COMMONWEALTH OF KENTUCKY
DEPARTMENT OF HIGHWAYS
FRANKFORT

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COMMISSIONER OF HIGHWAYS

May 25, 1967

ADDRESS REPLY TO
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H-2-20

MEMORANDUM

TO: W. B. Drake
Assistant State Highway Engineer
Chairman, Research Committee

SUBJECT: Research Report, Interim; "Flow Behavior of Asphalt Cements;" KYHPR-64-20
HPR-1(2), Part II

A few years ago the term "rheology" (flow) was familiar to only a few scholars and researchers; the term embraces the whole science of material mechanics -- elasticity, viscosity, creep, and relaxation. In a simpler sense, however, paving asphalts (bitumens) are glues or cements which hold aggregate particles together; if the glue were ideally elastic (Hookean), it could be represented as being analogous to a simple spring; but, inasmuch as bitumens are semi-solids and exhibit properties of both solids and liquids -- that is, elasticity and viscosity --, tractive or cohesive resistance necessarily becomes an extremely complex combination of mechanical moduli, temperature and time. A rheological model is, therefore, conceptually, a complete mechanistic analog of the behavior of a real material. Rheological coefficients are ultimately applicable to the design of paving mixtures and pavement structures. Although the ultimate objective has not yet been achieved, the true nature and quality of bituminous cements is best described in tese terms -- for example, there is considerable interest nationally in developing specifications in which asphalt cements will be designated according to ranges of viscosity. The report submitted herewith relates interim progress toward these objectives.

Mr. Mossbarger resigned from the Department June 30, 1966; Dr. Deacon rejoined our research staff last August and has continued the study to its present stage. The report, of course, reflects their joint authorship and individual dedication. The investigative work continued while the report was in

preparation. Additional measurements at low temperatures are either in progress or are planned.

Special attention is invited to the rational treatment of viscosity coefficients and to the evident necessity of discreet obedience to discrete definitions and measurement techniques. The curve-fitting technique employed in the viscoelastic analysis is thought to be somewhat original and may be useful in analyses of other types of data. The time-temperature superpositioning technique summarily portrays the viscoelastic character of a material throughout a given range of temperature.

The report does not require any Departmental action at this time; it is being issued as reference information and is somewhat pertinent to matter of viscosity-grading of asphalt cements, as mentioned previously.

Respectfully submitted,

Jas. H. Havens
Director of Research
Secretary, Research Committee

JHH:em
Attachment
cc: Member, Research Committee
A. O. Neiser
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R. A. Johnson
H. G. Mays

Research Report

FLOW BEHAVIOR OF ASPHALT CEMENTS
KYHPR-64-20: HPR-1(2)

by
W. A. Mossbarger, Jr., Former Research Engineer
and
J. A. Deacon, Research Engineer

Division of Research
DEPARTMENT OF HIGHWAYS
Commonwealth of Kentucky

In cooperation with the
U.S. Department of Transportation
Federal Highway Administration
Bureau of Public Roads

May, 1967

PREFACE

The Kentucky Department of Highways in cooperation with the Bureau of Public Roads is conducting a continuing investigation of the fundamental mechanical properties of flexible pavement materials. The ultimate objective of this investigation is to gain sufficient knowledge of the fundamental mechanical behavior of these materials to support the establishment of a responsive flexible pavement design procedure.

A preliminary report (1), issued in 1964, contained the results of the preparatory phase of this investigation. This report summarized from a theoretical point of view efforts that had been made to quantify the mechanical response of viscoelastic materials to known conditions of loading. In addition, it described the development of a rotating coaxial cylinder viscometer which was designed to measure the creep response in shear of solid or semi-solid bituminous materials. The usefulness of this viscometer was verified by testing a rubberized asphalt cement at several temperature and torque levels. It was found that rubber, when added to the asphalt cement in significant quantities, tended to increase, at the higher temperatures, the steady-state viscosity, the stiffness, the retardation time of the viscoelastic response, and the complexity of flow.

The current report summarizes results of a second phase of the continuing investigation in which the preparatory efforts have been expanded to encompass the creep testing of 13 asphalt cements in a second rotating coaxial cylinder viscometer. The 13 asphalt cements were selected to represent a variety of crude sources, penetration grades, and manufacturing processes. Design and construction of the viscometer, which were accomplished as a portion of this phase, reflect the basic features of the earlier viscometer modified on the basis of the recommendations contained in the first report (1).

In analyzing the data reported herein, efforts were made to apply existing theories for simple ideal materials such as the Newtonian liquid and the Bingham plastic whenever these theories produced results in reasonable accord with the actual data. In many instances, however, it was necessary to combine these simple theories with somewhat more complex concepts of linear visco-elasticity in order to adequately characterize the deformation properties of the materials.

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INTRODUCTION

In the past, flexible pavement design procedures have been based largely upon empiricism; that is, empirical correlations between observed pavement performance and various traffic, pavement, and other parameters thought to be significant with respect to their effects on pavement performance. Recently, however, emphasis has shifted to analyses of stresses, strains, and deflections in the pavement structure (2,3). The basic intent is to limit the magnitudes of the critical stresses, strains, and deflections to levels below those thought to cause distress. Because of this emphasis on the mechanical behavior of the pavement structure and on the concept of critical levels of stresses and strains, this more fundamental approach is not unlike that commonly employed in conventional structural analyses.

There are at least five major determinations to be made before the theoretical approach can be translated into a design criterion. These include: (1) the development of a suitable technique for computing the mechanical response of a pavement structure to highway loads; (2) the adoption of standard methods of test for measuring the pertinent mechanical properties of the component layers; (3) the identification of those critical stresses, strains, and deflections which control the development of various forms of distress; (4) the establishment of tolerable levels of these critical stresses, strains, and deflections; and (5) a characterization of the loading and environmental variables. It is to the first two of these determinations that this continuing study is being directed.

The most suitable technique currently available for computing the mechanical response of a pavement structure to highway loads appears to be that which embodies the classical concepts of elastic analyses. Solutions are currently available for the computation of stresses, strains, and deflections in multi-layered elastic systems (4-6). These solutions have been found to approximate the behavior of pavements in service particularly for small stresses, short durations of loading, and limited strains or deformations (2, 7, and 8). However, the constituent materials which comprise a flexible pavement system are known to exhibit time-dependent mechanical behavior, the time-dependent character of which is not directly compatible with the doctrines of elastic theory.

This apparent incompatibility between the time-dependent mechanical behavior of the constituent materials in a pavement structure and the time-independent assumptions of elastic theory has turned the attention of several researchers to theories of mechanical behavior which encompass the time-dependent domain. Of particular significance is the theory of linear viscoelasticity which, despite being relatively new in its application to pavement materials, offers some promise in this regard. The major attention has focused on investigating convenient mathematical representations of viscoelastic behavior and on developing methods to measure this behavior. Suitable techniques for computing the mechanical response of a viscoelastic pavement structure to highway loads are generally unavailable though some preliminary work has been accomplished (9-14).

The general mechanical response of linear viscoelastic materials has been adequately reviewed (15-18). Ferry (19)has discussed suitable techniques for measuring viscoelastic behavior and has pointed out difficulties which often arise in instrumentation.

In 1944, Traxler et al. (20) investigated the flow characteristics of several asphalts from different sources and processed by various methods. They used a rotary viscometer and found that some asphalts do exhibit complex flow characteristics, the complexity being evaluated by the slope of a double logarithmic plot of stress against rate of strain. Van Der Poel (21, 22) studied the mechanical behavior of bitumens under both static and dynamic test conditions and presented the results in terms of static and dynamic stiffness moduli which were defined to be the ratio of stress to strain and the ratio of the amplitude of alternating stress to that of strain, respectively. His results indicated, as stated earlier by Saal (23),that the classification of bitumens, according to their rheological properties at normal temperatures, can generally be divided into three groups: (1) those that behave entirely or almost entirely as Newtonian liquids, (2) those which show elastic effects upon initial deformation and Newtonian flow thereafter, and (3) those which show almost complete resilience after comparatively slight deformation and for greater deformations cease to exhibit proportionality between stress and rate of strain. Brodnyan (24), Gaskins et al. (25), and Brodnyan et al. (26) investigated several different asphalts representing a wide variety of industrial stocks and found that asphalt behavior is very similar to that of concentrated solutions of high polymers, that is, typical viscoelastic bodies. Corresponding studies by others (27-30) have indicated similar results.

Application of viscoelastic techniques to the study of bituminous mixes has also been attempted. Wood and Goetz (31) studied a sand-asphalt mixture subjected to static loading. They found that the mixture exhibited instantaneous elastic deformation, retarded elastic deformation, and flow. Upon removal of load, instantaneous elastic recovery was obtained. Pister and Monismith (32) reviewed the limitations imposed by elastic analyses of flexible pavements, and presented experimental data verifying the viscoelastic nature of bituminous mixes. They also illustrated the use of mechanical models to describe viscoelastic behavior and showed the formulation and solution of boundary value problems. In a later publication, Secor and Monismith (33) analyzed triaxial test data obtained on an asphalt concrete mixture and suggested a simplified mechanical model representing its viscoelastic response. The results of Baker and Papazian (34) indicated that elastic theory is satisfactory for small durations of time; however, they suggested that a more systematic and less empirical approach may be obtained by considering the behavior of flexible pavements to consist of both elastic and viscoelastic components. Papazian (35) presented a general review of linear viscoelastic theory and applied it to a study of asphalt concrete. He discussed the concept of complex material moduli, determined under dynamic test conditions, and illustrated methods for correlating dynamic with static test results.

Recently, advances have been made in the application of viscoelastic concepts to the study of soils (36-41) which indicate that some soils exhibit viscoelastic properties.

As stated earlier, it is necessary to fully understand the mechanical behavior of the constituent materials in order to predict the mechanical response of the pavement structure. For this reason, attention has first been directed toward a study of the mechanical behavior of asphalt cements. This report summarizes the work that has been directed to this phase of the study. The foregoing literature review dictated, in large measure, the approach that was taken. The total mechanical behavior had to be analyzed: various common measurements of consistency such as apparent viscosity and penetration would not suffice since they are point measurements and greatly dependent upon the use of standardized test procedures and conditions. The rotating coaxial cylinder viscometer enabled the accumulation of data for a wide range of temperatures and stress levels and loading times which extended into the equilibrium or steady-state flow regime. This viscometer was also particularly suitable for an analysis of the total flow behavior based on a model of the type illustrated in Figure 1 or simplifications thereof.

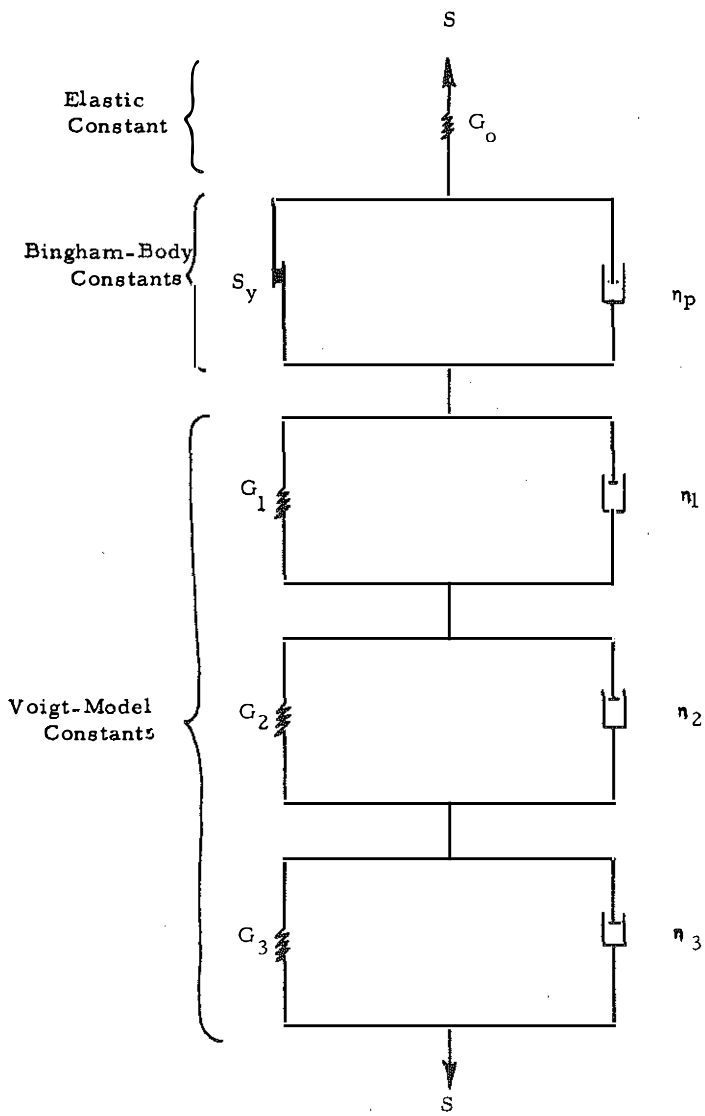


Figure 1. General Mechanical Model Applicable to Rubberized Asphalt Cements (1).

THEORETICAL CONSIDERATIONS

The creep behavior of certain ideal materials in the rotating coaxial cylinder viscometer can be readily determined. It is convenient first, however, to investigate the states of stress and strain in the viscometer when a constant torque is applied. A cross section through a rotating coaxial cylinder viscometer of the type employed in this study is depicted schematically in Figure 2. While testing, the cup is held stationary and a torque

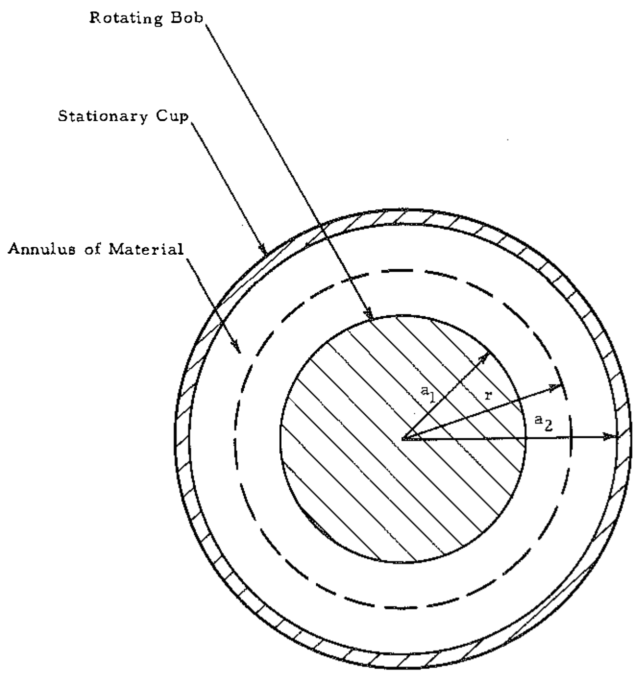


Figure 2. Cross Section through Rotating Coaxial Cylinder Viscometer.

is applied to the rotating bob. The resulting shear strain and rate of shear strain within the test material are given by the following equations (1, 42):

$$\gamma(r,t) = -r\partial\theta(r,t)/\partial r \tag{1}$$

and

$$\dot{\gamma}(r,t) = -r\partial\omega(r,t)/\partial r \qquad (2)$$

where r = distance from axis of rotation to a point within the test material

t = elapsed time from beginning of test

$\gamma(r,t)$ = shear strain in test material at distance, r, and time, t

$\theta(r,t)$ = angle of rotation of a point in the test material at distance, r, and time, t, which is a function of both the angle of rotation of the bob relative to the cup and the response of the material to shear stress

$\dot{\gamma}(r,t) = \partial\gamma(r,t)/\partial t$ = rate of shear strain in test material at distance, r, and time, t

$\omega(r,t) = \partial\theta(r,t)/\partial t$ = angular velocity within test material at distance, r, and time, t.

The shear stress resulting from the application of a constant torque is described by the following equation:

$$S(r) = T/2\pi r^2 L \qquad (3)$$

where $S(r)$ = shear stress at distance, r

T = constant torque applied to the bob

L = the length or height of the annulus of test material.

STEADY-STATE LIQUIDS

The behavior of certain ideal liquids is such that a steady-state flow condition is reached instantaneously after load application and the rate of strain is dependent only on the shearing stress. This behavior may be described in general by an equation of the following form:

$$\dot{\gamma} = f\{S\} \quad (4)$$

where f{S} = some time-independent function of stress.

When these materials are tested in a rotating coaxial cylinder viscometer, the rate of shear becomes:

$$\dot{\gamma}(r) = -r d\omega(r)/dr. \quad (5)$$

Combining Equations 4 and 5, the following equation is obtained:

$$f\{S(r)\} = - r d\omega(r)/dr. \quad (6)$$

Assuming no slippage occurs at the surfaces of the bob and cup, Equation 6 yields upon integration the following expression for angular velocity at a point:

$$\omega(r) = - \int_{a_2}^{r} f\{S(r)\} \frac{dr}{r} \quad (7)$$

where a_2 = radius of the stationary cup.

For the rotating coaxial cylinder viscometer, Equation 7 becomes:

$$\omega(r) = - \int_{a_2}^{r} f\left[\frac{T}{2\pi r^2 L}\right] \frac{dr}{r} . \quad (8)$$

Using the relationship, dr/r = - dS/2S, which was derived from Equation 3, a change in the variable of integration of Equation 8 yields:

$$\omega(r) = \frac{1}{2} \int_{S_2}^{S_r} \frac{f\{S\}}{S} dS \quad (9)$$

where S_r = shear stress at radius r

S_2 = shear stress at the inner wall of the cup.

The angular velocity of the bob relative to the cup can be obtained by selecting appropriate limits of integration in Equation 9 as follows:

$$\Omega = \omega(a_1) = \frac{1}{2} \int_{S_2}^{S_1} \frac{f\{S\}}{S} \, dS \qquad (10)$$

where Ω = angular velocity of the bob relative to the cup

S_1 = shear stress at surface of the bob.

Since the angular velocity, Ω, is constant for steady-state liquids, the angle of rotation of the bob relative to the cup is given by the following equation:

$$\Theta = \Omega t \qquad (11)$$

where Θ = angle of rotation of bob relative to cup

t = elapsed time.

Equations 10 and 11 yield the desired relationships for describing the behavior of ideal, steady-state liquids when subjected to a constant torque in a rotating coaxial cylinder viscometer. The first of these ideal liquids to be examined in detail is the Newtonian liquid.

Newtonian Liquid

The basic flow equation for a Newtonian liquid is:

$$\dot{\gamma} = f\{S\} = S/\eta \qquad (12)$$

where η = coefficient of viscosity.

Substituting Equation 12 into Equation 10 one obtains upon integration

$$\Omega = CT/\eta \qquad (13)$$

where $C = \frac{1}{4\pi L} (1/a_1{}^2 - 1/a_2{}^2)$.

The quantity, C, represents an instrument constant which is dependent upon the dimensions of the annulus of liquid. The angle of rotation as a function of time can be found by combining Equations 11 and 13 as follows:

$$\Theta = CTt/\eta. \tag{14}$$

The rate of shear is found by substituting Equations 3 and 13 into Equation 12 and is given by

$$\dot{\gamma}\,(r) = \left(\frac{2\Omega}{1/a_1^2 - 1/a_2^2}\right) 1/r^2. \tag{15}$$

The average rate of shear becomes:

$$\dot{\gamma}\,(av) = \left(\frac{2a_1a_2}{a_2^2 - a_1^2}\right)\Omega \tag{16}$$

where $\dot{\gamma}$ (av) = average rate of shear.

Figure 3 depicts the flow behavior of a Newtonian liquid in terms of the measurable parameters of the rotating coaxial cylinder viscometer. To evaluate the coefficient of viscosity for a Newtonian liquid, sufficient tests should be performed to enable the construction of curves similar to those shown on Figure 3. The coefficient of viscosity can be readily determined from the slope of the straight line of Figure 3b.

