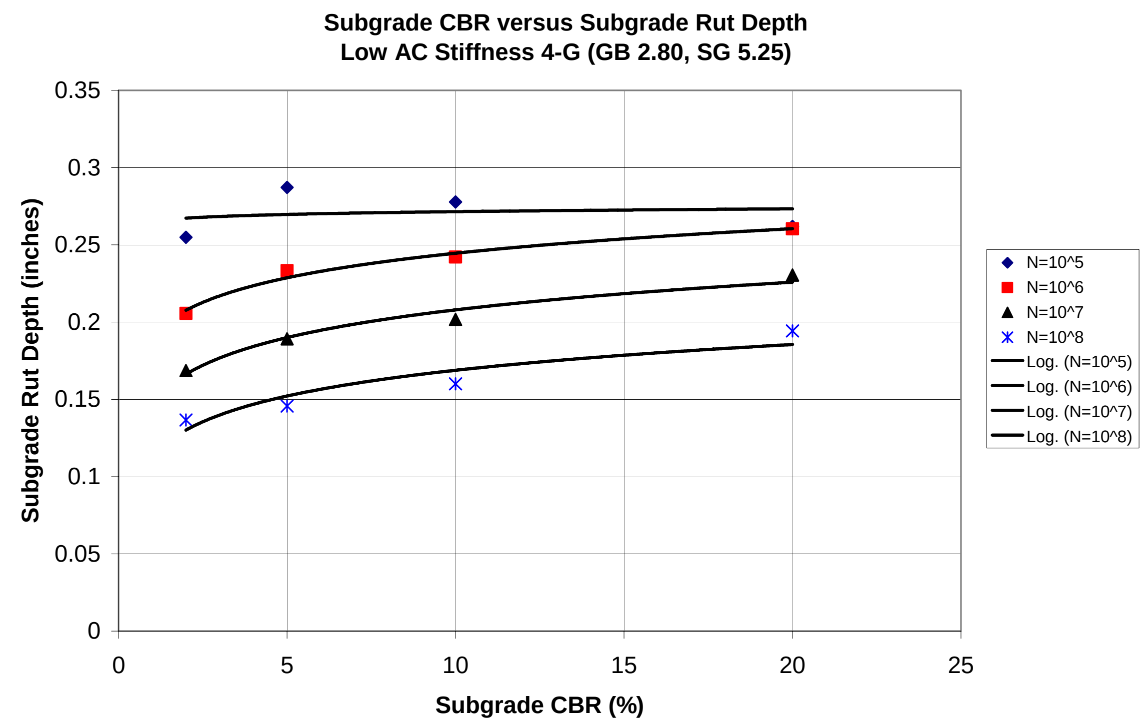
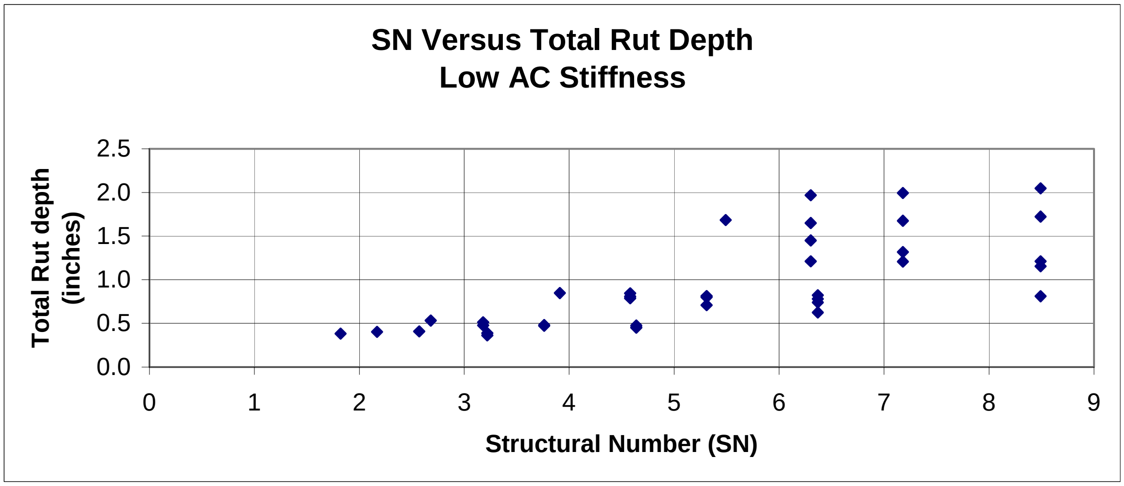
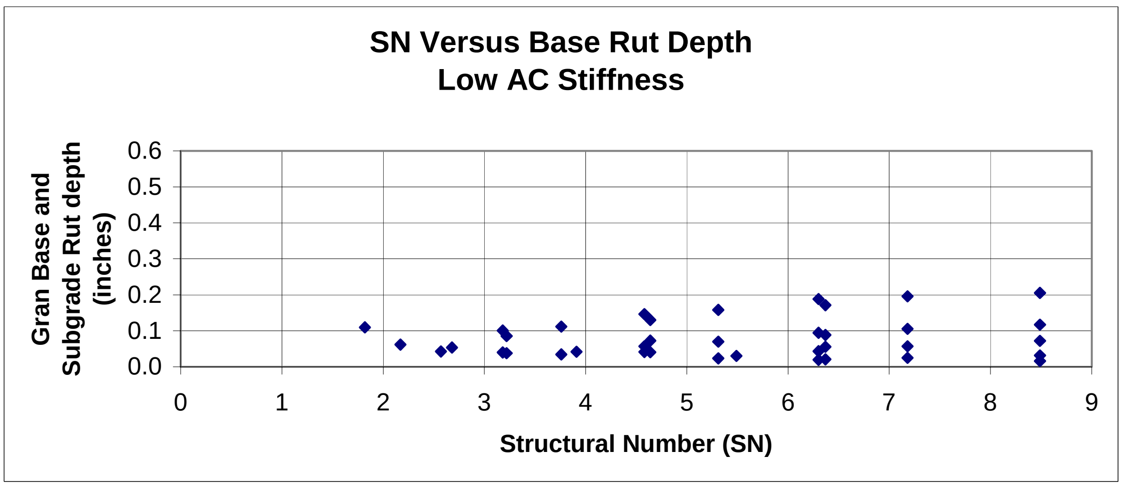


Figure D-266 Average Subgrade Rut Depth versus Subgrade CBR (%) Set 4-G





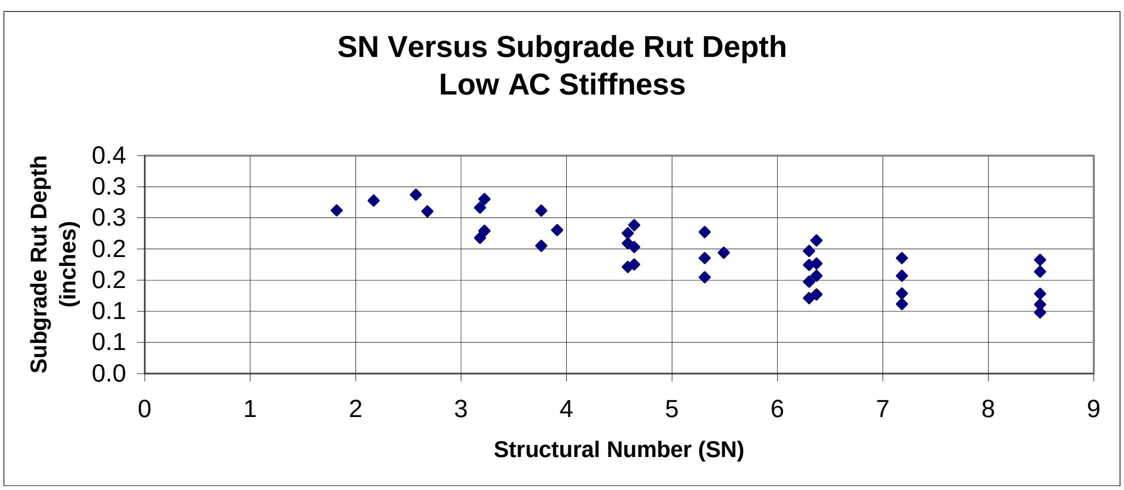
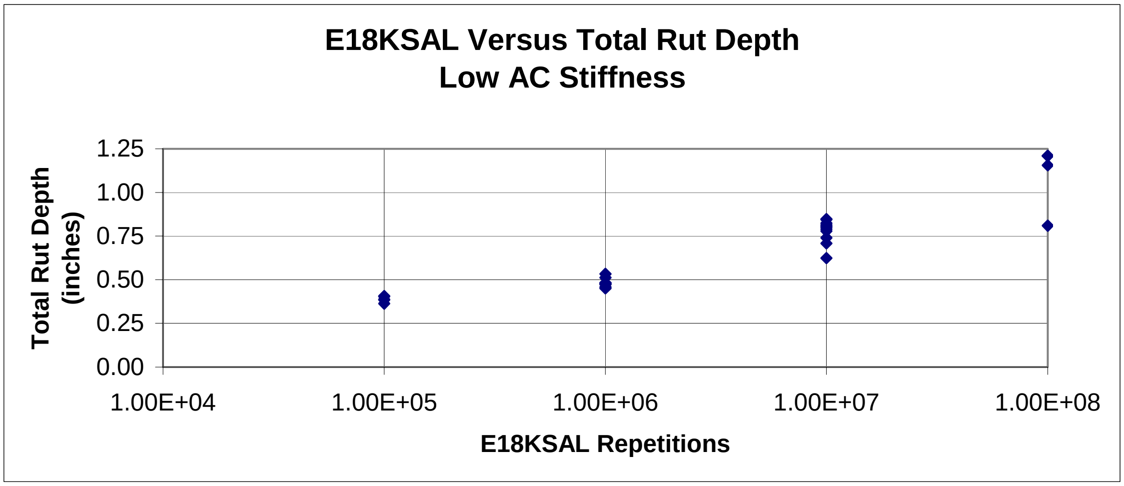
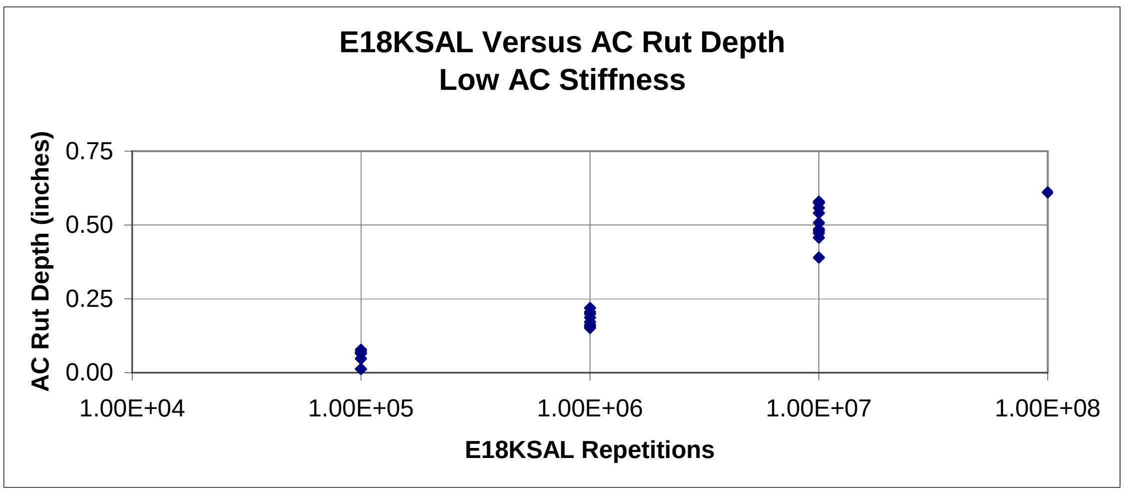


Figure D-267 Rut Depths versus Structural Number Set 4-G





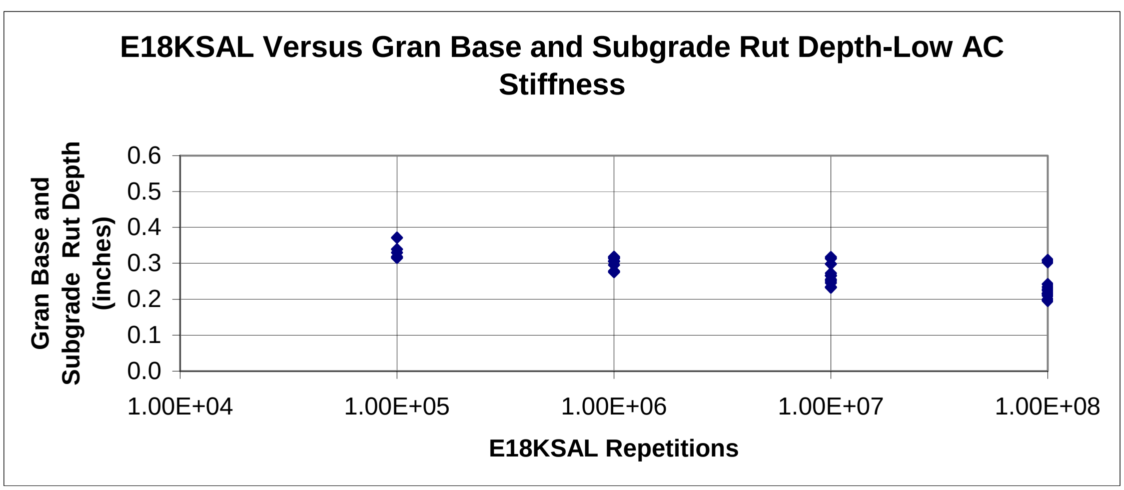
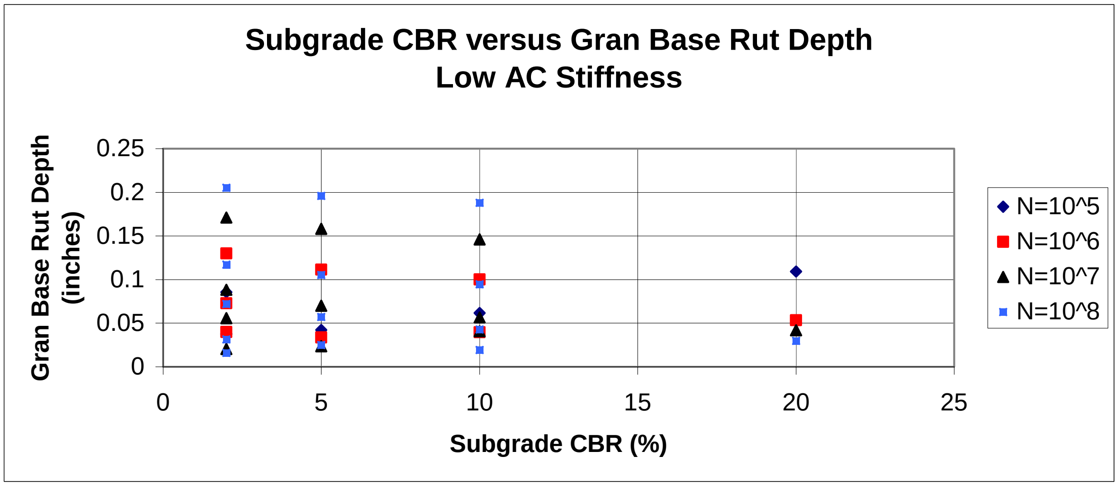


Figure D-268 Rut Depths versus 18KESAL Repetitions Set 4-G



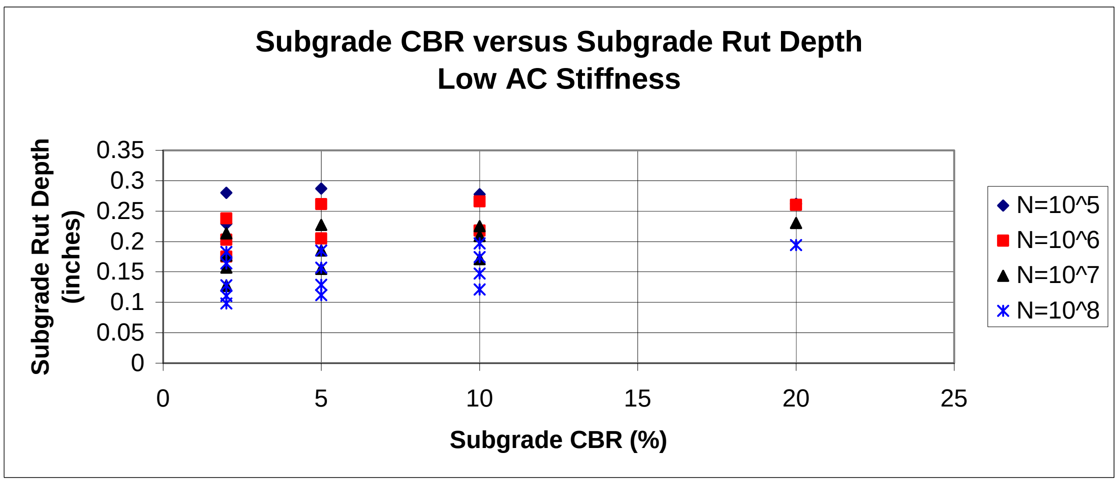


Figure D-269 Base / Subgrade Rut Depths versus Subgrade CBR (All data) Set 4-G

Table D-97 AASHTO Study Data – Set 5-G (β_{acr1} = 0.508, β_{acr2} = 0.9, β_{acr3} = 1.2, β_{GB} = 2.1, β_{SG} = 2.5)

				Rut Depth Value			
Hac	***CBRsg***	***N Design***	***SN***	***AC***	***GB***	***SG***	***Total***
2	2	1.00E+05	3.22	0.047	0.070	0.186	0.304
4	2	1.00E+05	3.22	0.070	0.033	0.211	0.314
3	5	1.00E+05	2.57	0.078	0.037	0.213	0.328
2	10	1.00E+05	2.17	0.065	0.054	0.201	0.320
1	20	1.00E+05	1.82	0.012	0.095	0.179	0.286
			Average	***0.054***	***0.058***	***0.198***	***0.310***
2	2	1.00E+06	4.64	0.152	0.121	0.193	0.466
4	2	1.00E+06	4.64	0.199	0.066	0.216	0.482
6	2	1.00E+06	4.64	0.172	0.040	0.240	0.452
2	5	1.00E+06	3.76	0.157	0.101	0.200	0.457
5	5	1.00E+06	3.76	0.187	0.034	0.238	0.458
2	10	1.00E+06	3.18	0.162	0.092	0.190	0.444
4	10	1.00E+06	3.18	0.206	0.039	0.222	0.467
3	20	1.00E+06	2.68	0.219	0.053	0.196	0.468
			Average	***0.182***	***0.068***	***0.212***	***0.462***
2	2	1.00E+07	6.37	0.481	0.173	0.182	0.836
5	2	1.00E+07	6.37	0.577	0.089	0.219	0.885
7	2	1.00E+07	6.37	0.507	0.055	0.239	0.801
10	2	1.00E+07	6.37	0.390	0.022	0.273	0.685
2	5	1.00E+07	5.31	0.486	0.158	0.181	0.825
5	5	1.00E+07	5.31	0.558	0.069	0.209	0.836
8	5	1.00E+07	5.31	0.458	0.025	0.244	0.727
2	10	1.00E+07	4.58	0.472	0.144	0.171	0.787
5	10	1.00E+07	4.58	0.580	0.056	0.201	0.836
6	10	1.00E+07	4.58	0.541	0.044	0.213	0.798
5	20	1.00E+07	3.91	0.575	0.045	0.190	0.810
			Average	***0.511***	***0.080***	***0.211***	***0.802***
2	2	1.00E+08	8.49	0.906	0.221	0.177	1.303
5	2	1.00E+08	8.49	1.820	0.126	0.198	2.144
8	2	1.00E+08	8.49	1.522	0.077	0.221	1.821
12	2	1.00E+08	8.49	0.960	0.032	0.270	1.262
14	2	1.00E+08	8.49	0.611	0.018	0.295	0.924
2	5	1.00E+08	7.18	0.901	0.209	0.151	1.261
5	5	1.00E+08	7.18	1.760	0.112	0.170	2.042
8	5	1.00E+08	7.18	1.462	0.060	0.201	1.723
11	5	1.00E+08	7.18	1.108	0.029	0.232	1.369
2	10	1.00E+08	6.3	0.900	0.200	0.134	1.233
5	10	1.00E+08	6.3	1.726	0.100	0.159	1.985
8	10	1.00E+08	6.3	1.432	0.044	0.184	1.660
10	10	1.00E+08	6.3	1.234	0.022	0.204	1.460
8	20	1.00E+08	5.49	1.461	0.034	0.171	1.666
			Average	***1.272***	***0.092***	***0.198***	***1.561***

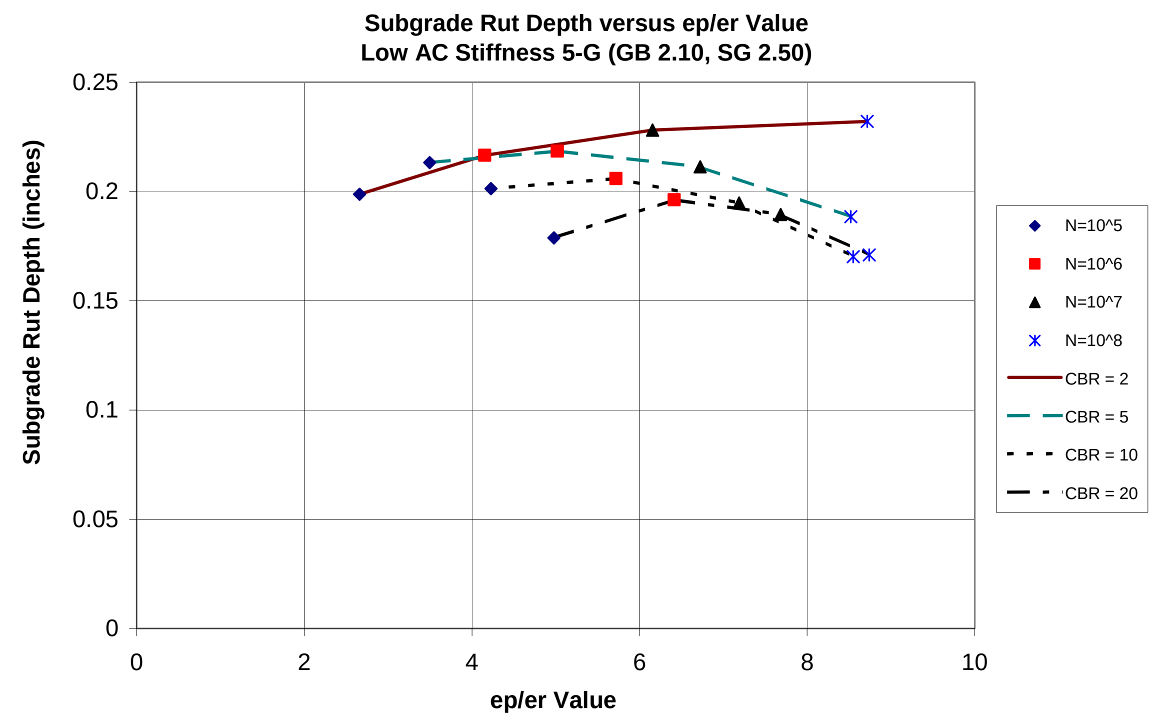


Figure D-270 Subgrade Rut Depth versus ep/er Value Set 5-G

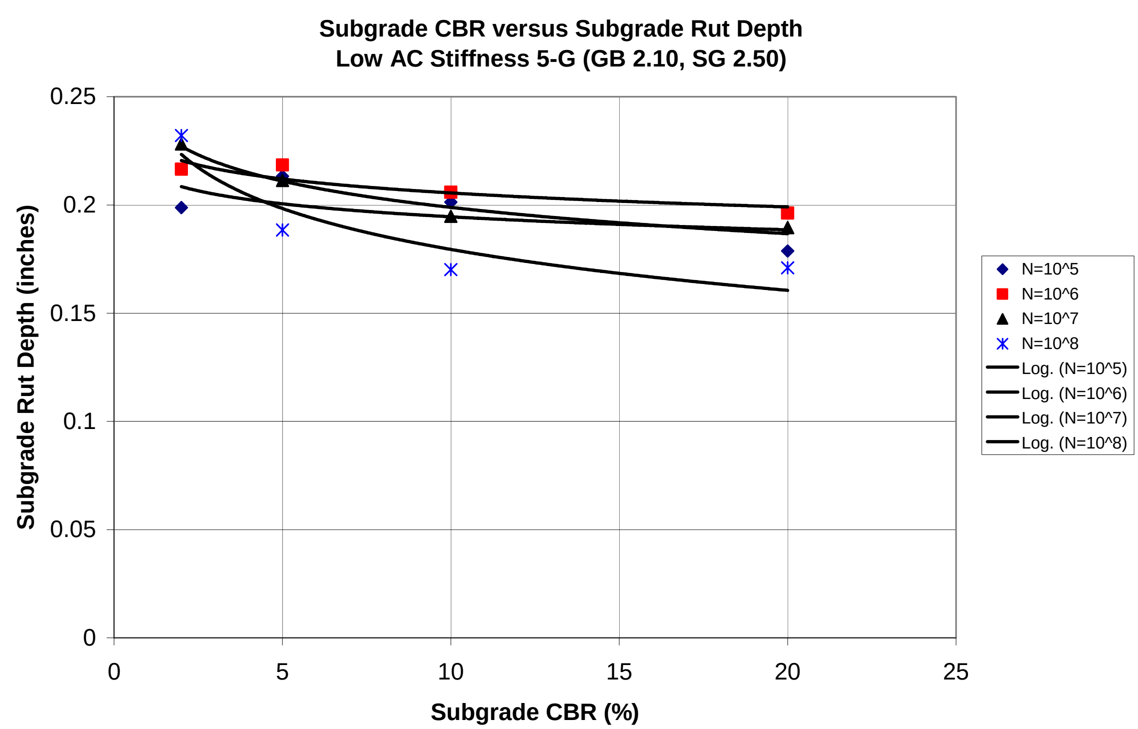
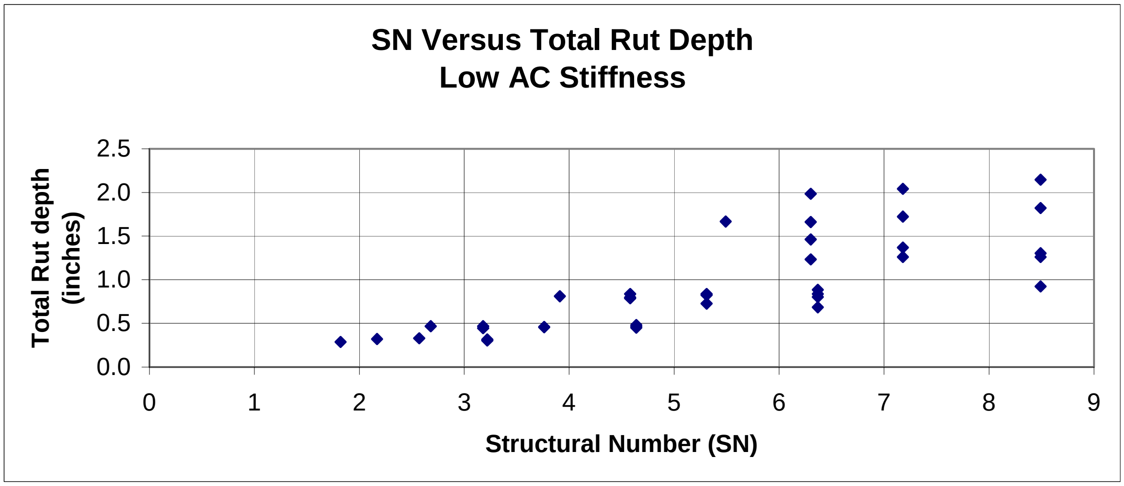
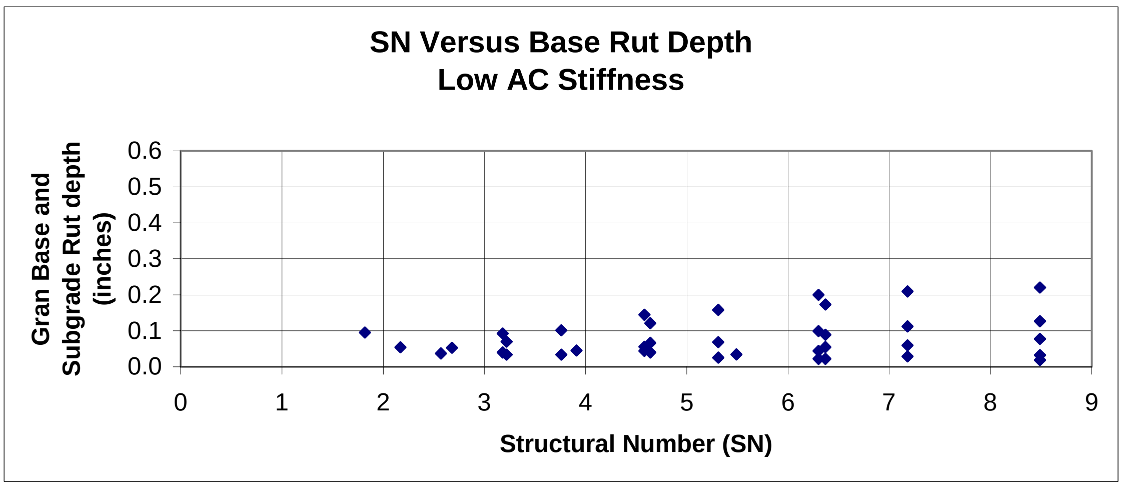


Figure D-271 Average Subgrade Rut Depth versus Subgrade CBR (%) Set 5-G





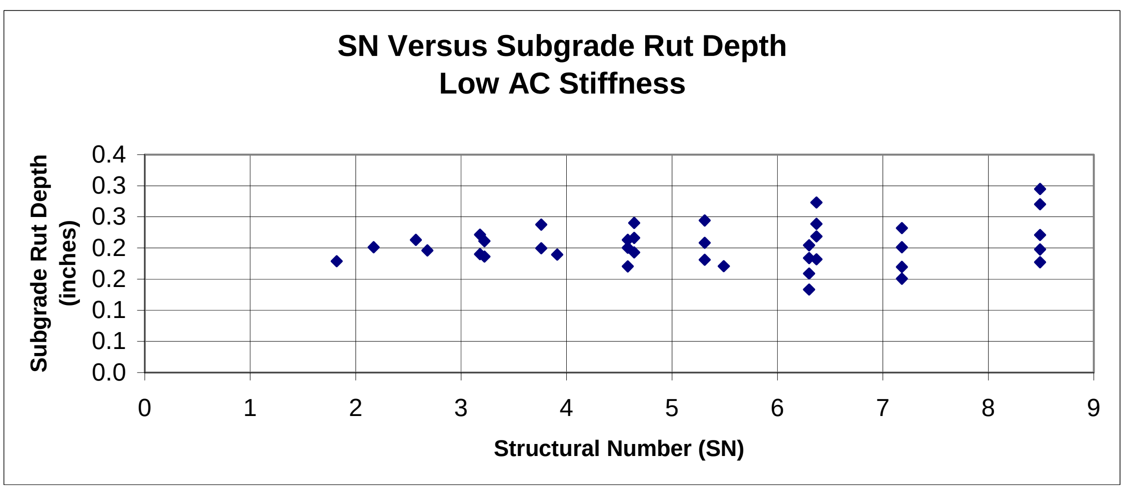
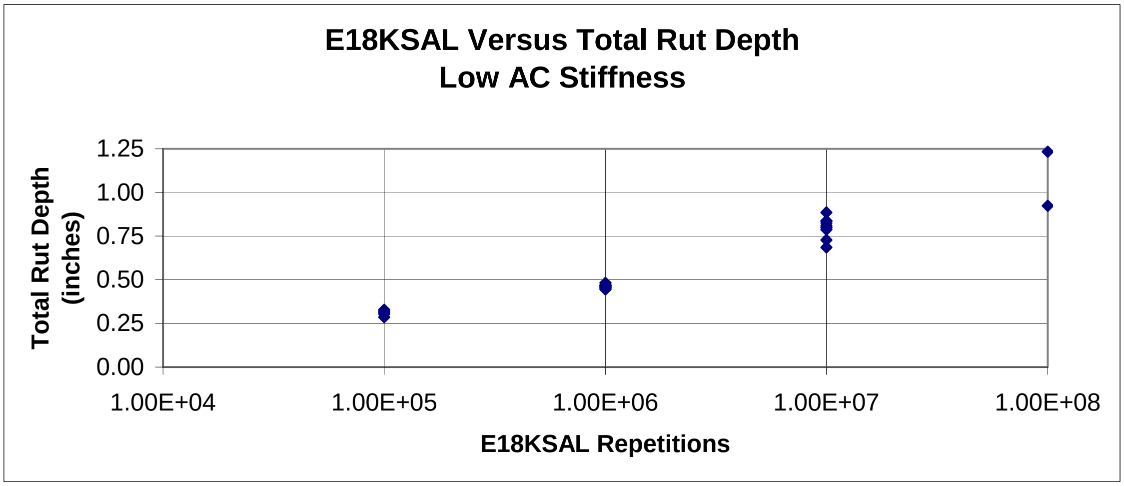
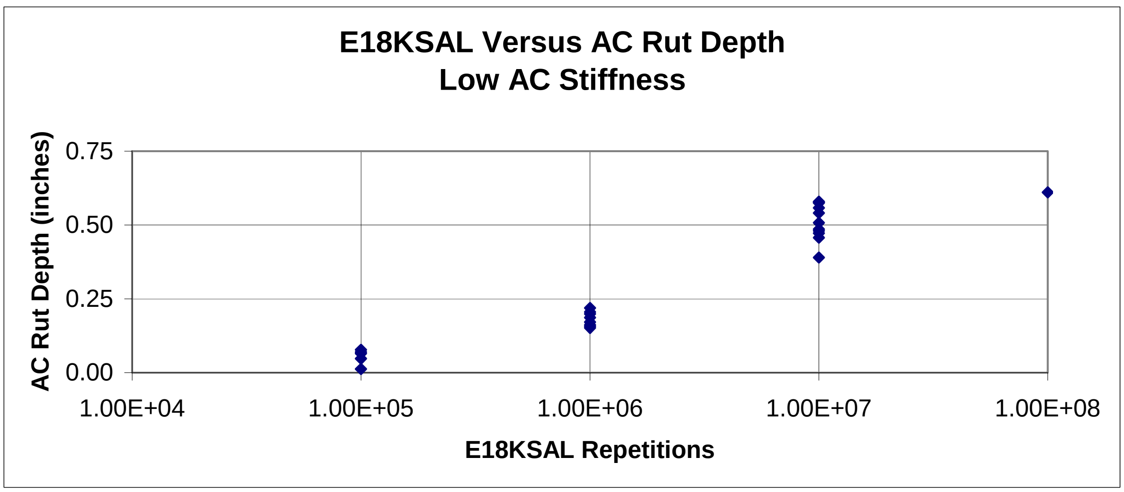


Figure D-272 Rut Depths versus Structural Number Set 5-G





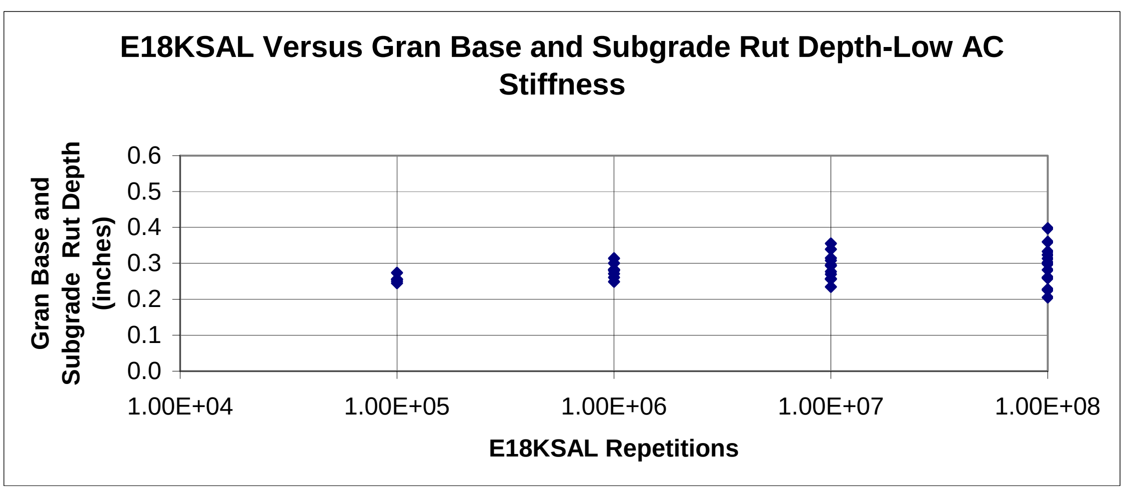
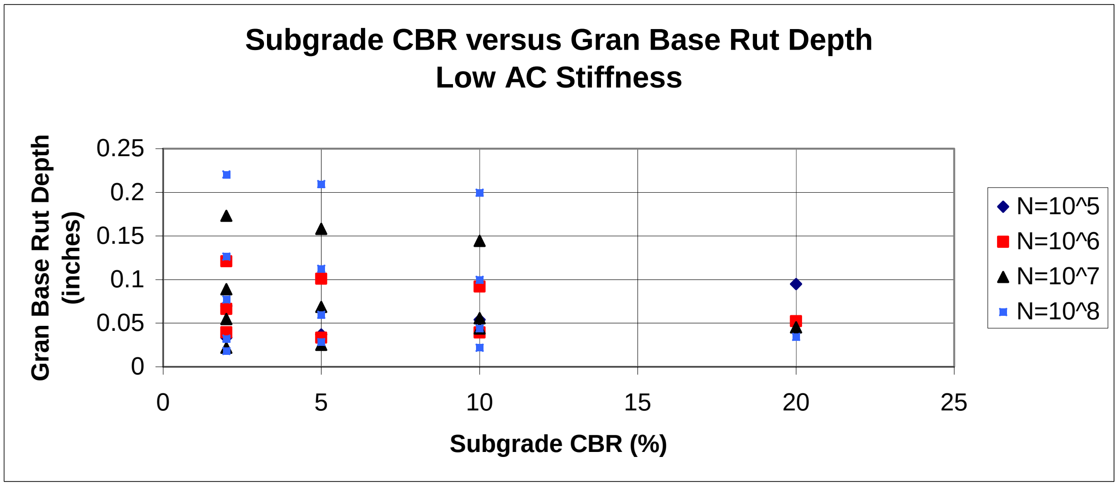