Bingham Plastic

The basic flow equation for a Bingham plastic is

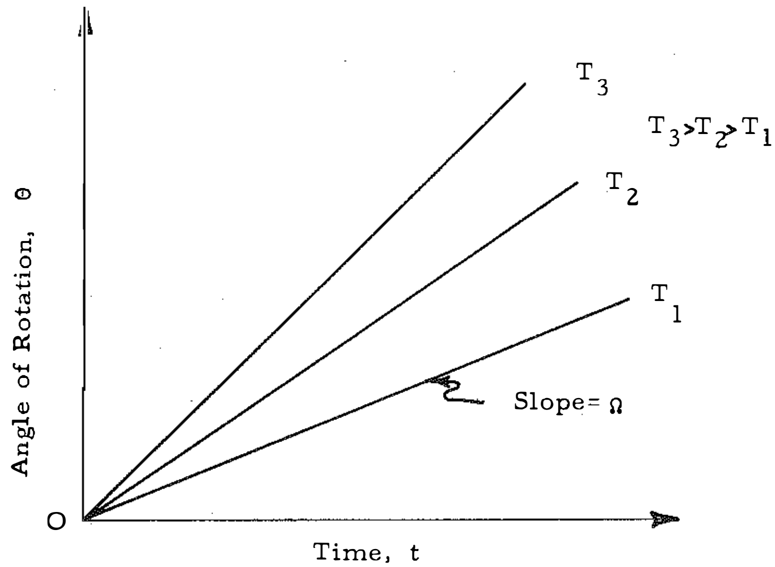
$$\dot{\gamma} = 0 \qquad \text{for } S \leq S_y \tag{17a}$$

and

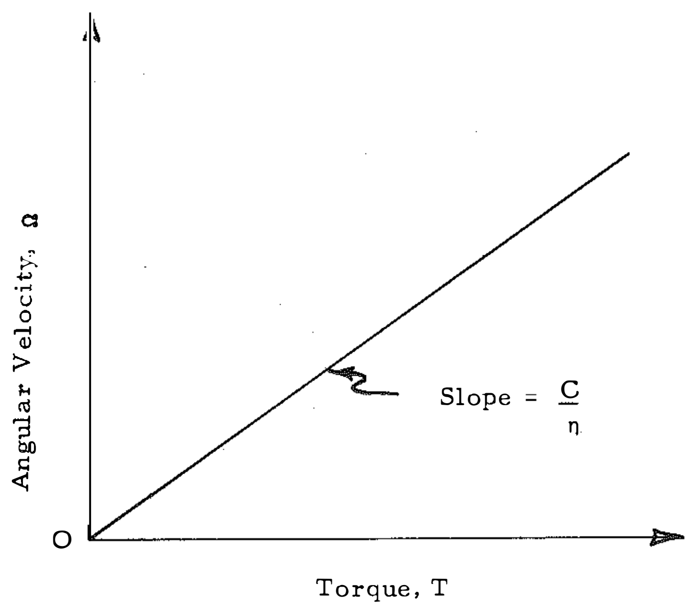
$$\dot{\gamma} = \frac{S - S_y}{\eta_p} \qquad \text{for } S > S_y \tag{17b}$$

where S_y = yield stress

η_p = coefficient of plastic viscosity.



a. Angle of Rotation as a Function of Time for Different Levels of Torque



b. Angular Velocity as a Function of Torque

Figure 3. Flow Behavior of Newtonian Liquid in Rotating Coaxial Cylinder Viscometer.

Flow occurs in these materials only when the applied shearing stress exceeds the yield stress. For this reason it is necessary to consider three distinct conditions of loading when a Bingham plastic is sheared in a rotating coaxial cylinder viscometer.

The first condition occurs when the applied torque is so small that the maximum shear stress (at the surface of the bob) is less than the yield stress. For this condition no flow occurs and

$$\Omega = 0 \qquad \text{for } S_1 \leq S_y \text{ or} \tag{18a}$$

$$T \leq 2\pi a_1^2 LS_y.$$

The second condition occurs when the yield stress is bracketed by a lower applied stress at the surface of the cup and a higher applied stress at the surface of the bob. Flow occurs only in that layer of material located between the surface of the bob and a critical radius, $r_c = (T/2\pi LS_y)^{1/2}$. The material located between this critical radius and the surface of the cup remains stationary. The angular velocity of the bob relative to the cup is then given by:

$$\Omega = \frac{1}{2}\int_{S_y}^{S_1} \frac{f\{S\}}{S} \, dS \tag{19}$$

which upon evaluation yields:

$$\Omega = \frac{1}{2\eta_p}\left[\frac{T}{2\pi a_1^2 L} - S_y - S_y \ln\left(\frac{T}{2\pi a_1^2 LS_y}\right)\right] \tag{18b}$$

$$\text{for } S_1 > S_y \geq S_2 \text{ or}$$

$$2\pi a_1^2 LS_y < T \leq 2\pi a_2^2 LS_y.$$

The third condition occurs when the applied stress at the surface of the cup exceeds the yield stress and flow occurs throughout the annulus of the material. The angular velocity becomes

$$\Omega = \frac{CT}{\eta_p} - \frac{S_y}{\eta_p} \ln\left(\frac{a_2}{a_1}\right) \qquad \text{for } S_y < S_2 \text{ or } T > 2\pi a_2^{\,2} L S_y. \tag{18c}$$

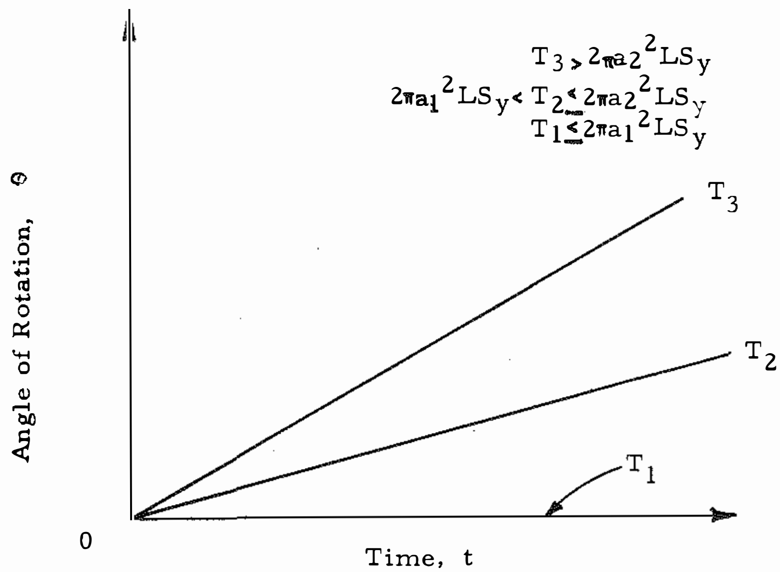
The angle of rotation of the bob relative to the cup is simply the product of elapsed time and the appropriate angular velocity of Equation 18.

Figure 4 depicts the flow behavior of a Bingham plastic in terms of the measurable parameters of the rotating coaxial cylinder viscometer. To evaluate the constants, η_p and S_y, sufficient tests should be performed to enable the construction of curves similar to those shown on Figure 4. The coefficient of plastic viscosity can be readily determined from the slope of the inclined, straight-line portion of Figure 4b. The yield stress is best determined from the intercept at point B of Figure 4b. It can also be estimated from the torques corresponding to points A and C. These torques are related by the following equation:

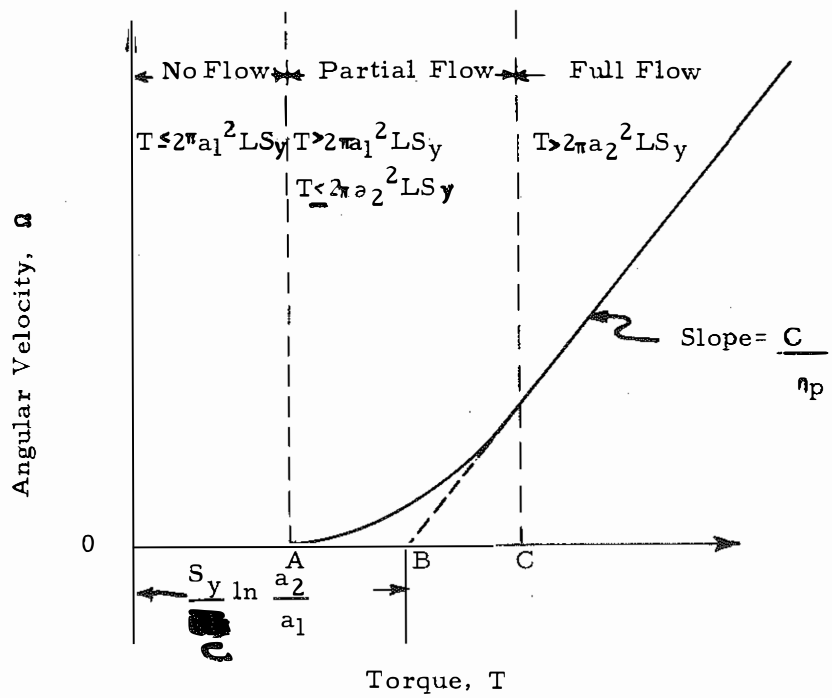
$$T_A/T_C = (a_1/a_2)^2. \tag{20}$$

Other Steady-State Liquids

The preceding analysis demonstrates the procedures used for predicting the behavior of certain steady-state liquids, namely, the Newtonian liquid and the Bingham plastic, in a rotating



a. Angle of Rotation as a Function of Time for Different Levels of Torque



b. Angular Velocity as a Function of Torque

Figure 4. Flow Behavior of Bingham Plastic in Rotating Coaxial Cylinder Viscometer.

coaxial cylinder viscometer. While other steady-state liquids do not exhibit the same linear relationship between rate of shear strain and shear stress as do these materials, the procedures for deriving the equations which predict their behavior in this viscometer remain essentially the same and, hence, are not included herein. At the same time, it is useful to define the basic flow equations for several of these materials and to present the equations describing their behavior in the coaxial cylinder viscometer.

Pseudoplastic liquids obeying the power-law relationship (43) are described by the following basic flow equation:

$$\dot{\gamma} = (S/k)^{1/n} \tag{21}$$

where k = a material constant related to the consistency of the liquid

n = a material constant assuming values less than one.

The non-Newtonian properties of these liquids become more pronounced as n diverges from a value of one. Their behavior in the rotating coaxial cylinder viscometer is described by the following equation:

$$\Omega = \frac{n(2/k)^{1/n}\ (CT)^{1/n}}{(1/a_1^{\,2} - 1/a_2^{\,2})^{1/n}} \left[(1/a_1^{\,2})^{1/n} - (1/a_2^{\,2})^{1/n} \right]. \tag{22}$$

The pseudoplastic liquids have no yield stress and the ratio of shear stress to rate of shear (the apparent viscosity) decreases with increasing shear rates.

Another of the steady-state liquids is the dilatent liquid which conforms to the same power-law flow equation as pseudoplastic liquids (Equation 21) with the exception that n exceeds the value of unity (43). Dilatent liquids exhibit no yield stress but, in contrast to pseudoplastics, their apparent viscosities increase with increasing rates of shear.

The final steady-state liquid to be considered is one conforming to the following basic flow equation:

$$\dot{\gamma} = (S/\eta_i)\ [1 + (S/G_i)] \qquad (23)$$

where η_i = viscosity constant defined as the limiting value of $S/\dot{\gamma}$

G_i = constant with dimensions of stress (termed the internal shear modulus).

This equation has been employed by Ferry (42) to describe the behavior of polymeric systems at low rates of shear. The angular velocity for a creep test in the rotating coaxial cylinder viscometer is given by the following equation:

$$\Omega = (CT)\left[\frac{1}{\eta_i} + \frac{CT}{G_i}\left(\frac{a_1^2 + a_2^2}{a_2^2 - a_1^2}\right)\right] \qquad (24)$$

The basic flow properties of the various steady-state liquids are graphically compared on Figure 5. Figure 6 depicts the type of behavior experienced when testing these materials in the rotating coaxial cylinder viscometer. It is recalled that, because of the steady-state nature of these liquids, their angles of rotation in the viscometer are linear functions of elapsed time.

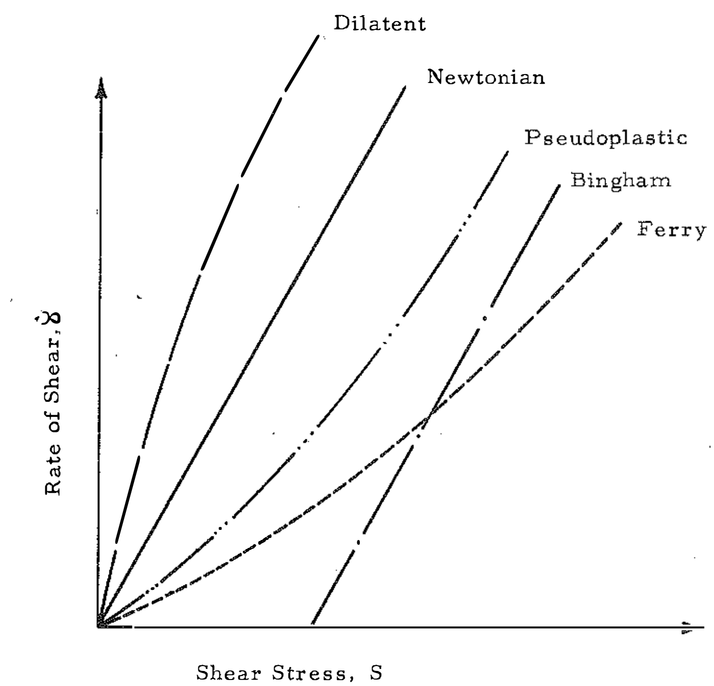


Figure 5. Flow Curves for Various Steady-State Liquids.

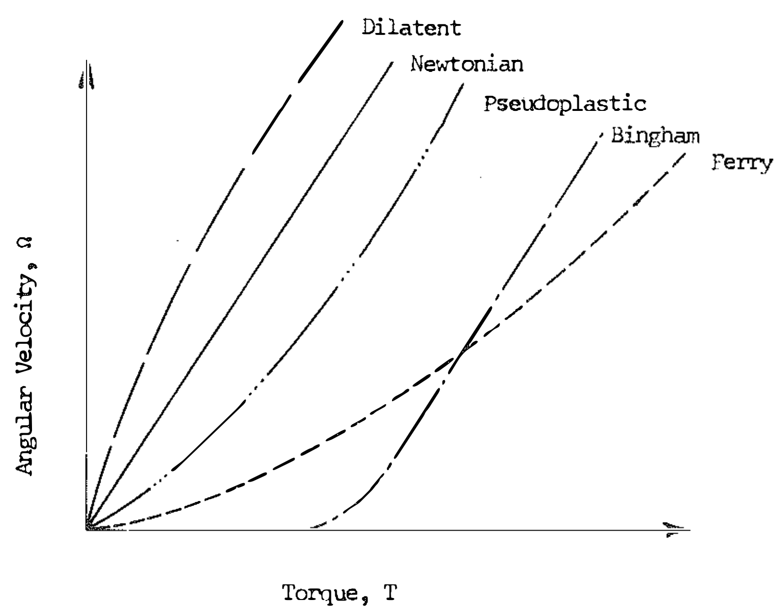


Figure 6. Flow Behavior of Various Steady-State Liquids in Rotating Coaxial Cylinder Viscometer.

VISCOELASTIC MATERIALS

When steady-state liquids are subjected to a constant torque in the rotating coaxial cylinder viscometer, a linear relationship is observed between the angle of rotation and time; that is, the angular velocity is independent of time. In contrast, a liquid for which the angular velocity is dependent on elapsed time may be called a non-steady-state liquid. Such liquids may exhibit either thixotropic or rheopectic behavior depending upon whether the shear strains cause a respective breakdown or formation of internal structure. However, neither of these two basic types of liquids possess properties of instantaneous and retarded elasticity and, upon load removal, elastic recovery.

To describe this somewhat more complex behavior, it is necessary to consider materials which simultaneously possess both elastic and viscous properties, that is, viscoelastic materials. Of particular interest is the special case where the ratio of stress to strain is a function only of elapsed time and not of the stress magnitude. Viscoelastic materials demonstrating this property are termed linear and are of primary importance since their mechanical behavior is mathematically tractable.

A linear viscoelastic material may be visualized in terms of the generalized Voigt body of Figure 7 (43). This mechanical model is composed of a series of elements, each of which consists of a spring and a dashpot which are connected in parallel. The relationship between strain and stress for a constant stress or creep test is as follows:

$$\gamma(t) = S_o \sum_{k=1}^{n} J_k [1 - \exp(-t/\tau_k)] \qquad (25)$$

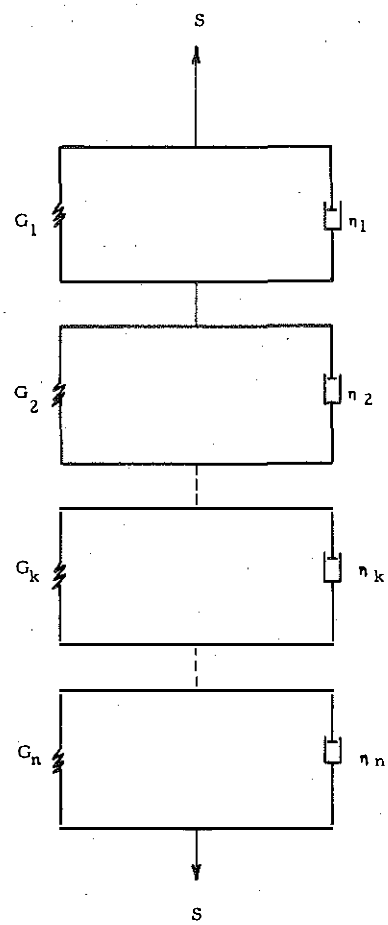


Figure 7. Generalized Voigt Body.

where $\gamma(t)$ = shear strain at time, t
S_o = constant shear stress
J_k = compliance $(1/G_k)$
η_k = viscosity coefficient
τ_k = retardation time (η_k/G_k)
t = elapsed time
G_k = shear modulus (rigidity modulus)
n = number of elements.

The generalized Voigt body represents a linear viscoelastic material with a discrete spectrum of retardation times. As the number of elements in this model approaches infinity (that is, $n \rightarrow \infty$), the stress-strain relationship for a creep test may be more conveniently specified in terms of the following:

$$\gamma(t) = S_o \int_o^\infty J(\tau) \, [\, 1 - \exp(-t/\tau)] \, d\tau \qquad (26)$$

where $J(\tau)$ = compliance distribution function
τ = retardation time (continuous variable).

This concept of a distribution of retardation times simplifies the mathematical approach since the mechanical behavior of the material can be described in terms of the compliance distribution function, $J(\tau)$.

The relationship between angle of rotation and time for a linear viscoelastic material subjected to a constant torque in the coaxial cylinder viscometer can be derived using Equations 1, 3, and 25 and is given by the following expression:

$$\Theta(t) = \sum_{k=1}^{n} CT\, J_k \, [1 - \exp(-t/\tau_k)]. \qquad (27)$$

The corresponding angular velocity is

$$\Omega(t) = \frac{d\,\Theta(t)}{dt} = \sum_{k=1}^{n} \frac{CTJ_k}{\tau_k} \, [\exp(\,-t/\tau_k)]. \qquad (28)$$

The creep function, $\Psi(t)$, for a linear viscoelastic material is defined as the ratio of strain to stress when the material is subjected to constant loading. Thus, from Equation 25, the creep function is

$$\Psi(t) = \gamma(t)/S_o = \sum_{k=1}^{n} J_k [1 - \exp(\,-t/\tau_k)] \qquad (29)$$

where $\Psi(t)$ = creep function.

But, from Equation 27,

$$\Theta(t)/CT = \sum_{k=1}^{n} J_k [1 - \exp(\,-t/\tau_k)]. \qquad (30)$$

On the basis of Equations 29 and 30, the creep function for a linear viscoelastic material may be evaluated using the coaxial cylinder viscometer in the following way:

$$\Psi(t) = \Theta(t)/CT. \tag{31}$$

OTHER MATERIALS

There are other engineering materials whose mechanical behavior may best be characterized by a series combination of an elastic element (spring), a viscous element (steady-state liquid), and a viscoelastic body (generalized Voigt body). When these more complex materials are subjected to a constant torque in the rotating coaxial cylinder viscometer, a creep curve similar to that illustrated in Figure 8 is observed. The total angle of rotation of the bob relative to the cup is depicted by curve 4.

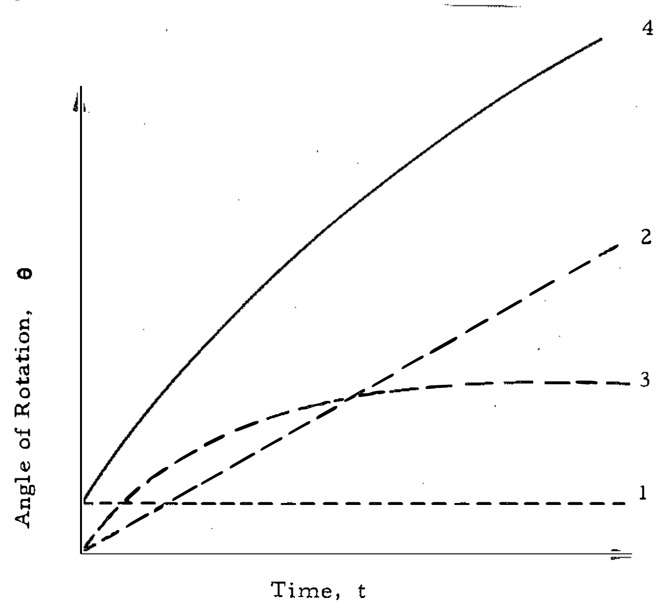


Figure 8. Creep Curve for a Material Exhibiting Instantaneous Elastic Deformation, Retarded Deformation, and Steady-State Flow.

Each ordinate on this curve may be considered to equal the sum of the corresponding ordinates on the remaining three curves.

The equation of curve 1, which represents an instantaneous elastic deformation, is

$$\theta_1 = CT/G_o \tag{32}$$

where G_o = elastic shear modulus.

Curve 2 represents the steady-state flow behavior of a steady-state liquid. Its equation is

$$\theta_2 = \Omega_o t \tag{33}$$

where Ω_o = the steady-state angular velocity given by Equation 13, 18, 22, or 24.

From Figure 8 and Equation 33, the steady-state portion of the angle of rotation is seen to linearly increase with time. Curve 3 represents the retarded elastic flow of the viscoelastic components. Equation 27, therefore, specifies the shape of this curve.

The total angle of rotation (curve 4) can be computed as follows:

$$\theta = \theta_1 + \theta_2 + \theta_3 \tag{34}$$

or

$$\theta = CT/G_o + \Omega_o t + \sum_{k=1}^{n} CT\, J_k[1 - \exp(-t/\tau_k)]. \tag{35}$$

Equation 35 represents a general flow equation describing the response of a wide variety of engineering materials to creep loading in a rotating coaxial cylinder viscometer. The parameters of Equation 35 may be evaluated for a specific material by obtaining θ-t curves from a suitably designed creep test program. The procedures recommended for this type of evaluation are discussed in subsequent sections.

APPARATUS, MATERIALS, AND PROCEDURE

APPARATUS

The rotating coaxial cylinder viscometer is a modified version of one used in the preliminary phases of the study (1). Its function is to apply a creep stress in shear to an annular specimen of solid or semi-solid bitumen over a wide range of stresses and temperatures. Figure 9 shows the viscometer and related equipment assembled for testing.

As depicted in Figure 10, the viscometer consists of an inner cylinder (or bob) and an outer cylinder (or cup) which are mounted concentrically to form an annulus. This annulus is filled with the test material which is subjected to shear stresses by applying a torque to the bob. The bob is rigidly attached to an axle or spindle which is supported by a ball bearing at the upper plate of the apparatus. The torque is generated by the suspension of weights from the drive pulley at the upper end of the axle. To eliminate bending in the axle, equal weights are suspended over diagonally opposite idle pulleys.

The angle through which the bob rotates is measured by a rotary variable differential transformer, type R3B2S, manufactured by Schaevitz Engineering. This device produces a voltage having a magnitude which varies linearly with the angular position of its shaft for a range of $\pm$ 40° from its null position. The voltage is monitored with a Sanborn, Model 321, carrier-amplifier recorder. An appropriate scale and vernier are also provided above the drive pulley for visual checking and calibration.

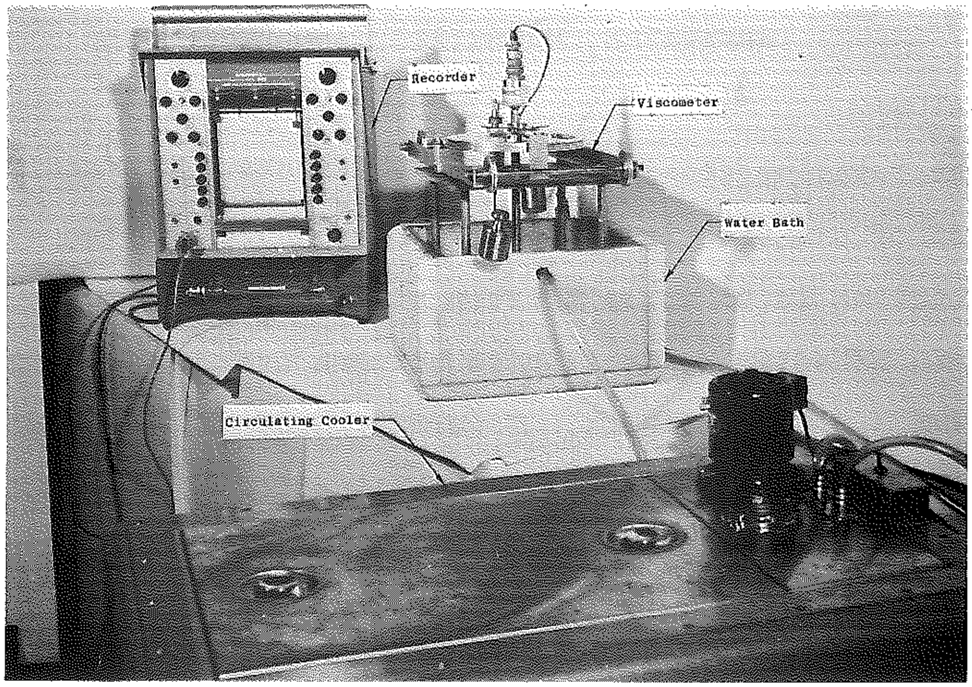


Figure 9. Viscometer and Related Equipment Assembled for Testing.

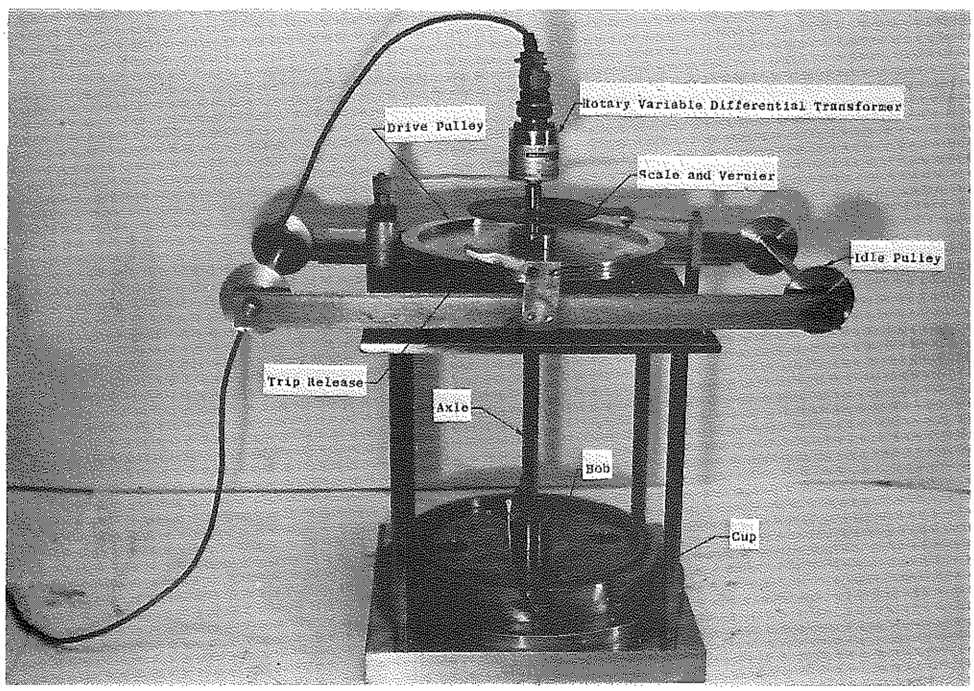


Figure 10. Rotating Coaxial Cylinder Viscometer without Weights (Large Cup and Bob).

In order to provide a wide range of shear rates, two different cup-and-bob assemblies are used. For testing the less viscous asphalts, the large cup and bob shown in Figure 10 may be used. The small cup and bob shown in Figure 11 are used for testing more viscous materials. For equal weights of the suspended loads, a lower shear rate is attained with the large cup-and-bob assembly.

Figure 12 shows the components of the large cup-and-bob assembly. The stainless steel bob contains a hardened steel, 60° conical bearing point which bears on a hardened steel cap screwed into the steel base plate. The cap contains a conical depression which receives the bearing point of the bob. This bearing arrangement is essentially free of friction and provides an excellent means for centering the bob.

During assembly the amalgamated brass ring is placed within the groove of the base plate. The stainless steel cup also fits within the groove and bears lightly against its outer edge. The bob extends into the groove of the base plate but bears only on the hardened steel bearing cap. Sufficient clearance is provided between the bob and the brass ring and between the bob and the base plate to insure freedom of rotation. When assembly is completed, mercury is poured into the annulus until its level is slightly above the lower edge of the bob. This prevents the test material from flowing beneath the bob and provides a completely fluid, floating bearing for the specimen which virtually eliminates end effects due to adhesion.

The pouring mold shown in Figure 13 is used to fill the annulus of the large cup-and-bob assembly with heated asphalt.

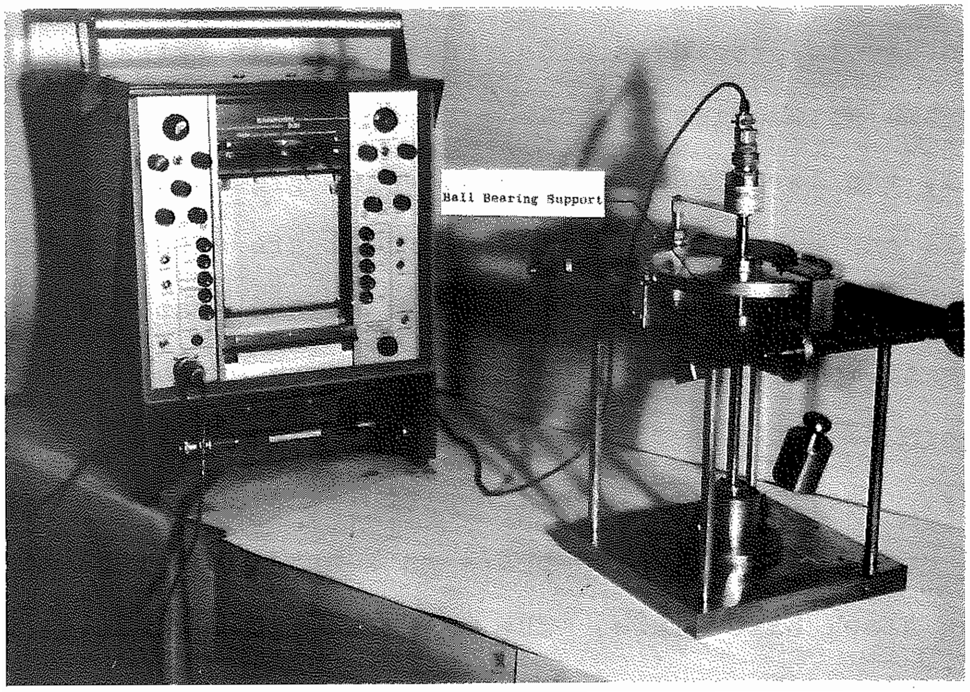


Figure 11. Rotating Coaxial Cylinder Viscometer with Weights (Small Cup and Bob).

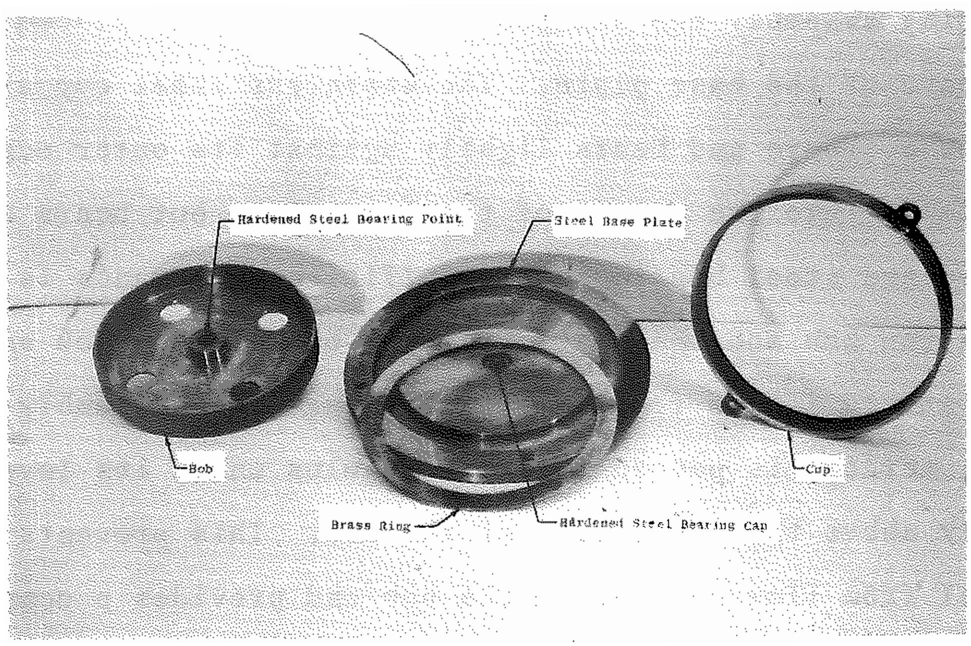


Figure 12. Large Cup-and-Bob Assembly.

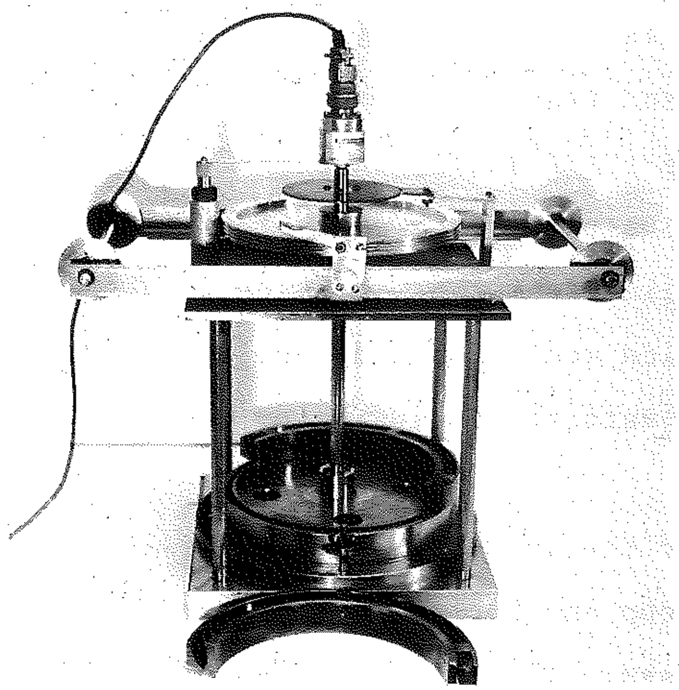


Figure 13. Pouring Mold Used with Large Cup-and-Bob Assembly.

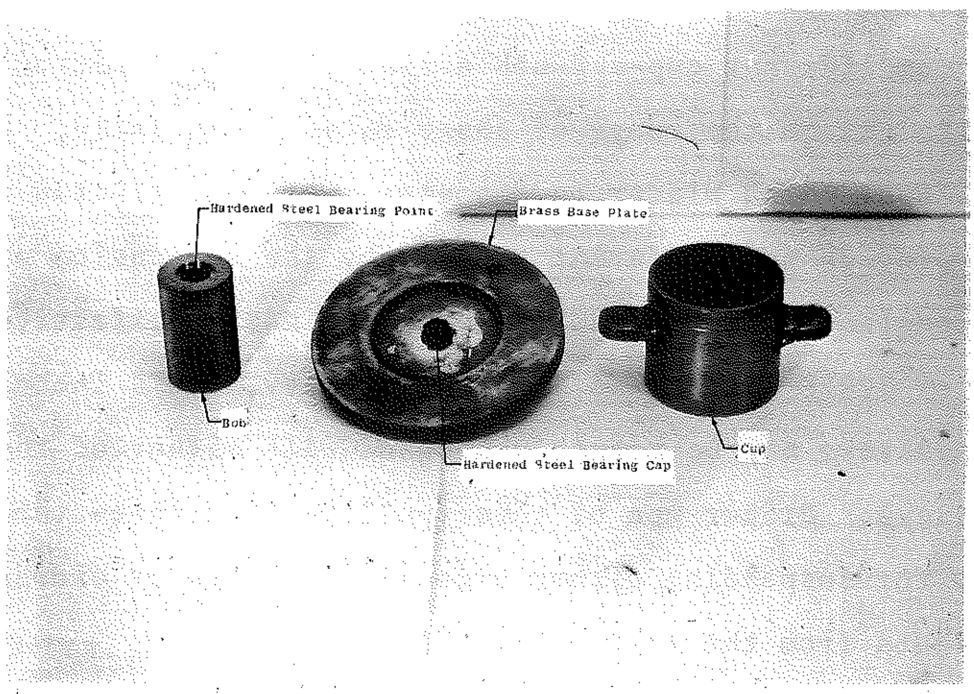


Figure 14. Small Cup-and-Bob Assembly.

This mold, which is constructed in two semi-circular sections, is supported by and temporarily mounted on the bob. Its narrow discharge opening (3/32 inch), which is centered over the annulus, permits the annulus to be progressively filled from the bottom to the top. This eliminates the necessity for heating the cup-and-bob assembly (which would be hazardous due to the presence of mercury) and prevents the inclusion of voids within the specimens.

Components of the small cup-and-bob assembly are shown in Figure 14. The cup and bob are made of stainless steel and the base plate of brass. The cup, bob, and base plate are assembled in much the same manner as for the larger assembly with the exception that no brass ring is used. A pouring mold is unnecessary due to the increased thickness of the annulus.

The two different cup-and-bob assemblies were constructed in order to extend the range of shear rates. Similarly, two drive pulleys, which differ in diameter, were constructed in order to provide two different torques by the suspension of a load of constant weight. The large pulley has an effective diameter of 7.875 inches and the small pulley, 3.875 inches. The idle pulleys may be properly aligned with either of the two drive pulleys. Proper use of these pulleys eliminates the necessity for suspending either excessively large or excessively small weights from the loading system.

Cups and bobs for both assemblies are provided with 1/64-inch-deep vertical grooves extending their full lengths. These grooves prevent the formation of slippage surfaces at the interfaces due to insufficient adhesion between the cup or bob and the specimen. The effective dimensions of the cups, bobs, and specimens are shown in Table 1.

TABLE 1

EFFECTIVE DIMENSIONS OF CUP, BOB, AND SPECIMEN

Item	Small Assembly	Large Assembly
Cup		
Diameter (in.)	2.005	7.741
Height (in.)	2.023	1.115
Bob		
Diameter (in.)	1.235	7.365
Specimen		
Thickness (in.)	0.385	0.188
Height (in.)	Variable, 2.023 Max.	Variable, 1.115 Max.

MATERIALS

The 13 asphalt cements used in this study were selected on the basis of the following factors: (1) crude source, (2) penetration grade, and (3) manufacturing process. Table 2 classifies the asphalts on the basis of these three factors. The asphalt numbers are identical to those used by the Bureau of Public Roads (44, 45) with the exception of asphalts PR-103 and PR-132 which were not evaluated by the Bureau. However, the asphalt samples were obtained from current production runs for which the refining processes and crude sources may have been slightly altered. Therefore, direct comparison between the results of this study and those of the earlier studies (44, 45) must be avoided.

TABLE 2

CRUDE SOURCES, PENETRATION GRADES, AND MANUFACTURING PROCESSES FOR ASPHALT CEMENTS

Asphalt Number	Crude Source	Penetration Grade	Method of Manufacture[1]
3	Mexico	85-100	S
13	Venezuela	85-100	V,S
45	Arkansas	85-100	V,S
53	Midcontinent	85-100	V,O
67	Texas	85-100	V
71	Midcontinent	85-100	V,P,B
72	Oklahoma	85-100	V,P,O,F
91	California	85-100	V,S,B,O
116	Wyoming	85-100	V
127	Venezuela	60-70	V,S
200	Venezuela	120-150	V,S
PR-103	Unknown	141[2]	-[3]
PR-132	Unknown	24[2]	-[3]

[1]V = vacuum distillation, S = steam distillation, O = blowing (oxidation), B = blending (different grade asphalts), P = propane fractionation, and F = fluxing (heavy oils).