Figure D-273 Rut Depths versus 18KESAL Repetitions Set 5-G



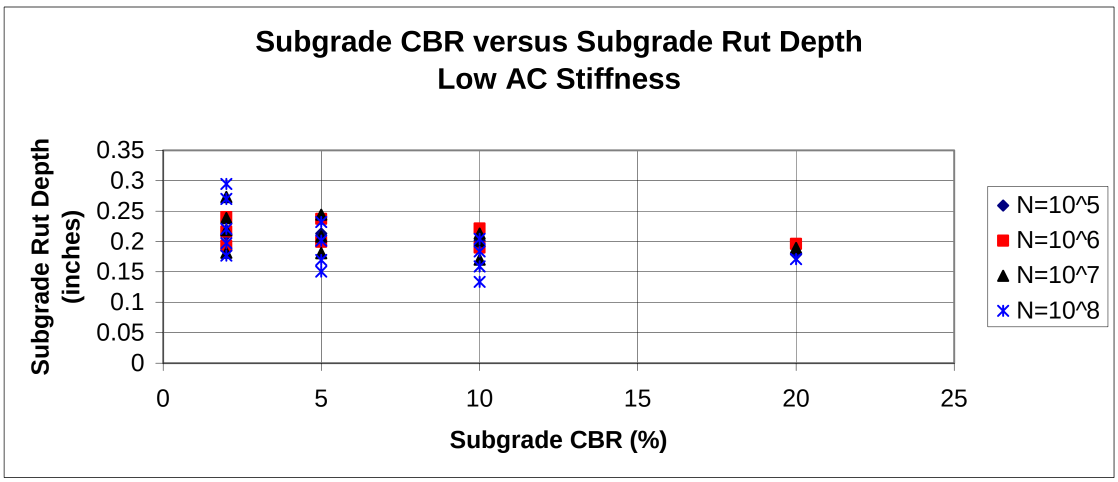


Figure D-274 Base / Subgrade Rut Depths versus Subgrade CBR (All data) Set 5-G

Annex E

MnRoad Study Dynamic Modulus Data

Table E-98 Dynamic Modulus Values for MnRoad Cells

		Dynamic Modulus (psi)						
Temperature (^{o}F)	Frequency (Hz)	MnRoad Cell 4	MnRoad Cell 16	MnRoad Cell 17	MnRoad Cell 18	MnRoad Cell 19	MnRoad Cell 20	MnRoad Cell 22
14	0.1	3,045,439	2,540,000	2,790,000	2,080,000	2,642,727	2,050,000	1,400,000
14	0.5	3,591,726	2,810,000	3,190,000	2,580,000	3,280,972	2,360,000	1,670,000
14	1	3,845,250	2,890,000	3,280,000	2,700,000	3,609,840	2,480,000	1,880,000
14	5	4,423,249	3,000,000	3,780,000	2,970,000	4,137,636	2,740,000	2,210,000
14	10	4,651,574	3,360,000	3,670,000	3,080,000	4,575,098	2,930,000	2,500,000
14	25	4,851,059	3,780,000	3,880,000	3,100,000	5,217,078	3,260,000	2,810,000
40	0.1	1,283,452	1,250,000	1,590,000	1,360,000	1,700,399	926,000	744,000
40	0.5	1,711,936	1,620,000	1,990,000	1,690,000	2,110,580	1,250,000	980,000
40	1	1,893,205	1,810,000	2,120,000	1,890,000	2,270,812	1,410,000	1,100,000
40	5	2,316,875	2,210,000	2,560,000	2,290,000	2,659,173	1,850,000	1,410,000
40	10	2,534,750	2,320,000	2,700,000	2,430,000	2,814,656	2,040,000	1,560,000
40	25	2,748,463	2,520,000	2,850,000	2,650,000	2,902,364	2,250,000	1,740,000
70	0.1	362,263	317,000	387,000	270,000	454,960	191,000	160,000
70	0.5	580,181	487,000	604,000	420,000	684,075	315,000	267,000
70	1	712,234	569,000	739,000	514,000	803,880	384,000	321,000
70	5	1,049,282	821,000	1,130,000	763,000	1,100,682	572,000	509,000
70	10	1,236,113	933,000	1,290,000	895,000	1,281,465	672,000	608,000
70	25	1,497,346	1,140,000	1,510,000	1,060,000	1,472,698	789,000	792,000
100	0.1	52,321	63,900	61,900	55,300	64,735	32,700	38,300
100	0.5	79,717	110,000	100,000	87,500	101,124	47,300	60,200
100	1	97,781	143,000	129,000	111,000	124,793	58,200	72,200
100	5	165,214	252,000	229,000	192,000	206,389	99,200	129,000
100	10	212,611	329,000	291,000	240,000	256,788	127,000	162,000
100	25	309,608	455,000	394,000	308,000	335,018	173,000	226,000
130	0.1	27,005	16,300	23,400	18,700	28,115	15,200	14,700
130	0.5	34,569	23,500	29,900	25,700	34,851	18,800	18,200
130	1	39,420	30,300	38,400	31,400	38,941	21,600	21,600
130	5	57,252	51,700	59,900	50,900	54,445	33,100	36,400
130	10	70,740	67,400	75,700	64,000	66,367	39,600	43,400
130	25	104,184	96,800	110,000	90,700	87,796	53,300	62,500

Table E-99 Binder Grade for MnRoad Cells

MnRoad Cell	Binder Grade
4	Pen 120-150
16	AC-20
17	AC-20
18	AC-20
19	AC-20
20	Pen 120-150
22	Pen 120-150

Table E-100 Dynamic Shearometer Results Pen 120-150

Temperature (F)	G* (psi)	δ
59	4100000	55.02
77	740000	64.1
95	120000	71.14
113	21000	76.95
140	2300	83.58
158	670	86.58
176	230	88.4
203	56	89.45
221	27	89.79
239	14	89.81

Table E-101 Dynamic Shearometer Results AC-20

Temperature (F)	G* (psi)	d
59	8700000	49.83
77	1700000	59.98
95	300000	67.64
113	48000	74.06
140	4900	81.75
158	1400	85.34
176	430	87.62
203	98	89.44
221	44	89.48
239	22	89.6

Table E-102 Dynamic Modulus Sigmoidal Function Coefficients For MnRoad Cells

	VTS	A	δ	α	β	γ	c
Cell 4	-3.589	10.703	3.9699	2.6748	-0.709	0.4888	1.4531
Cell 16	-3.561	10.65	2.3029	4.3553	-1.369	0.3368	1.4039
Cell 17	-3.561	10.65	3.8147	2.7826	-0.993	0.4982	1.3921
Cell 18	-3.561	10.65	3.5713	3.004	-0.918	0.4364	1.3803
Cell 19	-3.561	10.65	3.911	2.732	-0.901	0.4268	1.6562
Cell 20	-3.589	10.703	3.7846	2.7066	-0.607	0.4826	1.5071
Cell 22	-3.589	10.703	3.4554	2.9678	-0.804	0.4543	1.3138

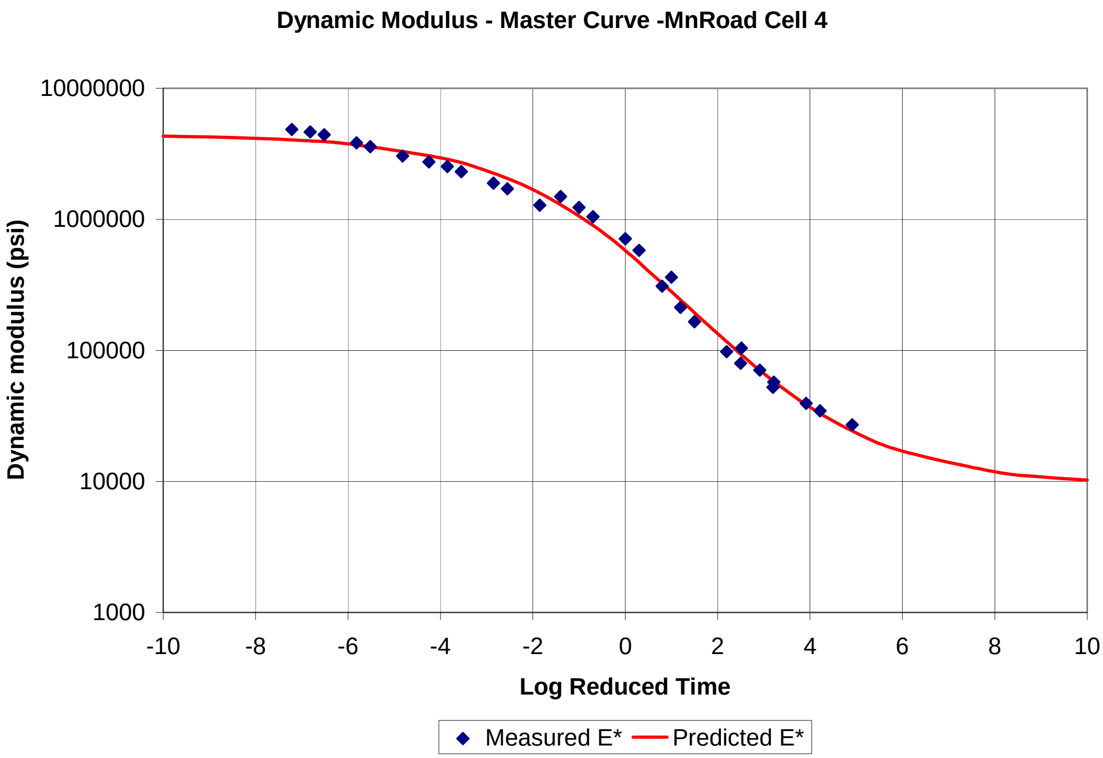


Figure E-275 Dynamic Modulus Master Curve Plot MnRoad Cell 4

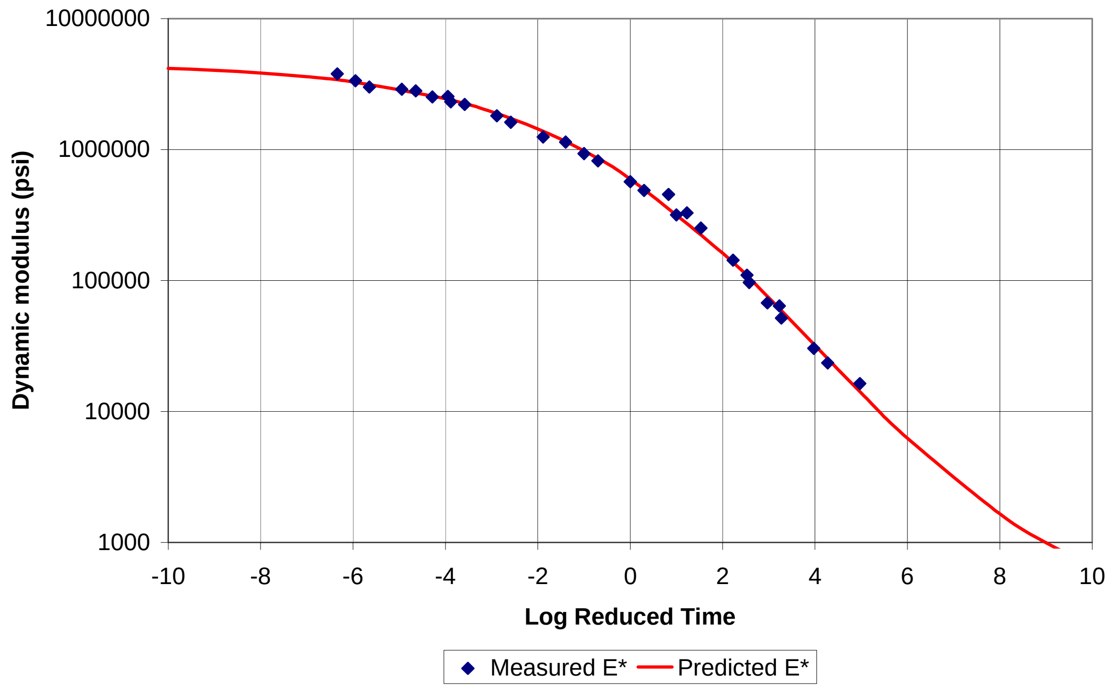


Figure E-276 Dynamic Modulus Master Curve Plot MnRoad Cell 16

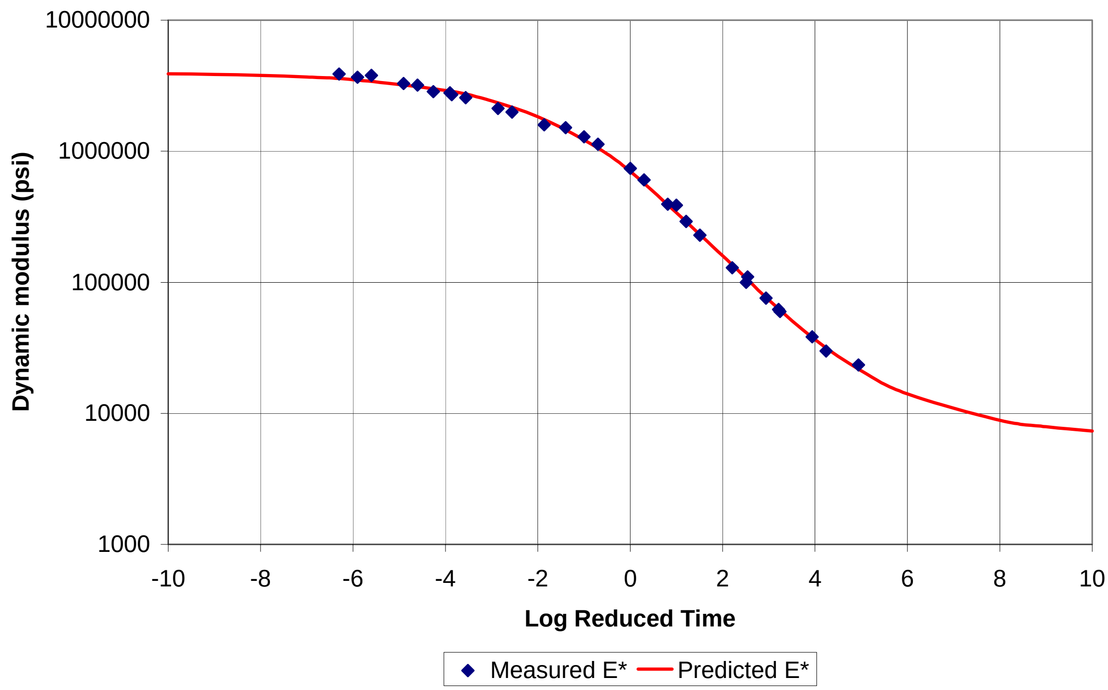


Figure E-277 Dynamic Modulus Master Curve Plot MnRoad Cell 17

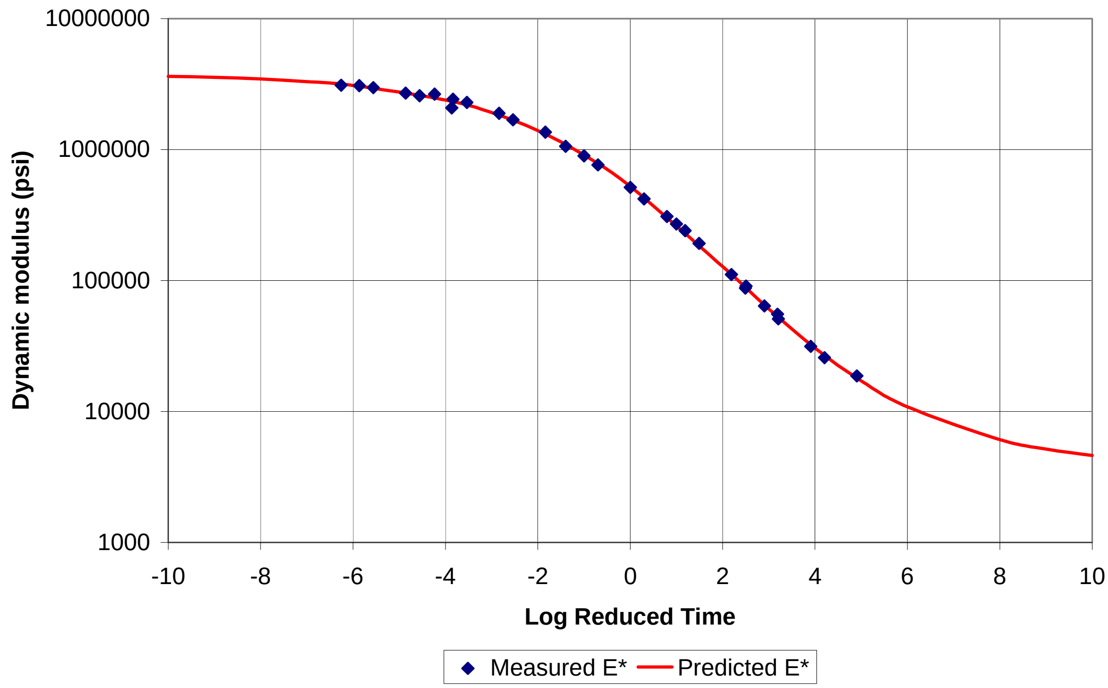


Figure E-278 Dynamic Modulus Master Curve Plot MnRoad Cell 18

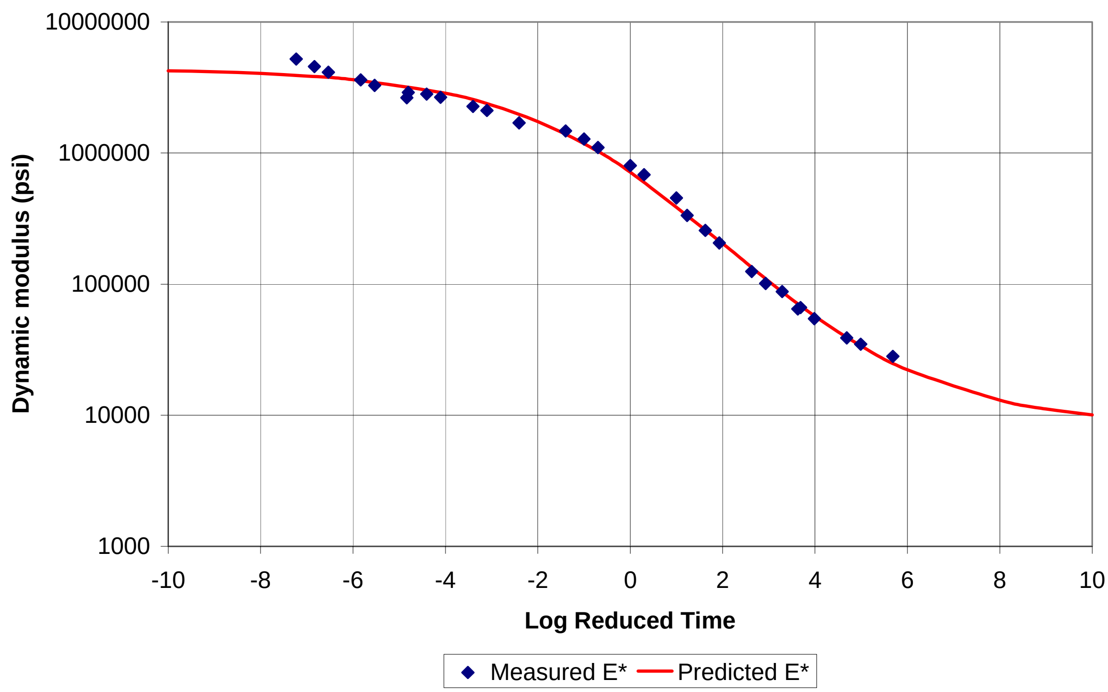


Figure E-279 Dynamic Modulus Master Curve Plot MnRoad Cell 19

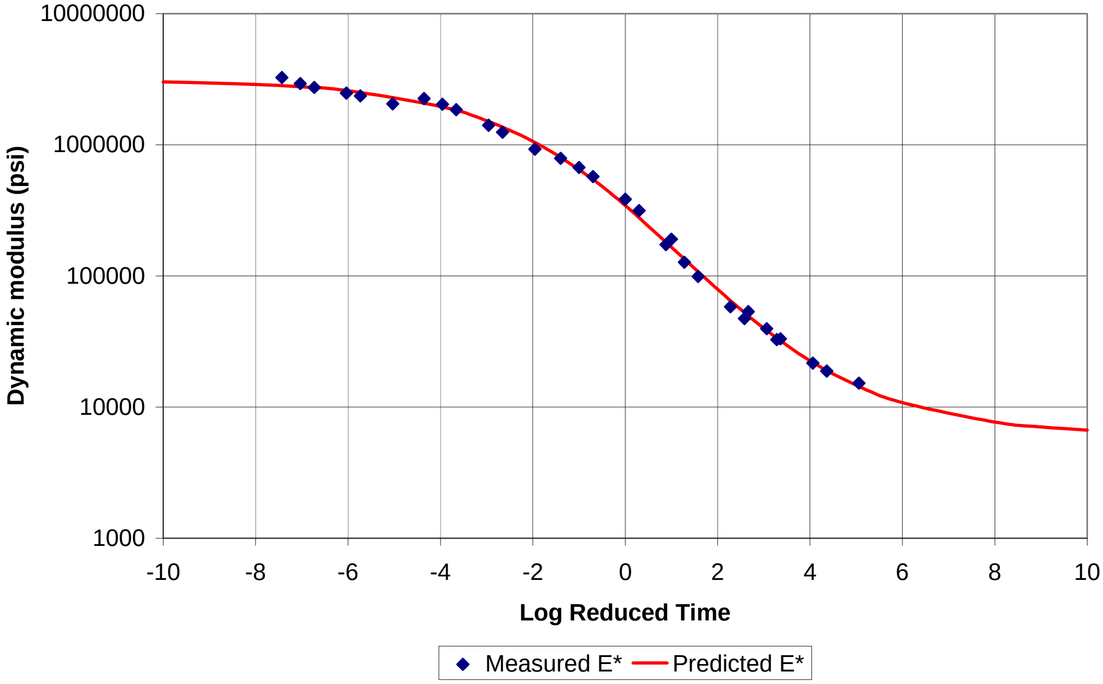


Figure E-280 Dynamic Modulus Master Curve Plot MnRoad Cell 20

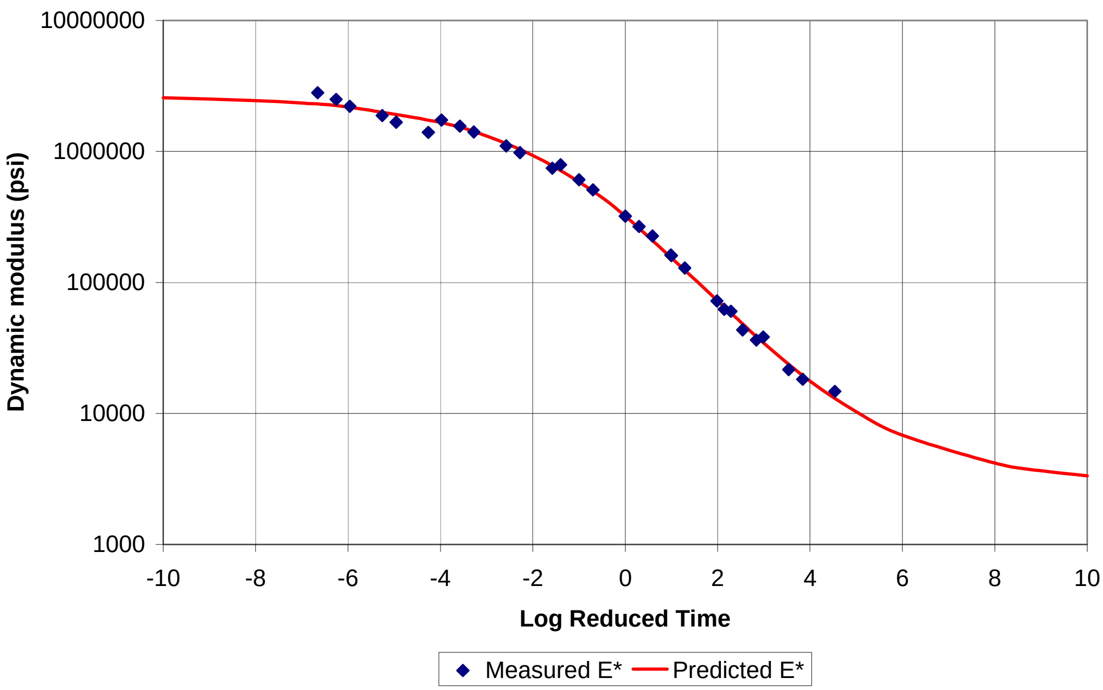


Figure E-281 Dynamic Modulus Master Curve Plot MnRoad Cell 22

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Guide for Mechanistic-Empirical Design
OF NEW AND REHABILITATED PAVEMENT STRUCTURES

FINAL DOCUMENT

APPENDIX GG-2:
SENSITIVITY ANALYSIS FOR PERMANENT DEFORMATION FOR FLEXIBLE PAVEMENTS

NCHRP

Prepared for
National Cooperative Highway Research Program
Transportation Research Board
National Research Council

Submitted by
ARA, Inc., ERES Division
505 West University Avenue
Champaign, Illinois 61820

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Disclaimer

This is the final draft as submitted by the research agency. The opinions and conclusions expressed or implied in this report are those of the research agency. They are not necessarily those of the Transportation Research Board, the National Research Council, the Federal Highway Administration, AASHTO, or the individual States participating in the National Cooperative Highway Research program.

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Research into the subject area covered in this Appendix was conducted at ASU. The authors of this Appendix are Dr. M. W. Witczak, Mr. M.M. El-Basyouny, and Mr. El-Badawy.

Foreword

The information contained in this appendix serves as a supporting reference to the permanent deformation discussions presented and PART 3, Chapters 3 and 6 of the Design Guide.

This appendix is the second in a series of two volumes on environmental effects on pavements. The other volume is:

Appendix GG-1: Calibration of Permanent Deformation Models for Flexible Pavements

General Table of Contents

Appendix GG-2

Sensitivity Analysis for Permanent Deformation for Flexible Pavements

APPENDIX GG-2: SENSITIVITY ANALYSIS FOR PERMANENT DEFORMATION

1 Introduction and Objectives

The objective of this major component of the overall Design Procedure sensitivity study is to investigate how the prediction of rutting is influenced by changes in magnitude of several different key input variables. To study the sensitivity of these input parameters on rutting the Design Guide computer program was run using several factorial combinations of the input parameters shown in Table 2.1 of this Appendix. Unless noted in the specific sensitivity write-up; most of the computer runs used parameters that were typically related to the "Medium" input levels shown in the table.

In general, the sensitivity study of permanent deformation was not intended to cover a complete full factorial matrix of all parameters. Rather, the intent was to investigate the effect of varying one parameter at a time, while keeping as many of the other variables to be constant input parameters.

The independent parameter that is used for the Design Guide prediction for the rutting distress is the amount of permanent deformation in each layer (asphalt, granular base, subgrade and total pavement) in inches.

In order to investigate the overall sensitivity of key parameters to rutting; a series of individual studies were performed. Each separate study had its own unique parametric objective. The sensitivity analysis for permanent deformation covered the following items shown below. The paragraph where the sensitivity study outcome is reported and discussed is also shown in the following list:

<u>Paragraph - Study ID</u>

3.1 Influence of AC Mix Stiffness upon Permanent Deformation (Thin Layer)
3.2 Influence of AC Mix Stiffness upon Permanent Deformation (Thick Layer)

3.3 Influence of AC Mix Stiffness upon Permanent Deformation as Function of Traffic Repetitions.

3.4 Influence of AC Thickness upon Permanent Deformation

3.5 Influence of AC Thickness upon AC Rutting as Function of Depth Within AC Layer.

3.6 Influence of AC Mix Air Voids upon Permanent Deformation

3.7 Influence of Asphalt Content (Effective Bitumen Volume) upon Permanent Deformation

3.8 Influence of MAAT upon Permanent Deformation

3.9 Influence of Base Thickness upon Permanent Deformation

3.10 Influence of Base Modulus upon Permanent Deformation

3.11 Influence of Subgrade Modulus upon Permanent Deformation

3.12 Influence of Truck Traffic Volume upon Permanent Deformation

3.13 Influence of Traffic Speed upon Permanent Deformation

3.14 Influence of Traffic Analysis Level upon Permanent Deformation

3.15 Influence of Traffic Wander upon Permanent Deformation

3.16 Influence of Bedrock Depth upon Permanent Deformation

3.17 Influence of Depth to GWT on Permanent Deformation

Prior to presenting the sensitivity report results; the following section of this report describes the general input parameters (and ranges of variables) that have been utilized in the study.

2 Major Program Input Parameters Used in Study

2.1 Introduction

To study the effect of the desired sensitivity input parameter on permanent deformation, the major pavement design input parameters were usually selected from one of three different levels of the parameter under study (Low, Medium and High). In certain special cases, a fourth level was employed to insure that an adequate range of the variable examined could be evaluated for the sensitivity study. In general, the majority of program runs were conducted using the "Medium levels" of all of the input variables, while varying the major parameter whose sensitivity was being examined. However, in some cases, traffic levels using a "High approach" were used to insure that adequate quantitative rutting levels would be obtained in the sensitivity runs. Table 2.1 shows the different input parameters used in this study and the three to four different levels for each parameter that were eventually investigated. Specifics concerning all of these input values are explained in the following sections.

2.2 Design Parameters and Pavement Structure

For the permanent deformation sensitivity analysis, only the deterministic analysis was used in the study. The design life selected for each program run was 10 years. This was simply selected to minimize the computational running time required for the entire sensitivity effort. The granular base construction completion date was set two months earlier than the asphalt construction completion date for all problems, while the traffic opening date was set to be the same as the asphalt construction completion date.

A simple conventional flexible pavement cross-section was used in the study. The structure is a three-layer pavement system with a single asphalt concrete layer, an unbound granular base layer (10 inches thick) and a subgrade. Figure 2.1 shows the pavement structure used in the study. The asphalt layer thickness was varied from 1 - 12 inches to study the effect of AC thickness on the permanent deformation.

2.3 Traffic

Only one traffic method was eventually used in the study: a general traffic module using the load spectrum (Level 1 type of analysis). The traffic volume was expressed by the average annual daily truck traffic (AADTT) selected to represent a very high traffic volume (50,000 daily truck), high truck traffic (7000 daily trucks), medium traffic (1000 daily trucks) and a low traffic (100 daily trucks). The general 10-year E18KSAL repetitions for these traffic levels are approximately: 100 million, 15 million, 2 million and 200,000. The rest of the traffic parameters were set to the default values given by the software.

Tables 2.2 to 2.5 show the values of the various traffic parameter inputs used in this study. Information regarding the general traffic parameters (Table 2.2), AADTT distributions by vehicle class (Table 2.3), number of axles per truck (Table 2.4) and the axle configurations (Table 2.5) is illustrated. The monthly adjustment factors for traffic were set at 1; while the standard deviation of traffic wander was taken to be 10 inches. Finally, no traffic growth was considered in the study.

2.4 Climate

Three different climatic regions were selected in the sensitivity study of permanent deformation. The climatic stations were selected to cover a broad range of US temperature conditions (cold, intermediate and hot region). One city was selected from each region to represent the climatic region. The cities were Minneapolis (Minnesota) for the cold climate, Oklahoma City (Oklahoma) for the intermediate climate and Phoenix (Arizona) for the hot weather. The mean annual air temperatures (MAAT) for these three stations were 46.1, 60.7 and 74.4 ºF, respectively.

Table 2.1 Parameters Used in the Sensitivity Runs

	Very Low	Low (L)	**Medium (M)**	Medium High	High (H)	Very High
Traffic Volume – AADTT (Vehicle/Day)		100	**1000**	4000	7000	50,000
Facility Type (Operating Speed (mph))	Intersection (2.0)	Urban Streets (25)	**State Primary (45)**		Interstate (60)	
Location (MAAT)		Minnesota (46.1ºF)	**Oklahoma** (60.7ºF)		Phoenix (74.4ºF)	
GWT depth (ft)		2	**7**		15	
AC Thickness (in)		1	**4**		12	
AC Stiffness (See Table 2.6)		Low Mix	**Med Mix**		High Mix	
AC Air Voids (@ time of Construction For Med Mix)		4	**7**		10	
AC Effective Binder Content		8	**11**		15	
SG Modulus (psi) (Plasticity index)	3,000 (45)	8,000 (30)	**15,000 (15)**		30,000 (0)	

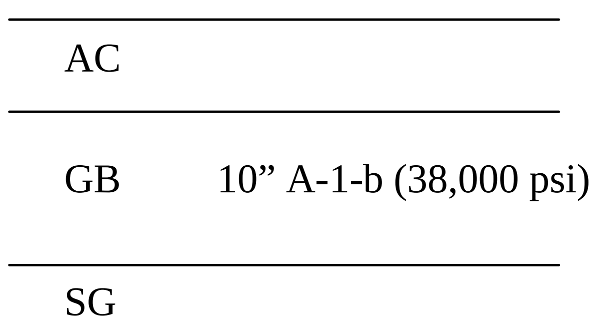

Figure 2.1 Pavement Structure

Table 2.2 Traffic Parameters used in the Study

Number of lanes in design direction	2
Percent of trucks in design direction (%)	50
Percent of trucks in design lane (%)	95
Design lane (ft)	12
Standard deviation of Traffic Wander (inch)	10

Table 2.3 AADTT Distributions by Vehicle Class

Class 4	1.8%
Class 5	24.6%
Class 6	7.6%
Class 7	0.5%
Class 8	5.0%
Class 9	31.3%
Class 10	9.8%
Class 11	0.8%
Class 12	3.3%
Class 13	15.3%

Table 2.4 Number of Axles per Truck

Vehicle Class	Single Axle	Tandem Axle	Tridem Axle	Quad Axle
Class 4	1.62	0.39	0.00	0.00
Class 5	2.00	0.00	0.00	0.00
Class 6	1.02	0.99	0.00	0.00
Class 7	1.00	0.26	0.83	0.00
Class 8	2.38	0.67	0.00	0.00
Class 9	1.13	1.93	0.00	0.00
Class 10	1.19	1.09	0.89	0.00
Class 11	4.29	0.26	0.06	0.00
Class 12	3.52	1.14	0.06	0.00
Class 13	2.15	2.13	0.35	0.00

Table 2.5 Axle Configurations

Average axle width (edge-to-edge) outside dimensions, ft)	8.5
Dual tire spacing (in)	12
Single Tire (psi)	120
Dual Tire (psi)	120
Axle Spacing - Tandem axle (in)	51.6
Axle Spacing - Tridem axle (in)	49.2
Axle Spacing - Quad axle (in)	49.2

2.5 Depth to Ground Water Table / Bedrock

For the majority of problems conducted, the ground water table depth (GWT) was set at the Medium level (7 ft), shown in Table 2.1. For the special case, where the effect of the GWT was analyzed for the sensitivity study parameter, it was varied as shown in Table 2.1 to have values of: 2 ft, 7 ft and 15 ft. The presence of a bedrock (stiff) layer was not considered as a variable in any of the studies, except for 3.15 and 3.16, which evaluated the influence of bedrock layers (1 to 20 ft) upon permanent deformation. The GWT depth and the depth to bedrock are measured from the surface of the pavement.

2.6 Material Characterizations

2.6.1 Asphalt Concrete Mixtures

Three different asphalt concrete mixtures were used in this study. The range of E* master curves (mix stiffnesses) selected was based upon using as broad a range in stiffness of historic AC mixtures as possible. Table 2.6 shows the typical mixture properties as well as typical binder grade and properties. The mixture E* master curves chosen are representative of mixtures utilizing PG 46-34; PG 58-28 and PG 76-16 binders.

Figure 2.2 shows the master curve for the three mixtures. These plots are typically defined, in mathematical models, by use of a sigmoidal function. Table 2.7 shows the dynamic modulus equation parameters (sigmoidal function) for the three AC mixtures utilized in the sensitivity study. The intermediate mixture was selected as the base mixture for the studies in which the air voids and the effective binder content were changed when to study the effect of these two parameters on the AC permanent deformation.

Table 2.8 summarizes the creep compliance values at different loading time and the tensile strength calculated for the three different asphalt concrete mixtures.

2.6.2 Unbound Layers Material

The unbound granular base properties were the same for all computer runs used in this study. However, the material properties for the subgrade soil were changed to reflect a very broad range of support values, from "very low" (Mr=3000 psi) to "high" (Mr=30,000 psi) conditions. These input values represent the "Design Conditions" for input into the program. Table 2.9 summarizes the input properties of the granular base and the four different subgrade soils used in this study.