[2]Test values.

[3]Petroleum pitch residue derived from cracking petroleum feed stocks for the production of ethylene.

Essentially six different crude sources based on geographical location were studied[1]. To investigate the variation in mechanical properties as related to penetration grade, three different grades (PAC-3, PAC-5, and PAC-7) from the Venezuelan crude were studied. Attempts were made to obtain samples which represented straight-run distillation, straight-run distillation with air blowing, and cracking manufacturing processes. As seen in Table

[1]These included Midcontinent, Gulf-Coastal, Rocky Mountain, Californian, Mexican, and Venezuelan crudes.

2, the asphalts are representative of the first two of these three processes. Asphalts manufactured by the cracking process were not available for testing. However, asphalts PR-103 and PR-132 were included in the test program since their properties are similar in nature to those of cracked asphalts despite their somewhat greater temperature susceptibilities.

The results of standard laboratory tests performed on the asphalt cements are presented in Table 3. The 85-100 penetration grade asphalts exhibited essentially similar properties with the exception of the low Saybolt Furol viscosities of asphalts 91 and 116. The thin film oven loss was somewhat high for asphalt 13 in comparison to the other 85-100 penetration asphalts but was properly ordered with respect to asphalts 127 and 200 which were obtained from the same crude source and refining process.

TEST PROCEDURE

Each asphalt was tested at temperatures of 39.2, 77, and 104°F. At each temperature, a minimum of three intensities of torque were applied. These intensities were chosen so as to provide significant angular displacements in a reasonable period of time. In order to avoid possible effects of strain history, a new specimen was used for each increment of torque. A single specimen was tested for each combination of temperature and torque.

Table 4 summarizes most of the testing reported as a portion of this study phase. Only the small cup-and-bob assembly was employed for these tests. The large drive pulley was used for

TABLE 3

RESULTS OF STANDARD TESTS ON ASPHALTS

Asphalt Number	Penetration				Ductility		Softening Point (°F)	Specific Gravity @77°F	Saybolt Furol Viscosity @275°F (sec)	Thin Film Oven Test	
	Grade	100 gm 5 sec 77°F (.1 mm)	200 gm 60 sec 39.2°F (.1 mm)	Pen. ratio 39.2/77 (%)	5 cm/min 77°F (cm)	1 cm/min 39.2°F (cm)				% Loss	Pen. Res. / Pen. Orig. (%)
3	85-100	87	43	49	150+	56	121	1.035	267	0.27	63
13	85-100	88	31	35	150+	84	125	1.032	253	0.73	37
45	85-100	92	29	32	150+	30	114	1.020	189	+0.09	62
53	85-100	86	33	38	150+	22	120	0.998	159	+0.28	67
67	85-100	90	41	46	150+	14	122	1.031	215	0.06	59
71	85-100	90	22	25	96	48	112	1.005	146	+0.02	64
72	85-100	95	37	39	150+	24	116	0.994	175	+0.54	58
91	85-100	96	25	26	150+	150+	111	1.013	84	0.09	69
116	85-100	88	28	32	150+	8	113	1.023	76	0.03	53
127	60-70	60	29	49	150+	16	119	1.033	348	0.65	50
200	120-150	122	40	33	150+	110	113	1.032	250	1.26	40
PR-103		141	50	35	-	110+	106	1.167	22	10.98	5
PR-132		24	2	8	-	-	134	1.163	43	7.54	0

TABLE 4

TEST PROGRAM

Asphalt Number	Temperature (°F)	Total Load (gms)	Approximate Shearing Stress Maximum (d/cm²)	Average (d/cm²)	Minimum (d/cm²)
All Asphalts[1]	39.2	800	107,700	66,400	40,900
		1,400	189,800	116,200	71,500
		2,000	269,000	166,000	102,200
	77	45	2,920	1,800	1,110
		90	5,840	3,600	2,220
		135	8,760	5,400	3,330
		180	11,680	7,200	4,440
	104	10	649	400	246
		15	973	600	370
		20	1,298	800	492
		25	1,620	1,000	615
3[2]	39.2	800	107,700	66,400	40,900
		1,200	161,400	99,600	61,400
		1,600	215,000	133,000	81,800
		2,000	269,000	166,000	102,200
200[2]	39.2	400	53,800	33,200	20,400
		600	80,600	49,800	30,700
		800	107,700	66,400	40,900
PR-132[2]	39.2			No Tests	
	77	180	11,680	7,200	4,440
		360	23,300	14,400	8,900
		540	35,000	21,600	13,300
		720	46,700	28,800	17,800

[1]All asphalts were tested under these conditions with the exceptions noted below.

[2]The tabulated data indicate how the testing for specific asphalts differed from the general testing program.

tests at 39.2°F, and the small pulley was used at the remaining two temperatures. The maximum and minimum shearing stresses noted in Table 4 were located at the surfaces of the bob and cup, respectively, and were computed using Equation 3. The average shearing stress through the annulus of the specimens was computed as follows:

$$S_{av} = T/2\pi a_1 a_2 L. \qquad (36)$$

The procedures for preparing the viscometer and specimens for testing and for conducting the creep tests are described in Appendix A. These procedures were prepared to guide laboratory personnel by standardization of the test methods.

After each set of tests was completed, arithmetic plots of θ vs. t and Ω_o[1] vs. CT were constructed. These plots were analyzed to ascertain the characteristics of observed flow behavior. The detailed procedures of data analysis are more fully described in subsequent sections.

---

[1] Ω_o is the steady-state angular velocity of the bob relative to the cup.

PRESENTATION OF RESULTS

Creep curves, which are plots of the angle of rotation of the bob relative to the cup and elapsed time, are the basic form of output from the viscometer. The graphs of such curves for asphalt 72 are shown in Figure 15. These graphs are similar in shape to those for all of the other asphalts and, therefore, may be considered typical creep curves. One graph has been constructed for each of the three test temperatures and an individual curve has been drawn for each value of the CT product -- that is, each level of shearing stress. The scales for each of these three graphs were chosen so as to best represent the extent of testing accomplished and, for this reason, are not identical. The curves do, however, retain their same relative shapes when identical scales are used.

It is readily apparent that the complexity of flow is influenced by the test temperature. For the duration of each test at temperatures of 104°F and 77°F, a linear relationship was observed between the angle of rotation and time. In each case, the experimental line may be assumed to pass through the origin. This behavior is indicative of steady-state flow. However, at 39°F a slight intercept with the angle-of-rotation axis was observed[1], a distinct curvature was noted for small times, and a linear condition was approached as the test progressed. This behavior is similar to that depicted by Figure 8 which

[1]This is not readily apparent from Figure 15 because of the scale that was used for this presentation.

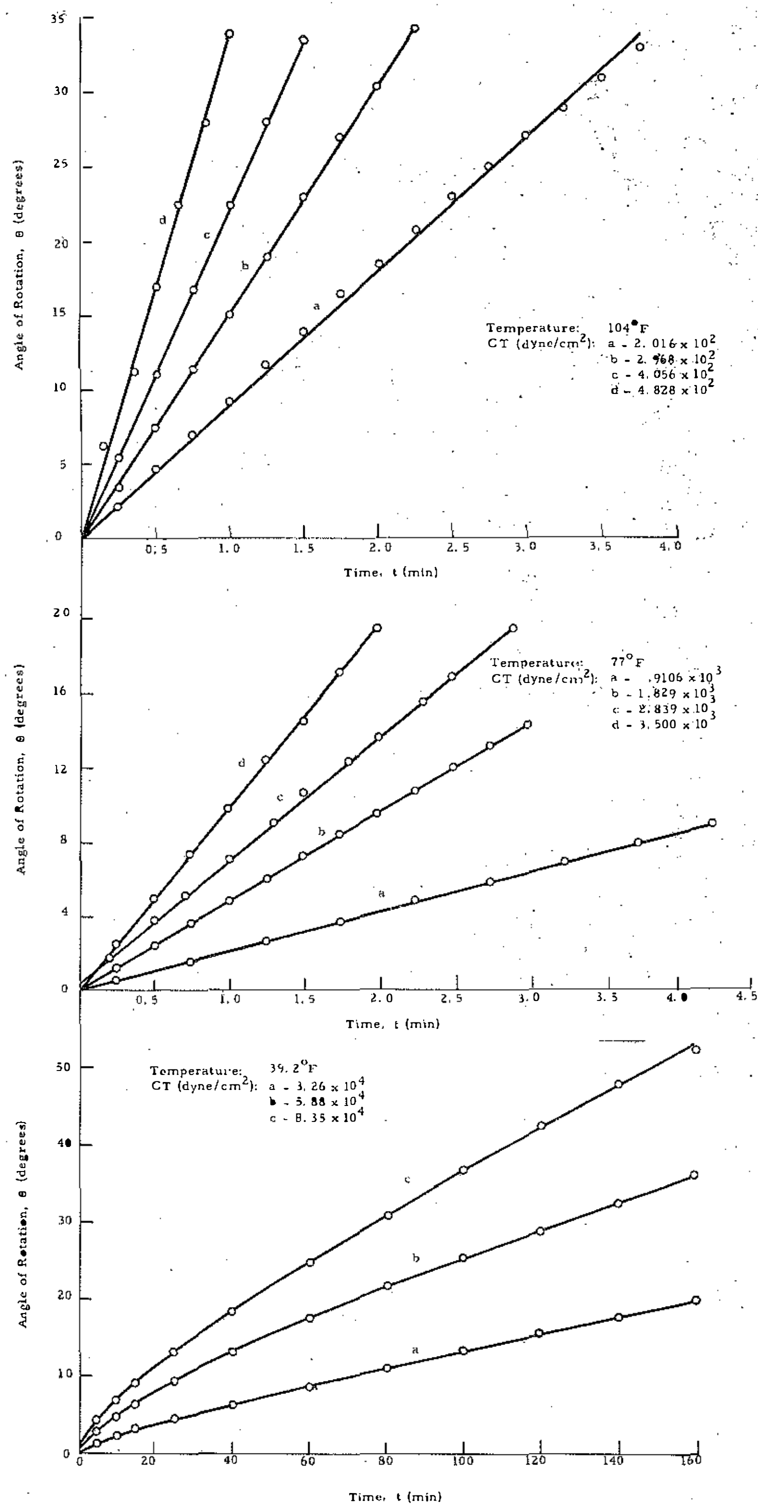


Figure 15. Creep Curves for Asphalt 72 at Three Temperatures.

represents a material exhibiting instantaneous elasticity, viscoelasticity, and steady-state flow.

TESTS AT 104°F

Angle of rotation vs. time plots were constructed for the tests at 104°F. The form of these plots revealed that all of the asphalts exhibited steady-state flow behavior at this temperature. The steady-state, angular velocity, Ω_o, was then determined from the slope of the linear Θ-t plot for each test condition. Figure 16 shows the relationship between the steady-state velocity and the CT product for each of the 13 asphalts. The curves of this figure show distinct linear relationships with extrapolated intercepts on the CT axis. Comparing this observed behavior with that summarized in Figure 6 for various ideal, steady-state liquids, it is concluded that each of the asphalts behave essentially as Bingham plastics at 104°F. The flow behavior of an ideal Bingham plastic in a rotating coaxial cylinder viscometer is more clearly depicted in Figure 4.

After the manner suggested in Figure 4, the yield stress, S_y, and the coefficient of plastic viscosity, η_p , were evaluated for each of the asphalts. The results of this evaluation are presented in Table 5. The yield stresses are quite small and range in value from 108 dynes/cm^2 to 216 dynes/cm^2. Since the minimum applied shearing stress of 246 dynes/cm^2 (from Table 4) exceeded all yield stresses, flow occurred throughout the annulus of the material and Equation 18c adequately describes the flow behavior.

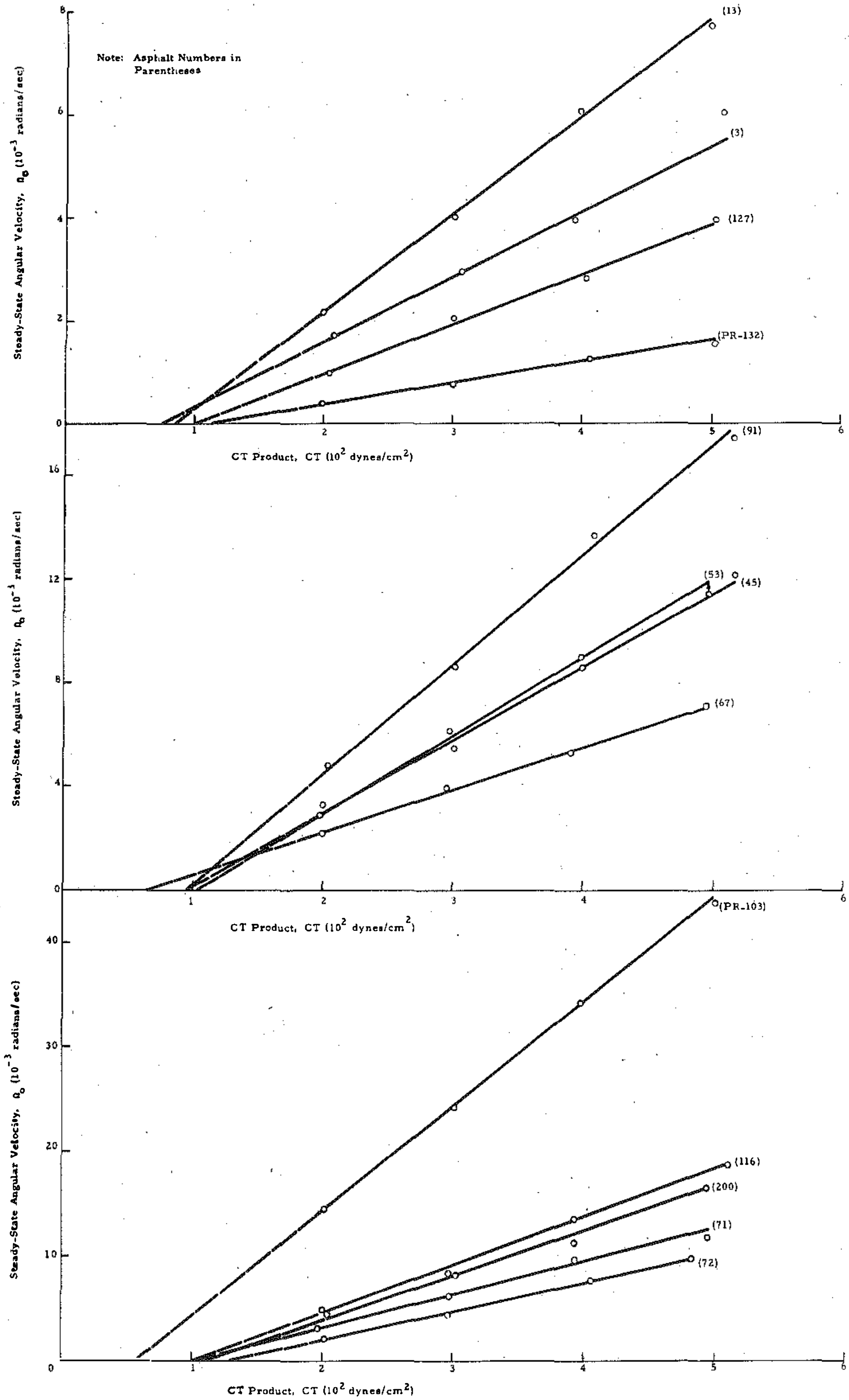


Figure 16. Steady-State Angular Velocity vs. CT Product for 104°F Tests.

TABLE 5

MATERIAL PARAMETERS EVALUATED AT 104°F

Asphalt Number	Yield Stress, S_y (10^2 dynes/cm^2)	Coefficient of Plastic Viscosity, η_p (10^4 poises)
3	1.98	7.03
13	1.73	5.35
45	1.97	3.54
53	1.82	3.56
67	1.33	6.13
71	1.73	3.40
72	2.09	3.66
91	2.00	2.31
116	2.05	2.22
127	2.09	10.30
200	2.09	2.49
PR-103	1.08	1.02
PR-132	2.16	25.50

The coefficient of plastic viscosity exhibited considerably more variability among the asphalts than did the yield stress. The coefficient of plastic viscosity ranged from a minimum of 1.02×10^4 poises (asphalt PR-103) to a maximum of 25.50×10^4 poises (asphalt PR-132). No discernable relationship was found to exist between the yield stress and the coefficient of plastic viscosity.

The plastic viscosity measurements may be used to classify or group the asphalts on the basis of their consistency at 104°F. Such a classification is presented in Table 6. The viscosity intervals were selected so that their ranges were approximately identical on a logarithmic plot. It is interesting to note that two of the PAC-5 asphalts (91 and 116) were slightly less viscous at 104°F than the PAC-7 asphalt (200). It may be recalled that

TABLE 6

CLASSIFICATION OF ASPHALTS BY PLASTIC VISCOSITY AT 104°F

Viscosity Interval (10^4 poises)	Asphalt Numbers
1.0-1.6	PR-103
1.6-2.6	91,116,200
2.6-4.2	45,53,71,72
4.2-6.8	13,67
6.8-11.0	3,127
>11.0	PR-132

these two PAC-5 asphalts had relatively low Saybolt Furol viscosities and ring-and-ball softening points.

TESTS AT 77°F

The test results obtained at 77°F were analyzed in a manner similar to those at 104°F. Once again all of the asphalts exhibited steady-state flow throughout the test duration. Figure 17 shows the relationships between the steady-state, angular velocities and the CT product for all of the asphalts tested at this temperature.[1] As before, all of the asphalts (with the exception of asphalt 127) exhibited properties indicative of a Bingham plastic. Asphalt 127 had no discernable yield stress and was, therefore, assumed to exhibit pure Newtonian flow.

Table 7 summarizes the values of the material parameters evaluated at 77°F. The yield stresses are again quite low and

[1]Asphalt PR-132, although tested at 77°F, was omitted from this figure because of its highly viscous properties when compared with the other asphalts. However, it also exhibited properties characteristic of a Bingham plastic.

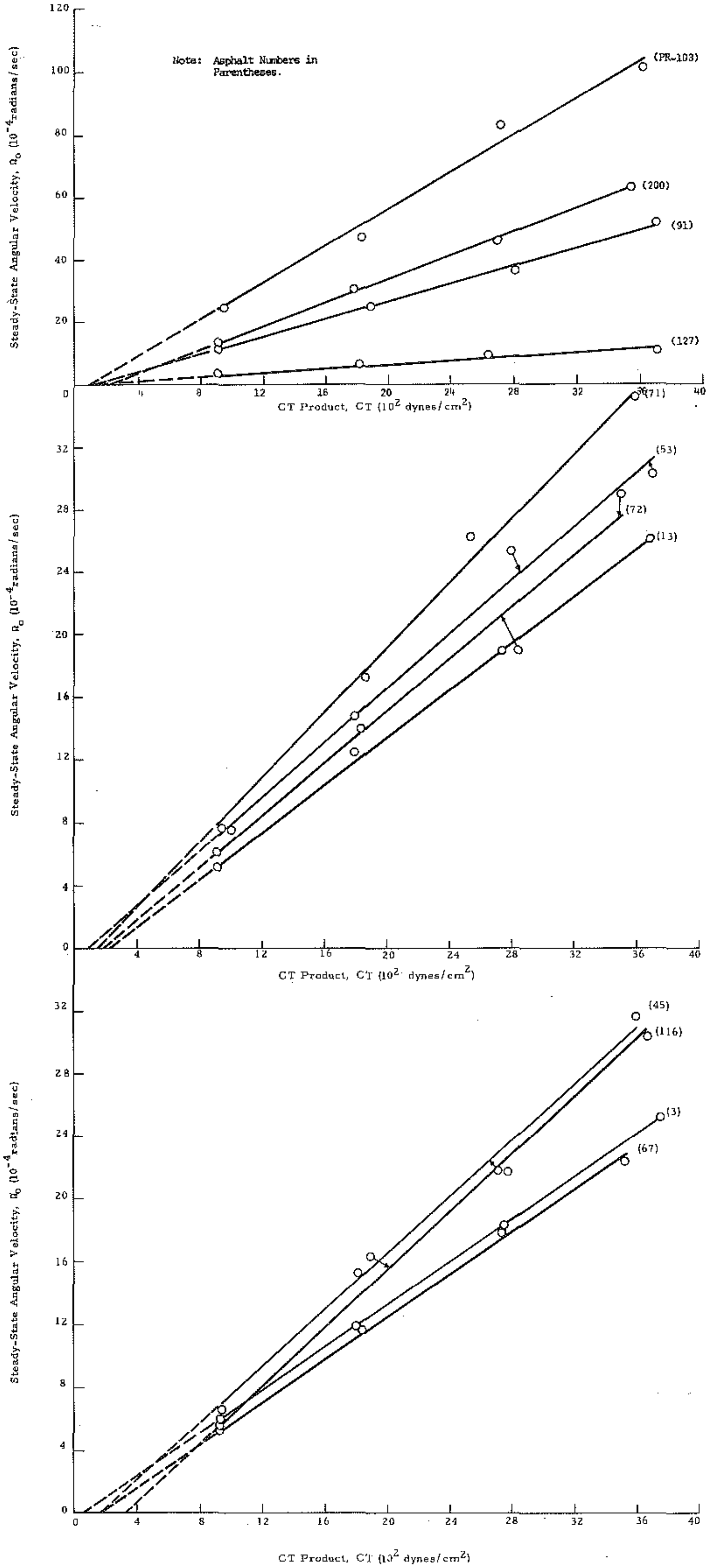


Figure 17. Steady-State Angular Velocity vs. CT Product for 77°F Tests.

TABLE 7

MATERIAL PARAMETERS EVALUATED AT 77°F

Asphalt Number	Yield Stress, S_y (10^2 dynes/cm^2)	Coefficient of Plastic Viscosity, η_p (10^6 poises)
3	1.04	1.47
13	3.66	1.34
45	4.63	0.94
53	1.45	1.15
67	1.94	1.51
71	3.73	0.97
72	3.66	1.24
91	2.91	0.70
116	4.97	1.12
127	0	3.89
200	4.07	0.53
PR-103	8.56	0.34
PR-132	11.90	21.60

asphalts 3, 53, and 127 had smaller yield stresses at this temperature than they had at 104°F. This apparent inconsistency is attributed to a combination of experimental and graphical errors magnified in effect due to the small yield stress levels. Comparing the yield stresses of Table 7 with the minimum applied shearing stresses of Table 4, it is apparent that flow occurred throughout the annulus of each test specimen with the exception of asphalt PR-132. Asphalt PR-132 had a yield stress of 1,190 dynes/cm^2 which was slightly in excess of the minimum applied shearing stress of 1,110 dynes/cm^2 for one of the tests. Again no discernable relationship was found to exist between the yield stress and the coefficient of plastic viscosity.

The asphalts are grouped according to plastic viscosity at 77°F in Table 8. The asphalts maintained their same relative

TABLE 8

CLASSIFICATION OF ASPHALTS BY PLASTIC VISCOSITY AT 77°F

Viscosity Interval (10^6 poises)	Asphalt Numbers
0.3-0.5	PR-103
0.5-0.8	91,200
0.8-1.4	13,45,53,71, 72,116
1.4-2.4	3,67
2.4-4.0	127
> 4.0	PR-132

grouping as at 104°F (Table 6) with the exception of asphalts 3, 13, and 116. Asphalts 3 and 13 became relatively less viscous due to their smaller temperature susceptibilities and asphalt 116 became relatively more viscous due to its greater temperature susceptibility.

TESTS AT 39.2°F

All of the test results at 39.2°F showed instantaneous elasticity and a combination of steady-state and viscoelastic flow. The creep curves were similar to those depicted in Figure 8 and Figure 15 (39.2°F). Each curve was analyzed by separating it into the three basic components (as shown in Figure 8); Θ_1 which represents instantaneous elastic deformation, Θ_2 which represents steady-state flow, and Θ_3 which represents viscoelastic flow.

The instantaneous elastic deformation, Θ_1, is described by Equation 32. This equation may be used to evaluate the elastic shear modulus, G_o, providing Θ_1 and CT are known. The angle, Θ_1, was determined by rapidly loading and unloading each sample a number of times and computing an average value for the instantaneous angle of rotation. This determination was made after each creep test was completed since Θ_1 is time-independent and should not be influenced by previous stress history. The elastic shear modulus, G_o, was determined from the slope of the linear plot of CT against Θ_1. Its value for each of the 12 asphalts tested at this temperature is summarized in Table 9.

TABLE 9

ELASTIC AND STEADY-STATE MATERIAL PARAMETERS EVALUATED AT 39.2°F

Asphalt Number	Elastic Modulus, G_o (10^7 dynes/cm^2)	Yield Stress, S_y (10^4 dynes/cm^2)	Coefficient of Plastic Viscosity, η_p (10^8 poises)
3	2.67	1.12	3.32
13	3.20	1.46	5.51
45	3.04	0	8.66
53	2.70	0	9.85
67	2.26	2.75	5.11
71	1.89	1.86	9.52
72	2.08	1.10	9.63
91	1.95	0.37	4.61
116	2.04	2.05	19.40
127	1.83	0.90	14.80
200	1.56	0	2.47
PR-103	1.55	0	2.84
PR-132		Not Tested	

The steady-state flow deformation, Θ_2, is described by Equation 33. The steady-state, angular velocity of this equation was determined by computing the slope of the straight-line portion of each creep curve. A plot of these steady-state, angular velocities against CT product was made for each asphalt tested at 39.2°F. The resulting graphs are presented in Figure 18. An analysis of these graphs indicates that the steady-state portion of flow is similar in some cases to that of Bingham plastics and in other cases to that of Newtonian materials. The distinction appears to be relatively insignificant, however, due to possible errors occasioned in extrapolation of the Ω_o-CT curve to its intercept on the CT axis and the relatively small intercepts that were observed.

The yield stress, S_y, and the coefficient of plastic viscosity, η_p, were evaluated from the steady-state behavior of each asphalt using the curves of Figure 18. The results of this evaluation are also summarized in Table 9. The yield stresses are relatively small and are exceeded in every case by the minimum applied shearing stresses (compare with Table 4). Once again, this indicates that steady-state flow occurred throughout the annulus of the test material. The steady-state flow deformation, Θ_2, may then be computed using Equations 18c and 33.

The asphalts are grouped according to their plastic viscosity at 39.2°F in Table 10. Again there were slight readjustments from the groupings at 104°F (Table 6) and 77°F (Table 8) which were caused by different temperature susceptibilities of the various asphalts.

The viscoelastic flow deformation, Θ_3, is described by Equation 27. To evaluate the constants, J_k and τ_k, of Equation 27, the following procedure was employed. First, Θ_3 was computed as follows:

$$\Theta_3 = \Theta - CT/G_o - \Omega_o t \qquad (37)$$

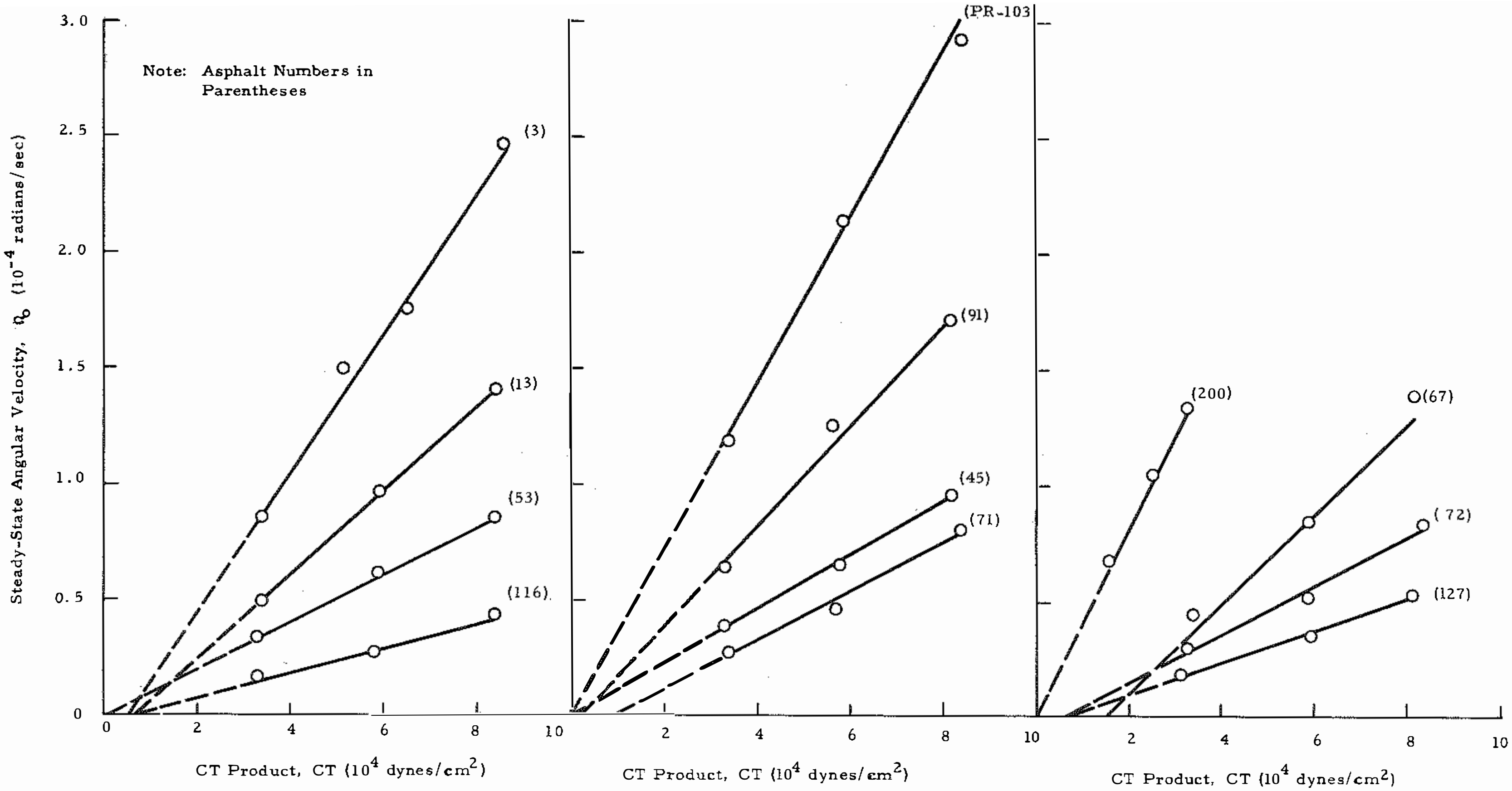


Figure 18. Steady-State Angular Velocity vs. CT Product for 39.2°F Tests.

TABLE 10

CLASSIFICATION OF ASPHALTS BY PLASTIC VISCOSITY AT 39.2°F

Viscosity Interval (10^8 poises)	Asphalt Numbers
2.4-3.7	3,PR-103,200
3.7-5.6	13,67,91
5.6-8.5	-
8.5-13.1	45,53,71,72
13.1-20	116,127

where Θ_3 = viscoelastic flow deformation

Θ = total observed angle of rotation

G_0 = experimentally evaluated elastic shear modulus

Ω_0 = experimentally evaluated steady-state angular velocity.

Equation 37 simply states that the viscoelastic flow deformation equals the total deformation less its components of steady-state flow and instantaneous elasticity. The quotient of Θ_3 and the CT product is the creep function, Ψ, for viscoelastic flow behavior and is ideally independent of shearing stress (see Equations 29 and 31). Thus,

$$\Psi(t) = (\Theta - CT/G_0 - \Omega_0 t)/CT. \qquad (38)$$

The experimental creep function for each of the asphalts and each level of applied shearing stress was computed using the above procedures. Figure 19 shows the results for asphalt 72. The creep functions for the three different stress levels should theoretically coincide if the viscoelastic behavior were linear and there were no experimental errors. Figure 19 shows that the experimental creep functions for asphalt 72 are obviously not identical. The data for this asphalt are representative of those

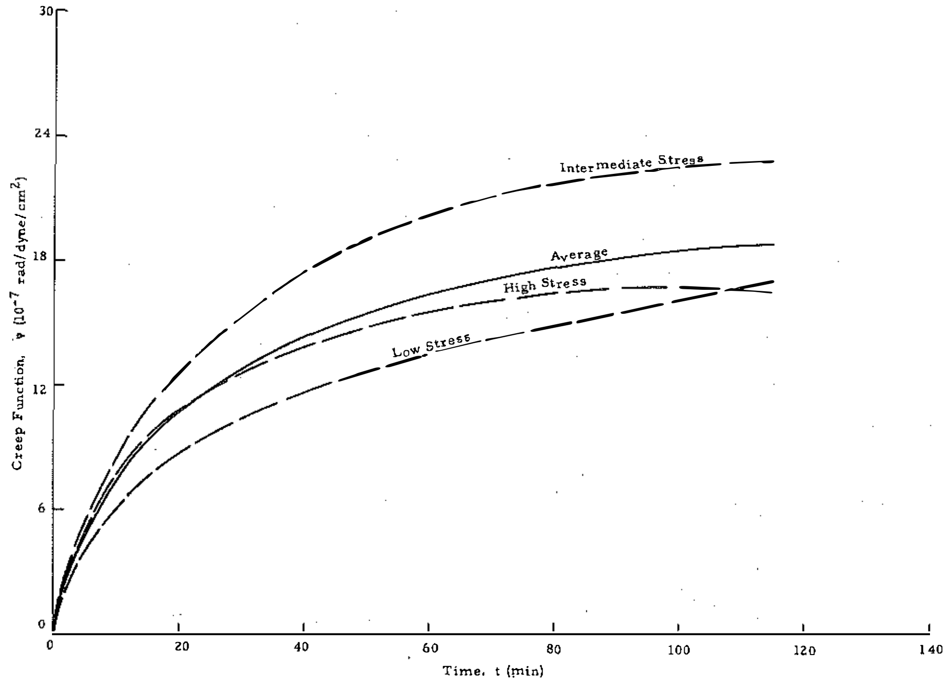


Figure 19. Experimental Creep Functions for Asphalt 72 at 39.2°F.

for the other asphalts. The results among the different asphalts were not predictable, however, in that the largest creep function generally occurred at the smallest stress level for six of the asphalts, at the intermediate level for four of the asphalts, and at the largest level for two of the asphalts.

Since there was apparently no consistent relationship between creep function and stress level, it was felt that the discrepancies among the creep functions could probably be attributed to experimental and graphical errors rather than to material behavior. This conclusion was substantiated by comparing the creep functions computed on the basis of the total angle of rotation, Θ , with those computed on the basis of Θ_3. The absolute value of the differences among the total-angle creep functions for the three stress levels averaged about 6 percent while for the Θ_3 creep functions this average difference was about 25 percent. Since the discrepancies in the total-angle creep functions were acceptably small (average of 6 percent) and well within the limits of experimental error, the asphalts appear to behave linearly under the conditions of test employed herein. Therefore, the larger discrepancies observed in the Θ_3 creep functions (average of 25 percent) are most probably due to experimental and graphical errors.

Despite these errors, it is felt that the creep functions do furnish a reliable indication of the general viscoelastic properties of the materials. Thus, an average creep function was calculated for each asphalt and this average was used in the evaluation of the viscoelastic parameters, G_k and τ_k. Figure 20 shows the average creep functions, computed on the basis of Θ_3, which were used in this analysis.

On the basis of Equation 29, the creep function for linear viscoelastic behavior is as follows:

$$\Psi(t) = \sum_{k=1}^{n} [1 - \exp(-t/\tau_k)]/G_k. \qquad (39)$$

A curve-fitting technique, which is described in detail in Appendix B, was developed and used to evaluate the material parameters of Equation 39. The material parameters were selected so that a best fit by the least squares criterion was achieved between the theoretical relationship of Equation 39 and the observed, average creep functions for the various asphalts. The number of Voigt elements, n, was varied beginning

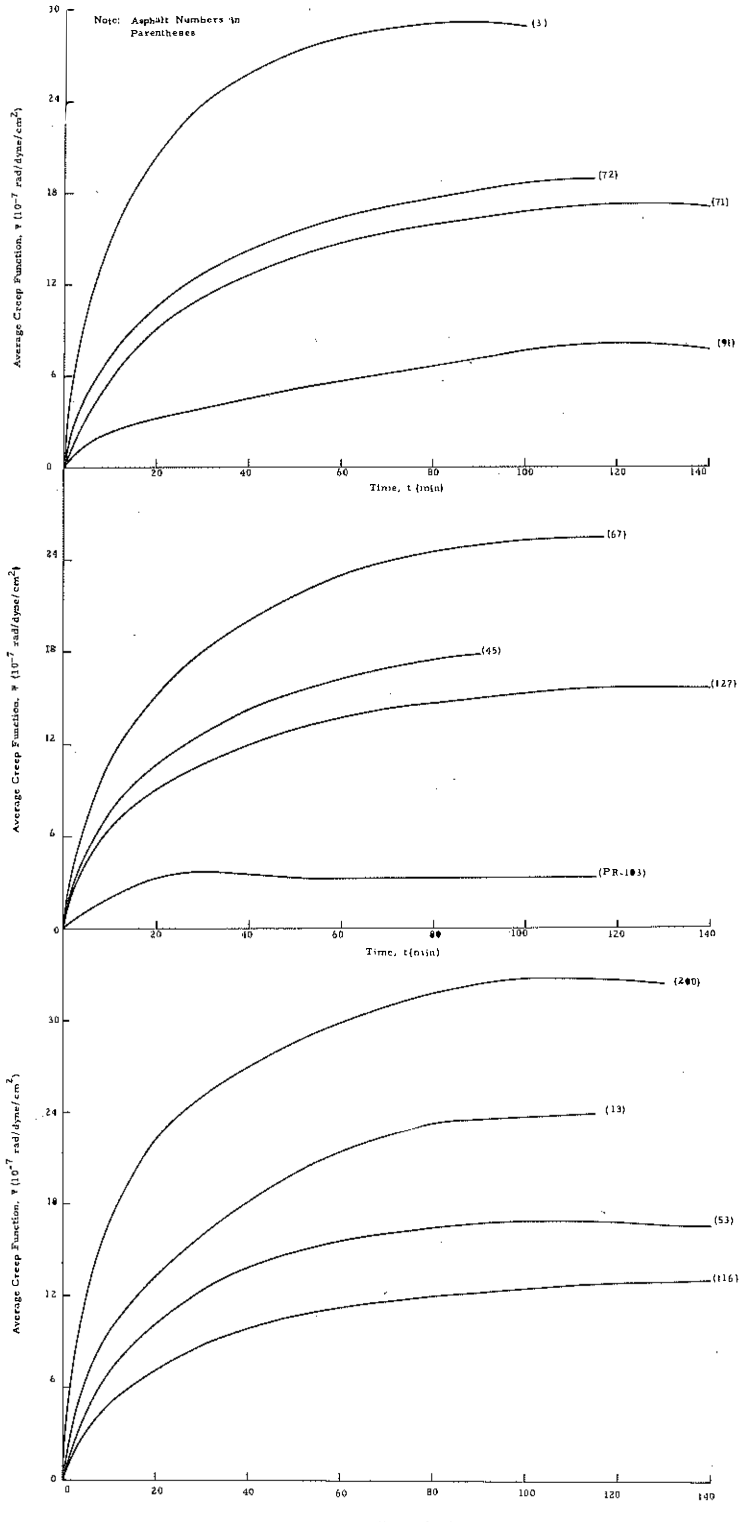


Figure 20. Average Creep Functions for All Asphalts at 39.2°F.

with one and increasing by increments of one until the computed values of the creep function were in satisfactory agreement with the observed values. The technique was programmed for the IBM 7040 computer: a discussion of this program is included as Appendix C.

A print-out of the results for asphalt 72 is included for illustration as Figure 21. The basic data for the analysis are given in the columns aligned beneath the heading "Data Sheet". The values of the observed, total angle of rotation and the Θ_3 creep function computed for each value of the CT product are printed for selected values of elapsed time. The headings "THETA 1" and "CF 1" correspond to the observed, total angle of rotation and the computed creep function respectively for the smallest CT product noted in the heading; "THETA 2" and "CF 2" correspond to the intermediate CT product; and, finally, "THETA 3" and "CF 3" correspond to the largest CT product. Only three levels of the CT product are permitted. The average creep function for these three levels is shown in the last column of the "Data Sheet".