Table 2.6 Asphalt Mixture properties

Variable	Low Mix	Med Mix	High Mix
Air Voids (%)	7	7	8
Effective Binder content (%)	12	11	10
VFA (%)	63	61	55
% Retained ¾”	0	11.62	30
% Retained 3/8”	1.16	35.3	47
% Retained # 4	27.65	52.64	52.8
% Passing # 200	11.12	7.28	8.38
PG Grade	46-34	58-28	76-16
Binder A	11.504	11.01	10.015
Binder VTS	-3.901	-3.701	-3.315

Table 2.7 Asphalt Concrete Dynamic Modulus Parameters (Sigmoidal Model Form)

Dynamic Modulus Parameters	Low Mixture	Med Mixture	High Mixture
Delta	2.8657	2.8234	-0.6719
Alpha	3.8185	3.9435	4.1776
Beta	-0.4236	-0.7920	-1.2554
Gamma	0.313351	0.313351	0.313351
C	1.255882	1.255882	1.255882

Table 2.8 Creep Compliance and Tensile Strength for each AC Mixture.

Low Mix

Loading Time (sec)	Creep Compliance (1/psi)		
	Temp (-20 ^{o}C)	Temp (-10 ^{o}C)	Temp (0 ^{o}C)
1	2.928E-07	3.955E-07	5.342E-07
2	3.681E-07	5.670E-07	8.732E-07
5	4.984E-07	9.128E-07	1.672E-06
10	6.267E-07	1.309E-06	2.733E-06
20	7.880E-07	1.876E-06	4.467E-06
50	1.067E-06	3.021E-06	8.554E-06
100	1.341E-06	4.331E-06	1.398E-05
Tensile Strength (psi)		467.4	

Med Mix

Loading Time (sec)	Creep Compliance (1/psi)		
	Temp (-20 ^{o}C)	Temp (-10 ^{o}C)	Temp (0 ^{o}C)
1	2.981E-07	4.027E-07	5.440E-07
2	3.302E-07	4.835E-07	7.081E-07
5	3.779E-07	6.157E-07	1.003E-06
10	4.185E-07	7.393E-07	1.306E-06
20	4.634E-07	8.876E-07	1.700E-06
50	5.303E-07	1.130E-06	2.409E-06
100	5.873E-07	1.357E-06	3.136E-06
Tensile Strength (psi)		413.44	

High Mix

Loading Time (sec)	Creep Compliance (1/psi)		
	Temp (-20 ^{o}C)	Temp (-10 ^{o}C)	Temp (0 ^{o}C)
1	3.284E-07	4.437E-07	5.993E-07
2	3.568E-07	5.023E-07	7.069E-07
5	3.982E-07	5.917E-07	8.794E-07
10	4.326E-07	6.698E-07	1.037E-06
20	4.700E-07	7.583E-07	1.223E-06
50	5.244E-07	8.934E-07	1.522E-06
100	5.697E-07	1.011E-06	1.795E-06
Tensile Strength (psi)		392.5	

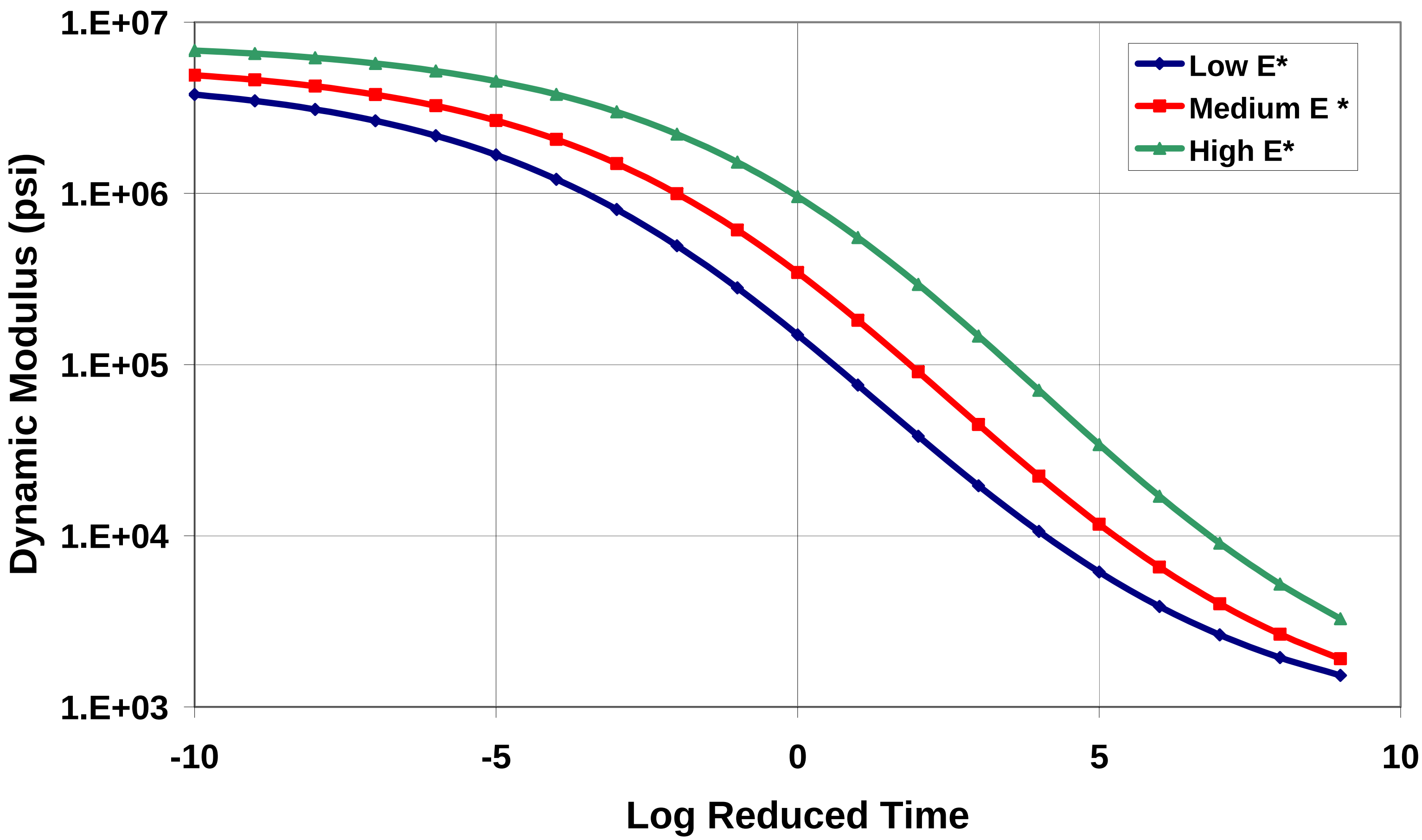

Figure 2.2 Asphalt Concrete Mixtures Master Curves

Table 2.9 Unbound Material Properties

Layer	GB	SG Very low	SG Low	SG Med	High
Classification	A–1–b	CL	A–7–6	A – 6	A – 3
Modulus (psi)	38,000	3,000	8,000	15,000	30,000
Plasticity Index – PI (%)	0	45	30	15	0
% Passing # 4	40	100	100	95	85
% Passing # 200	3	97	80	50	7
D_{60} (mm)	2	0.01	0.02	0.1	0.3

3 Sensitivity Analysis for Permanent Deformation

The following sections of this report describe the individual sensitivity studies that were conducted for the permanent deformation analysis. The ensuing sections are presented by individual report associated with each of the individual studies noted in section 1 of this report.

3.1 Influence of AC Mix Stiffness upon Permanent Deformation (Thin AC Layers)

3.1.1 Objective

The objective of this section is to study the effect of changing the AC mix stiffness upon the amount of rut depth in each of the pavement layers for thin AC layers.

3.1.2 Input Parameters

a. Traffic: Medium traffic volume (1000 AADTT)
b. Traffic Speed: 45 mph
c. Environment: Oklahoma
d. Depth to GWT: Medium (7 ft)
e. Pavement Cross Section: Three layered system as shown in Figure 2.1
f. Layer properties:
    - AC layer: 1 inch
    - AC Mix Stiffness: Low, Medium and High as shown in Table 2.6 and Figure 2.2
    - Granular Base layer: As shown in Table 2.9 and Figure 2.1
    - Subgrade: Medium Support (Mr=15,000 psi) as shown in Table 2.9
g. Depth to bedrock: No Bedrock present

3.1.3 Results

Figures 3.1-1 shows the amount of rut in the asphalt layer after 10 years of loading for three levels of AC layer stiffness. Figure 3.1-2 shows the rut depth predicted in the base layer. While, Figure 3.1-3 shows the subgrade rut depth. It is important to recognize that these results are representative for only a very thin (1 inch thick) layer of asphaltic mix.

3.1.4 Discussion of Results

Asphalt Layer

The results shown in Figure 3.1-1 are reasonable in that the amount of rutting in the asphalt layer is very small. Also, as the stiffness of the asphalt layer decreases, the rut depth in the AC layer increases. However, the influence of the mix stiffness is not very significant because the layer thickness is only 1 inch.

Base Layer

The results shown in Figure 3.1-2 show that, for the 1 inch AC layer, the amount of rutting in the base layer is only slightly affected by the AC mix stiffness. It can be seen that base rutting does logically decrease as the stiffness of the thin AC layer increases.

Subgrade Layer

The results shown in Figure 3.1-3 show that the amount of rutting in the subgrade layer is nearly independent of the AC mix stiffness. This is a direct consequence of the fact that the subgrade stress states (and hence resilient vertical strain) are nearly equal under any mix stiffness provided that the AC layer is very thin.

3.1.5 Summary and Conclusions

In essence, if very thin AC layers are used, the stiffness of the AC mixture will play a minor role, if any, in dictating the amount of rutting that occurs. Rutting in the AC (thin) layer will be quite small. However rutting in the base and subgrade layers may be very large due to lack of protection (reduction in stress state) provided by a thin AC layer.

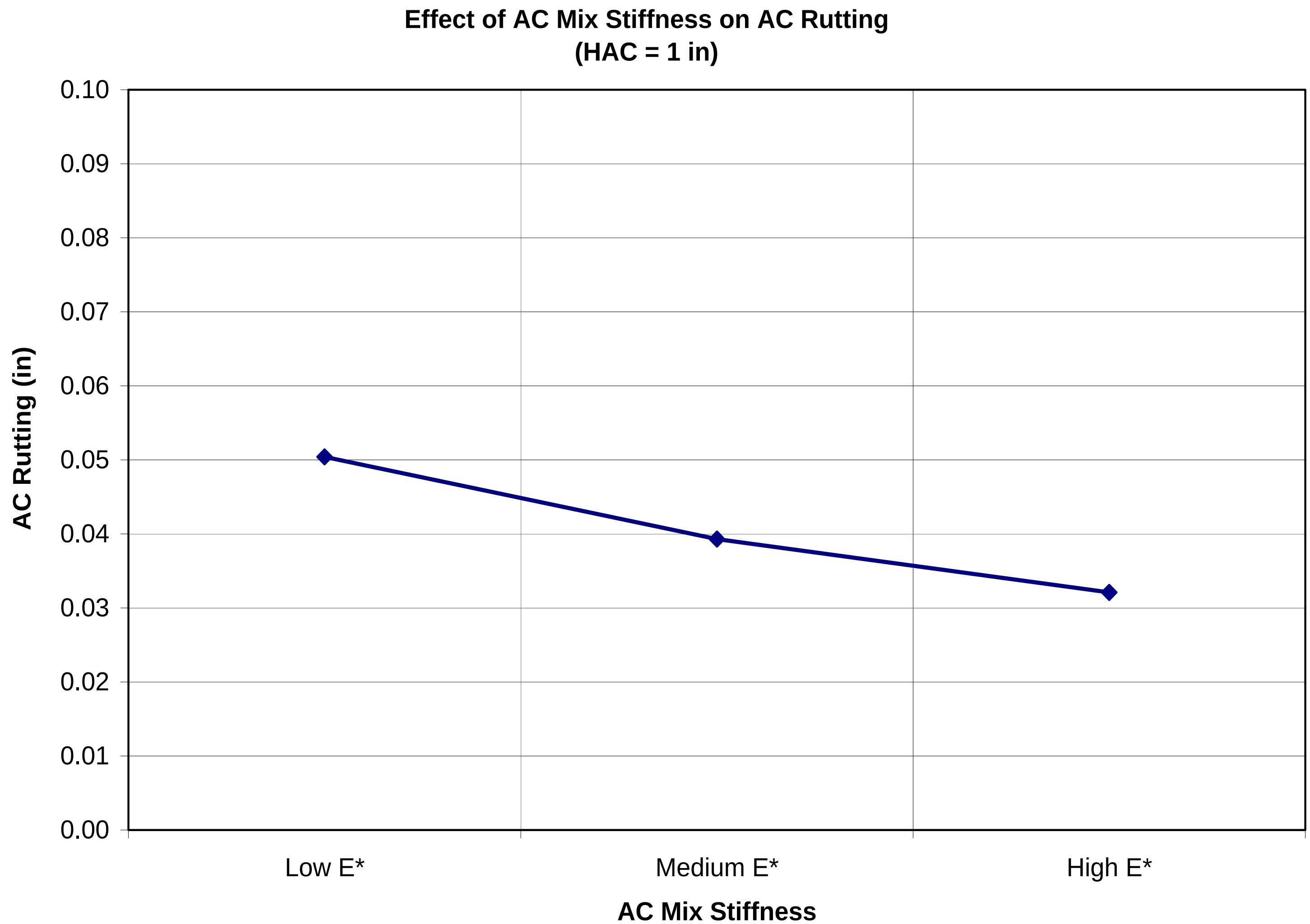

Figure 3.1-1 Effect of AC Mix Stiffness on AC Rut Depth, (H_{ac} = 1 in)

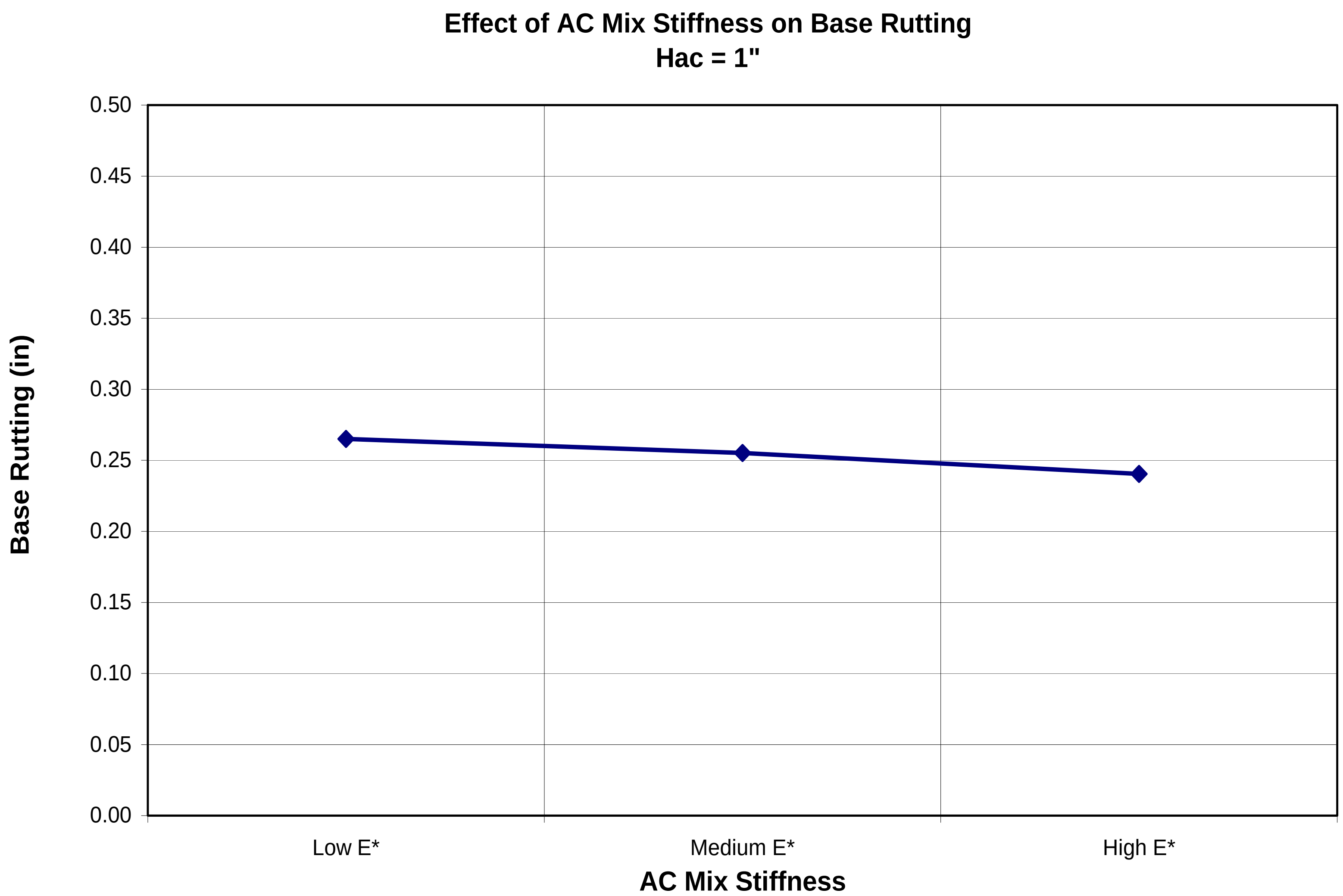

Figure 3.1-2 Effect of AC Mix Stiffness on Base Rut Depth, (H_{ac} = 1 in)

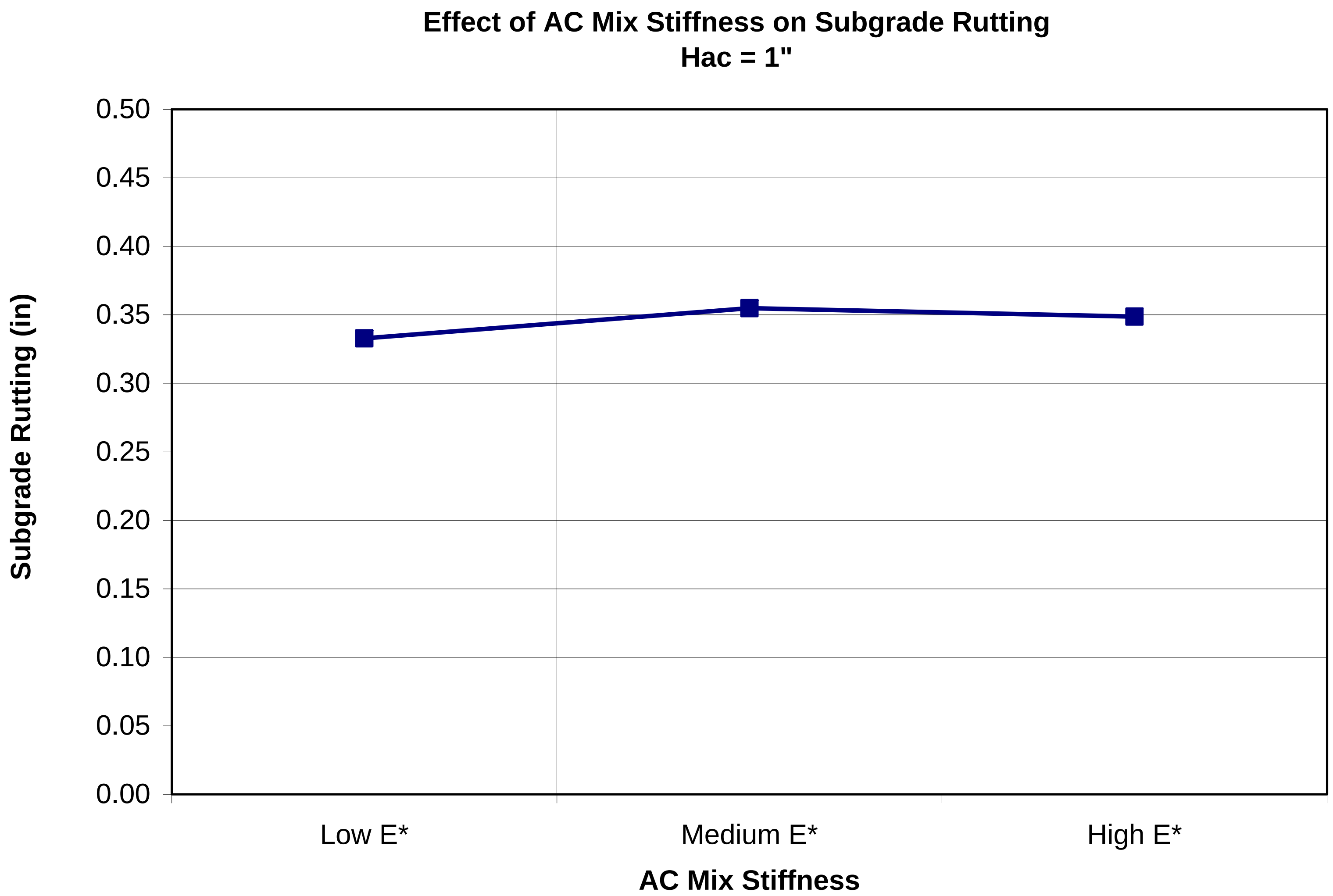

Figure 3.1-3 Effect of AC Mix Stiffness on Subgrade Rut Depth, (H_{ac} = 1 in)

3.2 Influence of AC Mix Stiffness upon Permanent Deformation (Thick AC Layers)

3.2.1 Objective

The objective of this section is to study the effect of changing the AC mix stiffnesses on the amount of rut depth for thick AC layers.

3.2.2 Input Parameters

a. Traffic: Medium traffic volume (1000 AADTT)
b. Traffic Speed: 45 mph
c. Environment: Oklahoma
d. Depth to GWT: Medium (7 ft)
e. Pavement Cross Section: Three layered system as shown in Figure 2.1
f. Layer properties:
   - AC layer: 12 inch
   - AC Mix Stiffness: Low, Medium and High as shown in Table 2.6 and Figure 2.2
   - Granular Base layer: As shown in Table 2.9 and Figure 2.1
   - Subgrade: Medium Support (Mr=15,000 psi) as shown in Table 2.9
g. Depth to bedrock: No Bedrock present

3.2.3 Results

Figures 3.2-1, 3.2-2 and 3.2-3 show the asphalt, base and subgrade rut depth, respectively, after 10 years of loading for three levels of AC layer stiffness. It should be recognized that these results are based upon a pavement structure having a 12 inch AC layer.

3.2.4 Discussion of Result

Asphalt Layer
The results for the rutting within the AC layer are shown in Figure 3.2-1. It can be observed that the magnitude of this rutting is highly sensitive to the AC mix stiffness. The results are logical in that the AC rutting decreases significantly as the AC mix stiffness becomes larger. It should also be apparent that the relative magnitude of the AC layer rutting of the 12 inch thick HMA layer is much greater (as what one would logically reason) compared to the thin, 1 in AC layer noted in section 3.1.

Base Layer

Figure 3.2-2 shows the influence of the AC stiffness upon rutting in the base course. The results are very logical in that the AC mix stiffness has little, if any, impact upon the rutting in the base course. The rut depth magnitude in the base is very small due to the thick AC layer and as would be expected, the high stiffness AC layer would yield slightly less base course rutting due to the fact that a lower resilient strain would be present in the base.

Subgrade Layer

The influence of the mix stiffness upon subgrade rutting is shown in Figure 3.2-3. As expected, there is little sensitivity in the subgrade rut depth due to the AC mix stiffness, because of the large AC mix layer thickness. As seen, the rutting in the subgrade is slightly decreased for the higher AC mix stiffness. This is again a reasonable and logical result because the subgrade resilient strain for the high E* mix condition, becomes less. This directly leads to a lower permanent strain and rutting level.

3.2.5 Summary and Conclusions

For thick AC layers, the magnitude of the rutting within the AC layer is very significantly tied to the HMA AC mix stiffness (E*). As the mix stiffness is increased the predicted AC rut depth will decrease. Rut depths within the base and subgrade layer will also tend to decrease with increasing E*. However, the relative change in rut depth magnitude due to variable mix E* will be quite small.

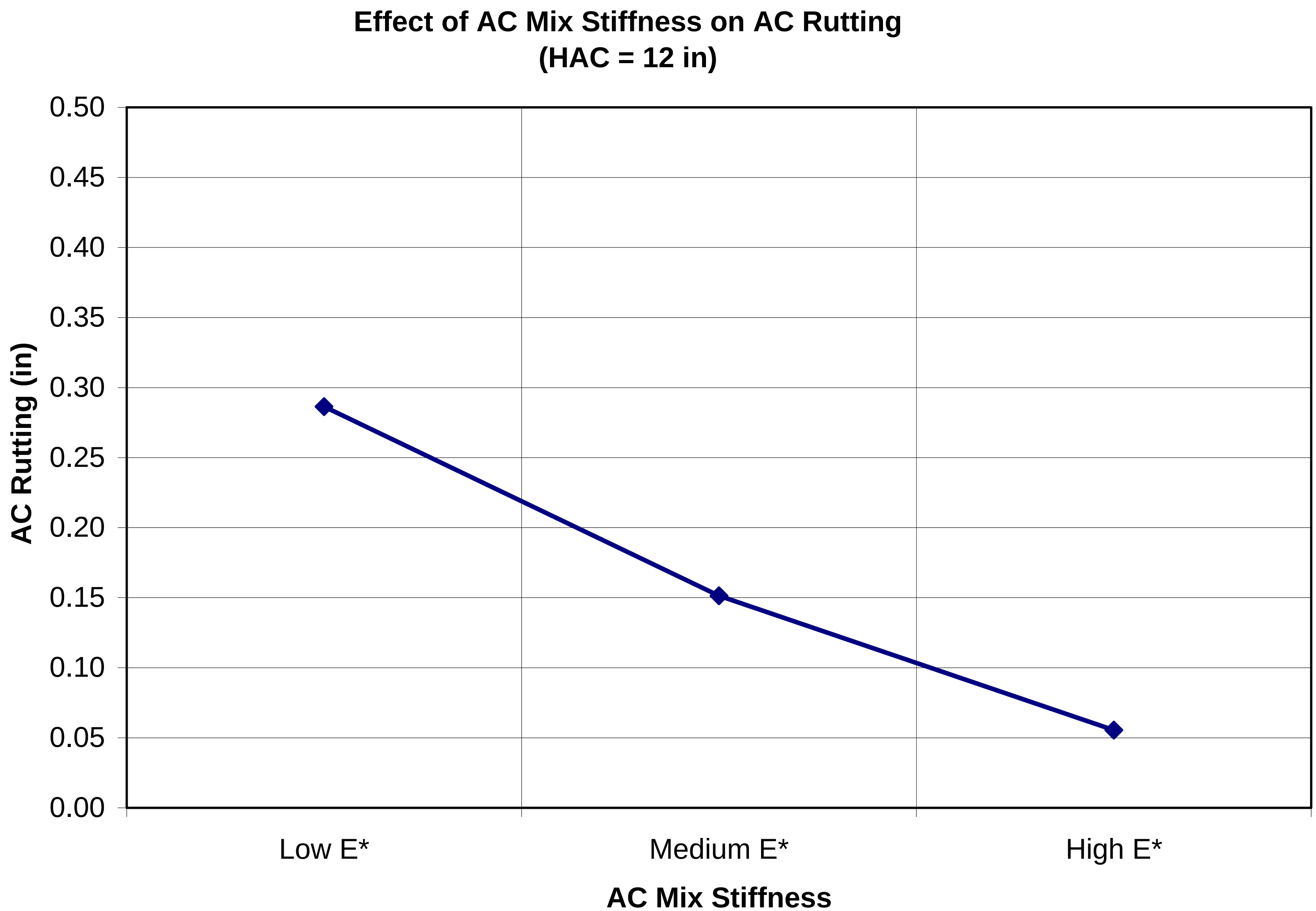

Figure 3.2-1 Effect of AC Mix Stiffness on AC Rut Depth, (H_{ac} = 12 in)

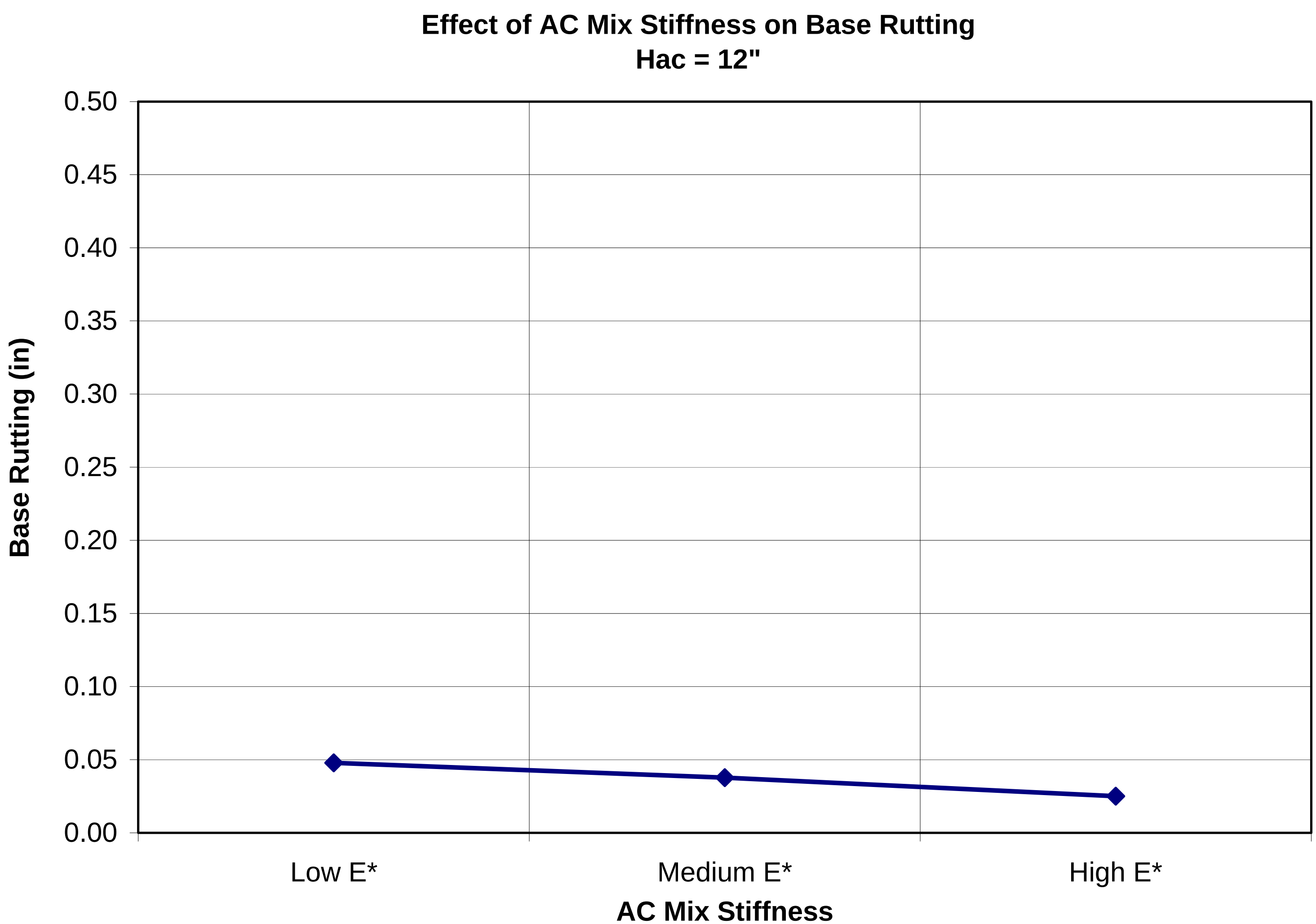

Figure 3.2-2 Effect of AC Mix Stiffness on Base Rut Depth, (H_{ac} = 12 in)

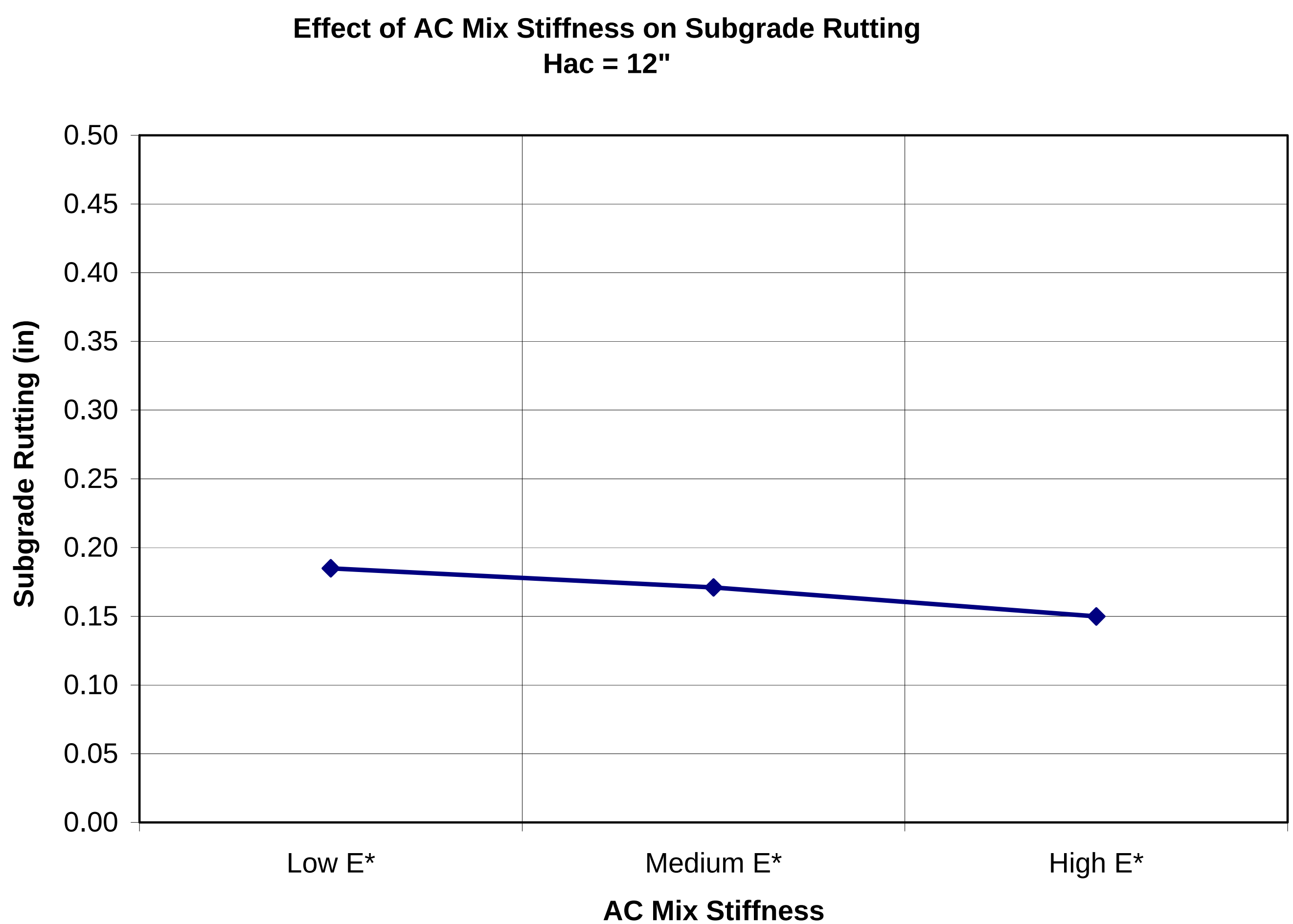

Figure 3.2-3 Effect of AC Mix Stiffness on Subgrade Rut Depth, (H_{ac} = 12 in)

3.3 Influence of AC Mix Stiffness upon Permanent Deformation as Function of Traffic Repetitions

3.3.1 Objective

The objective of this section is to study the effect of increasing traffic repetitions upon the amount of rut depth, within each pavement layer, for AC mixtures with differing mix stiffnesses.

3.3.2 Input Parameters

a. Traffic: Four different traffic volumes (100, 1000, 4000 and 7000 AADTT)
b. Traffic Speed: 45 mph
c. Environment: Oklahoma
d. Depth to GWT: Medium (7 ft)
e. Pavement Cross-Section: Three layered system as shown in Figure 2.1
f. Layer properties:
    - AC layer: 4 inches
    - AC Mix Stiffness: Low, Medium and High Stiffness Mixtures as shown in Table 2.6and Figure 2.2
    - Granular Base layer: As shown in Table 2.9and Figure 2.1
    - Subgrade: Medium support value (Mr= 15000 psi) as shown in Table 2.9
g. Depth to bedrock: No Bedrock present

3.3.3 Results

Figures 3.3-1 to 3.3-3 summarize the rutting results for the AC , base and subgrade layers. The layer rut depths are shown as a function of the Truck Traffic Volume, for each AC mix stiffness analyzed.

3.3.4 Discussion of Results

<u>Asphalt layer</u>
As observed in Figure 3.3-1, the impact of traffic volume (heavy trucks) plays a very significant role in determining the amount of rutting that will occur in an AC layer. However, more importantly, it can be seen that the AC mix stiffness is unquestionably the most significant factor defining the ultimate magnitude of AC rutting that will occur. Clearly, this figure shows the vital importance of a proper AC mix design to control the structural rutting behavior of the AC layer within the flexible pavement system.