Information concerning the equation of best fit is given in the set of columns aligned beneath the heading, "Equation of Best Fit". One such set of columns is shown for each value of n, the number of Voigt elements in the model. For a two-element model, for example, "TAU1", "G1", and "VISC1" refer to the retardation time, shear modulus, and coefficient of viscosity, respectively, for the first element while "TAU2", "G2", and "VISC2" refer to the same values for the second element. The values shown for these parameters are those derived from the

SUMMARY SHEET FOR VISCOELASTIC ANALYSIS

ASPHALT AC- 72 LOADS- 800 1400 2000 GM
TEST TEMP- 39.2 F CTS- 32566. 58617. 83485. DY/SQCM

TIME MIN	THETA 1- RAD	CF 1 RA/D/SQCM	THETA 2 RAD	CF 2 RA/D/SQCM	THETA 3 RAD	CF 3 RA/D/SQCM	AVG CF RA/D/SQCM
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

TAU1 = 0.1277866E 04 SEC G1 = 0.5591615E 06 DYNES/SQ CM VISC1 = 0.7122969E 09 POISES

OBSERVED THETA 1 (RAD)	CALCULATED THETA 1 (RAD)	OBSERVED THETA 2 (RAD)	CALCULATED THETA 2 (RAD)	OBSERVED THETA 3 (RAD)	CALCULATED THETA 3 (RAD)	OBSERVED CF FUNCTION (RA/D/SQCM)	CALCULATED CF FUNCTION (RA/D/SQCM)
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

TAU1 = 0.1965948E 04 SEC G1 = 0.4250558E 06 DYNES/SQ CM VISC1 = 0.1220927E 10 POISES

TAU2 = 0.1060739E 03 SEC G2 = 0.3180280E 07 DYNES/SQ CM VISC2 = 0.3373448E 09 POISES

OBSERVED THETA 1 (RAD)	CALCULATED THETA 1 (RAD)	OBSERVED THETA 2 (RAD)	CALCULATED THETA 2 (RAD)	OBSERVED THETA 3 (RAD)	CALCULATED THETA 3 (RAD)	OBSERVED CF FUNCTION (RA/D/SQCM)	CALCULATED CF FUNCTION (RA/D/SQCM)
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

STD DEV = 0.7568?E-02 0.1494?E-01 0.9646?E-02 0.8712?E-07 STD DEV = 0.7165?E-02 0.1470?E-01 0.6873?E-02 0.1471?E-07

Figure 21. Viscoelastic Analysis for Asphalt 72 at 39.2°F.

TAU1 = 0.2282571E 04 SEC   G1 = 0.6666441E 06 DYNES/SQ CM   VISC1 = 0.1521662E 10 POISES

TAU2 = 0.3563419E 03 SEC   G2 = 0.3058437E 07 DYNES/SQ CM   VISC2 = 0.1089871E 10 POISES

TAU3 = 0.2690098E 02 SEC   G3 = 0.7687294E 07 DYNES/SQ CM   VISC3 = 0.2067958E 09 POISES

TIME (MIN)	OBSERVED THETA 1 (RAD)	CALCULATED THETA 1 (RAD)	OBSERVED THETA 2 (RAD)	CALCULATED THETA 2 (RAD)	OBSERVED THETA 3 (RAD)	CALCULATED THETA 3 (RAD)	OBSERVED CP FUNCTION (RA/D/SQCM)	CALCULATED CP FUNCTION (RA/D/SQCM)
0.0	0.69813E-03	0.15642E-02	0.17453E-02	0.28250E-02	0.34907E-02	0.40078E-02	-0.	-0.
0.1	0.20944E-02	0.28976E-02	0.52360E-02	0.52175E-02	0.92502E-02	0.74619E-02	0.51476E-07	0.55403E-07
0.2	0.33161E-02	0.40584E-02	0.69813E-02	0.72903E-02	0.12043E-01	0.10475E-01	0.79427E-07	0.65506E-07
0.3	0.38397E-02	0.50805E-02	0.87267E-02	0.91286E-02	0.13963E-01	0.13131E-01	0.96748E-07	0.91349E-07
0.4	0.50615E-02	0.59910E-02	0.10472E-01	0.10757E-01	0.16057E-01	0.15501E-01	0.12191E-06	0.11377E-06
0.5	0.52360E-02	0.68116E-02	0.11868E-01	0.12224E-01	0.17977E-01	0.17640E-01	0.13368E-06	0.13342E-06
0.6	0.59341E-02	0.75598E-02	0.10821E-01	0.13559E-01	0.19897E-01	0.19594E-01	0.13696E-06	0.15065E-06
0.7	0.66323E-02	0.82493E-02	0.13963E-01	0.14709E-01	0.21642E-01	0.21347E-01	0.16329E-06	0.16649E-06
0.8	0.69813E-02	0.88915E-02	0.15533E-01	0.15933E-01	0.23213E-01	0.23079E-01	0.17644E-06	0.18066E-06
0.9	0.75049E-02	0.94951E-02	0.16057E-01	0.17027E-01	0.24784E-01	0.24662E-01	0.18544E-06	0.19366E-06
1.0	0.83776E-02	0.10067E-01	0.17453E-01	0.18025E-01	0.26529E-01	0.26105E-01	0.20366E-06	0.20569E-06
1.1	0.87267E-02	0.10614E-01	0.18675E-01	0.18997E-01	0.27925E-01	0.27602E-01	0.21414E-06	0.21693E-06
1.2	0.90757E-02	0.11140E-01	0.19373E-01	0.19930E-01	0.29496E-01	0.28966E-01	0.22234E-06	0.22753E-06
1.3	0.95993E-02	0.11648E-01	0.20769E-01	0.20832E-01	0.30892E-01	0.30314E-01	0.23560E-06	0.23760E-06
1.4	0.10472E-01	0.12142E-01	0.21293E-01	0.21708E-01	0.31940E-01	0.31626E-01	0.24608E-06	0.24722E-06
1.5	0.10472E-01	0.12624E-01	0.22689E-01	0.22563E-01	0.33161E-01	0.32897E-01	0.25329E-06	0.25647E-06
1.6	0.10821E-01	0.13095E-01	0.23562E-01	0.23399E-01	0.34907E-01	0.34142E-01	0.26317E-06	0.26542E-06
1.7	0.11519E-01	0.13558E-01	0.24435E-01	0.24220E-01	0.36303E-01	0.35365E-01	0.27524E-06	0.27409E-06
1.8	0.12217E-01	0.14014E-01	0.25307E-01	0.25027E-01	0.37176E-01	0.36569E-01	0.28522E-06	0.28295E-06
1.9	0.12217E-01	0.14464E-01	0.26180E-01	0.25823E-01	0.38397E-01	0.37756E-01	0.28945E-06	0.29080E-06
2.0	0.12392E-01	0.14907E-01	0.27576E-01	0.26609E-01	0.39968E-01	0.38934E-01	0.29983E-06	0.29789E-06
2.1	0.12915E-01	0.15346E-01	0.27925E-01	0.27386E-01	0.41015E-01	0.40091E-01	0.30575E-06	0.30683E-06
2.2	0.13614E-01	0.15781E-01	0.29147E-01	0.28155E-01	0.42062E-01	0.41246E-01	0.31840E-06	0.31463E-06
2.3	0.13963E-01	0.16211E-01	0.29671E-01	0.28917E-01	0.43633E-01	0.42380E-01	0.32562E-06	0.32230E-06
2.4	0.14137E-01	0.16638E-01	0.30543E-01	0.29672E-01	0.45030E-01	0.43519E-01	0.33233E-06	0.32967E-06
2.5	0.14312E-01	0.17062E-01	0.31416E-01	0.30421E-01	0.45728E-01	0.44631E-01	0.33626E-06	0.33734E-06
2.6	0.15010E-01	0.17402E-01	0.32289E-01	0.31165E-01	0.47124E-01	0.45745E-01	0.34833E-06	0.34470E-06
2.7	0.15533E-01	0.17900E-01	0.33161E-01	0.31903E-01	0.48171E-01	0.46851E-01	0.35722E-06	0.35199E-06
2.8	0.15708E-01	0.18315E-01	0.34034E-01	0.32637E-01	0.49218E-01	0.47950E-01	0.36254E-06	0.35918E-06
2.9	0.15883E-01	0.18727E-01	0.34907E-01	0.33365E-01	0.50440E-01	0.49043E-01	0.36855E-06	0.36630E-06
3.0	0.16406E-01	0.19137E-01	0.35779E-01	0.34090E-01	0.51662E-01	0.50129E-01	0.37814E-06	0.37334E-06
4.0	0.19897E-01	0.23113E-01	0.43459E-01	0.41114E-01	0.62308E-01	0.60679E-01	0.44395E-06	0.44007E-06
5.0	0.23213E-01	0.26901E-01	0.50615E-01	0.47797E-01	0.72431E-01	0.70746E-01	0.50291E-06	0.50691E-06
6.0	0.26529E-01	0.30528E-01	0.57421E-01	0.54190E-01	0.82205E-01	0.80461E-01	0.55690E-06	0.55186E-06
7.0	0.29671E-01	0.34016E-01	0.63705E-01	0.60332E-01	0.91106E-01	0.89710E-01	0.60586E-06	0.60185E-06
8.0	0.32987E-01	0.37383E-01	0.69988E-01	0.66255E-01	0.10053E 00	0.98648E-01	0.65709E-06	0.65652E-06
9.0	0.35605E-01	0.40644E-01	0.76620E-01	0.71987E-01	0.10926E 00	0.10740E 00	0.70036E-06	0.70123E-06
10.0	0.38397E-01	0.43811E-01	0.82205E-01	0.77551E-01	0.11764E 00	0.11560E 00	0.73610E-06	0.74308E-06
11.0	0.41539E-01	0.46897E-01	0.88488E-01	0.82966E-01	0.12549E 00	0.12415E 00	0.78127E-06	0.78243E-06
12.0	0.43982E-01	0.49910E-01	0.94248E-01	0.88250E-01	0.13369E 00	0.13213E 00	0.81572E-06	0.81950E-06
13.0	0.46949E-01	0.52858E-01	0.99658E-01	0.93417E-01	0.14172E 00	0.14014E 00	0.85286E-06	0.85661E-06
14.0	0.49393E-01	0.55748E-01	0.10542E 00	0.98479E-01	0.14940E 00	0.14771E 00	0.88522E-06	0.88794E-06
15.0	0.52360E-01	0.58586E-01	0.11100E 00	0.10345E 00	0.15725E 00	0.15554E 00	0.92265E-06	0.91967E-06
16.0	0.54454E-01	0.61377E-01	0.11589E 00	0.10833E 00	0.16476E 00	0.16305E 00	0.94580E-06	0.94998E-06
17.0	0.57247E-01	0.64126E-01	0.12165E 00	0.11314E 00	0.17209E 00	0.17046E 00	0.98036E-06	0.97694E-06
18.0	0.59516E-01	0.66836E-01	0.12619E 00	0.11787E 00	0.17907E 00	0.17776E 00	0.10012E-05	0.10067E-05
19.0	0.61959E-01	0.69510E-01	0.13125E 00	0.12255E 00	0.18640E 00	0.18477E 00	0.10282E-05	0.10334E-05
20.0	0.64577E-01	0.72151E-01	0.13631E 00	0.12716E 00	0.19338E 00	0.19210E 00	0.10556E-05	0.10591E-05
21.0	0.66846E-01	0.74762E-01	0.14137E 00	0.13172E 00	0.20054E 00	0.19915E 00	0.10802E-05	0.10839E-05
22.0	0.69639E-01	0.77344E-01	0.14643E 00	0.13622E 00	0.20735E 00	0.20613E 00	0.11096E-05	0.11077E-05
23.0	0.71733E-01	0.79901E-01	0.15149E 00	0.14068E 00	0.21415E 00	0.21306E 00	0.11300E-05	0.11308E-05
24.0	0.74700E-01	0.82432E-01	0.15621E 00	0.14510E 00	0.22061E 00	0.21990E 00	0.11569E-05	0.11531E-05
25.0	0.76795E-01	0.84940E-01	0.16074E 00	0.14947E 00	0.22724E 00	0.22667E 00	0.11746E-05	0.11747E-05
26.0	0.79063E-01	0.87427E-01	0.16581E 00	0.15380E 00	0.23335E 00	0.23340E 00	0.11949E-05	0.11957E-05
27.0	0.81056E-01	0.89892E-01	0.17087E 00	0.15810E 00	0.23998E 00	0.24006E 00	0.12227E-05	0.12157E-05
28.0	0.83950E-01	0.92338E-01	0.17471E 00	0.16236E 00	0.24627E 00	0.24671E 00	0.12351E-05	0.12356E-05
29.0	0.86219E-01	0.94764E-01	0.17977E 00	0.16658E 00	0.25237E 00	0.25328E 00	0.12594E-05	0.12547E-05
30.0	0.88837E-01	0.97173E-01	0.18413E 00	0.17077E 00	0.25901E 00	0.25972E 00	0.12775E-05	0.12733E-05
32.0	0.93201E-01	0.10194E 00	0.19373E 00	0.17907E 00	0.27157E 00	0.27275E 00	0.13148E-05	0.13008E-05
34.0	0.97913E-01	0.10664E 00	0.20263E 00	0.18724E 00	0.28362E 00	0.28552E 00	0.13497E-05	0.13423E-05
36.0	0.10228E 00	0.11128E 00	0.21118E 00	0.19531E 00	0.29479E 00	0.29813E 00	0.13755E-05	0.13741E-05
38.0	0.10647E 00	0.11587E 00	0.22009E 00	0.20329E 00	0.30578E 00	0.31061E 00	0.14008E-05	0.14041E-05
40.0	0.11135E 00	0.12041E 00	0.22864E 00	0.21116E 00	0.31695E 00	0.32245E 00	0.14320E-05	0.14325E-05
42.0	0.11519E 00	0.12490E 00	0.23719E 00	0.21895E 00	0.32777E 00	0.33517E 00	0.14511E-05	0.14575E-05
44.0	0.11956E 00	0.12934E 00	0.24574E 00	0.22666E 00	0.34226E 00	0.34727E 00	0.14901E-05	0.14891E-05
46.0	0.12392E 00	0.13374E 00	0.25412E 00	0.23429E 00	0.35343E 00	0.35976E 00	0.15150E-05	0.15093E-05
48.0	0.12793E 00	0.13809E 00	0.26581E 00	0.24184E 00	0.36442E 00	0.37114E 00	0.15543E-05	0.15327E-05
50.0	0.13230E 00	0.14241E 00	0.27402E 00	0.24933E 00	0.37594E 00	0.38293E 00	0.15796E-05	0.15540E-05
52.0	0.13614E 00	0.14669E 00	0.27768E 00	0.25675E 00	0.38677E 00	0.39442E 00	0.15709E-05	0.15747E-05
54.0	0.13958E 00	0.15094E 00	0.28536E 00	0.26410E 00	0.39881E 00	0.40622E 00	0.15899E-05	0.15943E-05
56.0	0.14434E 00	0.15516E 00	0.29304E 00	0.27140E 00	0.40980E 00	0.41774E 00	0.16101E-05	0.16129E-05
58.0	0.14835E 00	0.15934E 00	0.30020E 00	0.27864E 00	0.42080E 00	0.42914E 00	0.16230E-05	0.16305E-05
60.0	0.15237E 00	0.16350E 00	0.30735E 00	0.28583E 00	0.43197E 00	0.44055E 00	0.16381E-05	0.16472E-05
62.0	0.15708E 00	0.16762E 00	0.31433E 00	0.29297E 00	0.44279E 00	0.45194E 00	0.16572E-05	0.16631E-05
64.0	0.16074E 00	0.17172E 00	0.32149E 00	0.30006E 00	0.45413E 00	0.46305E 00	0.16687E-05	0.16782E-05
66.0	0.16493E 00	0.17580E 00	0.32899E 00	0.30710E 00	0.46548E 00	0.47422E 00	0.16875E-05	0.16925E-05
68.0	0.16930E 00	0.17985E 00	0.33650E 00	0.31410E 00	0.47613E 00	0.48512E 00	0.17053E-05	0.17060E-05
70.0	0.17296E 00	0.18388E 00	0.34331E 00	0.32106E 00	0.48677E 00	0.49618E 00	0.17120E-05	0.17189E-05
72.0	0.17767E 00	0.18788E 00	0.34959E 00	0.32799E 00	0.49829E 00	0.50735E 00	0.17299E-05	0.17311E-05
74.0	0.18151E 00	0.19187E 00	0.35657E 00	0.33487E 00	0.50876E 00	0.51028E 00	0.17387E-05	0.17426E-05
76.0	0.18535E 00	0.19584E 00	0.36390E 00	0.34172E 00	0.51941E 00	0.52917E 00	0.17501E-05	0.17536E-05
78.0	0.19007E 00	0.19979E 00	0.37053E 00	0.34854E 00	0.53006E 00	0.54000E 00	0.17666E-05	0.17641E-05
80.0	0.19373E 00	0.20372E 00	0.37717E 00	0.35532E 00	0.54053E 00	0.55087E 00	0.17716E-05	0.17739E-05
82.0	0.19792E 00	0.20763E 00	0.38397E 00	0.36208E 00	0.55083E 00	0.56155E 00	0.17822E-05	0.17833E-05
84.0	0.20228E 00	0.21153E 00	0.39095E 00	0.36881E 00	0.56077E 00	0.57276E 00	0.17943E-05	0.17922E-05
86.0	0.20595E 00	0.21542E 00	0.39759E 00	0.37551E 00	0.57072E 00	0.58233E 00	0.17972E-05	0.18007E-05
88.0	0.20979E 00	0.21929E 00	0.40404E 00	0.38218E 00	0.58067E 00	0.59359E 00	0.18009E-05	0.18087E-05
90.0	0.21380E 00	0.22315E 00	0.41103E 00	0.38883E 00	0.59079E 00	0.60417E 00	0.18101E-05	0.18163E-05
92.0	0.21817E 00	0.22699E 00	0.41801E 00	0.39546E 00	0.60074E 00	0.61479E 00	0.18221E-05	0.18234E-05
94.0	0.22201E 00	0.23082E 00	0.42446E 00	0.40207E 00	0.61069E 00	0.62527E 00	0.18259E-05	0.18303E-05
96.0	0.22602E 00	0.23464E 00	0.43110E 00	0.40865E 00	0.62134E 00	0.63574E 00	0.18351E-05	0.18364E-05
98.0	0.23021E 00	0.23845E 00	0.43825E 00	0.41522E 00	0.63163E 00	0.64620E 00	0.18478E-05	0.18430E-05
100.0	0.23405E 00	0.24225E 00	0.44506E 00	0.42177E 00	0.64141E 00	0.65677E 00	0.18528E-05	0.18498E-05
105.0	0.24435E 00	0.25171E 00	0.46164E 00	0.43806E 00	0.66567E 00	0.68273E 00	0.18673E-05	0.18622E-05
110.0	0.25447E 00	0.26112E 00	0.47822E 00	0.45426E 00	0.69098E 00	0.70864E 00	0.18881E-05	0.18739E-05
115.0	0.26354E 00	0.27047E 00	0.49393E 00	0.47037E 00	0.71559E 00	0.73442E 00	0.18885E-05	0.18841E-05