<u>Base layer</u>

Figure 3.3-2 illustrates the influence of truck traffic and AC mix stiffness upon the rutting within the base layer. It is observed that there is only a minimal influence of rut depth magnitude in the base layer as the traffic level is increased. It can be further observed that the AC mix stiffness plays a minor, if any, role on the base rutting. Extremely small (lower) changes in rutting are observed for the use of high AC stiffness mixtures. This is logical and reasonable due to the fact that slightly lower stress states will occur in the base course if a stiff AC surface course is present. These lower stresses will, in turn, result in a lower strain and hence lower plastic (permanent strain) that will eventually result in a lower rut depth.

Subgrade layer

Figure 3.3-3 summarizes the rutting within the subgrade layer. It should be observed that the trends due to both traffic and AC mix stiffness are very similar to those shown for the base layer. While the changes in traffic volume are more significant for the subgrade rutting (due primarily to a larger rut depth predicted for the subgrade compared to the base layer), the influence of the AC mixture stiffness is quite small and insignificant upon rutting within the subgrade layer.

3.3.5 Summary and Conclusions

The influence of truck traffic volume will tend to increase rutting in all layers of a flexible pavement system. However, truck traffic plays a very significant role in determining the rutting within the AC layer, while having a more moderate (minor) influence for the base and subgrade layers. In addition, the influence of the AC mix stiffness is a very major factor characterizing the rutting within the AC layer and is a more sensitive design parameter than the traffic level. In contrast, the AC mix stiffness plays a minor role in the rut depth that would be observed in the unbound base and subgrade layers.

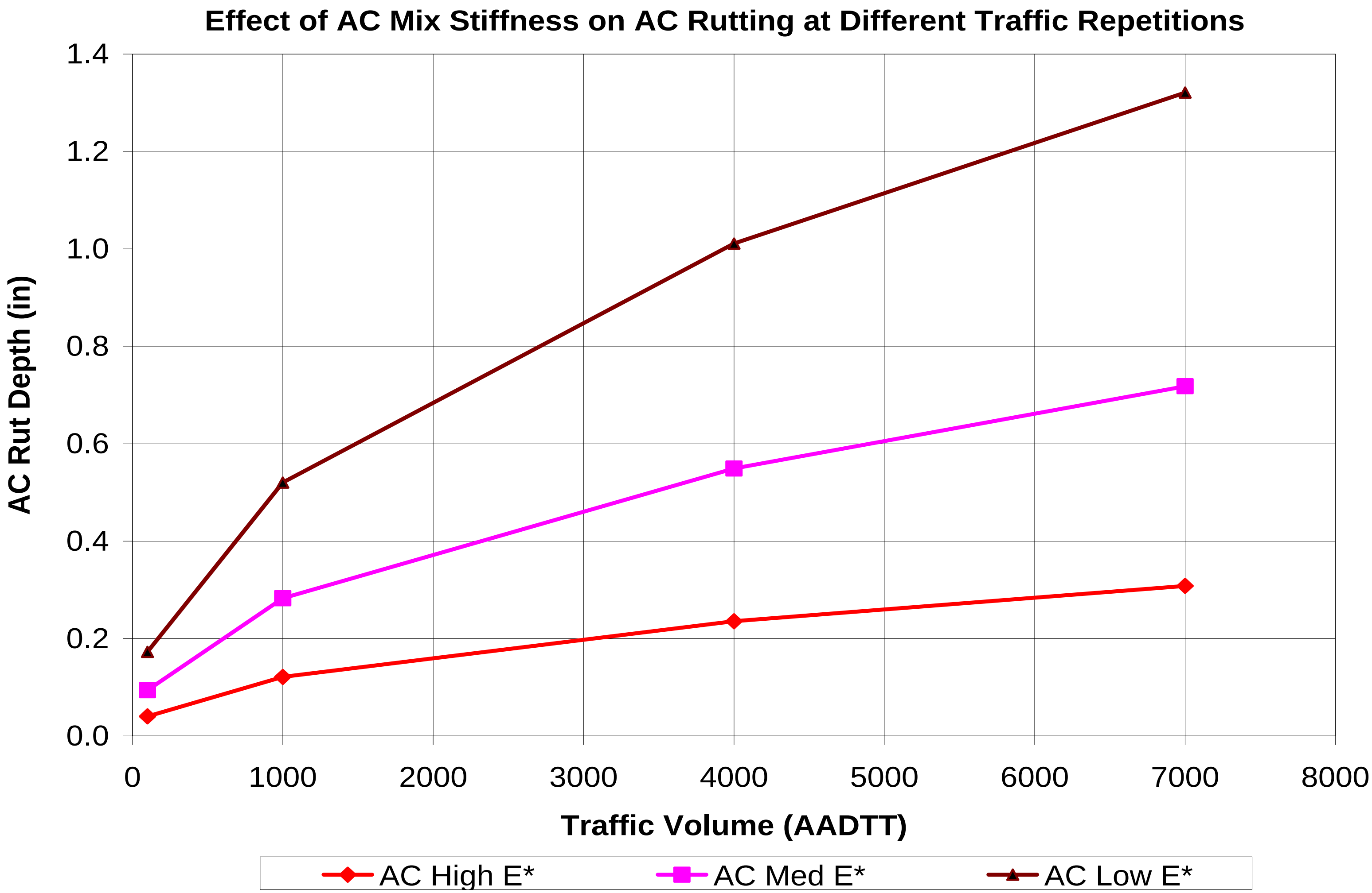

Figure 3.3-1 Effect of AC Mix Stiffness on AC Rut Depth at Different Traffic Repetitions

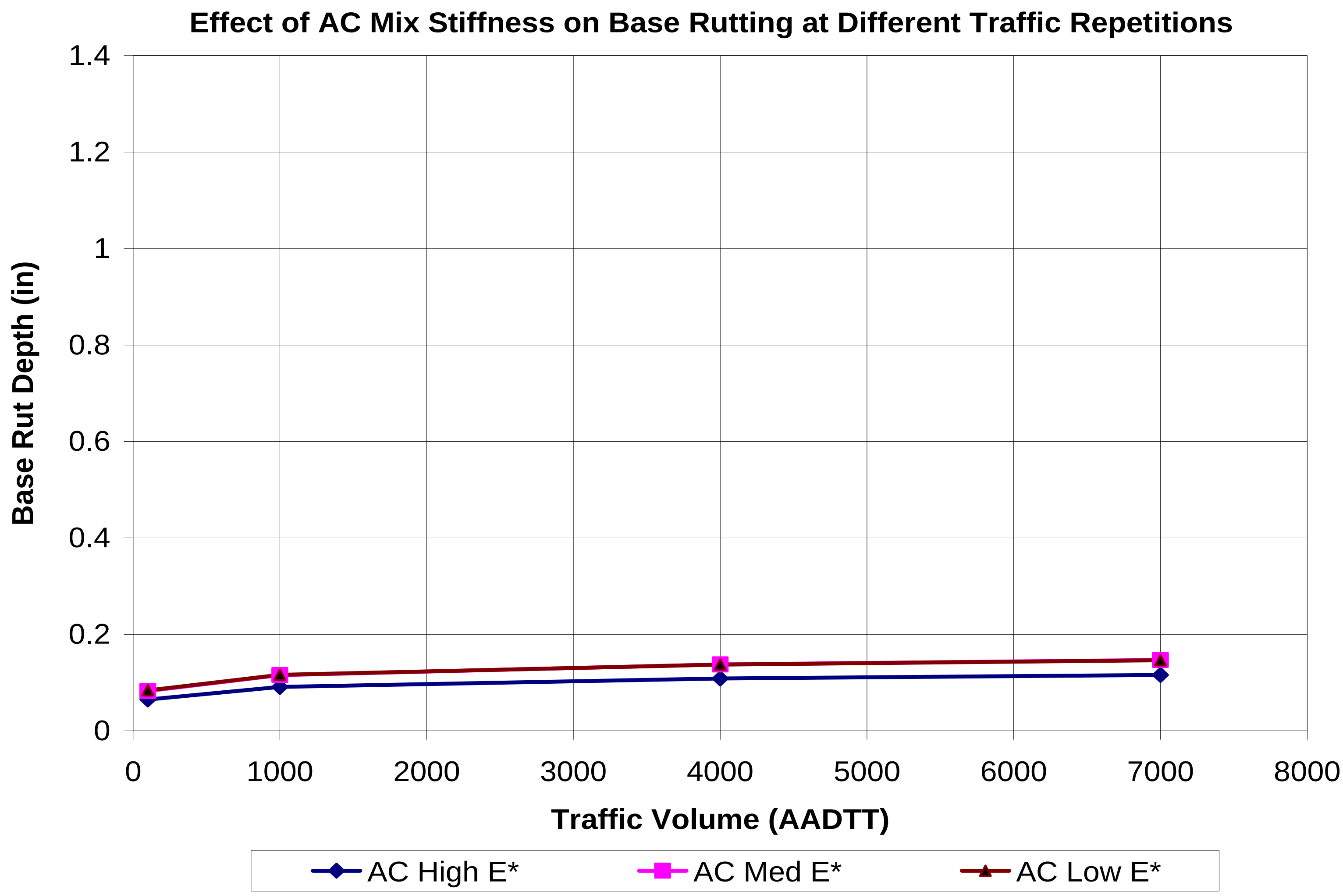

Figure 3.3-2 Effect of AC Mix Stiffness on Base Layer Rut Depth at Different Traffic Repetitions

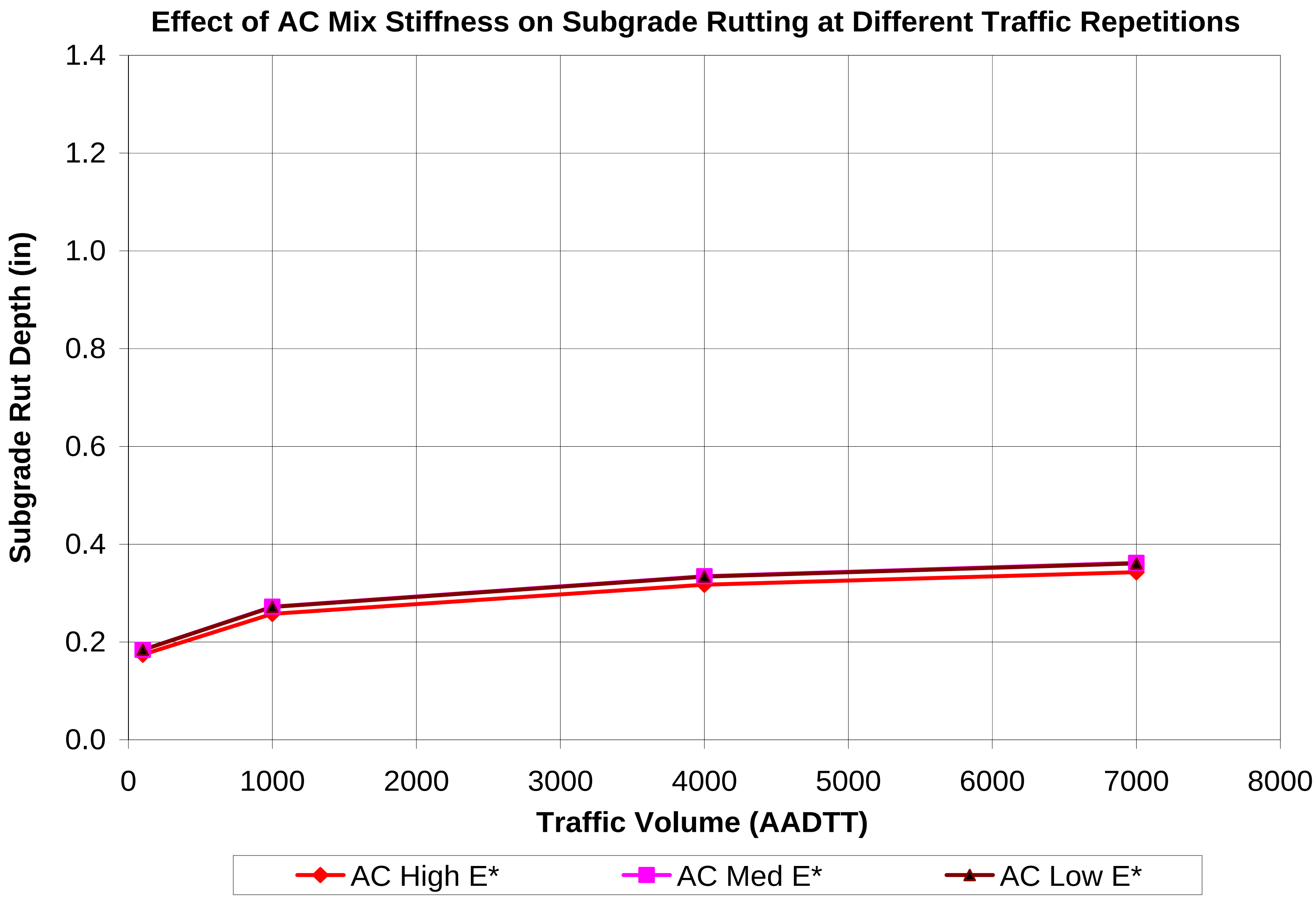

Figure 3.3-3 Effect of AC Mix Stiffness on Subgrade Layer Rut Depth at Different Traffic Repetitions

3.4 Influence of AC Thickness upon Permanent Deformation

3.4.1 Objective

The objective of this section is to study the effect of AC layer thickness on the amount of rut depth.

3.4.2 Input Parameters

a. Traffic: Medium traffic volume (1000 AADTT)
b. Traffic Speed: 45 mph
c. Environment: Oklahoma
d. Depth to GWT: Medium (7 ft)
e. Pavement Cross-Section: Three layered system as shown in Figure 2.1
f. Layer properties:
   - AC layer: 1, 2, 4, 6, 8 and 10 inches
   - AC Mix Stiffness: Medium Stiff Mixture as shown in Table 2.6 and Figure 2.2
   - Granular Base layer: As shown in Table 2.9and Figure 2.1
   - Subgrade: Three different subgrade support values used (Mr=30,000; 15,000 and 8,000 psi) as shown in Table 2.9
g. Depth to bedrock: No Bedrock present

3.4.3 Results

Figure 3.4-1 illustrates the influence of the rut depth observed after 10 years of loading in the AC layer, as a function of the AC layer thickness, for various levels of subgrade support. Figures 3.4-2 and 3.4-3 show the same influence on the rutting in the base and subgrade layers, respectively.

3.4.4 Discussion of Results

<u>Asphalt layer</u>
The relationship shown in Figure 3.4-1 illustrates an extremely important fundamental fact regarding the amount of rutting within asphalt layers of variable thickness. First of all, for all levels of AC thickness, it can be clearly observed that the magnitude of rutting in the AC layer does not significantly change as the subgrade support is changed. Thus AC rutting is primarily influenced by the external load properties (gear type, load pressure) and the quality of the AC layer itself.

It can also be observed that the thickness of the AC layer has a big influence on the amount of rutting in the AC layer. The figure clearly indicates that the greatest potential for AC rut is really associated with AC layers that are typically in the 3" to 5" thick range. At 1-inch thickness, the amount of rutting is low due to the small thickness of the asphalt layer.

As the thickness of the AC becomes larger, it is observed that the total AC rutting will actually decrease (be smaller compared to 3" to 5" thick layers) due to the difference in the deviatoric stress depth distribution patterns between thin, moderate and thick AC layers.

Base layer

The base rut depth shown in Figure 3.4-2 illustrates another extremely important fundamental fact regarding the amount of rut depth for flexible pavement systems. First of all, for all levels of AC thickness, it can be observed that the magnitude of rutting in the base layer is increased as the subgrade support is decreased. It can also be observed that the sensitivity, or impact of the subgrade support upon base rutting, is directly related to the thickness of the AC layer. These decreases in base rutting associated with increasing AC thickness and /or increasing subgrade moduli are all related to a decrease in the resilient strain in the base. It can be seen that as the AC layer get thicker the base rut decreases. The reason for this is that the AC layer protects (reduces the stress state and vertical strain state) in the base layer. As this protection increases, the rut depth will decrease.

Subgrade layer

Similar conclusions for the subgrade rut depth, shown in Figure 3.4-3 can be made for the conclusions drawn in the base layer rutting discussion previously presented. Figure 3.4-3 illustrates that for all levels of AC thickness; the magnitude of rutting in the subgrade is increased as the subgrade support is decreased. It can be also seen that as the AC layer get thicker the subgrade rut decreases. These consequences are directly related to changes in resilient strain state in the subgrade caused by subgrade modulus changes and changes in the AC layer thickness.

3.4.5 Summary and Conclusions

When one considers a range of AC thickness for a design structure, maximum rutting in the AC layer will generally occur at an optimum thickness of the AC layer, near a value of 3 to 5 inches. However, increasing the asphalt layer thickness also protects the base and subgrade layers and reduces the rutting in these layers. In addition, base and subgrade rutting will be increased as the subgrade support becomes weaker (poorer).

While thin AC layers will have minimal AC rutting, one must consider that other major distress problems, particularly, repetitive shear deformations, leading to permanent deformation or excessive rutting in the unbound base and subgrade will become the most salient design consideration for these pavement types. In pavement systems that have very small AC layer thicknesses, the stress states in the unbound layers (bases, subbases and subgrades) are quite large and will tend to increase the probability of rutting in these unbound layers, overlain by thin layers of AC.

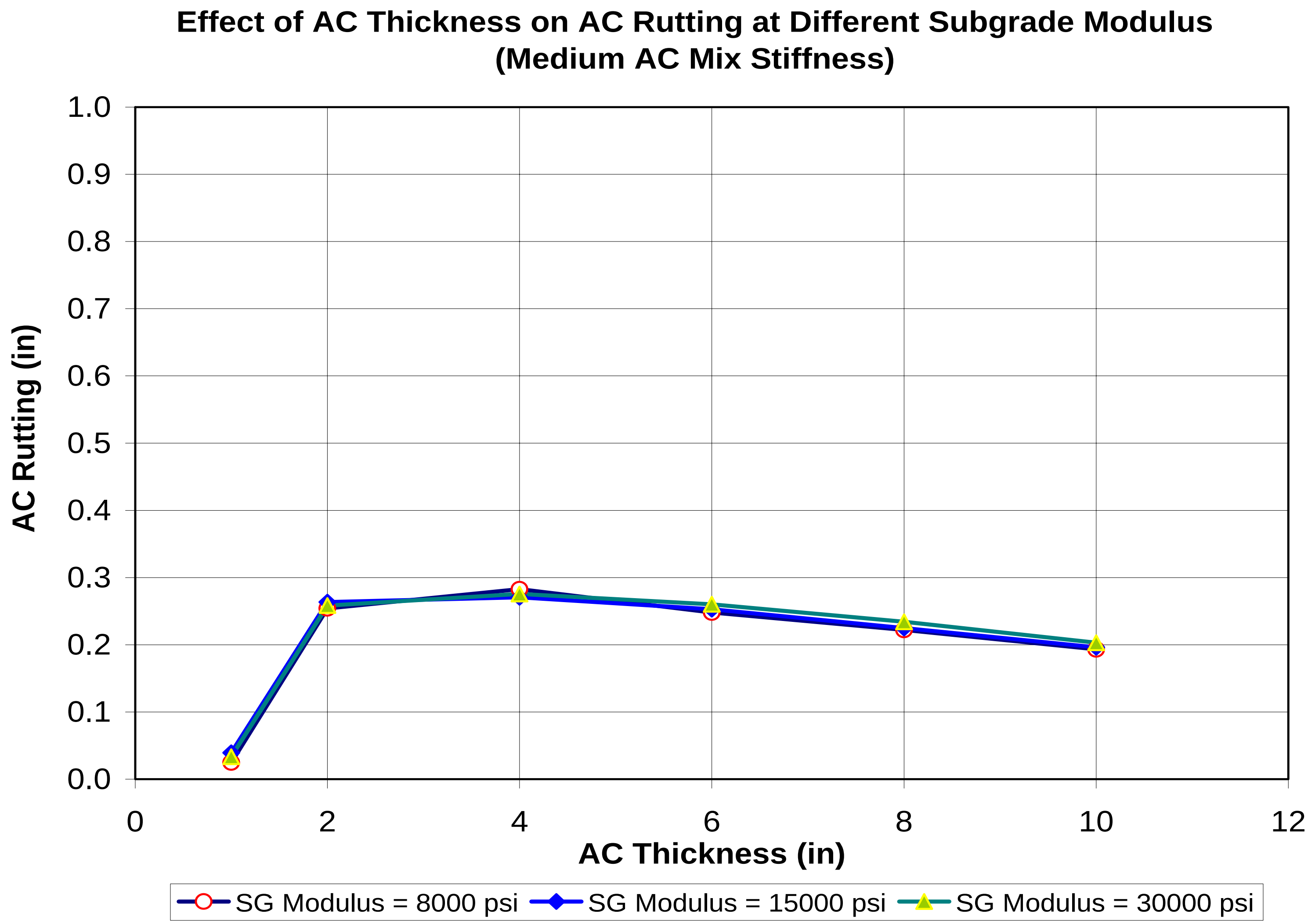

Figure 3.4-1 Effect of AC Layer Thickness on AC Rut Depth

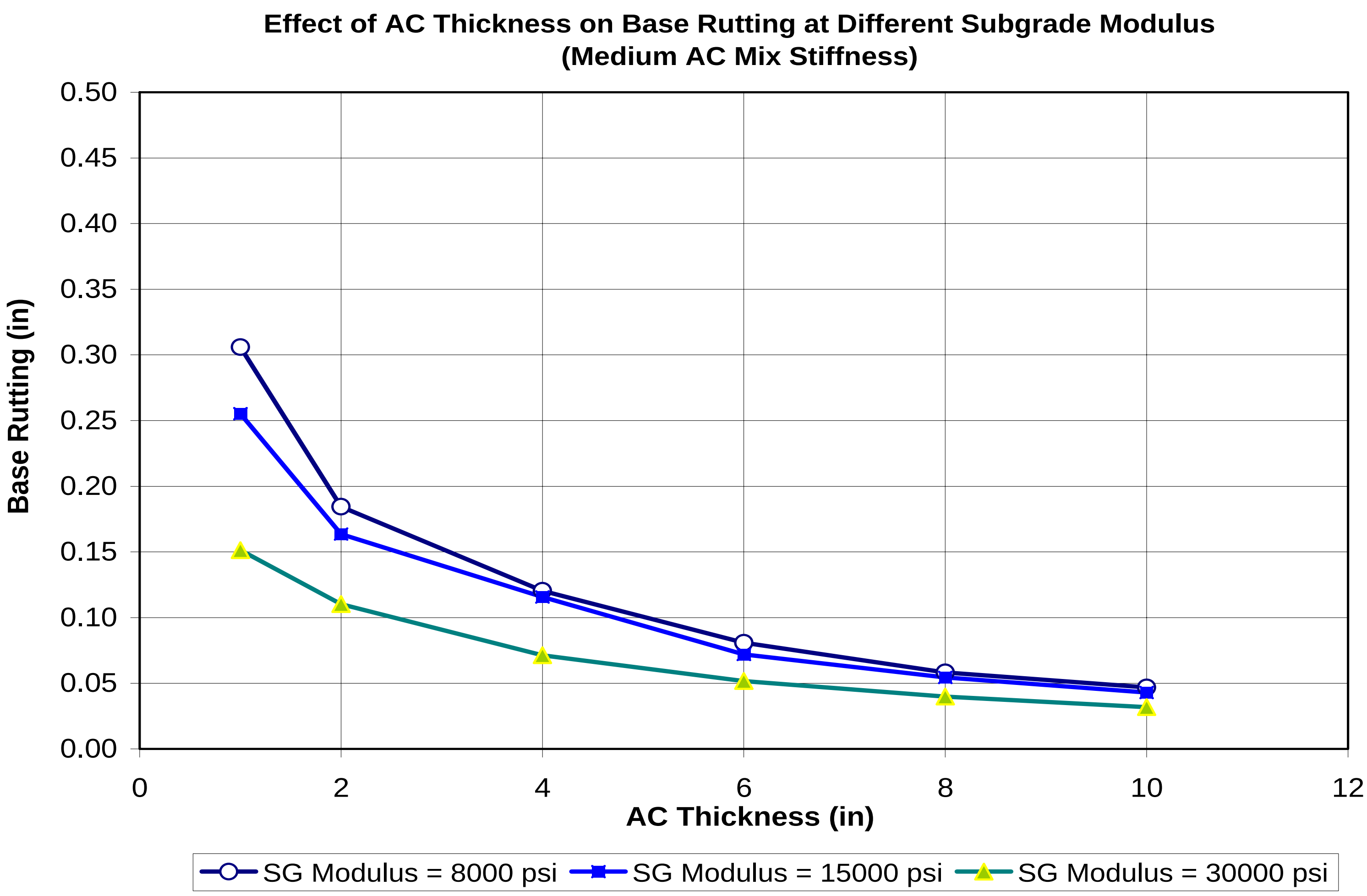

Figure 3.4-2 Effect of AC Layer Thickness on Base Rut Depth

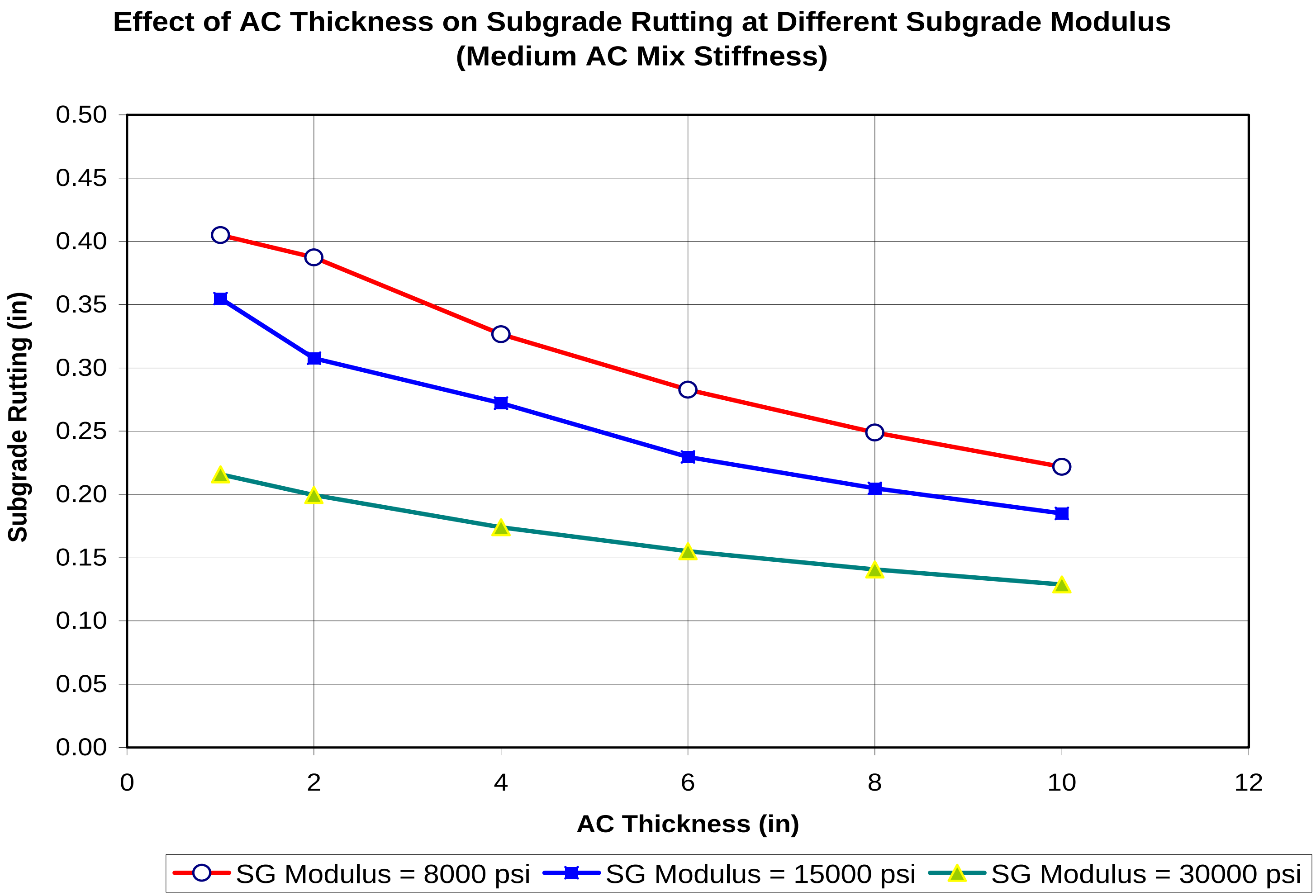

Figure 3.4-3 Effect of AC Layer Thickness on Subgrade Rut Depth

3.5 Influence of AC Thickness upon AC Rutting as Function of Depth Within AC Layer

3.5.1 Objective

The objective of this section is to study the effect of AC thickness upon the AC rutting as a function of depth within the AC layer

3.5.2 Input Parameters

a. Traffic: Medium traffic volume (1000 AADTT)
b. Traffic Speed: 45 mph
c. Environment: Oklahoma
d. Depth to GWT: Medium (7 ft)
e. Pavement Cross-Section: Three layered system as shown in Figure 2.1
f. Layer properties:
   - AC layer: 4 inches
   - AC Mix Stiffness: Medium Stiff Mixture as shown in Table 2.6 and Figure 2.2
   - Granular Base layer: As shown in Table 2.9 and Figure 2.1
   - Subgrade: Subgrade support value (Mr=15,000 psi) as shown in Table 2.9
g. Depth to bedrock: No Bedrock present

3.5.3 Results

Figure 3.5-1 illustrates the AC rut depth, at the mid point of a sublayer within the AC layer, for a variety of AC layer total thicknesses, ranging from 1 inch to 12 inches.

3.5.4 Discussion of Results

The results shown in the figure are extremely important to understanding the fundamental concepts related to permanent deformation behavior in AC layers. One of the most important principles shown in the figure is that very little rutting, regardless of AC thickness, is observed in the top 1 inch of the AC layer. The fundamental –mechanistic reason for this behavior is that at , or near the surface of the AC layer, the horizontal confining stresses caused by the wheel load are nearly equivalent to the vertical stress (tire or contact stress). This results in a triaxial stress state that approaches a hydrostatic (zero shear) condition. Thus little to no shear deformations are observed and hence little to no rutting will occur.

In contrast to the upper 1 inch sublayer, it can be seen that the AC sublayer rutting tends to reach maximum values in the 1 inch to 3 inch depth. This implies that the maximum rutting percentage within any AC layer thickness will occur within the upper 3 inch to 4 inch range. Beyond this depth within the AC layer, only small increments of additional AC rutting will occur in the entire AC layer.

Finally, it should be observed that the peak or maximum amount of AC sublayer rutting will decrease as the total thickness of the AC layer is increased. This finding logically supports the other sensitivity findings that an increase in the AC layer thickness, beyond thicknesses of 4+ inches will actually have less rutting than thinner AC layer thicknesses.

3.5.5 Summary and Conclusions

The distribution of rutting within the AC layer as a function of depth within the AC thickness leads to several important conclusions. Very little rutting will occur in the near surface AC sublayers due to the special state of stress (near hydrostatic – state of zero shear stress) in the top 1+ inch sublayer. AC sublayer rutting appears to be at an optimum (maximum) condition at sublayer depths in the 2 in to 4+ in range and then will drastically reduce at greater depths. The greatest rut depth within the AC layer appears to occur at depths less than 4+ inches from the surface of the AC layer. Finally, the amount of rutting that will occur appears to be maximized at Ac layer thicknesses near 4+ inches. As the thickness of the Ac is increased, smaller levels of rut depth are actually found to occur.

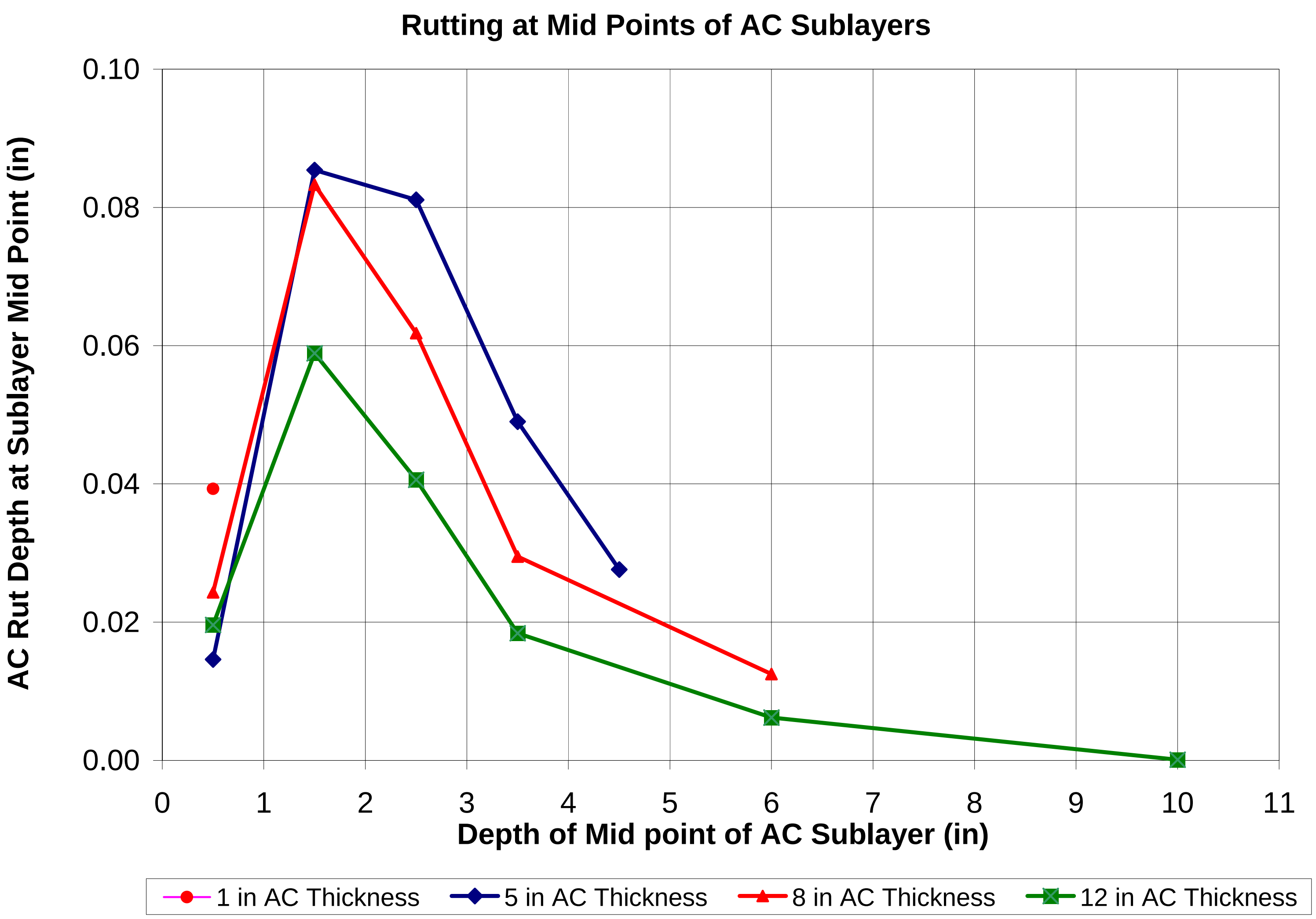

Figure 3.5-1 Effect of AC Thickness on the AC Rut Depth as Function of Depth Within AC Layer

3.6 Influence of AC Mix Air Voids upon Permanent Deformation

3.6.1 Objective

The objective of this section is to study the effect of the in-situ AC air voids on the rut depth within the HMA layer.

3.6.2 Input Parameters

a. Traffic: Medium traffic volume (1000 AADTT)
b. Traffic Speed: 45 mph
c. Environment: Oklahoma
d. Depth to GWT: Medium (7 ft)
e. Pavement Cross-Section: Three layered system as shown in Figure 2.1
f. Layer properties:
    - AC layer: 4 inches
    - AC Mix Stiffness: Medium Stiff Mixture as shown in Table 2.6 and Figure 2.2
    - AC Mix Air Voids: 4, 7, and 10%
    - Granular Base layer: As shown in Table 2.9 and Figure 2.1
    - Subgrade: Medium Support (Mr=15,000 psi) as shown in Table 2.9
g. Depth to bedrock: No Bedrock present

3.6.3 Results

Figure 3.6-1 shows the amount of AC rut depth after 10 years of loading for the three levels of AC mix air voids used in the sensitivity study. The range of air voids used in the study reflects a realistic range under typical construction conditions (4% to 10%).

3.6.4 Discussion of Results

The results shown in the figure reflect the importance of air voids upon rutting in the AC layer. The in-place air voids of an asphalt mixture have an optimum value at which the minimum rutting will occur. It is a well known mixture design fundamental that when air voids fall below a threshold of 2 to 4%, plastic flow will occur. As the Design Guide model for AC rutting does not incorporate tertiary flow (plastic flow) consideration; users should be cautioned not to use design air voids less than 4 to 5% for in-situ condition. In reality, it is the mix Voids Filled with Bitumen parameter that directly influences the rutting potential. Thus, this sensitivity study is directly tied to air voids and the AC content. (Also see Study 3.7).

3.6.5 Summary and Conclusions

In summary, the air voids within an AC mixture are an important parameter to influence asphalt layer rutting. Increasing or decreasing the amount of air voids in the AC mix may significantly increase the amount of rut depth. For one thing, the influence of air voids shown in the figure is primarily a consequence of a lower mix stiffness (E*) resulting from a high level of air voids. While this is true, the AC rutting model does not incorporate the direct influence of higher air voids density in the calibrated model used. As a consequence, the true relationship of higher voids would probably result in an even higher level of rutting in the AC layer (at high air voids) than what is predicted by the Design Guide model.