STD DEV = 0.71513E-02   0.14215E-01   0.67207E-02   0.60619E-08

TAU1 = 0.2505176E 04 SEC   G1 = 0.7150541E 06 DYNES/SQ CM   VISC1 = 0.1791338E 10 POISES

TAU2 = 0.6134303E 03 SEC   G2 = 0.2097040E 07 DYNES/SQ CM   VISC2 = 0.1654463E 10 POISES

TAU3 = 0.9144135E 02 SEC   G3 = 0.6668424E 07 DYNES/SQ CM   VISC3 = 0.6097697E 09 POISES

TAU4 = 0.7940851E 01 SEC   G4 = 0.1694402E 08 DYNES/SQ CM   VISC4 = 0.1277723E 09 POISES

TIME (MIN)	OBSERVED THETA 1 (RAD)	CALCULATED THETA 1 (RAD)	OBSERVED THETA 2 (RAD)	CALCULATED THETA 2 (RAD)	OBSERVED THETA 3 (RAD)	CALCULATED THETA 3 (RAD)	OBSERVED CP FUNCTION (RA/D/SQCM)	CALCULATED CP FUNCTION (RA/D/SQCM)
0.0	0.69813E-03	0.15642E-02	0.17453E-02	0.28250E-02	0.34907E-02	0.40091E-02	-0.	-0.
0.1	0.20944E-02	0.33359E-02	0.52360E-02	0.60092E-02	0.92502E-02	0.85879E-02	0.51476E-07	0.48862E-07
0.2	0.33161E-02	0.45078E-02	0.69813E-02	0.81100E-02	0.12043E-01	0.11628E-01	0.79427E-07	0.77307E-07
0.3	0.38397E-02	0.53988E-02	0.87267E-02	0.97034E-02	0.13963E-01	0.13947E-01	0.96748E-07	0.10112E-06
0.4	0.50615E-02	0.61632E-02	0.10472E-01	0.11050E-01	0.16057E-01	0.15917E-01	0.12191E-06	0.11875E-06
0.5	0.52360E-02	0.68369E-02	0.11868E-01	0.12264E-01	0.17977E-01	0.17705E-01	0.13368E-06	0.13420E-06
0.6	0.59341E-02	0.74801E-02	0.10821E-01	0.13415E-01	0.19897E-01	0.19391E-01	0.13696E-06	0.14941E-06
0.7	0.66323E-02	0.80970E-02	0.13963E-01	0.14513E-01	0.21642E-01	0.21207E-01	0.16329E-06	0.16181E-06
0.8	0.69813E-02	0.86643E-02	0.15533E-01	0.15577E-01	0.23213E-01	0.22757E-01	0.17644E-06	0.17461E-06
0.9	0.75049E-02	0.92756E-02	0.16057E-01	0.16611E-01	0.24784E-01	0.24100E-01	0.18544E-06	0.18692E-06
1.0	0.83776E-02	0.98430E-02	0.17453E-01	0.17620E-01	0.26529E-01	0.25549E-01	0.20366E-06	0.19980E-06
1.1	0.87267E-02	0.10393E-01	0.18675E-01	0.18606E-01	0.27925E-01	0.27043E-01	0.21414E-06	0.21029E-06
1.2	0.90757E-02	0.10941E-01	0.19373E-01	0.19571E-01	0.29496E-01	0.28417E-01	0.22234E-06	0.22142E-06
1.3	0.95993E-02	0.11473E-01	0.20769E-01	0.20516E-01	0.30892E-01	0.29873E-01	0.23560E-06	0.23272E-06
1.4	0.10472E-01	0.11595E-01	0.21293E-01	0.21443E-01	0.31940E-01	0.31241E-01	0.24608E-06	0.24270E-06
1.5	0.10472E-01	0.12507E-01	0.22689E-01	0.22352E-01	0.33161E-01	0.32597E-01	0.25329E-06	0.25292E-06
1.6	0.10821E-01	0.13010E-01	0.23562E-01	0.23244E-01	0.34907E-01	0.33922E-01	0.26317E-06	0.26279E-06
1.7	0.11519E-01	0.13504E-01	0.24435E-01	0.24122E-01	0.36303E-01	0.35227E-01	0.27524E-06	0.27242E-06
1.8	0.12217E-01	0.13990E-01	0.25307E-01	0.24984E-01	0.37176E-01	0.36507E-01	0.28522E-06	0.28181E-06
1.9	0.12217E-01	0.14469E-01	0.26180E-01	0.25833E-01	0.38397E-01	0.37776E-01	0.28945E-06	0.29097E-06
2.0	0.12392E-01	0.14940E-01	0.27576E-01	0.26668E-01	0.39968E-01	0.39014E-01	0.29983E-06	0.29990E-06
2.1	0.12915E-01	0.15405E-01	0.27925E-01	0.27491E-01	0.41015E-01	0.40246E-01	0.30575E-06	0.30852E-06
2.2	0.13614E-01	0.15863E-01	0.29147E-01	0.28303E-01	0.42062E-01	0.41451E-01	0.31840E-06	0.31714E-06
2.3	0.13963E-01	0.16315E-01	0.29671E-01	0.29103E-01	0.43633E-01	0.42644E-01	0.32562E-06	0.32547E-06
2.4	0.14137E-01	0.16761E-01	0.30543E-01	0.29893E-01	0.45030E-01	0.43823E-01	0.33233E-06	0.33362E-06
2.5	0.14312E-01	0.17201E-01	0.31416E-01	0.30672E-01	0.45728E-01	0.44978E-01	0.33626E-06	0.34151E-06
2.6	0.15010E-01	0.17636E-01	0.32289E-01	0.31443E-01	0.47124E-01	0.46116E-01	0.34833E-06	0.34943E-06
2.7	0.15533E-01	0.18067E-01	0.33161E-01	0.32204E-01	0.48171E-01	0.47274E-01	0.35722E-06	0.35710E-06
2.8	0.15708E-01	0.18497E-01	0.34034E-01	0.32957E-01	0.49218E-01	0.48400E-01	0.36254E-06	0.36463E-06
2.9	0.15883E-01	0.18919E-01	0.34907E-01	0.33702E-01	0.50440E-01	0.49526E-01	0.36855E-06	0.37202E-06
3.0	0.16406E-01	0.19330E-01	0.35779E-01	0.34439E-01	0.51662E-01	0.50675E-01	0.37814E-06	0.37928E-06
4.0	0.19897E-01	0.23305E-01	0.43459E-01	0.41461E-01	0.62308E-01	0.61172E-01	0.44395E-06	0.44972E-06
5.0	0.23213E-01	0.27021E-01	0.50615E-01	0.48013E-01	0.72431E-01	0.71053E-01	0.50291E-06	0.50459E-06
6.0	0.26529E-01	0.30560E-01	0.57421E-01	0.54248E-01	0.82205E-01	0.80497E-01	0.55690E-06	0.55785E-06
7.0	0.29671E-01	0.33976E-01	0.63705E-01	0.60249E-01	0.91106E-01	0.89541E-01	0.60586E-06	0.60713E-06
8.0	0.32987E-01	0.37277E-01	0.69988E-01	0.66064E-01	0.10053E 00	0.98417E-01	0.65709E-06	0.65927E-06
9.0	0.35605E-01	0.40499E-01	0.76620E-01	0.71725E-01	0.10926E 00	0.10705E 00	0.70036E-06	0.69677E-06
10.0	0.38397E-01	0.43645E-01	0.82205E-01	0.77251E-01	0.11764E 00	0.11546E 00	0.73610E-06	0.73798E-06
11.0	0.41539E-01	0.46725E-01	0.88488E-01	0.82655E-01	0.12549E 00	0.12371E 00	0.78127E-06	0.77712E-06
12.0	0.43982E-01	0.49743E-01	0.94248E-01	0.87948E-01	0.13369E 00	0.13130E 00	0.81572E-06	0.81438E-06
13.0	0.46949E-01	0.52705E-01	0.99658E-01	0.93141E-01	0.14172E 00	0.13975E 00	0.85286E-06	0.85992E-06
14.0	0.49393E-01	0.55615E-01	0.10542E 00	0.98239E-01	0.14940E 00	0.14757E 00	0.88522E-06	0.88366E-06
15.0	0.52360E-01	0.58477E-01	0.11100E 00	0.10325E 00	0.15725E 00	0.15526E 00	0.92265E-06	0.91632E-06
16.0	0.54454E-01	0.61294E-01	0.11589E 00	0.10818E 00	0.16476E 00	0.16284E 00	0.94580E-06	0.94740E-06
17.0	0.57247E-01	0.64069E-01	0.12165E 00	0.11303E 00	0.17209E 00	0.17031E 00	0.98036E-06	0.97715E-06
18.0	0.59516E-01	0.66804E-01	0.12615E 00	0.11782E 00	0.17907E 00	0.17761E 00	0.10012E-05	0.10058E-05
19.0	0.61959E-01	0.69503E-01	0.13125E 00	0.12253E 00	0.18640E 00	0.18491E 00	0.10282E-05	0.10352E-05
20.0	0.64577E-01	0.72167E-01	0.13631E 00	0.12719E 00	0.19338E 00	0.19216E 00	0.10556E-05	0.10596E-05
21.0	0.66846E-01	0.74779E-01	0.14137E 00	0.13178E 00	0.20054E 00	0.19925E 00	0.10802E-05	0.10850E-05
22.0	0.69639E-01	0.77399E-01	0.14643E 00	0.13632E 00	0.20735E 00	0.20627E 00	0.11096E-05	0.11094E-05
23.0	0.71733E-01	0.79971E-01	0.15149E 00	0.14081E 00	0.21415E 00	0.21322E 00	0.11300E-05	0.11330E-05
24.0	0.74700E-01	0.82516E-01	0.15621E 00	0.14529E 00	0.22061E 00	0.22010E 00	0.11569E-05	0.11557E-05
25.0	0.76795E-01	0.85035E-01	0.16074E 00	0.14964E 00	0.22724E 00	0.22697E 00	0.11746E-05	0.11776E-05
26.0	0.79063E-01	0.87550E-01	0.16581E 00	0.15399E 00	0.23335E 00	0.23367E 00	0.11949E-05	0.11989E-05
27.0	0.81056E-01	0.90001E-01	0.17087E 00	0.15829E 00	0.23998E 00	0.24030E 00	0.12227E-05	0.12193E-05
28.0	0.83950E-01	0.92451E-01	0.17471E 00	0.16256E 00	0.24627E 00	0.24700E 00	0.12351E-05	0.12391E-05
29.0	0.86219E-01	0.94080E-01	0.17977E 00	0.16679E 00	0.25237E 00	0.25354E 00	0.12594E-05	0.12593E-05
30.0	0.88837E-01	0.97269E-01	0.18413E 00	0.17098E 00	0.25901E 00	0.26011E 00	0.12775E-05	0.12769E-05
32.0	0.93201E-01	0.10205E 00	0.19373E 00	0.17927E 00	0.27157E 00	0.27316E 00	0.13148E-05	0.13122E-05
34.0	0.97913E-01	0.10674E 00	0.20263E 00	0.18743E 00	0.28362E 00	0.28574E 00	0.13497E-05	0.13455E-05
36.0	0.10228E 00	0.11137E 00	0.21118E 00	0.19549E 00	0.29479E 00	0.29810E 00	0.13755E-05	0.13760E-05
38.0	0.10647E 00	0.11595E 00	0.22009E 00	0.20342E 00	0.30578E 00	0.31008E 00	0.14008E-05	0.14064E-05
40.0	0.11135E 00	0.12047E 00	0.22864E 00	0.21127E 00	0.31695E 00	0.32319E 00	0.14320E-05	0.14343E-05
42.0	0.11519E 00	0.12494E 00	0.23719E 00	0.21902E 00	0.32777E 00	0.33527E 00	0.14511E-05	0.14601E-05
44.0	0.11956E 00	0.12936E 00	0.24574E 00	0.22670E 00	0.34226E 00	0.34733E 00	0.14901E-05	0.14857E-05
46.0	0.12392E 00	0.13374E 00	0.25412E 00	0.23430E 00	0.35343E 00	0.35927E 00	0.15150E-05	0.15094E-05
48.0	0.12793E 00	0.13808E 00	0.26581E 00	0.24182E 00	0.36442E 00	0.37113E 00	0.15543E-05	0.15319E-05
50.0	0.13230E 00	0.14235E 00	0.27402E 00	0.24920E 00	0.37594E 00	0.38268E 00	0.15796E-05	0.15532E-05
52.0	0.13614E 00	0.14665E 00	0.27768E 00	0.25667E 00	0.38677E 00	0.39457E 00	0.15709E-05	0.15734E-05
54.0	0.13990E 00	0.15099E 00	0.28536E 00	0.26401E 00	0.39881E 00	0.40609E 00	0.15899E-05	0.15927E-05
56.0	0.14434E 00	0.15510E 00	0.29304E 00	0.27129E 00	0.40980E 00	0.41758E 00	0.16101E-05	0.16110E-05
58.0	0.14835E 00	0.15927E 00	0.30020E 00	0.27852E 00	0.42080E 00	0.42900E 00	0.16230E-05	0.16283E-05
60.0	0.15237E 00	0.16342E 00	0.30735E 00	0.28569E 00	0.43197E 00	0.44034E 00	0.16381E-05	0.16449E-05
62.0	0.15708E 00	0.16754E 00	0.31433E 00	0.29282E 00	0.44279E 00	0.45167E 00	0.16572E-05	0.16606E-05
64.0	0.16074E 00	0.17164E 00	0.32149E 00	0.29991E 00	0.45413E 00	0.46285E 00	0.16687E-05	0.16756E-05
66.0	0.16493E 00	0.17571E 00	0.32899E 00	0.30695E 00	0.46548E 00	0.47403E 00	0.16875E-05	0.16898E-05
68.0	0.16930E 00	0.17976E 00	0.33650E 00	0.31395E 00	0.47613E 00	0.48516E 00	0.17053E-05	0.17034E-05
70.0	0.17296E 00	0.18377E 00	0.34331E 00	0.32091E 00	0.48677E 00	0.49615E 00	0.17120E-05	0.17163E-05
72.0	0.17767E 00	0.18780E 00	0.34959E 00	0.32784E 00	0.49829E 00	0.50715E 00	0.17299E-05	0.17286E-05
74.0	0.18151E 00	0.19179E 00	0.35657E 00	0.33473E 00	0.50876E 00	0.51804E 00	0.17387E-05	0.17403E-05
76.0	0.18535E 00	0.19577E 00	0.36390E 00	0.34159E 00	0.51941E 00	0.52899E 00	0.17501E-05	0.17515E-05
78.0	0.19007E 00	0.19972E 00	0.37053E 00	0.34842E 00	0.53006E 00	0.53984E 00	0.17666E-05	0.17621E-05
80.0	0.19373E 00	0.20366E 00	0.37717E 00	0.35522E 00	0.54053E 00	0.55065E 00	0.17716E-05	0.17723E-05
82.0	0.19792E 00	0.20759E 00	0.38397E 00	0.36200E 00	0.55083E 00	0.56143E 00	0.17822E-05	0.17819E-05
84.0	0.20228E 00	0.21150E 00	0.39095E 00	0.36874E 00	0.56077E 00	0.57216E 00	0.17943E-05	0.17911E-05
86.0	0.20595E 00	0.21539E 00	0.39759E 00	0.37546E 00	0.57072E 00	0.58280E 00	0.17972E-05	0.17999E-05
88.0	0.20979E 00	0.21927E 00	0.40404E 00	0.38216E 00	0.58067E 00	0.59343E 00	0.18009E-05	0.18082E-05
90.0	0.21380E 00	0.22314E 00	0.41103E 00	0.38883E 00	0.59079E 00	0.60416E 00	0.18101E-05	0.18162E-05
92.0	0.21817E 00	0.22700E 00	0.41801E 00	0.39548E 00	0.60074E 00	0.61474E 00	0.18221E-05	0.18238E-05
94.0	0.22201E 00	0.23084E 00	0.42446E 00	0.40211E 00	0.61069E 00	0.62537E 00	0.18259E-05	0.18310E-05
96.0	0.22602E 00	0.23468E 00	0.43110E 00	0.40872E 00	0.62134E 00	0.63587E 00	0.18351E-05	0.18379E-05
98.0	0.23021E 00	0.23850E 00	0.43825E 00	0.41531E 00	0.63163E 00	0.64634E 00	0.18478E-05	0.18445E-05
100.0	0.23405E 00	0.24232E 00	0.44506E 00	0.42188E 00	0.64141E 00	0.65684E 00	0.18528E-05	0.18507E-05
105.0	0.24435E 00	0.25181E 00	0.46164E 00	0.43824E 00	0.66567E 00	0.68309E 00	0.18673E-05	0.18651E-05
110.0	0.25447E 00	0.26125E 00	0.47822E 00	0.45450E 00	0.69098E 00	0.70894E 00	0.18881E-05	0.18779E-05
115.0	0.26354E 00	0.27064E 00	0.49393E 00	0.47067E 00	0.71559E 00	0.73494E 00	0.18885E-05	0.18892E-05

EV = 0.71495E-02   0.14216E-01   0.67236E-02   0.50776E-08

END-OF-DATA ENCOUNTERED ON SYSTEM INPUT FILE.

Figure 21. Viscoelastic Analysis for Asphalt 72 at 39.2°F (Cont'd.).

least squares criterion and, hence, represent the best values for the two-element model. The first three pairs of columns compare the observed total angles of rotation for the three stress levels with those calculated on the basis of the generalized model (Equation 35). The last two columns show a comparison between the observed average creep function and the creep function computed from Equation 39 using the tabulated values of G_k and τ_k. The standard deviations between the observed and calculated values are printed at the bottom of each pair of "observed" and "calculated" columns. As a matter of record, the output for all of the asphalts tested at 39.2°F is included as Appendix D.

The best correlation between the observed and computed creep functions was obtained for asphalt 72. Figure 22 depicts the data for this asphalt. The agreement between the observed creep function and that computed for the three-element model is considered quite acceptable and no significant improvement can be realized by increasing the number of elements. The worst correlation was obtained for asphalt 3, the data for which are shown in Figure 23. The two-element model is considered optimal in this instance since further increases in the number of elements do not significantly improve the correlation.

The viscoelastic material parameters for all of the asphalts are summarized in Table 11. The optimal number of Voigt elements was selected as that number beyond which significant increases in the degree of correlation between the observed and computed creep functions could not be achieved. This selection was made by

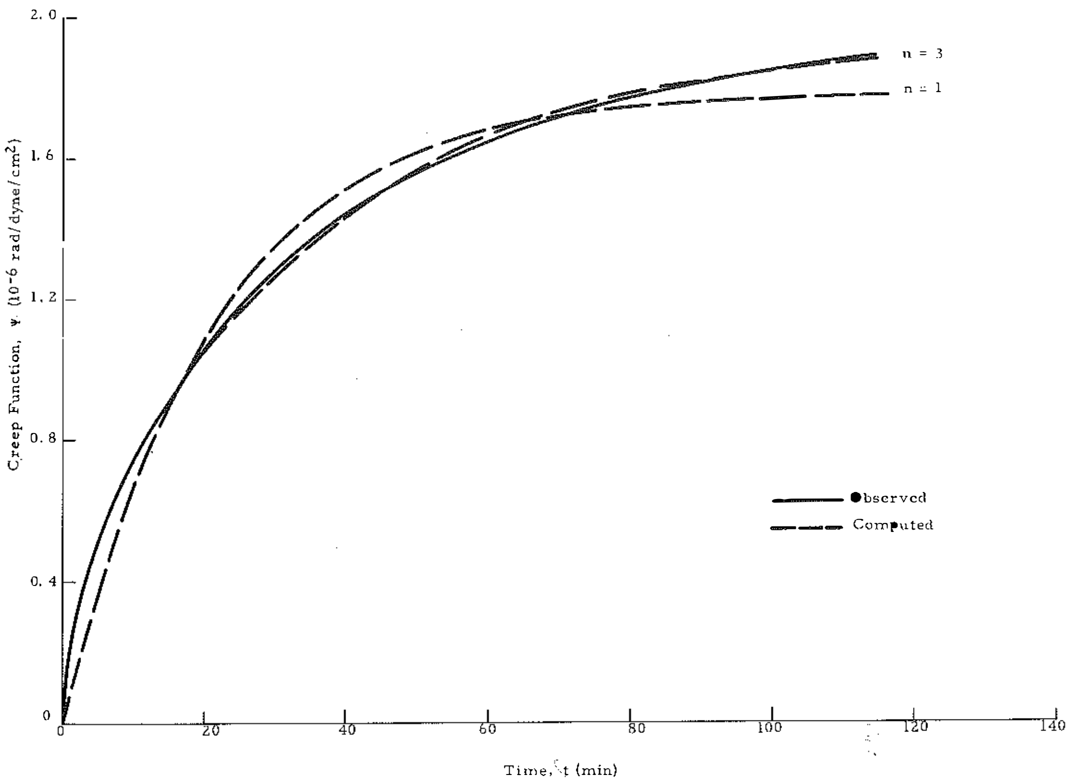


Figure 22. Comparison Between Observed and Computed Creep Functions for Asphalt 72.