Another real practical consideration that is not incorporated into the AC rutting model is the fact that tertiary shear flow, at air voids less than a threshold level of 2 to 4% is not built into the AC rut model. Thus real field AC rut depth on mixtures that have been densified, compacted to very low air voids; would also be expected to be greater than those shown in the figure.

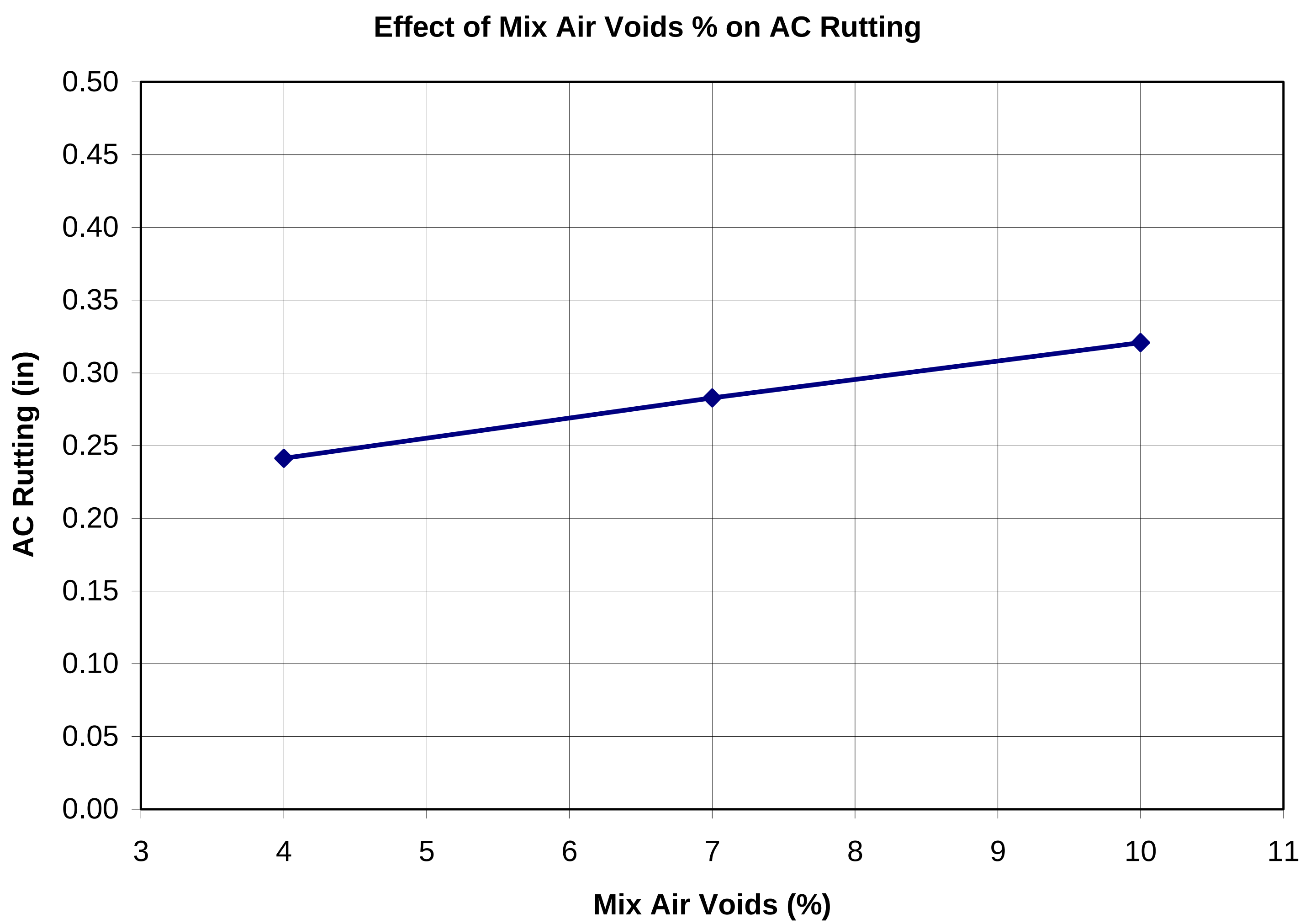

Figure 3.6-1 Effect of Percent AC Mix Air Voids on AC Rut Depth

3.7 Influence of Asphalt Content (Effective Bitumen Volume) Upon Permanent Deformation

3.7.1 Objective

The objective of this section is to study the influence of the magnitude of the effective bitumen volume present in an AC mixture upon the amount of permanent deformation occurring within the AC layer.

3.7.2 Input Parameters

a. Traffic: Medium traffic volume (1000 AADTT)
b. Traffic Speed: 45 mph
c. Environment: Oklahoma
d. Depth to GWT: Medium (7 ft)
e. Pavement Cross-Section: Three layered system as shown in Figure 2.1
f. Layer properties:
    - AC layer: 4 inches
    - AC Mix Stiffness: Medium Stiff Mixture as shown in Table 2.6 and Figure 2.2
    - AC Mix Effective Binder Content: 8, 11 and 15%
    - Granular Base layer: As shown in Table 2.9 and Figure 2.1
    - Subgrade: Medium Support (Mr=15,000 psi) as shown in Table 2.9
g. Depth to bedrock: No Bedrock present

3.7.3 Results

Figure 3.7-1 shows the amount of rut depth after 10 years of loading for three assumed values of effective bitumen volume (Vbe) within a given mix. The Vbe (%) value is approximately 2.0 to 2.2 times the numerical value of the AC content, in percentage form. Thus the ranges of Vbe investigated (8, 11 and 15 %) translate into approximate AC % values of 4%, 5+% and 7+%.

3.7.4 Discussion of Results

Like the previous study presented on the influence of mixture air voids, the influence of the amount of asphalt present in a mix also plays a significant role upon the amount of AC rut depth that may occur. It is observed from the figure that there is an increase in the amount of rut depth within the AC layer as the amount of the effective binder (or asphalt content) volume increases.

3.7.5 Summary and Conclusions

In summary, the amount of asphalt binder present in a mixture will directly influence the amount of AC rutting that will occur in the field. When the effective bitumen volume (amount of asphalt) is increased in a mix; the amount of rutting will be increased.

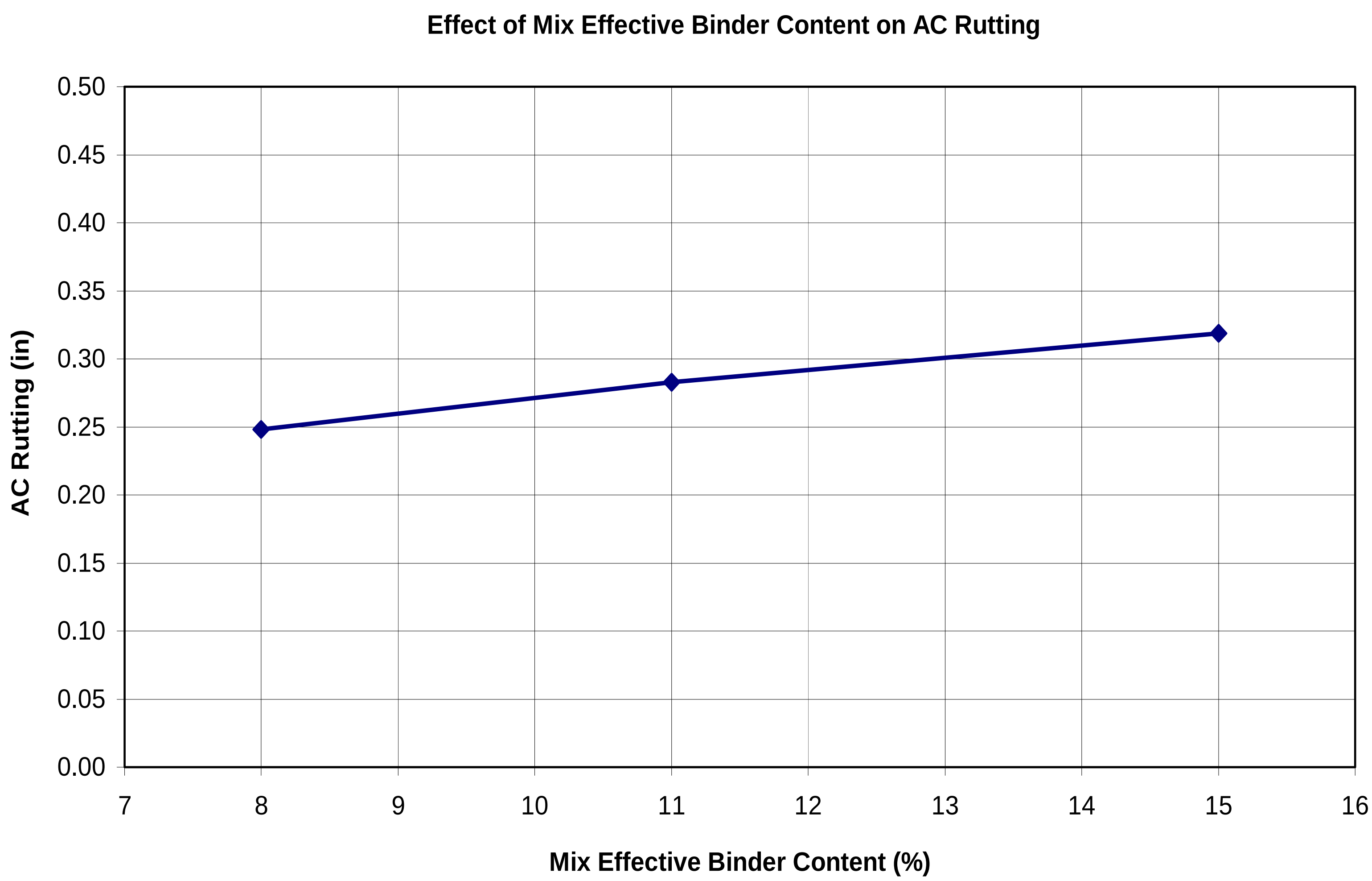

Figure 3.7-1 Effect of Percent AC Binder by volume on AC Rut Depth

3.8 Influence of MAAT upon Permanent Deformation

3.8.1 Objective

The objective of this section is to study the effect of MAAT on the rut depth within an AC layer.

3.8.2 Input Parameters

a. Traffic Volume: Medium (1000 AADTT)
b. Traffic Speed: 45 mph
c. Environment: (MAAT): Minnesota (46 deg F); Oklahoma (61 deg F) and Phoenix (74 deg F)
d. Depth to GWT: Medium (7 ft)
e. Pavement Cross-Section: Three layered system as shown in Figure 2.1
f. Layer properties:
    - AC layer: 4 inches
    - AC Mix Stiffness: High, Medium and Low Mixture Stiffnesses as shown in Table 2.6 and Figure 2.2
    - Granular Base layer: As shown in Table 2.9 and Figure 2.1
    - Subgrade: Medium Support (Mr=15,000 psi) as shown in Table 2.9
g. Depth to bedrock: No Bedrock present

3.8.3 Results

The full results of the sensitivity analysis concerning the influence of environmental location (MAAT) upon rut depth are shown in Figures 3.8-1. The amount of rut depth, within the AC layer, shown reflects 10 years of loading for the three levels of MAAT (geographic locations) investigated.

3.8.4 Discussion of Results

The results shown in Figure 3.8-1 are quite important relative to the selection of the appropriate level of AC mix stiffness (E*) as a function of the location where the pavement will be built. These results are very logical and mirror the practical experience historically gained with respect to the influence of mix stiffness relative to the specific design environment. The figure shows that, irrespective of the AC mix stiffness, the higher the MAAT the more rutting that will be expected in the AC layer. Very importantly, it also illustrates that as the mix stiffness increases the rutting will decrease. Finally, the rate of change in AC rutting as a function of the MAAT is shown to increase as the MAAT temperature is increased.

3.8.5 Summary and Conclusions

This study clearly demonstrates the influence of the mix stiffness and geographic location (environmental temperature) upon the rutting that will occur in an AC layer. This emphasizes the importance of a proper mix design and mixture selection within the structural design analysis.

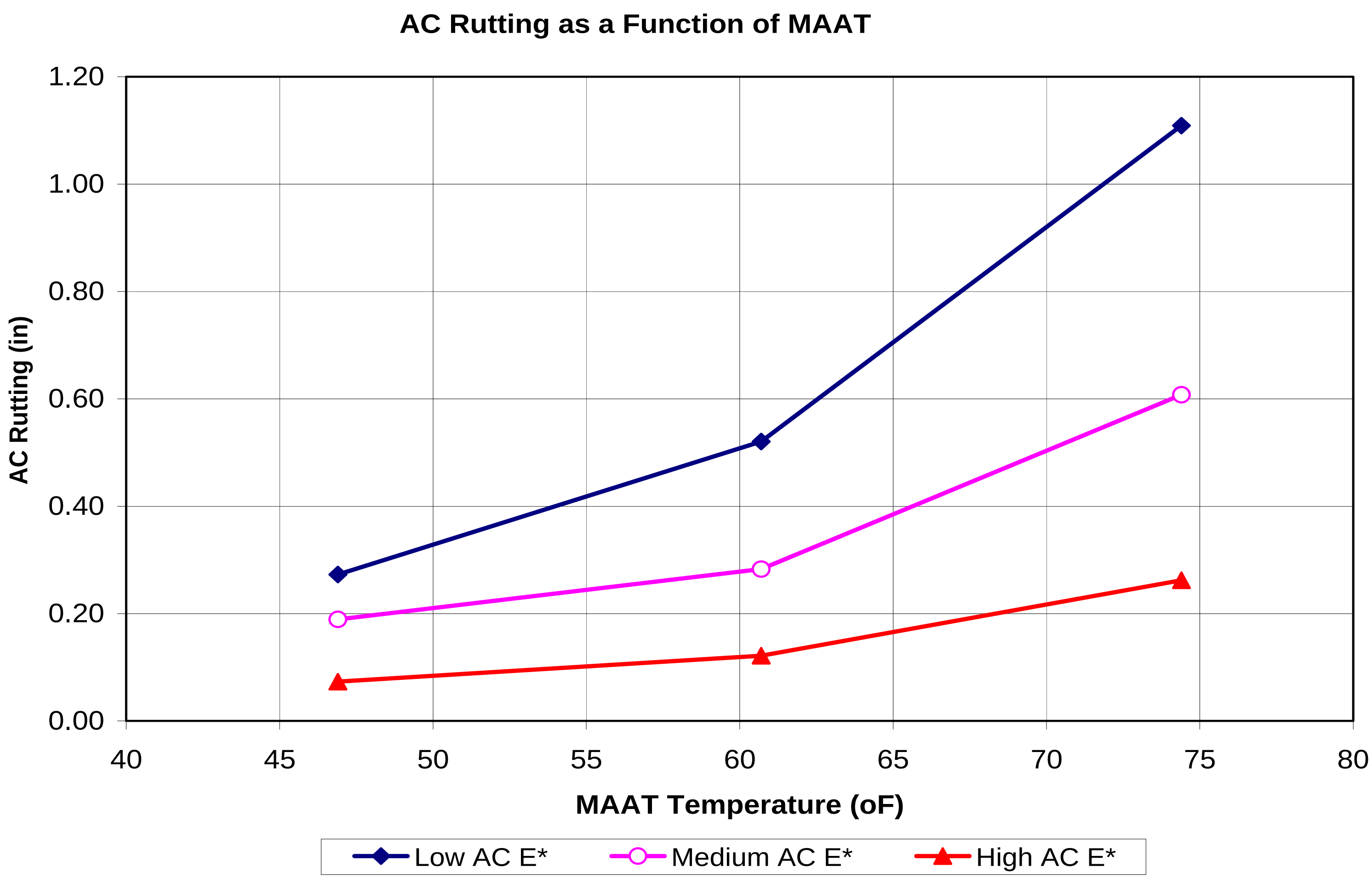

Figure 3.8-1 Effect of MAAT on AC Rut Depth

3.9 Influence of Base Thickness upon Permanent Deformation

3.9.1 Objective

The objective of this section is to study the effect of changing the base layer thickness within a flexible pavement upon the amount of rut depth occurring within each layer of the flexible pavement system.

3.9.2 Input Parameters

a. Traffic: Medium traffic volume (1000 AADTT)
b. Traffic Speed: 45 mph
c. Environment: Oklahoma
d. Depth to GWT: Medium (7 ft)
e. Pavement Cross-Section: Three layered system as shown in Figure 2.1
f. Layer properties:
   - AC layer: 4 inches
   - AC Mix Stiffness: Medium as shown in Table 2.6 and Figure 2.2
   - Granular Base layer: As shown in Table 2.9 and Figure 2.1
   - Granular Base thickness: 5,10 and 15 inches
   - Subgrade: Low – Medium – High support (Mr=3,000 psi; 15,000 psi and 30,000 psi) as shown in Table 2.9
g. Depth to bedrock: No bedrock was used.

3.9.3 Results

Figures 3.9-1, 3.9-2 and 3.9-3 show the amount of rut depth (after 10 years of loading) within the asphalt, base and subgrade layer respectively, as the base thickness is changed.

3.9.4 Discussion of Results

Asphalt Layer

It is clear from the plots that the effect of changing the base thickness on the AC rutting is negligible. This result is also true (for all practical purposes) as the subgrade type (modulus) is also changed. This finding reinforces the fundamental concept that rutting in the AC layer is principally only a function of the AC layer thickness, AC mix stiffness and traffic mix characteristics. As a general rule, the thickness and properties of the unbound base and subgrade do not significantly influence the rutting within the AC layer.

Base Layer

Figure 3.9-2 shows that the base rut depth will slightly increase as the base thickness is increased. This is realistic because as the layer thickness is increased, the layer rut depth, which is the product of the thickness and plastic strain, will directly increase due to the larger thickness.

Subgrade Layer
As one would logically surmise, the subgrade is the layer most impacted by changes in the base thickness. There are two fundamental mechanisms at work in this analysis. For small base thicknesses, the stress state in the subgrade creates a larger resilient strain in the subgrade. This, in turn, will lead to a larger resilient strain and larger plastic strain. The larger plastic strain will result in a larger rut depth in any subgrade type. The second factor at work is that, at a given base thickness, the resilient strain, plastic strain and hence rutting will become greater for lower subgrade modulus types.

3.9.5 Summary and Conclusions

Increasing the base layer thickness does not really help decrease the rutting in all layers. As the base / subbase layer is increased, the impact upon rutting in the AC layer is minimal to non-existent. Rutting should slightly increase in the base layer as the thickness of the base increases. This is directly due to the fact that a thicker layer of base material is now being subjected to repeated load deformation under traffic. Thus, all things being equal, the larger the base thickness; the larger the expected rutting will be in the base.

By far, the most significant impact of increasing the base / subbase thickness is that it will tend to protect the subgrade layer from a higher stress state that will tend to cause a larger resilient strain, plastic strain and eventually rutting. As the thickness of the base / subbase is increased; the subgrade rut depth will decrease. The amount of base / subbase thickness required to bring the subgrade into a tolerable rut depth range is a direct function of the quality of the subgrade being used. Greater thicknesses will be required for very low modulus layers will thinner sections will be required over stronger subgrades.

In summary, these important conclusions reinforce the basic historic premise of flexible pavement design which focused upon increasing the unbound base / subbase thickness in order to protect the shearing (rutting) deformations to occur in the subgrade.

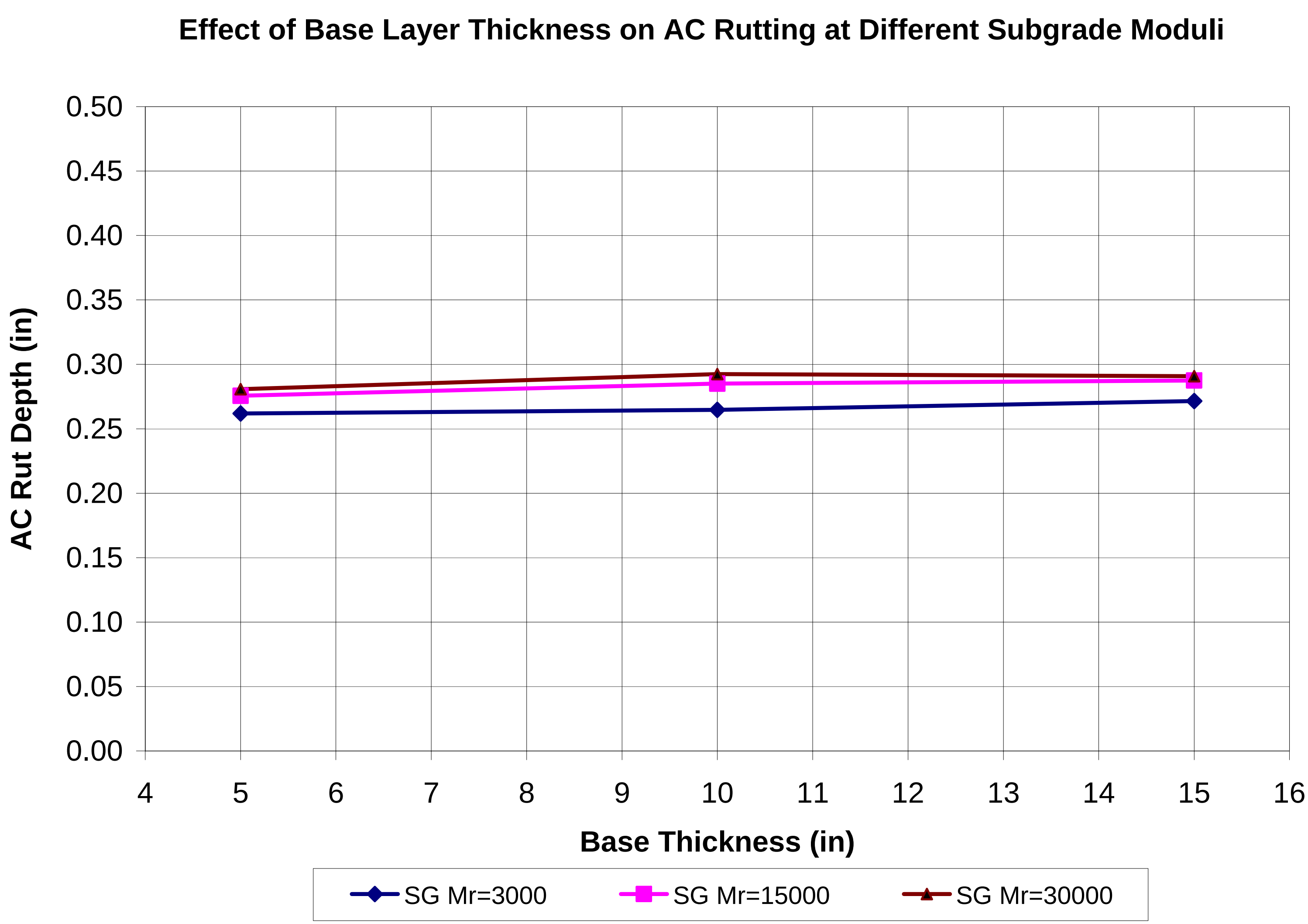

Figure 3.9-1 Effect of Base Thickness upon AC Rut Depth at Different Subgrade Moduli

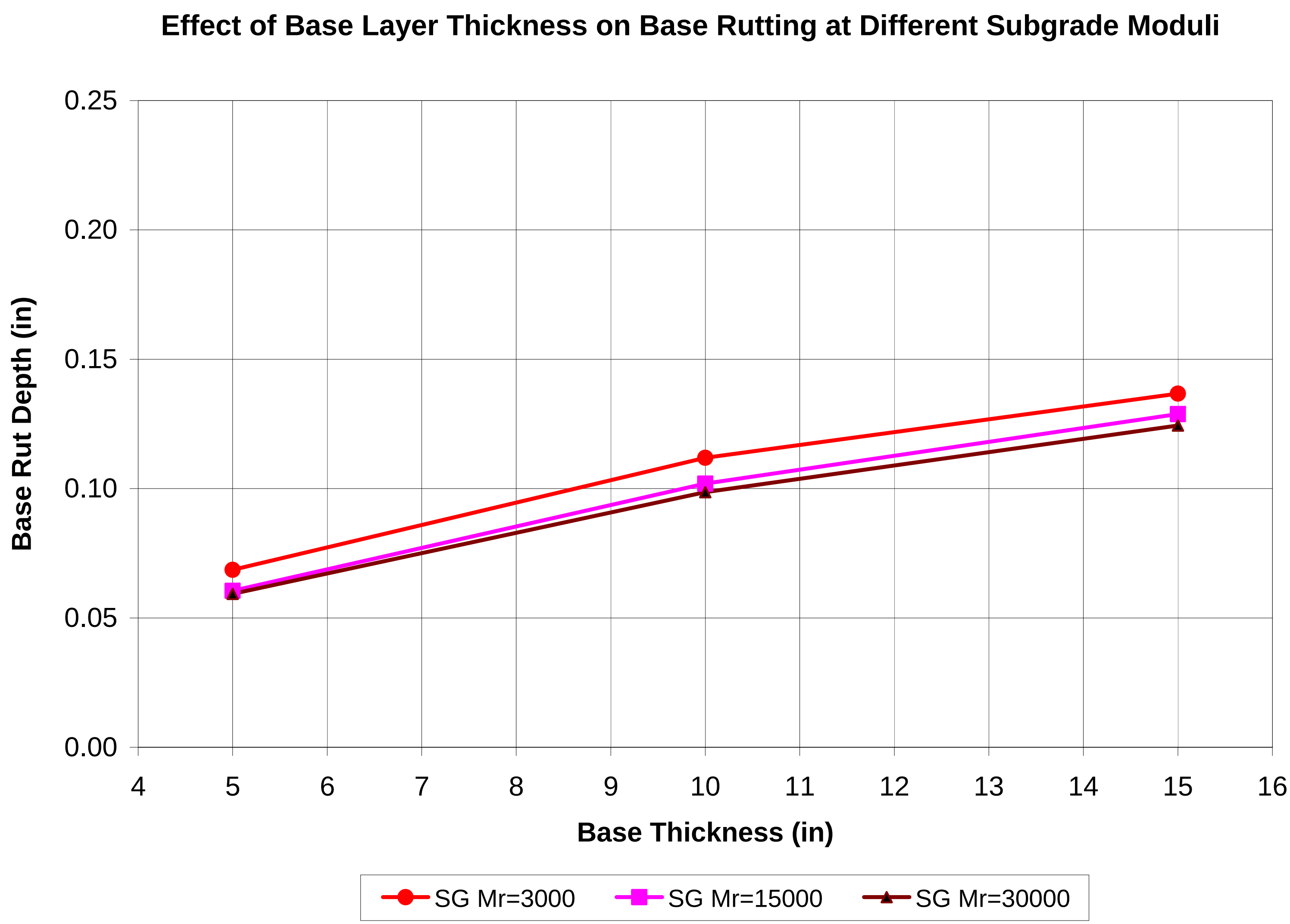

Figure 3.9-2 Effect of Base Thickness upon Base Rut Depth at Different Subgrade Moduli

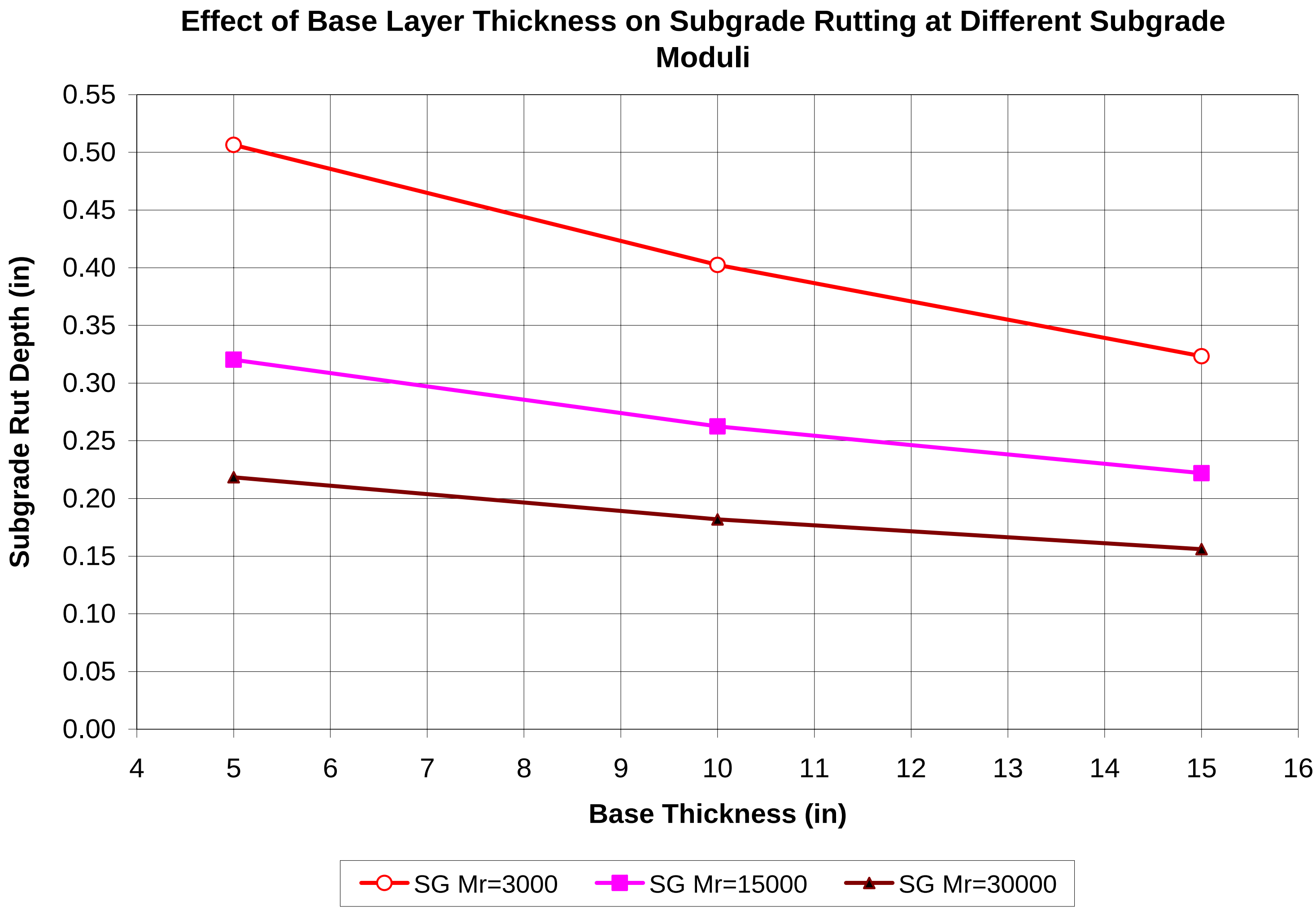

Figure 3.9-3 Effect of Base Thickness upon Subgrade Rut Depth at Different Subgrade Moduli

3.10 Influence of Base Quality upon Permanent Deformation

3.10.1 Objective

The objective of this section is to study the effect of changing the quality of the unbound base/subbase layer upon the amount of rut depth predicted in each layer of a flexible pavement system.

3.10.2 Input Parameters

a. Traffic: Medium traffic volume (1000 AADTT)
b. Traffic Speed: 45 mph
c. Environment: Oklahoma
d. Depth to GWT: Medium (7 ft)
e. Pavement Cross-Section: Three layered system as shown in Figure 2.1
f. Layer properties:
    - AC layer: 4 inch
    - AC Mix Stiffness: Medium as shown in Table 2.6 and Figure 2.2
    - Granular Base layer: As shown in Table 2.9 and Figure 2.1
    - Granular Base modulus: 20,000, 38,000 and 50,000 psi
    - Subgrade: Medium support used (Mr=15,000) as shown in Table 2.9
g. Depth to bedrock: No bedrock was used.

3.10.3 Results

Figures 3.10-1, 3.10-2 and 3.10-3 show the amount of rut depth (after 10 years of loading) as a function of the unbound base modulus, within the asphalt, base and subgrade layers respectively. In general, base modulus values of 20; 38 and 50 ksi used in the study are approximately equivalent to CBR vales of 25; 70 and 100+ %.

3.10.4 Discussion of Results

<u>Asphalt Layer</u>
As can be observed in Figure 3.10-1, the influence of base modulus upon the rutting within the AC layer is quite small. A slight reduction in the AC rutting can be seen as the unbound base quality is increased from 20,000 psi to 50,000 psi.

<u>Base Layer</u>
Figure 3.10-2 shows that the base rut depth decreases as the base quality is increased. This observation is reasonable and logical due to the fact that as the base course modulus increases, the resilient strain (and hence permanent strain) will be decreased in the

unbound layer. This, in turn, will result in less of a rut depth magnitude to occur in the layer.

Subgrade Layer
The change of rutting within the subgrade layer mirrors the influence of base quality upon rutting in the base layer itself. As the base quality is increased, stress and strain states in the subgrade layer are decreased. This results in a lower resilient strain state, lower permanent strain and subsequently a lower rutting level to occur. Because the range in stiffness for unbound base/subbase layers is not large (i.e., 20 ksi to 50 ksi); one should not expect a major (significant) change in rutting within the subgrade (foundation) layer to occur.

3.10.5 Summary and Conclusions

Increasing the unbound base modulus will tend to reduce the rutting in all pavement layers. However, the rate of change is not overly significant for any layer. The reason for this is due to the fact that the range in modulus expected for a wide range of unbound base/subbase material is not significant by itself (Mr= 20 ksi to 50 ksi).

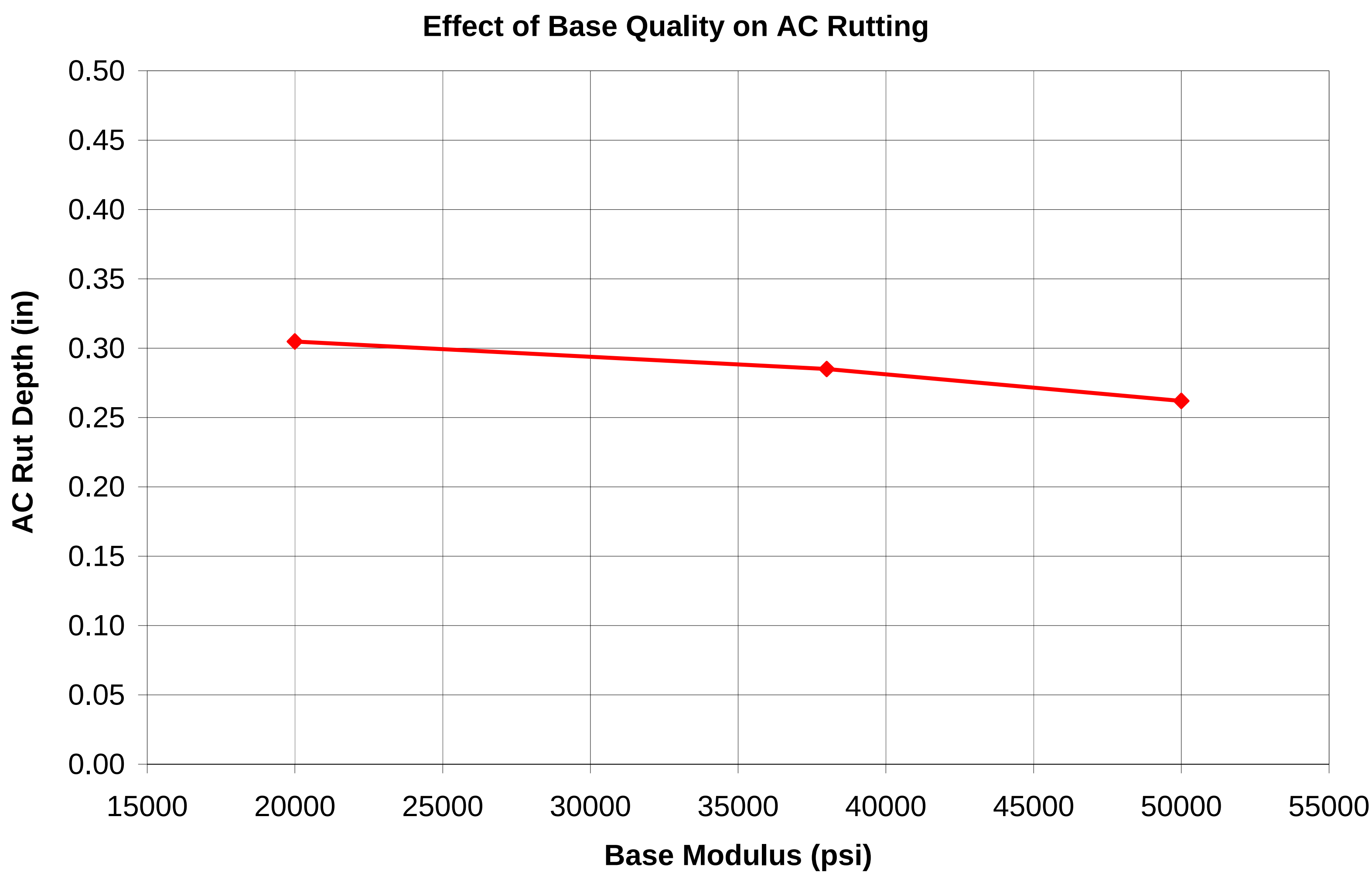

Figure 3.10-1 Effect of Base Quality upon AC Rut Depth

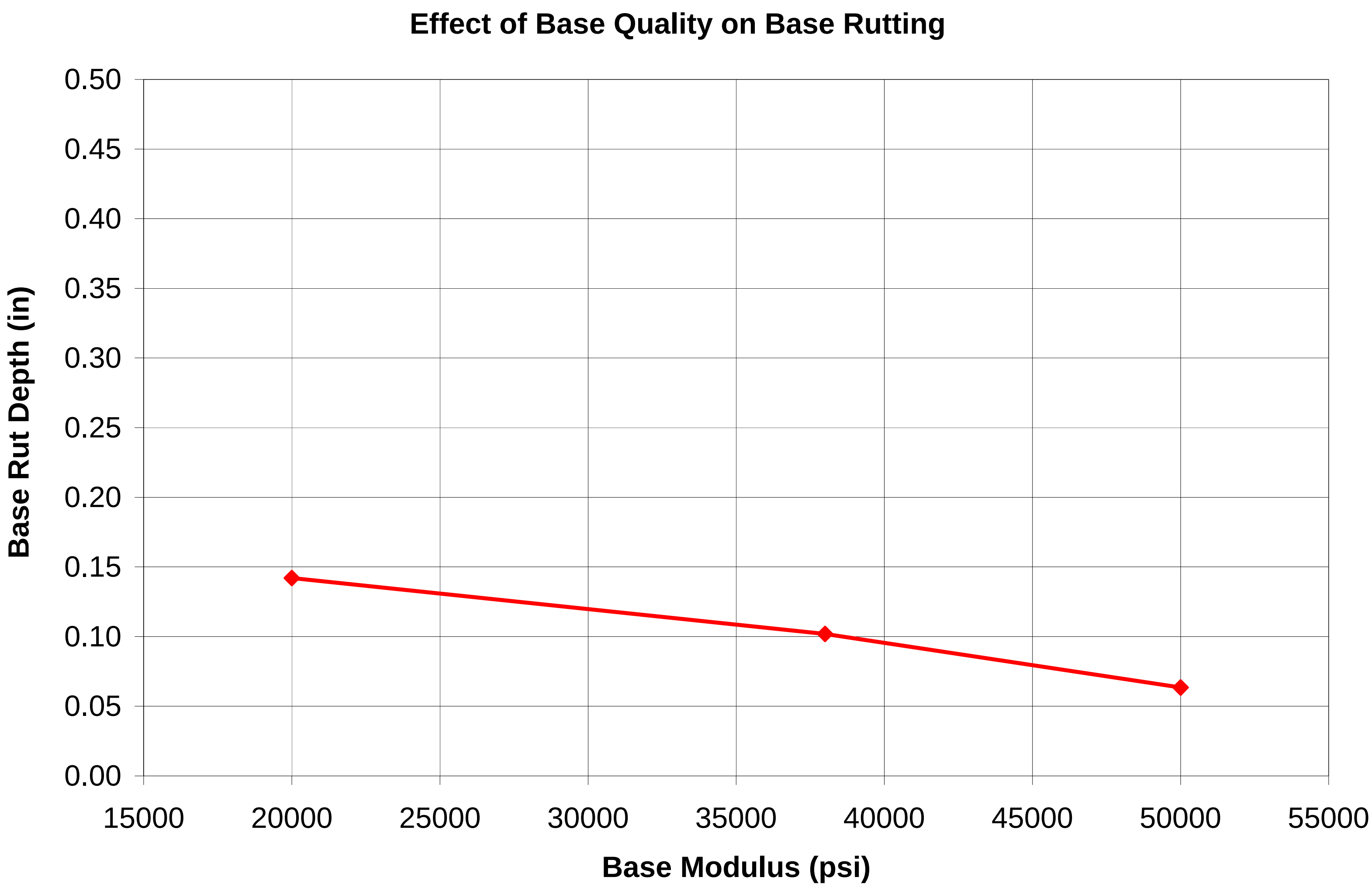

Figure 3.10-2 Effect of Base Quality upon Base Rut Depth

Figure 3.10-3 Effect of Base Quality upon Subgrade Rut Depth

3.11 Influence of Subgrade Modulus upon Permanent Deformation

3.11.1 Objective

The objective of this section is to study the effect of subgrade modulus on the amount of rut depth predicted in all layers of a flexible pavement structure.

3.11.2 Input Parameters

a. Traffic: Medium traffic volume (1000 AADTT)
b. Traffic Speed: 45 mph
c. Environment: Oklahoma
d. Depth to GWT: Medium (7 ft)
e. Pavement Cross-Section: Three layered system as shown in Figure 2.1
f. Layer properties:
   - AC layer: 4 inches
   - AC Mix Stiffness: Medium Stiff Mixture as shown in Table 2.6 and Figure 2.2
   - Granular Base layer: As shown in Table 2.9 and Figure 2.1
   - Subgrade: Three different subgrade support values used (Mr=30,000; 15,000 and 8,000 psi) as shown in Table 2.9
g. Depth to bedrock: No Bedrock present

3.11.3 Results

Figure 3.11-1 shows the amount of AC rut depth after 10 years of loading for the three levels of subgrade modulus used in the sensitivity study. While, Figure 3.11-2 shows the rutting in the base layers at the same levels of subgrade modulus. Figure 3.11-3 shows the same influence on the subgrade rut depth.

3.11.4 Discussion of Results

<u>Asphalt layer</u>
Figure 3.11-1 shows that there is not a significant influence of the subgrade modulus on the asphalt rut depth. This is entirely consistent with the general conclusion that the only significant factors influencing rutting within an AC layer are the AC thickness, AC mixture quality, and external traffic condition.

<u>Base layer</u>
Figure 3.11-2 clearly illustrates the fundamental fact that the stronger the foundation (subgrade) support of the pavement system becomes; the less the amount of base rut depth that will occur. The relative sensitivity of the amount of base rutting, due to variable subgrade support, is a function of many other design variables, such as: traffic

and thickness of the AC layer used in the cross section. Nonetheless, for all other conditions being constant, as the subgrade modulus increases, rutting within the base layer should also decrease slightly. This is directly due to the fact that increasing the subgrade modulus will decrease the deviatoric stress state in the base layer. This will lead to a lower elastic strain and lower rut level to occur in the base layer. As can be observed the magnitude of the rut depth decrease is not overly significant within the base layer.

Subgrade layer
As one would intuitively surmise, the influence of the subgrade modulus plays a very significant role in the prediction of rutting within the subgrade. Decreases in the subgrade stiffness will lead to rather significant increases in the subgrade layer rutting. This is directly due to the fact that resilient subgrade strains are inversely proportional to the subgrade modulus value by Hooke's law. Thus for an Esg = 3000 psi, one would anticipate an approximate strain 10 times as large as a subgrade having a modulus of 30,000 psi. This large resilient subgrade strain for the low stiffness subgrade would result in plastic strain in the order of 10 times as large as those found in a stiffer subgrade.

3.11.5 Summary and Conclusions

Decreasing the subgrade support modulus will result in an increased level of base and subgrade rut depth in any pavement system. The impact of subgrade support upon the asphalt layer rut depth should not be significant. By far, the greatest impact of subgrade support will focus upon the rutting observed within the subgrade layer itself. The sensitivity of subgrade support to the magnitude of rut depth is also a function of many other design input parameters as well.

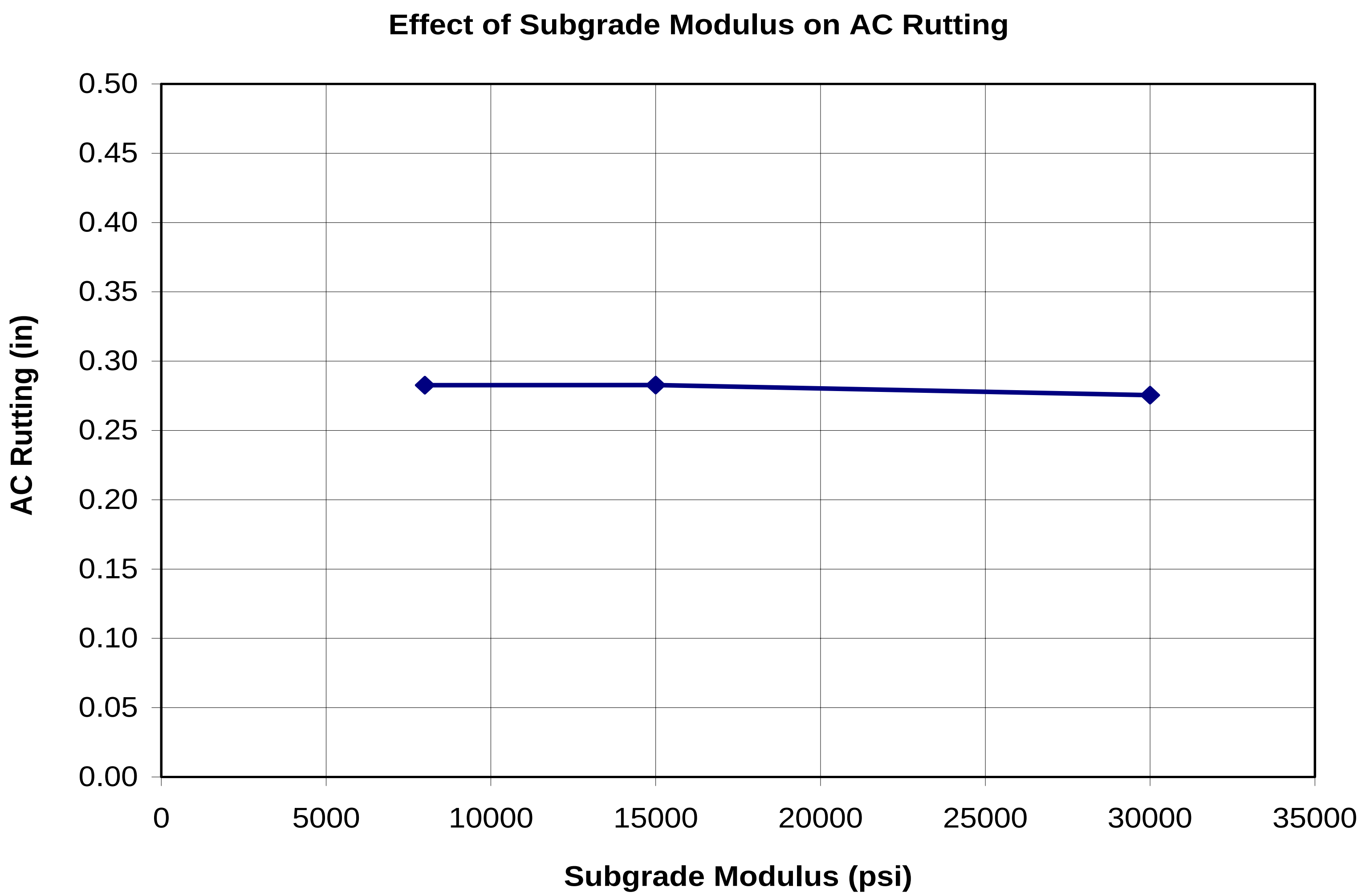

Figure 3.11-1 Effect of Subgrade Modulus on AC Rut Depth

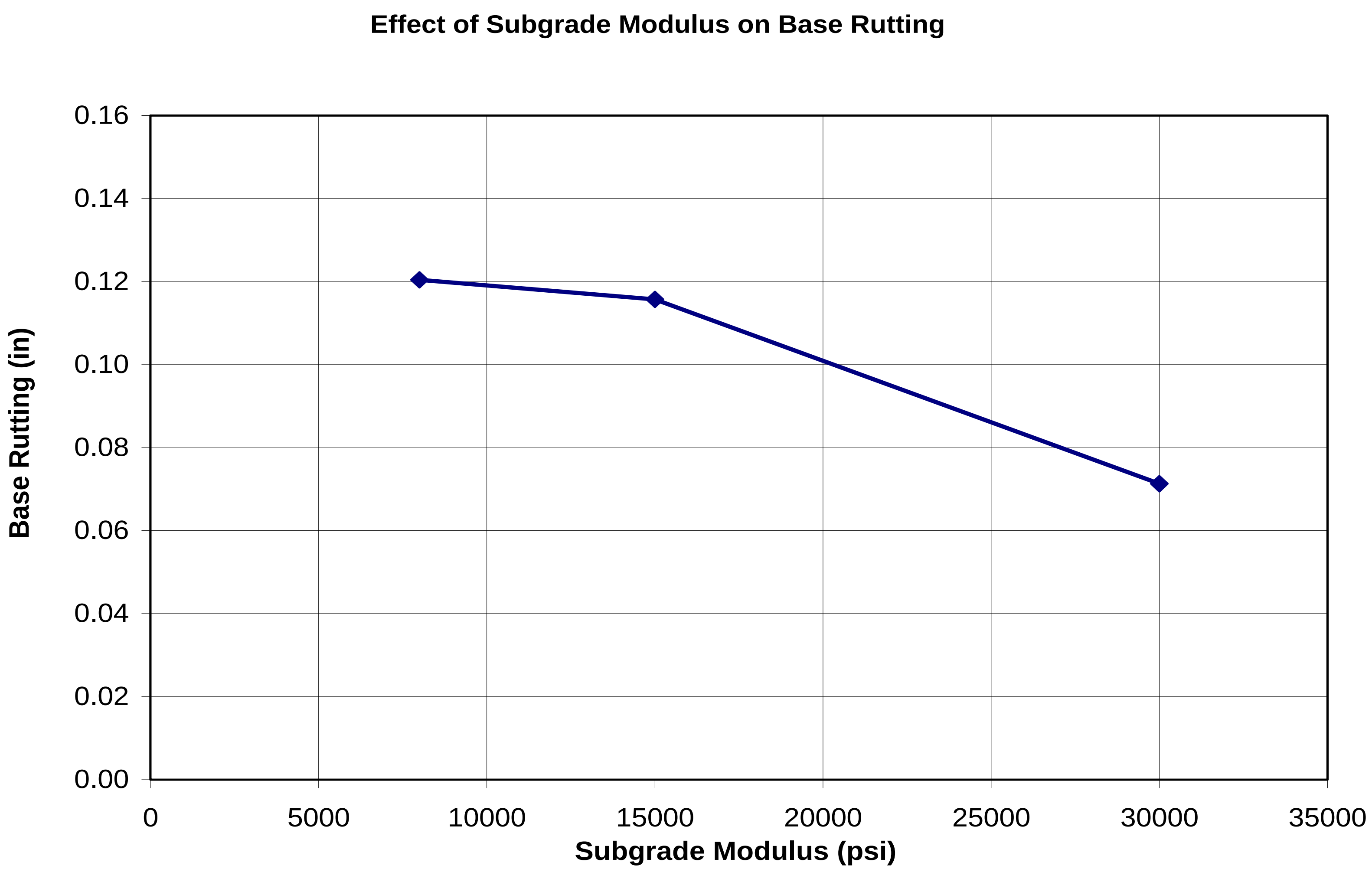

Figure 3.11-2 Effect of Subgrade Modulus on Base Rut Depth

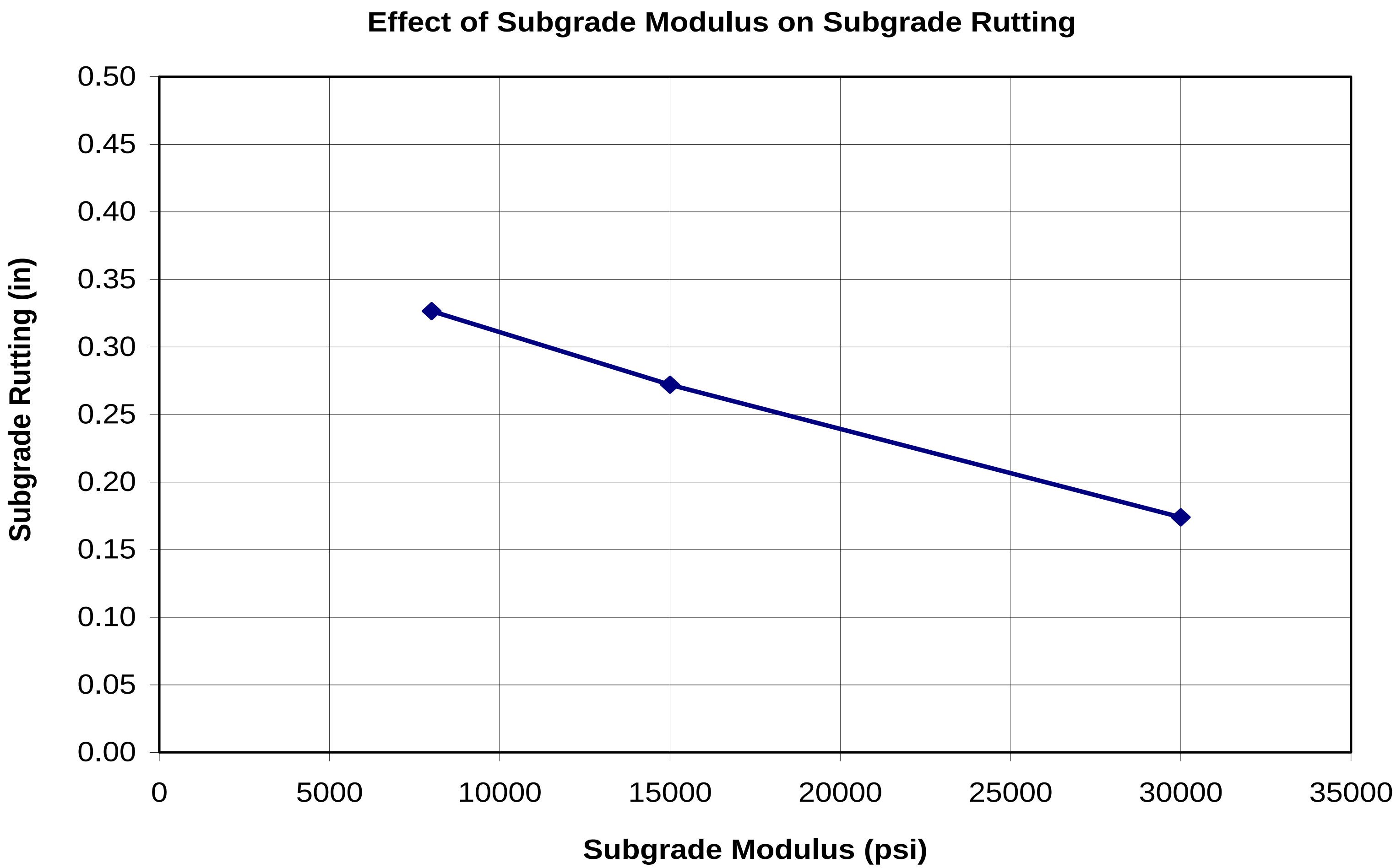

Figure 3.11-3 Effect of Subgrade Modulus on Subgrade Rut Depth

3.12 Influence of Truck Traffic Volume upon Permanent Deformation

3.12.1 Objective

The objective of this section is to investigate the influence of the truck traffic volume upon rut depth in all layers of the flexible pavement structure.

3.12.2 Input Parameters

a. Traffic Volume (AADTT): 100, 1000 and 7000
b. Traffic Speed: 45 mph
c. Environment: Oklahoma
d. Depth to GWT: Medium (7 ft)
e. Pavement Cross-Section: Three layered system as shown in Figure 2.1
f. Layer properties:
   - AC layer: 4 inches
   - AC Mix Stiffness: Medium Stiff Mixture as shown in Table 2.6 and Figure 2.2
   - Granular Base layer: As shown in Table 2.9 and Figure 2.1
   - Subgrade: Medium Support (Mr=15,000 psi) as shown in Table 2.9
g. Depth to bedrock: No Bedrock present

3.12.3 Results

Figures 3.12-1, 3.12-2 and 3.12-3 show the amount of AC, base and subgrade rut depth, respectively, after 10 years of loading for three levels of truck traffic volume expressed in AADTT (Average Annual Daily Truck Traffic). These levels of truck volumes approximately equate to: 200,000; 2,000,000 and 100,000,000 ESALs respectively.

3.12.4 Discussion of Results

It can be observed from the figures that, as one would intuitively surmise, the magnitude of the truck volume plays a very significant role upon the amount of rutting that occurs in the pavement system. As traffic volume (AADTT) increases, the amount of rut depth increases in a very significant fashion.

The rutting in the AC layer is especially affected by the truck volume. Differences between the low volume (AADTT = 100 / ESAL = 200,000) and the high volume condition (AADTT = 7000 / ESAL = 100,000,000) yields an increase of about 700 % for AC rutting. In contrast, the rutting levels in the base and subgrade doubled for the high traffic level.

3.12.5 Summary and Conclusions

Increasing the truck traffic volume (AADTT) increases the amount of rut depth in all pavement layers. In essence, the parameter of truck traffic (volume), or ESALs, is an extremely sensitive parameter to rutting within the AC layer. While rutting in the unbound layers is significant with truck traffic increases; it is nowhere near as sensitive compared to the AC rutting.

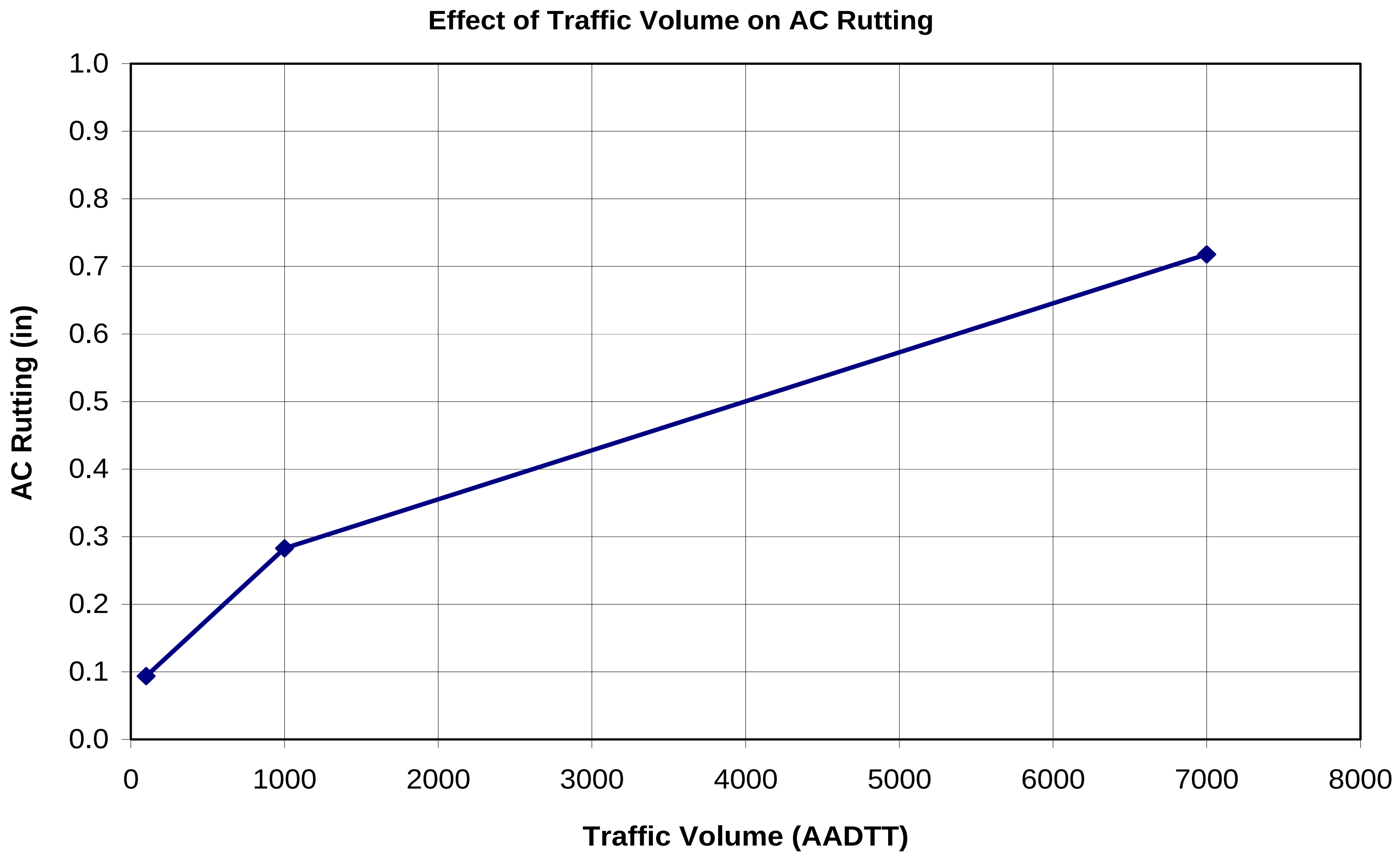

Figure 3.12-1 Effect of Truck Traffic Volume on AC Rut Depth

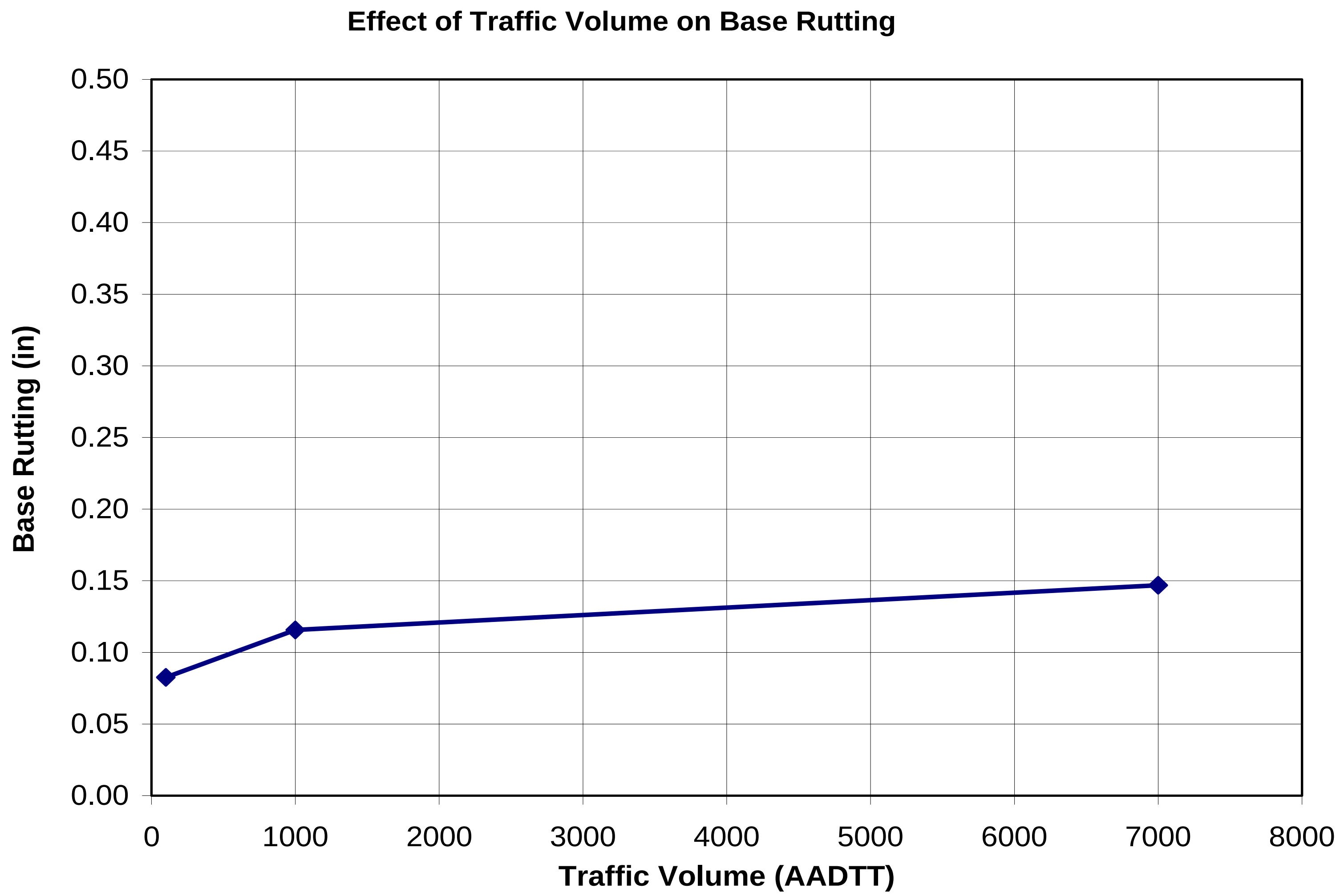

Figure 3.12-2 Effect of Truck Traffic Volume on Base Rut Depth

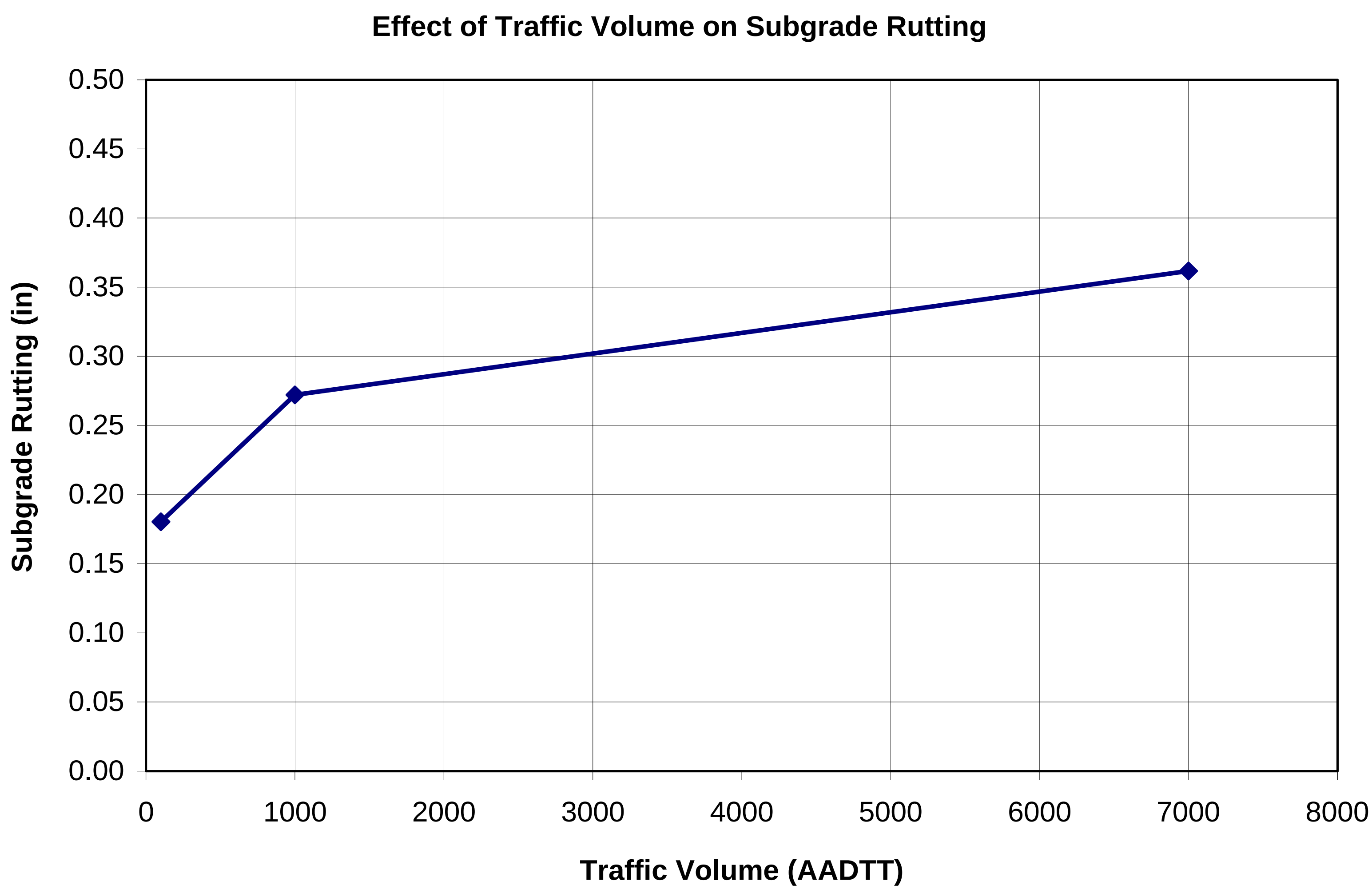

Figure 3.12-3 Effect of Truck Traffic Volume on Subgrade Rut Depth

3.13 Influence of Traffic Speed upon Permanent Deformation

3.13.1 Objective

The objective of this section is to study the effect of traffic speed on rut depth within all layers of an asphalt pavement.

3.13.2 Input Parameters

a. Traffic: Medium traffic volume (1000 AADTT)
b. Traffic Speed: 2, 45 and 60 mph
c. Environment: Oklahoma (for variable level subgrade support study); Minnesota (for supplemental studies of Hac thickness effect)
d. Depth to GWT: Medium (7 ft)
e. Pavement Cross-Section: Three layered system as shown in Figure 2.1
f. Layer properties:
   - AC layer: 4 inches
   - AC Mix Stiffness: Medium Stiff Mixture as shown in Table 2.6 and Figure 2.2
   - Granular Base layer: As shown in Table 2.9 and Figure 2.1
   - Subgrade: Medium support (Mr=15,000 psi) as shown in Table 2.9
g. Depth to bedrock: No Bedrock present

3.13.3 Results

Figures 3.13-1, 3.13-2 and 3.13-3 show the results of the sensitivity study relative to traffic speed upon rut depth in the asphalt, base and subgrade layers respectively. The figures contain results of the amount of rut depth after 10 years of loading for three levels of traffic speed (2 mph to 60 mph) evaluated.

3.13.4 Discussion of Results

<u>Asphalt layer</u>
The influence of the traffic speed is a very important design consideration for the AC layer. The reason for this is that the vehicle speed possesses a significant impact on the AC mix stiffness as the time rate of load (vehicle speed and frequency) is changed. As the speed is decreased, the time of load increases and the AC modulus is decreased. In turn, a reduction in the modulus results in an increase in the AC rut depth. This is very clearly noted in Figure 3.13-1. At high speeds the mix behaves stiffer and the rutting is less. In general, it should also be recognized that as one proceeds at greater depths within the AC layer, the time load will increase and the influence of speed will also be increased.

Base layer
As noted in Figure 3.13-2, there is no significant influence of vehicle speed upon rutting within the base. The only influence that will lead to speed changes in the base course are, in reality, due to stiffness changes and/or thickness changes in the AC layer itself. As the AC modulus decreases, the stress and strain state within the unbound base layer may be slightly increased. This will lead to a slight, but insignificant increase in base rutting at very low creep speeds. Finally, it should be noted that because the base course is modeled as a linear elastic material (in contrast to a visco-elastic material) there are no time dependent effects upon the modulus of the unbound granular base/subbase. This assumption is in excellent agreement with actual field behavior for almost all granular base/subbase layers.

Subgrade layer
Figure 3.13-3 illustrates a slight decrease in subgrade rutting as a function of vehicle speed. The pattern shown in this figure is simply explained by the changes in stress-resilient strain-plastic strain states caused by changes in the AC stiffness with speed. Unlike base/subbase layer materials; subgrades (particularly cohesive) actually exhibit some form of visco-elastic (time rate) dependent moduli in the field. This time dependency of these soils is not accounted for in the material model used in the Design Guide. Thus, a more time dependent influence of vehicle speed (similar to AC layer) probably truly occurs in the field but is not considered in the current methodology.

3.13.5 Summary and Conclusions

As a general conclusion, changes in the vehicular operational speed, will tend to be very significant on the amount of rutting occurring within the asphalt layer. However, they may not be very significant for the base and subgrade layers.

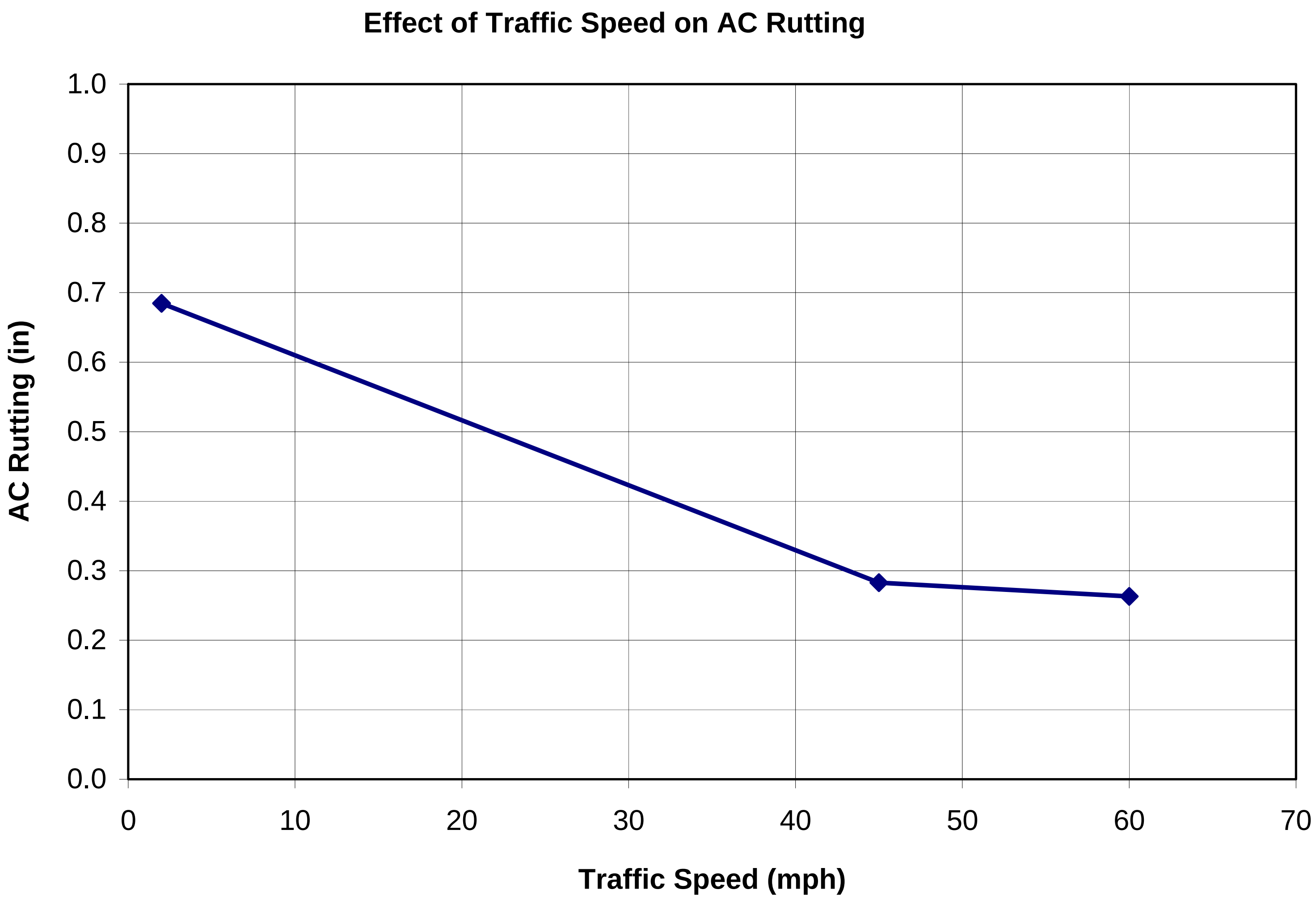

Figure 3.13-1 Effect of Traffic Speed on AC Rut Depth

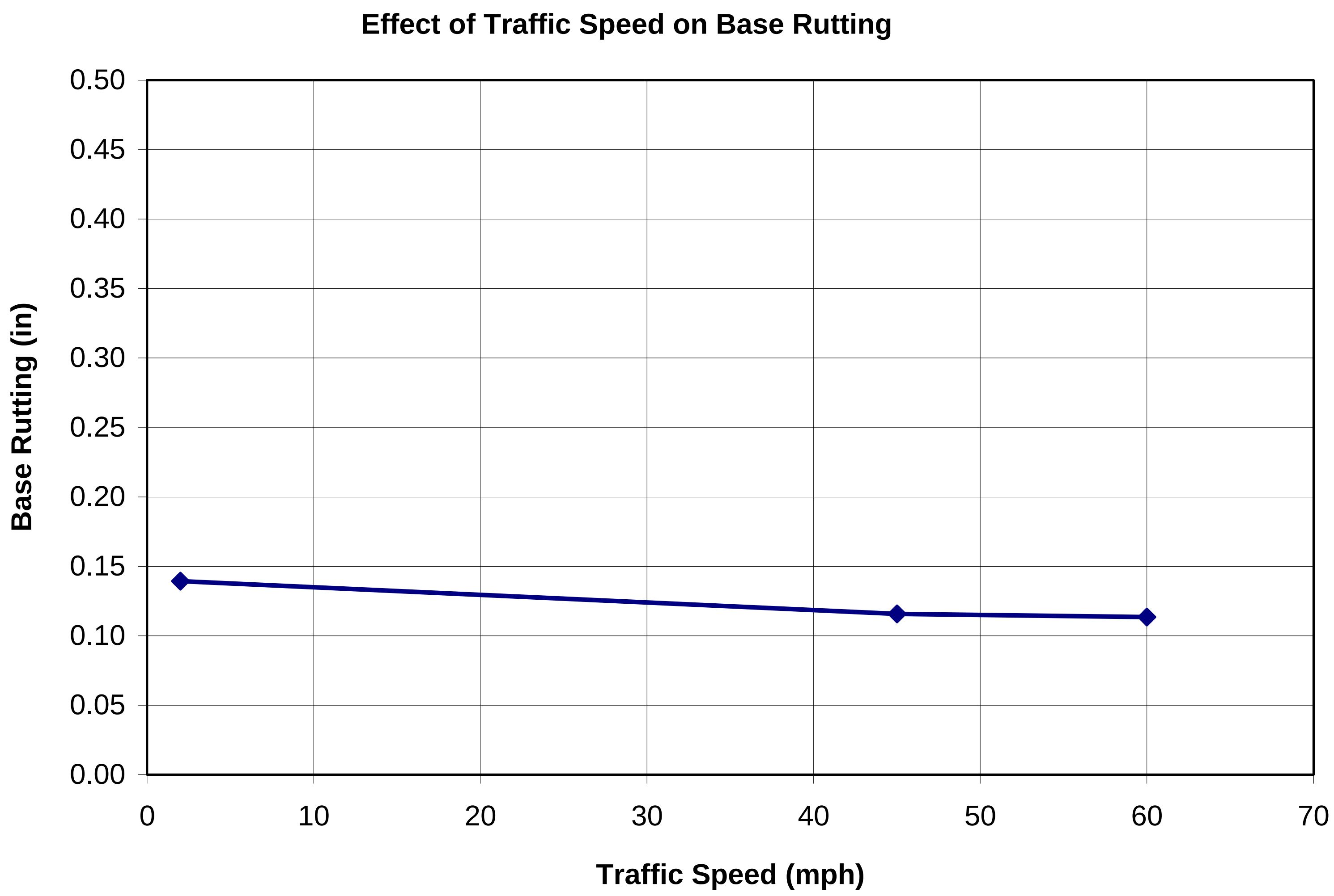

Figure 3.13-2 Effect of Traffic Speed on Base Rut Depth

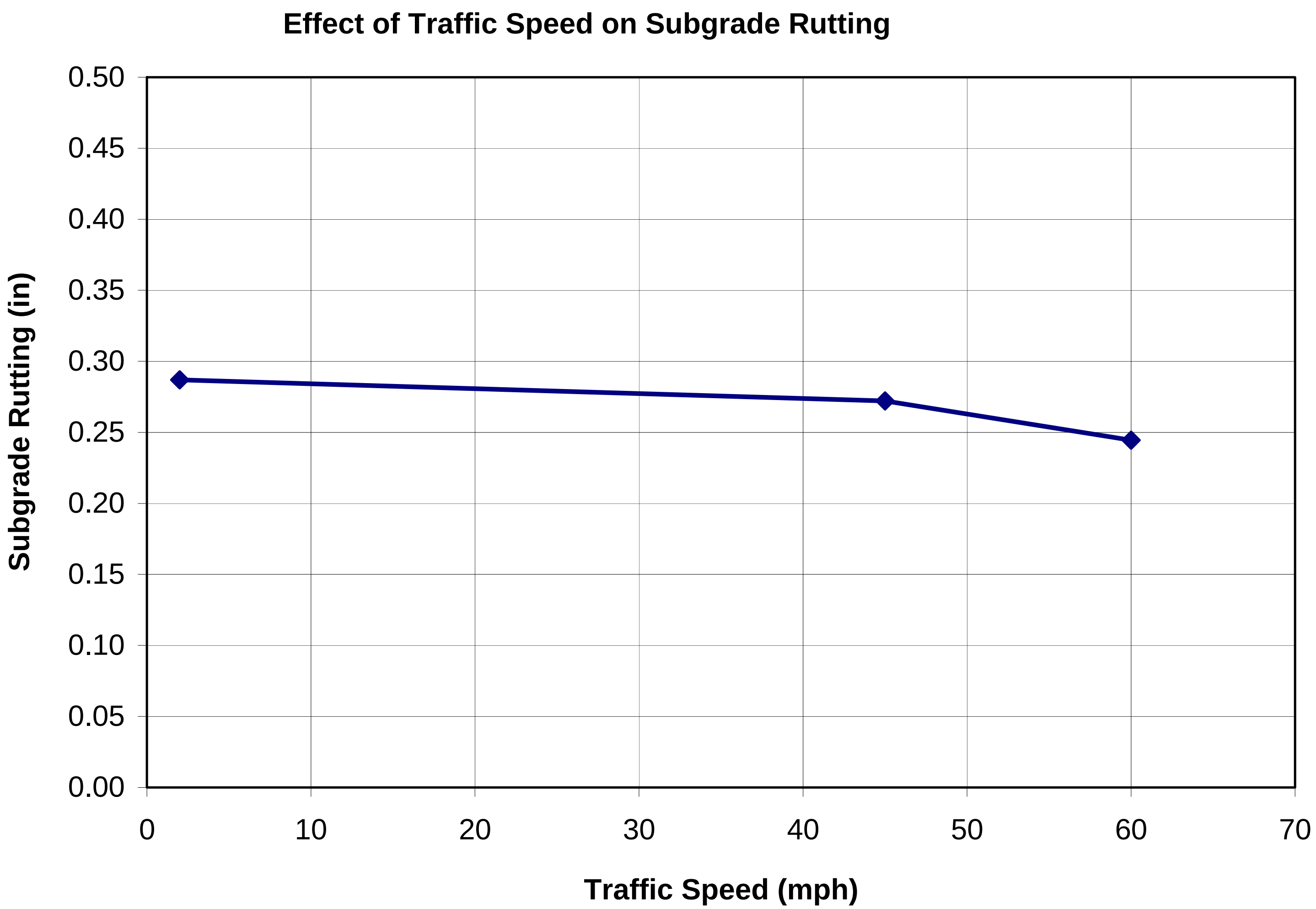

Figure 3.13-3 Effect of Traffic Speed on Subgrade Rut Depth

3.14 Influence of Traffic Analysis Level upon Permanent Deformation

3.14.1 Objective

The objective of this section is to investigate the influence of Hierarchical Traffic Level used in the analysis upon the amount of rut depth predicted in all layers of a flexible pavement system.

3.14.2 Input Parameters

a. Traffic Volume: See discussion in 3.14.3 "Results" section below
b. Traffic Speed: 45 mph
c. Environment: Oklahoma (61 deg F)
d. Depth to GWT: Medium (7 ft)
e. Pavement Cross-Section: Three layered system as shown in Figure 2.1
f. Layer properties:
    - AC layer: 4 inches
    - AC Mix Stiffness: Medium Stiff Mixture as shown in Table 2.6 and Figure 2.2
    - Granular Base layer: As shown in Table 2.9 and Figure 2.1
    - Subgrade: Medium Support (Mr=15,000 psi) as shown in Table 2.9
g. Depth to bedrock: No Bedrock present

3.14.3 Results

Figure 3.14-1, 3.14-2 and 3.14-3 shows the impact of the Hierarchical Traffic Level approach selected upon the relationship of the amount of rut depth (after 10 years of loading) for a range of traffic volumes (distributions) for the asphalt, base and subgrade layers respectively. In this plot, three specific traffic distributions (volumes) were investigated. For the Traffic Level 1 approach, the actual traffic load axle spectrums were used as input into the Design Guide program. The load spectrum approach used the input traffic assumptions noted in Tables 2.2 to 2.5. The rutting results using the Level 1 approach, for each of the three traffic volumes, are denoted as the "Load Spectra" results in the plot. For each of the three axle load spectrum distributions; the mixture axle type-load combinations were then transformed into Equivalent 18 Kip Single Axle Load repetitions (ESALs) through the use of conventional AASHTO truck damage factors, defined at a pt=2.5 and SN=5. The approximate cumulative 10-year ESAL values have been noted in Table 2.1.

3.14.4 Discussion of Results

The rut depth results shown in Figure 3.14-1, 3.14-2 and 3.14-3 clearly indicate that the use of actual traffic load spectra, in the structural distress prediction model, results in a substantial difference in predicted rutting, compared to the use of the empirical ESAL approach to traffic that has been historically used in pavement design. This result appears to be consistent for rutting within all three layers evaluated (AC, base and subgrade). As observed within all three figures, it can be seen that rut depths predicted within the traffic load spectra approach (Level 1) appear to yield about 50% to 60% more rutting compared to the use of E18KSAL's.

3.14.5 Summary and Conclusions

The use of a Level 1 traffic approach, based upon the actual traffic load spectra, yields a much higher level of rutting compared to the classical use of E18KSAL's.

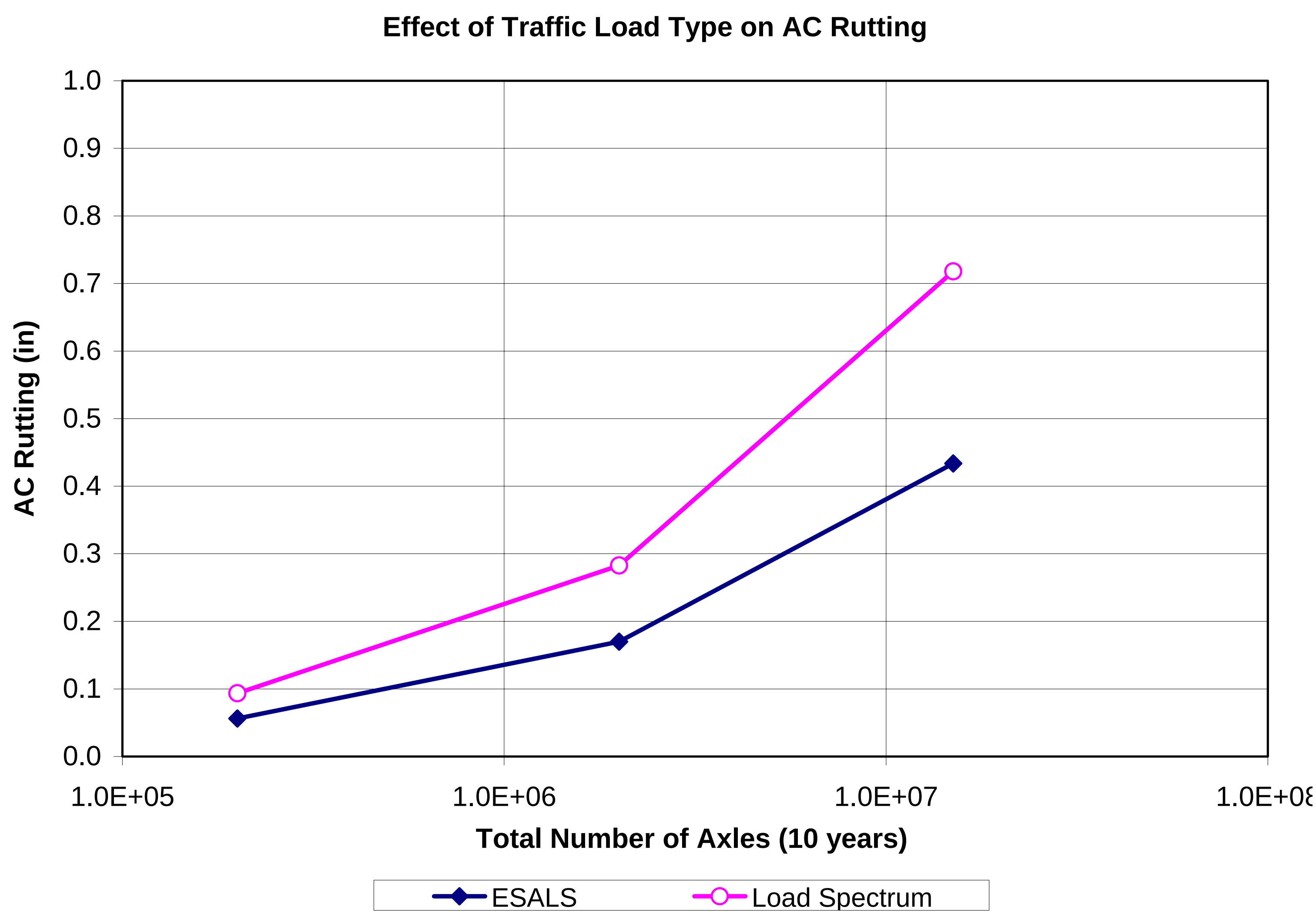

Figure 3.14-1 Effect of Traffic Analysis Level upon AC Rut Depth

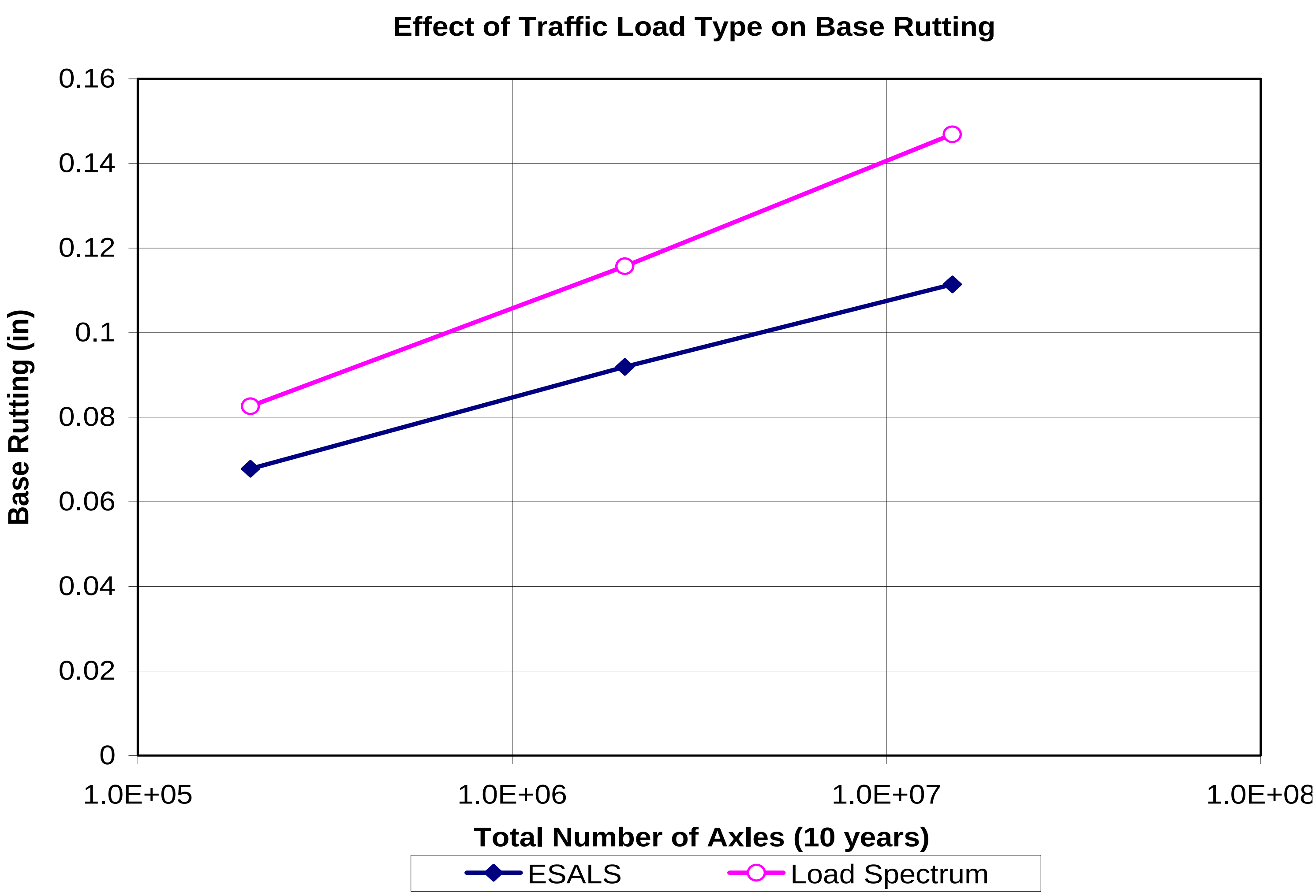

Figure 3.14-2 Effect of Traffic Analysis Level upon Base Rut Depth

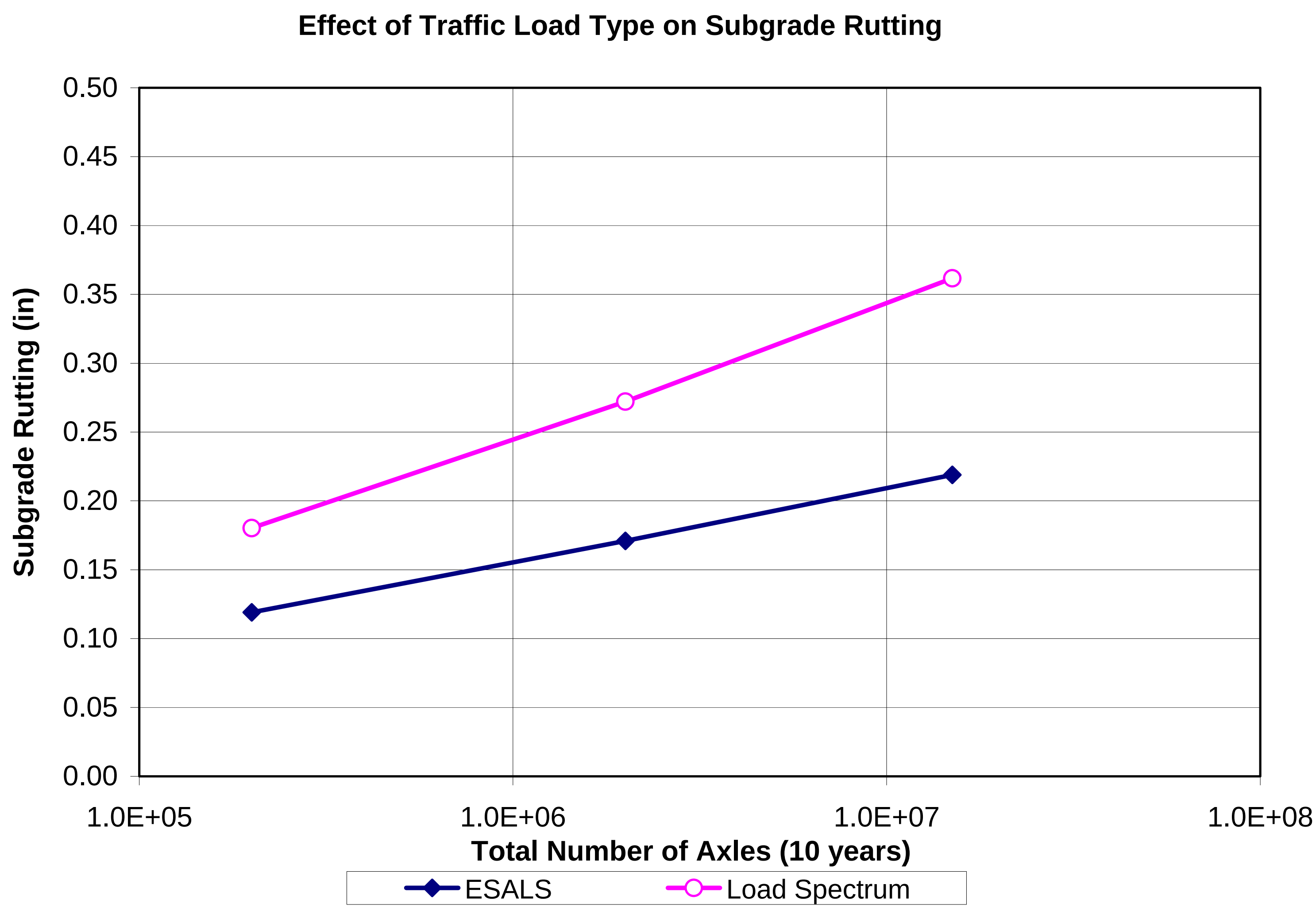

Figure 3.14-3 Effect of Traffic Analysis Level upon Subgrade Rut Depth

3.15 Influence of Traffic Wander upon Permanent Deformation

3.15.1 Objective

The objective of this section is to investigate the influence of the degree of lateral vehicle wander upon the radial and vertical distribution of rutting within all layers of a flexible pavement system.

3.15.2 Input Parameters

a. Traffic: Medium traffic volume (1000 AADTT)
b. Traffic Speed: 45 mph
c. Traffic Wander = 0, 10, 20 inches
d. Environment: Oklahoma (61 deg F)
e. Depth to GWT: Medium (7 ft)
f. Pavement Cross-Section: Three layered system as shown in Figure 2.1
g. Layer properties:
   - AC layer: 4 inches
   - AC Mix Stiffness: Medium Stiff Mixture as shown in Table 2.6 and Figure 2.2
   - Granular Base layer: As shown in Table 2.9 and Figure 2.1
   - Subgrade: Medium Support (Mr=15,000 psi) as shown in Table 2.9
h. Depth to bedrock: No Bedrock present

3.15.3 Results

Figure 3.15-1, 3.15-2 and 3.15-3 show the impact of the vehicle lateral traffic wander magnitude selected upon the relationship of the amount of rut depth (after 10 years of loading), in a radial (transverse) direction, for the asphalt, base and subgrade layers respectively. Figures 3.15-4, 3-15-5 and 3.15-6 show the maximum layer depths as a function of the lateral wander. In this study, three specific traffic wanders (standard deviation for assumed normal distribution curves) were investigated. They were : wander = 0 inches (no wander); 10 inches (realistic assumption for current primary-interstate traffic) and 20 inches.

3.15.4 Discussion of Results

<u>Transverse (Radial) Influence</u>

Figures 3.15-1 thru 4 provide a very important look at the influence of traffic vehicle wander upon the transverse distribution of each layer rutting. For rutting within the AC layer, it is observed that rutting basins are quite small, particularly as the wander

magnitude is very small. As the wander is increased, the width of the rutting basin gradually is increased. The major impact of the wander magnitude to the maximum rutting should not be lost upon the reader as the assumption of the precise magnitude of the wander in a design consideration will be one of the more significant design considerations in the distress prediction mode.

As one proceeds into rutting within the base layer; several important considerations should be noted. First, the rutting basin width becomes larger, compared to the Ac rut basin. This is a natural consequence of the fact that the width of the stress pulse becomes larger as one proceeds with depth into the flexible pavement system. Additionally, one notes that a single modal rut depth distribution curve starts appearing, even at very low wander deviations.

Finally, for the plot of transverse rutting within the subgrade layer; it should be noticed that the rutting basin widths are even greater than those observed for the base and Ac layer. As one proceeds deeper into the pavement system, the influence of stress overlap principles to obtain highly symmetric and uni-modal rut distribution curves are highly evident.

Maximum Layer Rutting Versus Wander Magnitude

Figures 3.15-4 to –6 show the influence of the magnitude of the lateral wander assumed as a function of the maximum rut depth predicted within each pavement layer. The reader can quickly surmise that the wander magnitude becomes a very important consideration in the design process for the AC rutting predictions. Using the commonly accepted wander effect of 10 inches will lead to AC rut depth predictions of almost 50% of the rutting predicted without considering any wander. Hence, selection of the correct wander value is of paramount importance to accurately predict rutting in any AC layer. This finding should also point out the extreme need to properly document load wander used in any ALF (Accelerated Loading Facilities) to model pavement distress and performance behavior.

Viewing the figures for the base and subgrade conditions; it is observed that the wander becomes less significant upon rutting compared to the AC layer. Figures 3.15-5 and –6 clearly show that there is only a minor, if any, practical impact upon the maximum layer rut depth as one proceeds into deeper pavement layers.

3.15.5 Summary and Conclusions

The value of vehicular traffic wander that is assumed in the Design Guide analysis, for a flexible pavement system, is an important design consideration. This is predominantly true for the accurate predictions of rutting within AC layers. In general, as the magnitude of lateral wander is increased, the maximum predicted rut depth will decrease. As one proceeds into layers found deeper in the pavement structure; the impact of lateral wander is significantly reduced. The selection of an appropriate wander value will also be a factor in dictating the width of the rut basin (transverse) that will occur.

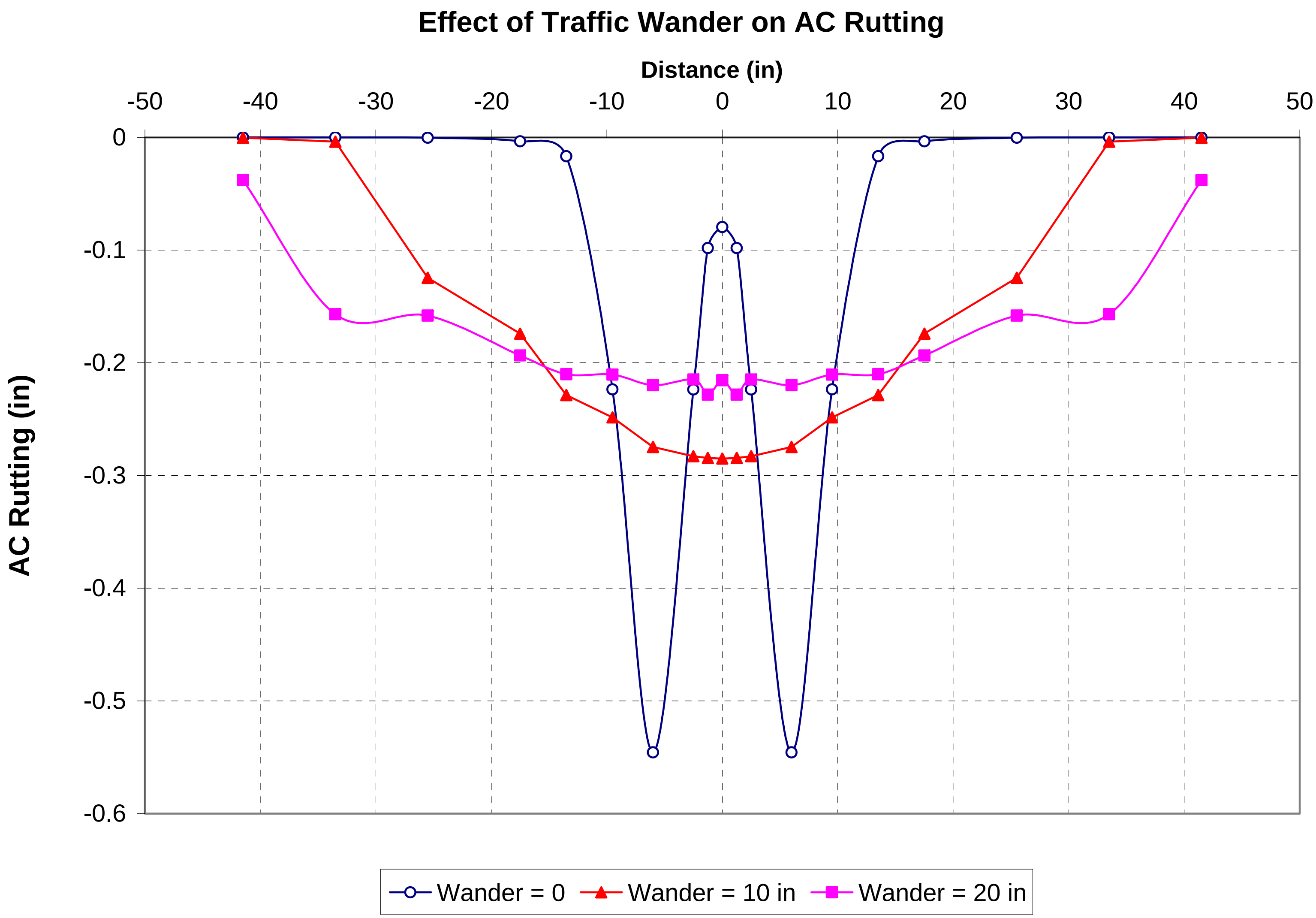

Figure 3.15-1 Effect of Traffic Wander upon The Transverse Distribution of AC Rut Depth

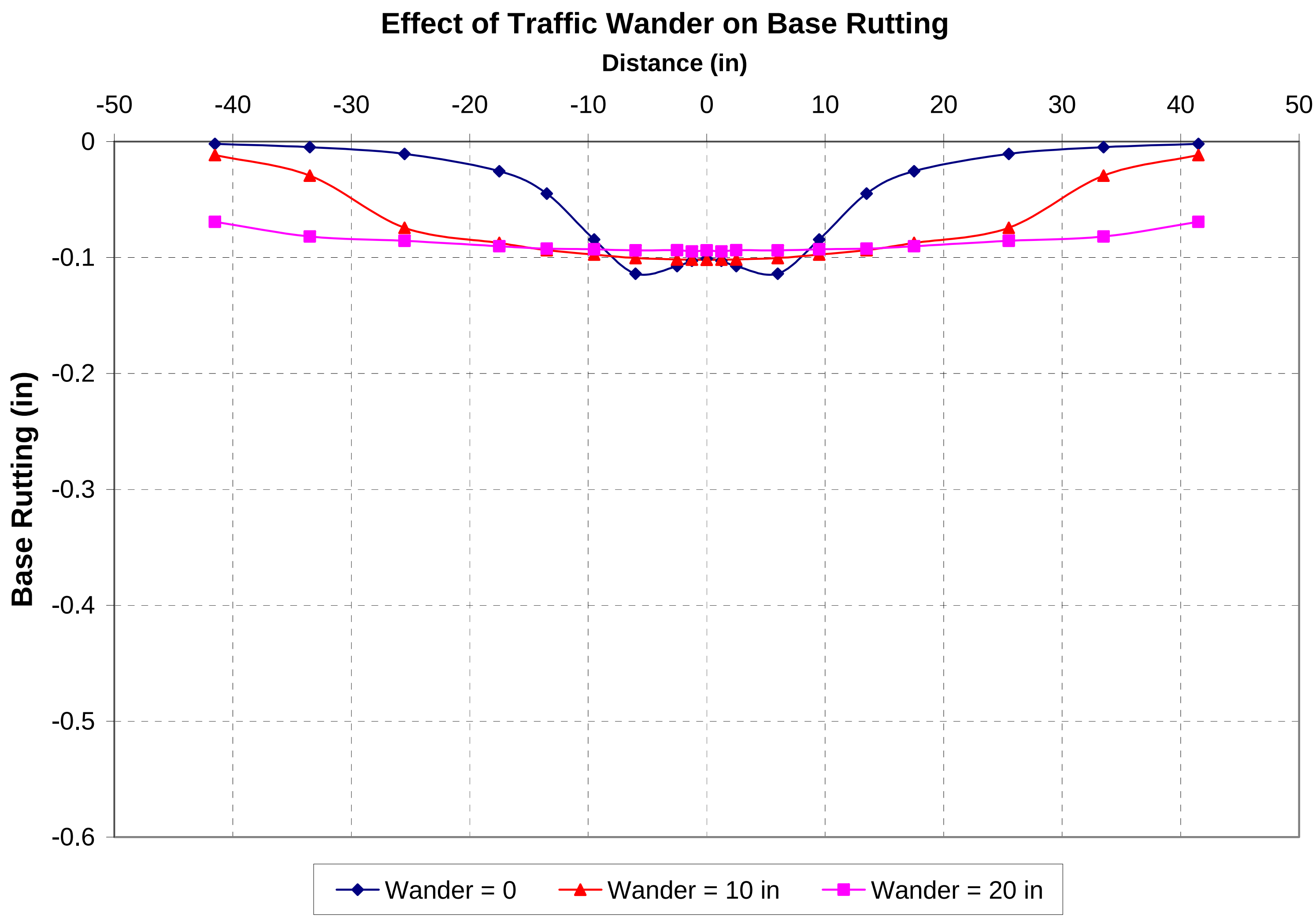

Figure 3.15-2 Effect of Traffic Wander upon The Transverse Distribution of Base Rut Depth

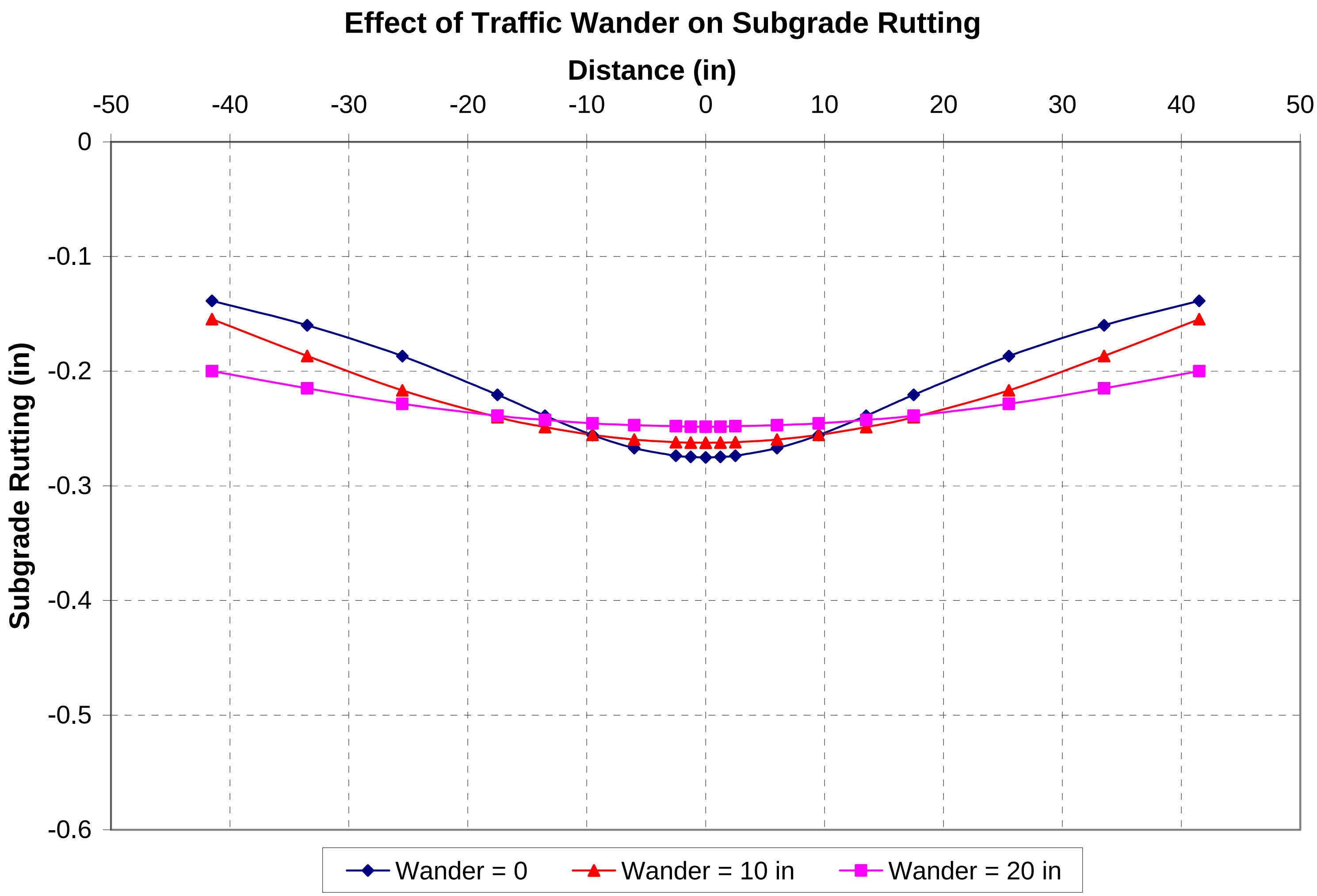

Figure 3.15-3 Effect of Traffic Wander upon The Transverse Distribution of Subgrade Rut Depth

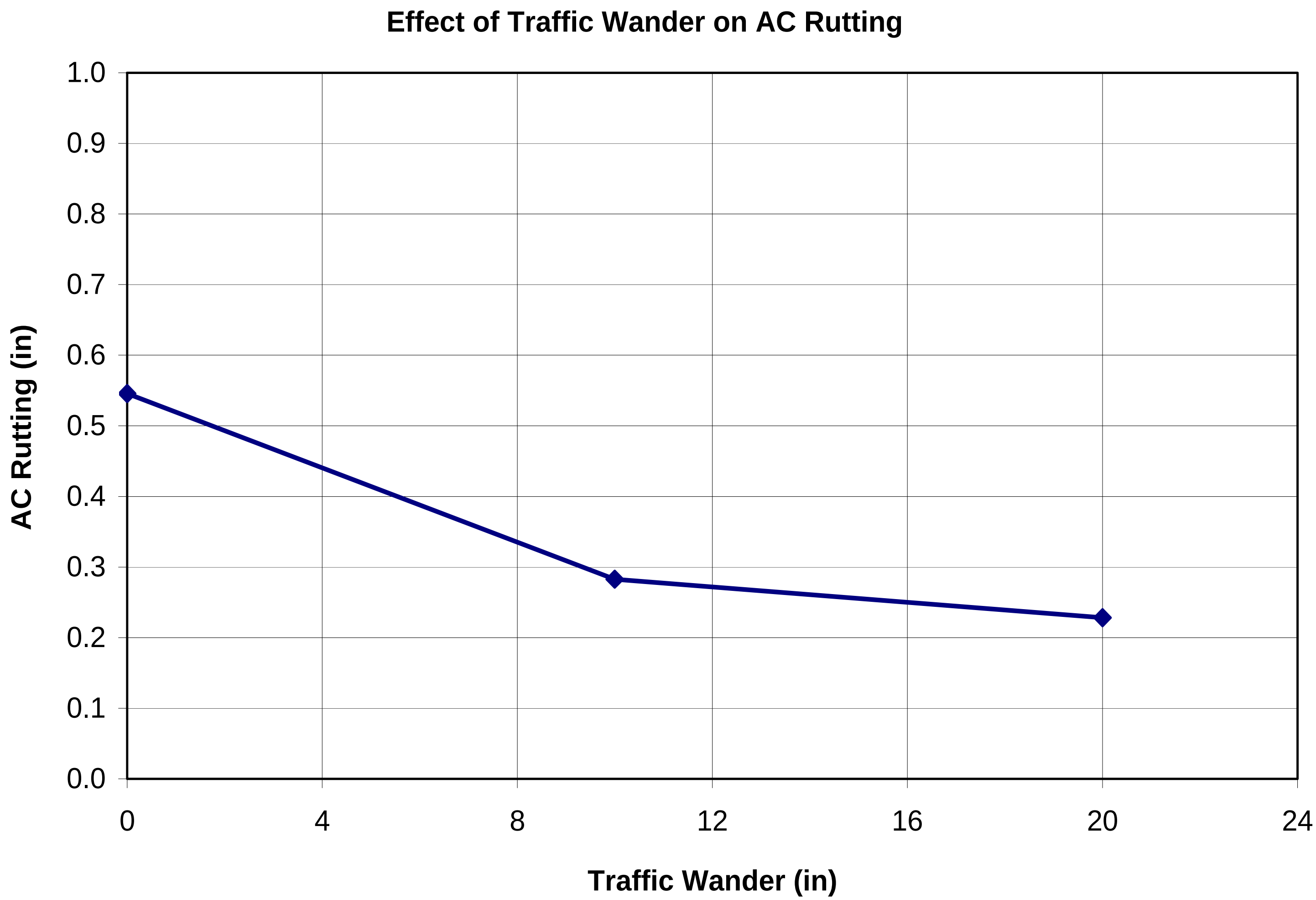

Figure 3.15-4 Effect of Traffic Wander upon AC Rut Depth

Figure 3.15-5 Effect of Traffic Wander upon Base Rut Depth

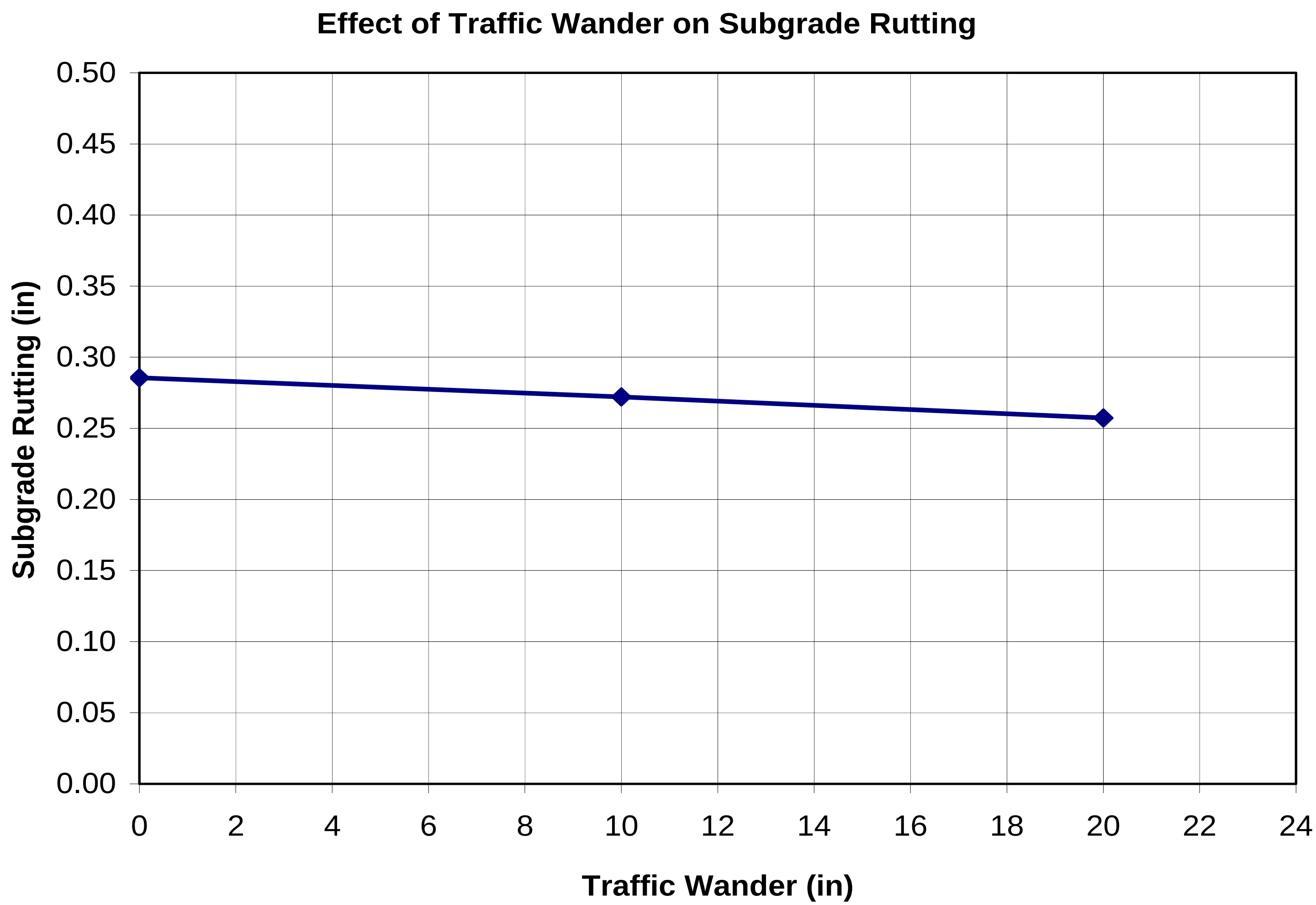

Figure 3.15-6 Effect of Traffic Wander upon Subgrade Rut Depth

3.16 Influence of Bedrock Depth upon Permanent Deformation

3.16.1 Objective

The objective of this section is to study the effect of the depth of bedrock under a flexible pavement upon the amount of rut depth predicted in all layers of the flexible pavement system.

3.16.2 Input Parameters

a. Traffic: Medium traffic volume (1000 AADTT)
b. Traffic Speed: 45 mph
c. Environment: Oklahoma
d. Depth to GWT: Medium (7 ft) for bedrock depths 10 and 20 ft; GWT at top of Bedrock for all depths less than 5 ft
e. Pavement Cross-Section: Three layered system as shown in Figure 2.1
f. Layer properties:
   - AC layer: 4 inch
   - AC Mix Stiffness: Medium as shown in Table 2.6 and Figure 2.2
   - Granular Base layer: As shown in Table 2.9 and Figure 2.1
   - Subgrade: Medium support (Mr=15,000 psi) as shown in Table 2.9
g. Depth to bedrock: 2’, 3', 4', 5', 10' and 20' (from top of pavement): Ebr= 750,000 psi

3.16.3 Results

The influence of bedrock depth is shown in Figures 3.16-1, 3.16-2 and 3.16-3. These plots show the amount of rut depth (after 10 years of loading), as a function of the depth of the Bedrock layer, for the asphalt, base and subgrade layer respectively.

3.16.4 Discussion of Results

Asphalt Layer

It is clear from the Figure 3.16-1 that the effect of the bedrock depth on the AC rutting is negligible across the entire range of depths evaluated. This conclusion is consistent with the subgrade study (Section 3.11), which showed that the subgrade modulus did not impact the rutting in the asphalt layer. As a general conclusion, it can be stated that changes in the foundation layers (thickness, material types, layer moduli) will typically not influence the rutting within an AC layer.

Base Layer
From Figure 3.16-2, it is apparent that bedrock depth has no impact upon the rutting that will occur in the unbound base layer.

Subgrade Layer
As observed in the figure, the subgrade rutting was the only layer impacted by the bedrock. For shallow bedrock depths, less rutting is observed in the subgrade. The rutting increases as the bedrock depth is increased to levels of 10 ft to 20 ft. The reason for this is apparent in that the stiffness of the bedrock is so large that it may be considered to be incompressible. The other main factor for the low subgrade rutting levels, at low bedrock depths, is due to the fact that the rut depth integral is evaluated from the subgrade surface to the depth of the bedrock surface. Thus the smaller the compressible subgrade layer causing the rutting, the lower the rutting within the subgrade.

3.16.5 Summary and Conclusions

The presence of bedrock within a flexible pavement cross-section will only influence the magnitude of rut depth that may occur in the subgrade. Little, if any, influence of the bedrock depth upon rutting will be found in either the asphalt or unbound base layer. In general, the closer the bedrock layer is to the surface, the less subgrade rutting that will occur.

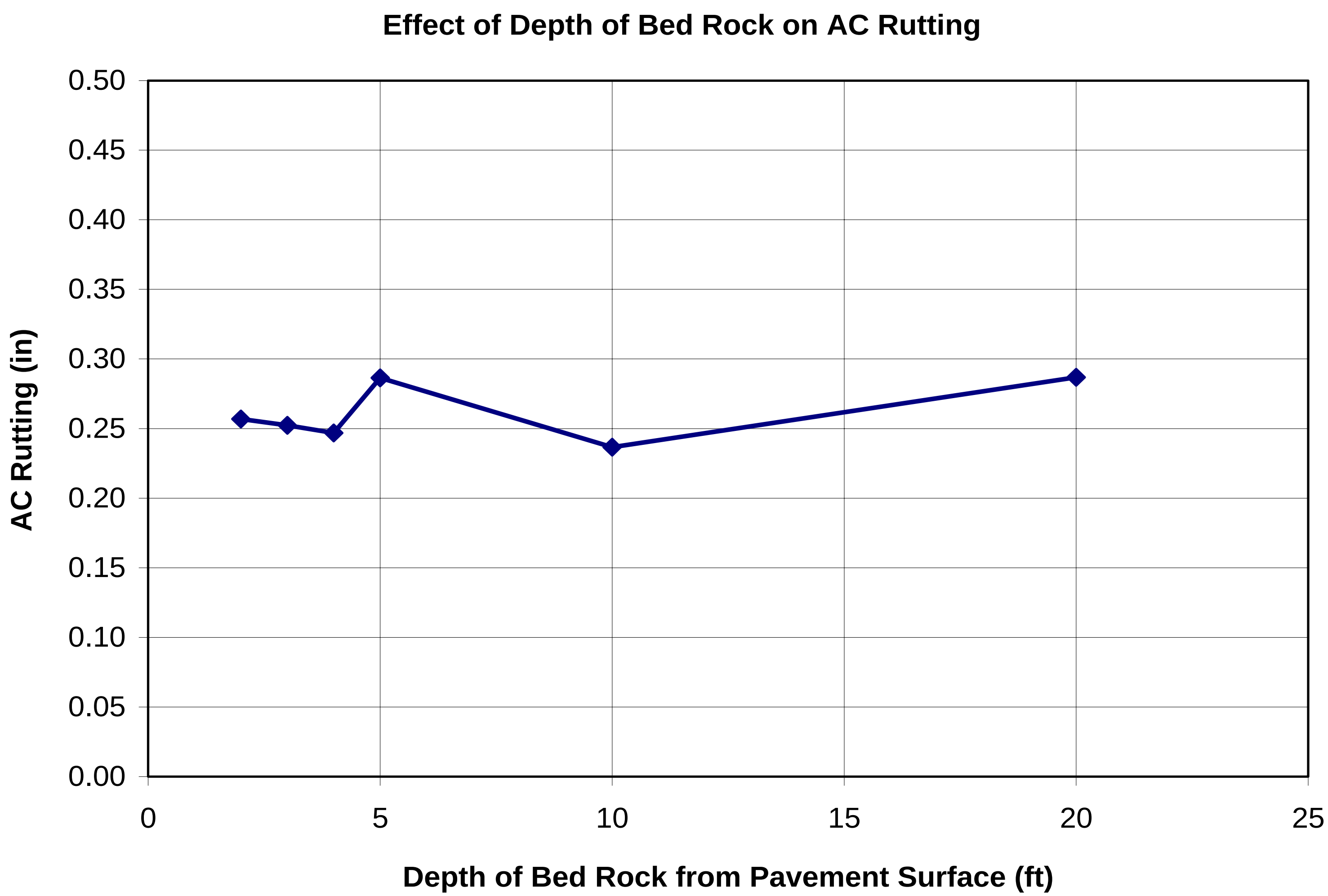

Figure 3.16-1 Effect of Bedrock Depth upon AC Rut Depth

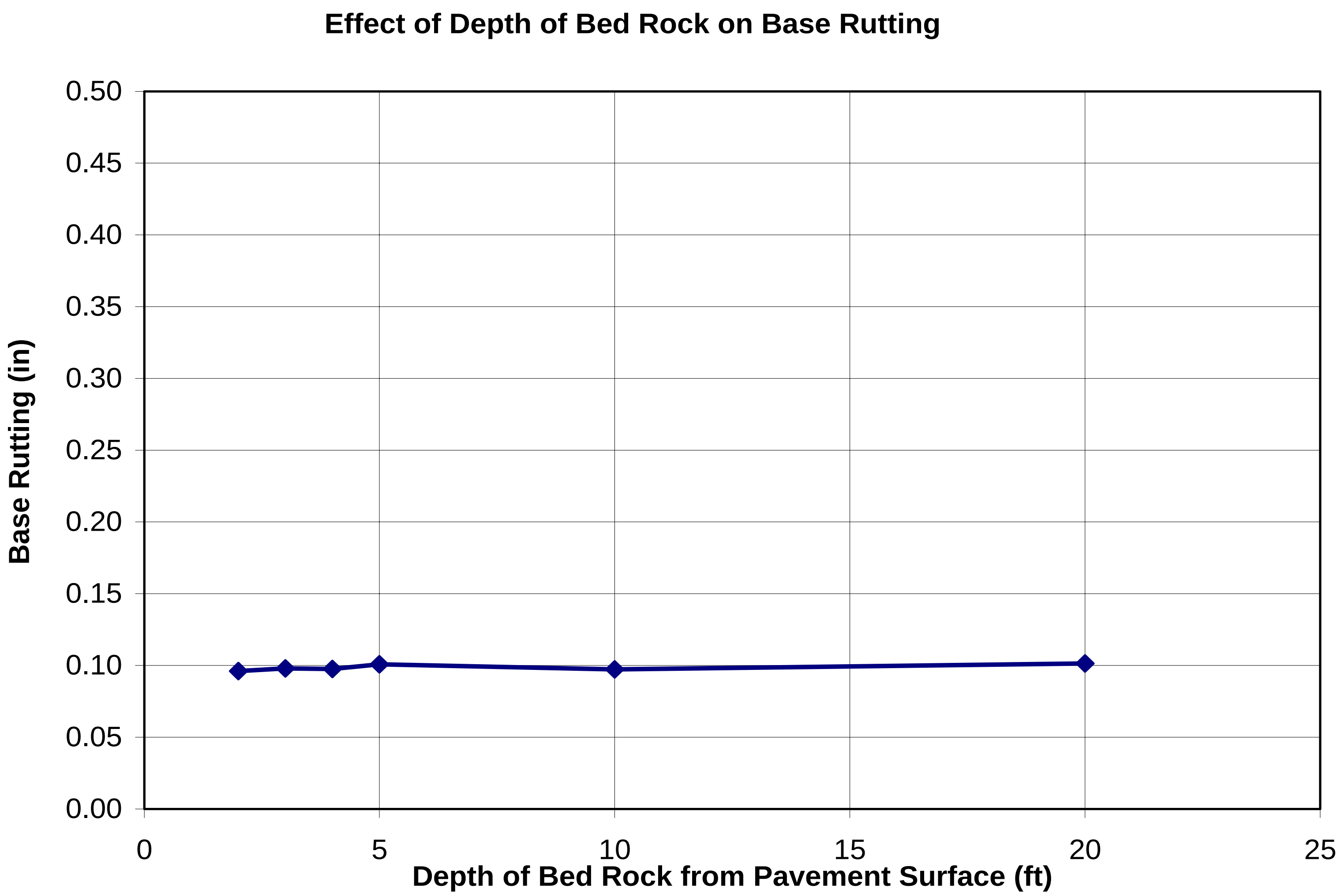

Figure 3.16-2 Effect of Bedrock Depth upon Base Rut Depth

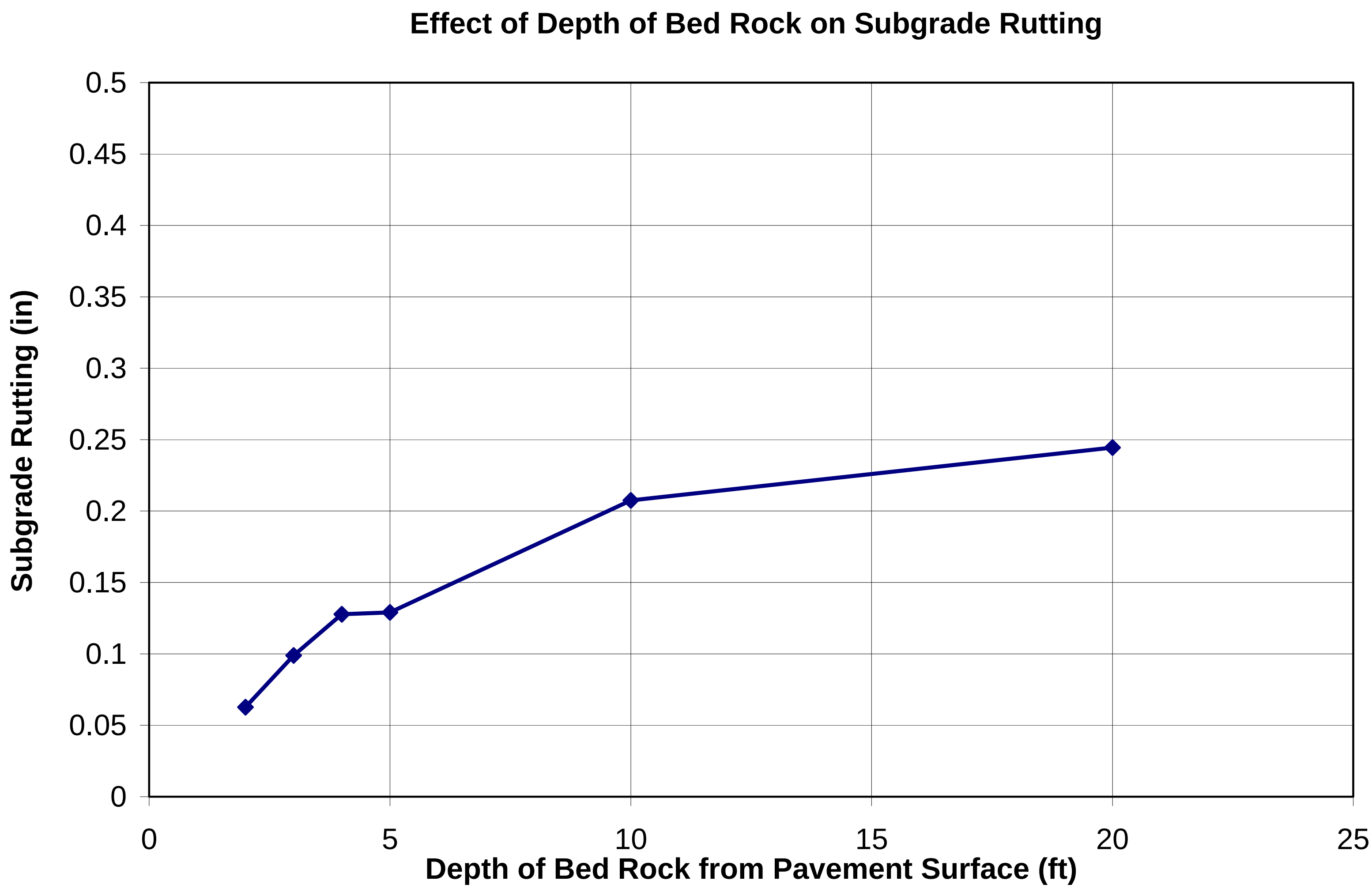

Figure 3.16-3 Effect of Bedrock Depth upon Subgrade Rut Depth

3.17 Influence of Depth to GWT on Permanent Deformation

3.17.1 Objective

The objective of this section is to study the effect of depth to GWT on the amount of permanent deformation within all layers of a flexible pavement.

3.17.2 Input Parameters

a. Traffic: Medium traffic volume (1000 AADTT)
b. Traffic Speed: 45 mph
c. Environment: Phoenix
d. Depth to GWT: 2, 4, 7 and 15 ft.
e. Pavement Cross-Section: Three layered system as shown in Figure 2.1
f. Layer properties:
   - AC layer: 6 inches
   - AC Mix Stiffness: High Stiff Mixture as shown in Table 2.6 and Figure 2.2
   - Granular Base layer: Constant modulus = 38,000 psi.
   - Subgrade: Five different subgrade support values used (above GWT/ below GWT) (Mr=34,000/17,600; 25,000/13075; 18,000/10260, 10,000/5,860 and 6,000/2250 psi).
g. Depth to bedrock: No Bedrock present

3.17.3 Results

Figures 3.17-1, 3.17-2 and 3.17-3 show the amount of AC, base and subgrade rut depth, respectively after 10 years of loading for four levels of depth to GWT at different subgrade modulus values.

3.17.4 Discussion of Results

<u>Asphalt Layer</u>
It is clear from the Figure 3.17-1 that the effect of the GWT depth on the AC rutting is negligible across the entire range of depths evaluated. This important point is consistent with the results of other studies presented, which clearly show that the influence of all other cross-sectional properties, other than the thickness and quality of the AC layer, <u>**do not**</u> influence rutting within the AC layer. As a general conclusion, it can be stated that changes in the foundation layers (thickness, material types, layer moduli) will typically not influence the rutting within an AC layer.

<u>Base Layer</u>
From Figure 3.17-2, it is apparent that GWT depth has no impact upon the rutting that will occur in the unbound base layer. This is true because open graded ("clean") base

courses have no affinity to hold capillary water from the more wetter subgrade soils. Hence, little to no change is moisture content will be observes and therefore little, to no, change in rutting would be expected. However, as the base (subbase) becomes “dirtier” (more fines); soil suction within these material layers will draw moisture into the layers and allow for the possibility of increased rutting within the granular layers.

<u>Subgrade Layer</u>
The influence of the GWT depth, as observed in Figure 3.17-3, is much more pronounced on subgrade rutting, compared to the other pavement layers. For shallow GWT depths, more rutting is observed in the subgrade regardless of the subgrade stiffness. The significance of the GWT is more critical at GWT depths less than 5 feet to 7 feet. However, as the subgrade gets softer (low modulus) the influence of the GWT depth on the subgrade becomes more and the change in the rutting is very significant.

3.17.5 Summary and Conclusions

The presence of GWT within a flexible pavement cross-section will only influence the magnitude of rut depth that may occur in the subgrade. Little, if any, influence of the GWT depth upon rutting will be found in either the asphalt or unbound base layer. In general, the closer the GWT is to the surface, the more subgrade rutting that will occur. The degree of rutting and sensitivity of the GWT is greatly significant for low stiffness (modulus) subgrade materials.

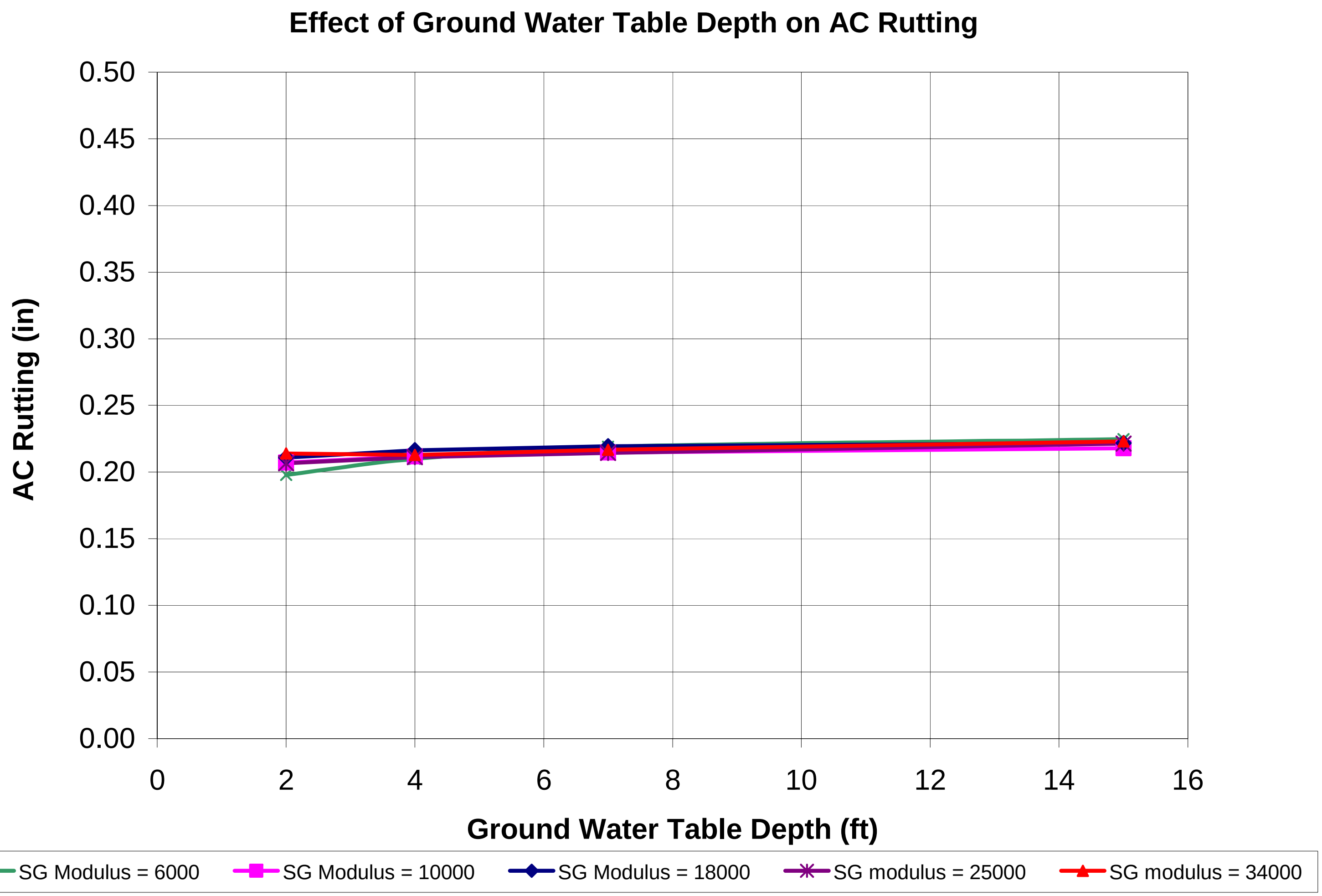

Figure 3.17-1 Effect of Depth to GWT on AC Rut Depth

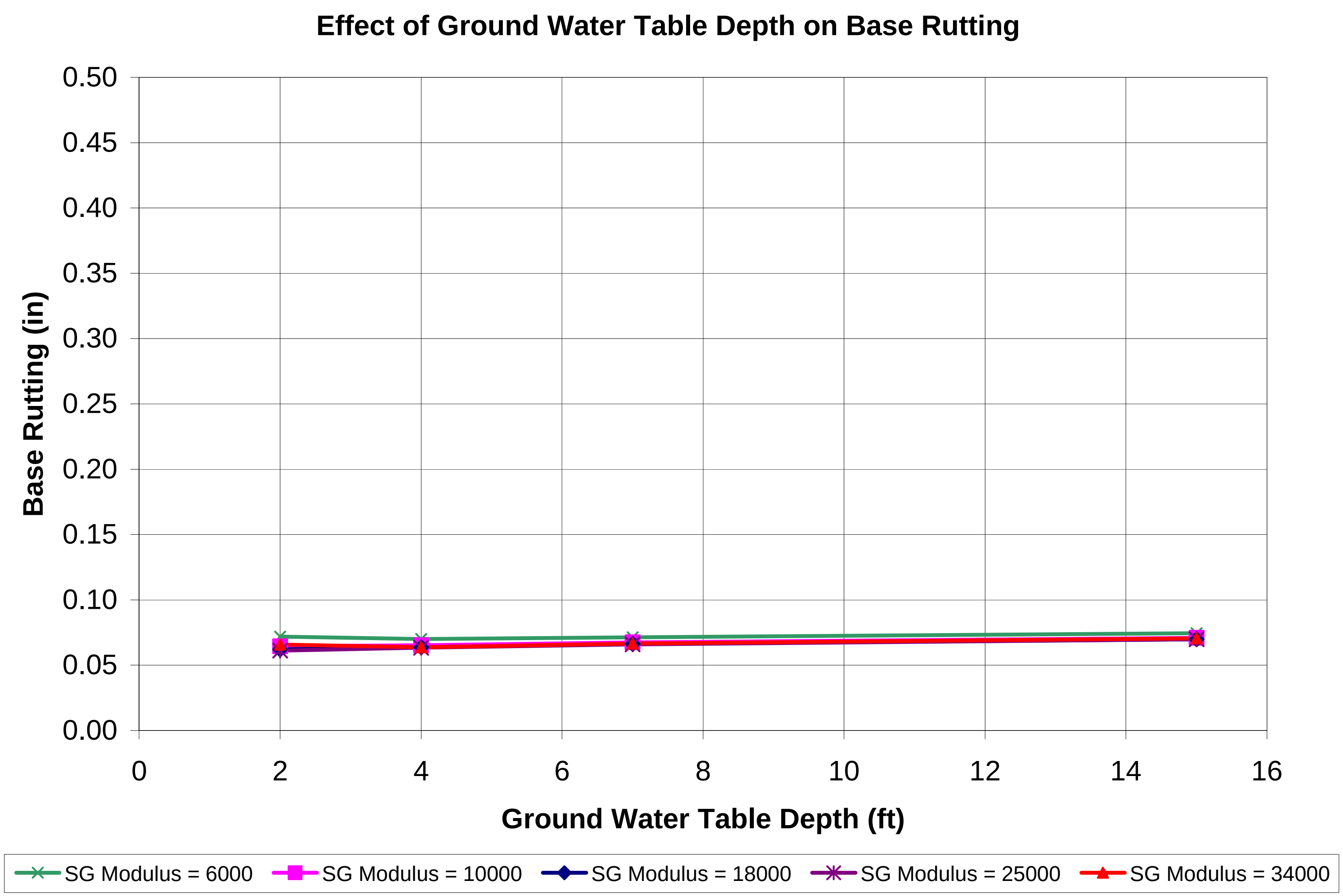

Figure 3.17-2 Effect of Depth to GWT on Base Rut Depth

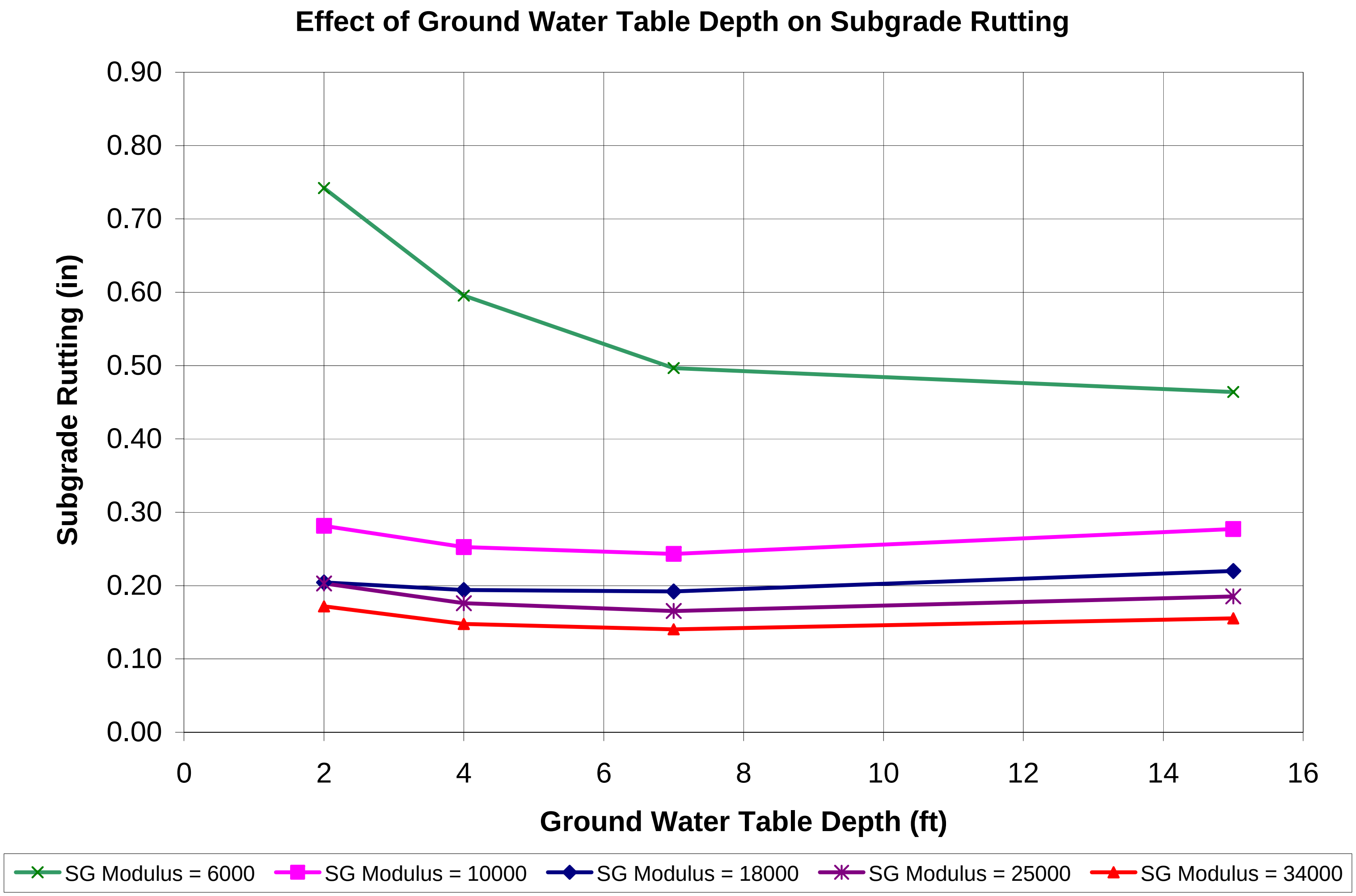

Figure 3.17-3 Effect of Depth to GWT on Subgrade Rut Depth