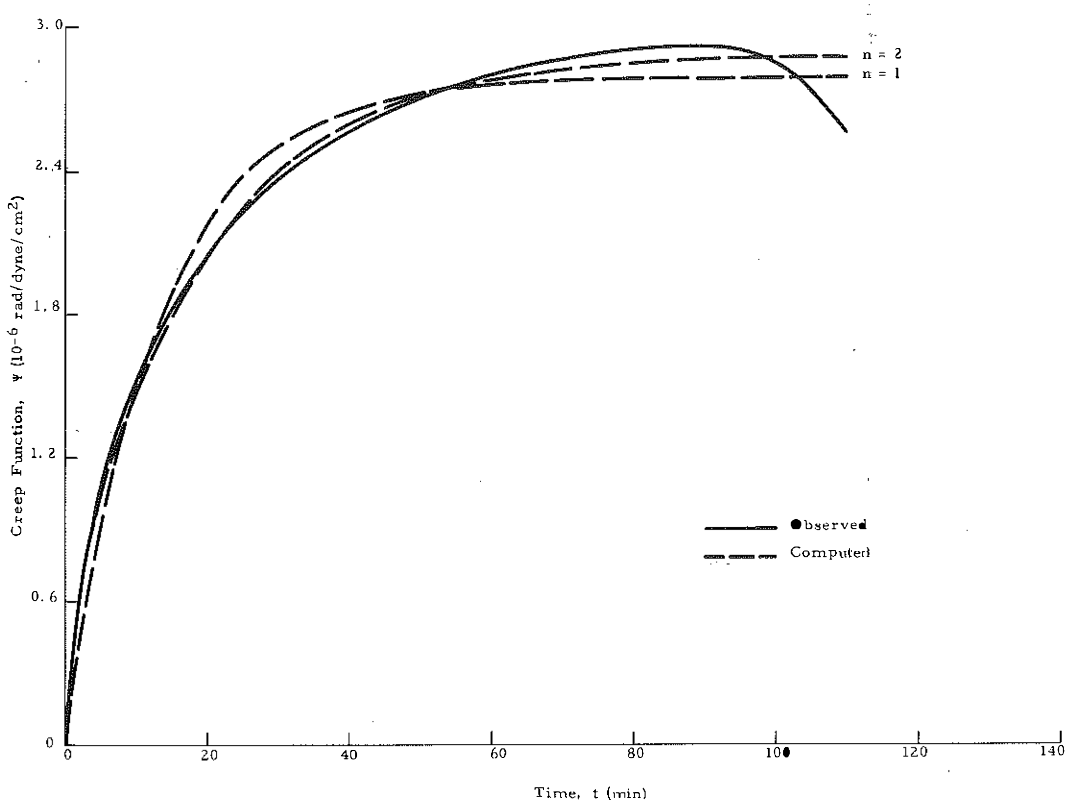


Figure 23. Comparison Between Observed and Computed Creep Functions for Asphalt 3.

TABLE 11

VISCOELASTIC MATERIAL PARAMETERS EVALUATED AT 39.2°F

Asphalt Number	Optimal Number of Voigt Elements	Viscoelastic Parameters: First Element G_1 (10^6 d/cm^2)	First Element η_1 (10^9 poises)	Second Element G_2 (10^6 d/cm^2)	Second Element η_2 (10^9 poises)	Third Element G_3 (10^6 d/cm^2)	Third Element η_3 (10^9 poises)	Standard Deviation (10^{-8} rad/d/cm^2)
PR-103	1	3.17	1.38					2.60
3	2	0.41	--[1]	2.27	0.15			4.35
13	2	0.48	1.02	2.34	0.26			2.34
53	2	0.68	1.09	4.18	0.46			1.50
71	2	0.64	1.26	5.82	0.62			0.94
91	2	1.09	5.67	9.54	0.27			3.30
116	2	0.86	1.47	7.76	0.63			3.41
45	3	0.70	1.54	2.92	1.05	7.92	0.21	0.64
67	3	0.49	0.95	2.38	0.46	7.64	0.10	1.49
72	3	0.67	1.52	3.06	1.09	7.69	0.21	0.61
127	3	0.81	1.68	3.82	0.92	12.10	0.21	0.90
200	3	3.71	0.11	0.53	1.07	0.87	0.33	2.92

[1] 1.70 x 10^{38} poises

ascertaining the minimum number of elements for which the decrease in standard deviation due to an increase of one in the number of elements was less than 20 percent.

No particular physical significance should be attached to the optimal numbers of elements given in Table 11 since the analysis was based on empirical correlations and curve-fitting techniques. What is of importance, however, is the fact that the viscoelastic portion of the total flow behavior can be closely approximated by the generalized Voigt body consisting of a maximum of three elements.

ANALYSIS OF RESULTS

APPARENT VISCOSITY

The method for evaluating material parameters which has been used in preceding sections is based on an analysis of the complexity of flow exhibited by each asphalt under each set of test conditions. At the same time, the rotating coaxial cylinder viscometer can also be used to obtain a shear-dependent, apparent viscosity[1] which does not require an evaluation of the complexity of flow. The apparent viscosity is computed as follows:

$$\eta_a = \frac{CT}{\Omega} \qquad (40)$$

where η_a = apparent viscosity

Ω = angular velocity of bob relative to cup.

The corresponding rate of shear and average rate of shear are given by Equations 15 and 16, respectively, which are repeated here for convenience.

$$\mathring{\gamma}(r) = \left[\frac{2}{1/a_1^2 - 1/a_2^2}\right]\left[\frac{1}{r^2}\right]\Omega \qquad (15)$$

[1]The apparent viscosity (46) is the ratio of shearing stress to rate of shear and, for non-Newtonian liquids, is dependent upon rate of shear and, in some instances, upon shearing stress.

$$\dot{\gamma}(av) = \frac{2a_1a_2}{a_2^2 - a_1^2} \Omega \qquad (16)$$

The angular velocity in these equations may be defined simply as the quotient of the angle of rotation and elapsed time. Figure 24 shows a hypothetical creep curve that may be used to

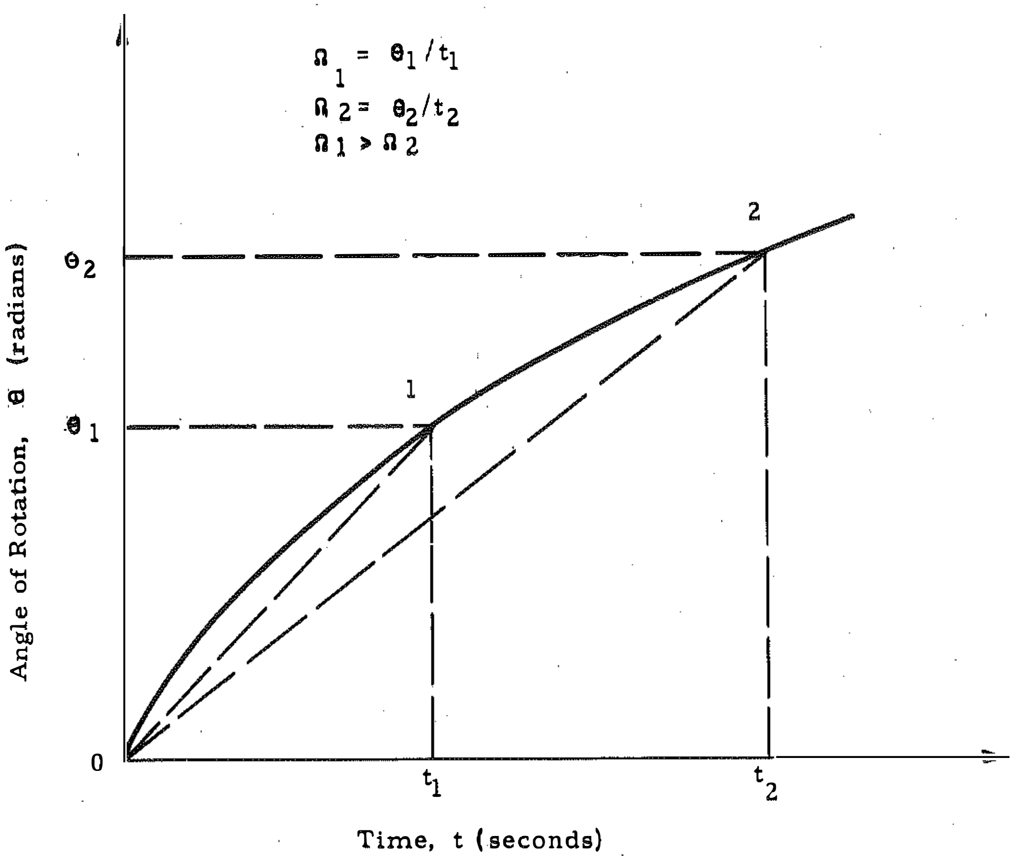


Figure 24. Evaluation of Angular Velocity by Secant Method.

illustrate this method of defining angular velocity by the secant method. For a creep curve having this characteristic shape, the angular velocity at point 1 exceeds that at point 2. According to Equations 15, 16, and 40, the apparent viscosity is, therefore larger at point 2 while the shear rate is larger at point 1. Thus, for this type of creep testing and non-Newtonian materials, the apparent viscosity is obviously a function of shear rate.

When the shearing stress is changed, an entirely new relationship is obtained. This is illustrated in Figure 25 which shows viscosities obtained for asphalt 3 at 39.2°F. At this temperature, asphalt 3 has a creep curve similar in shape to

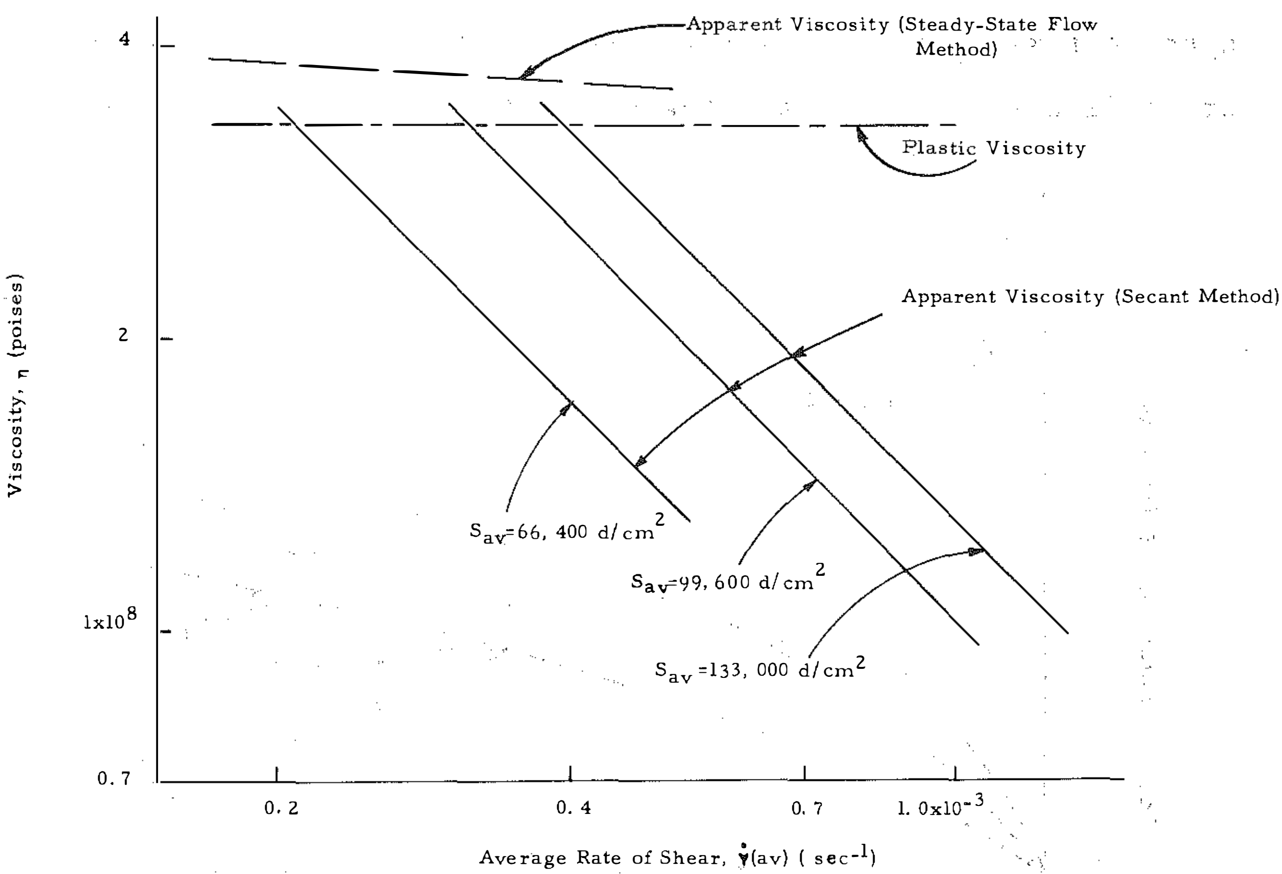


Figure 25. Comparison of Viscosities of Asphalt 3 at 39.2°F.

that shown in Figure 24. Examine now only those curves of Figure 25 for which the apparent viscosities have been computed using the previously explained secant method of defining angular velocity. The secant, apparent viscosity is obviously a function of both shearing stress and shearing rate.

Because of this dependence of the secant, apparent viscosity on both shearing stress and shearing rate, it is usual to redefine the angular velocity of Equation 40 as that velocity corresponding to steady-state flow (47). Figure 26 shows hypothetical creep curves which extend into the region of steady-state flow -- that is, the region in which there is a linear

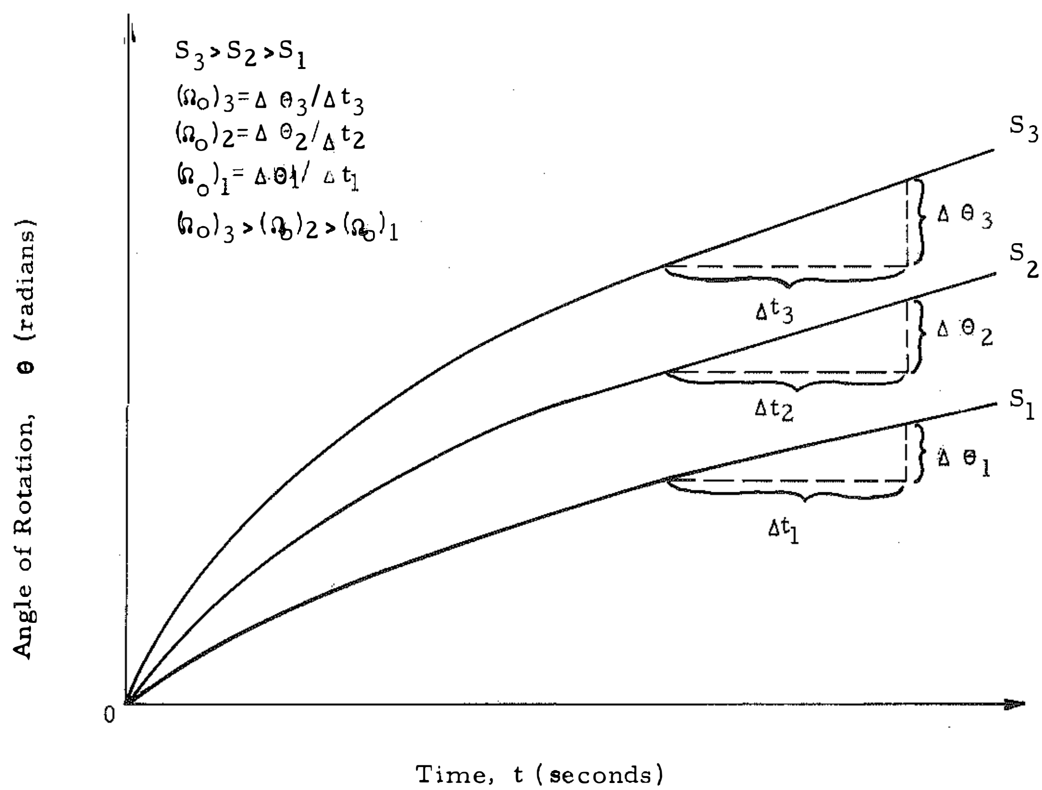


Figure 26. Evaluation of Angular Velocity in Region of Steady-State Flow.

relationship between angle of rotation and time. The steady-state, angular velocity then equals the slope of the creep curve in this region. Both the angular velocity and the shear rate in the steady-state region increase as the stress level is increased. Since the secant, angular velocities for a given shearing stress exceed the steady-state, angular velocities, the steady-state, apparent viscosities generally exceed the secant viscosities (Equation 40). This is also depicted in the actual data of Figure 25. From this figure, the apparent viscosities evaluated by the steady-state flow method are seen to be dependent only upon shearing rate. By specifying a standard shear rate, a viscosity measurement can be obtained which is useful in classifying or grading asphalts on the basis of consistency (46,47).

There are two other viscosity measurements of interest because of their independence of both shearing rate and shearing stress. The first of these is the limiting or initial viscosity which occurs at low rates of shear and low shearing stresses -- that is, when the material is behaving in a Newtonian fashion -- and which is generally considered to exceed the apparent viscosities evaluated in the shear-dependent region (48).

The second of these shear-independent viscosity measurements is that of plastic viscosity. Before evaluating the plastic viscosity, it is necessary to first establish that the behavior of asphalt cements in the steady-state flow regime may be represented by that of a Bingham plastic. Figures 16,17, and 18 indicate that the 13 asphalt cements of this study generally behave as Bingham plastics in the steady-state region (at least for temperatures between 39.2°F and 104°F and for moderate shearing stresses). Figure 27 shows the theoretical relationship

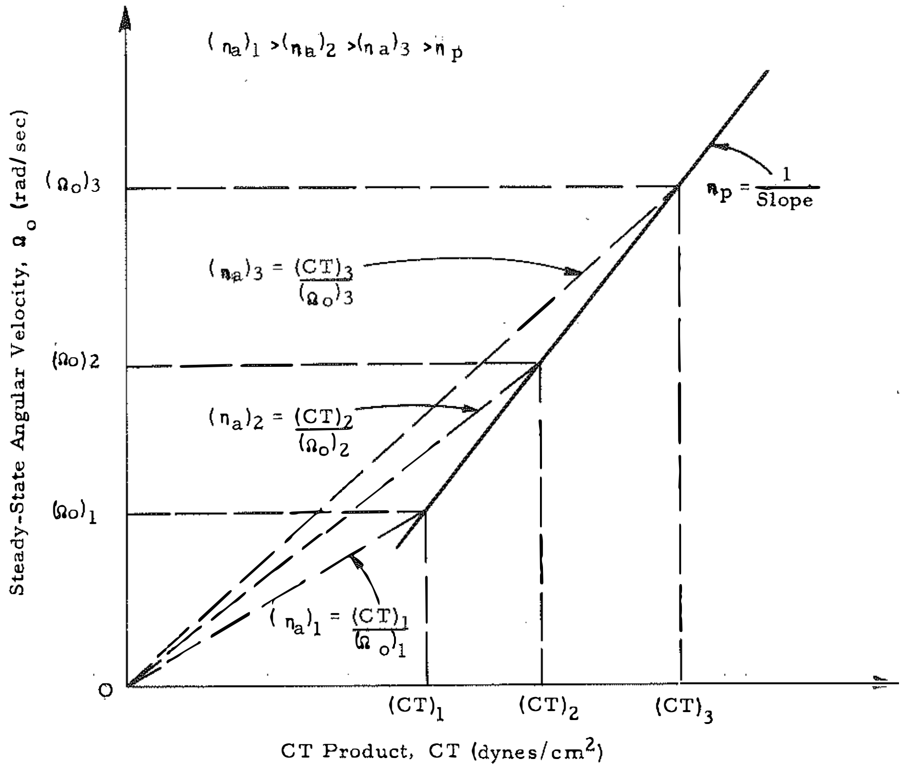


Figure 27. Theoretical Comparison of Steady-State, Apparent Viscosity, η_a, and Plastic Viscosity, η_p.

between the steady-state, apparent viscosities and the plastic viscosity, η_p. It is obvious from this figure that the steady-state, apparent viscosities should generally exceed the plastic viscosity and should approach its value only at high shearing stresses or high rates of shear[1]. This is supported by the actual data of Figure 25.

[1]A word of caution is warranted at this point. This observation is based on the premise that the steady-state flow behavior may be represented as a Bingham plastic. While this premise is supported by the data of this study, it may be in error if a wider range in shearing rates or temperatures is considered.

It is of interest to compare the apparent viscosity measurements obtained with the rotating coaxial cylinder viscometer with those obtained on identical asphalts but with a different type of viscometer. To enable such a comparison, the Bureau of Public Roads furnished three samples of their viscosity-graded asphalts. These samples were all of the AC-10 grade and were designated C-10, E-10, and O-10. A complete description of these asphalts and a summary of the viscosity measurements obtained by the Bureau may be found in Reference 48.

The Bureau used a sliding plate viscometer which was operated at controlled rates of shear. Computations of apparent viscosity were based on the maximum load attained at each rate of shear. The test equipment and procedures are fully described in Reference 46.

Figure 28 shows a comparison between the viscosities obtained with the coaxial cylinder viscometer and those obtained with the sliding plate viscometer for asphalt C-10 at 45°F. These results are generally indicative of those obtained for each of the three asphalts at all test temperatures. It was impossible to obtain a limiting viscosity for the tests with the coaxial cylinder viscometer since a rather limited range in shearing rates was employed. The apparent viscosities obtained with the coaxial cylinder viscometer were larger than those obtained with the sliding plate viscometer. Ideally, of course,

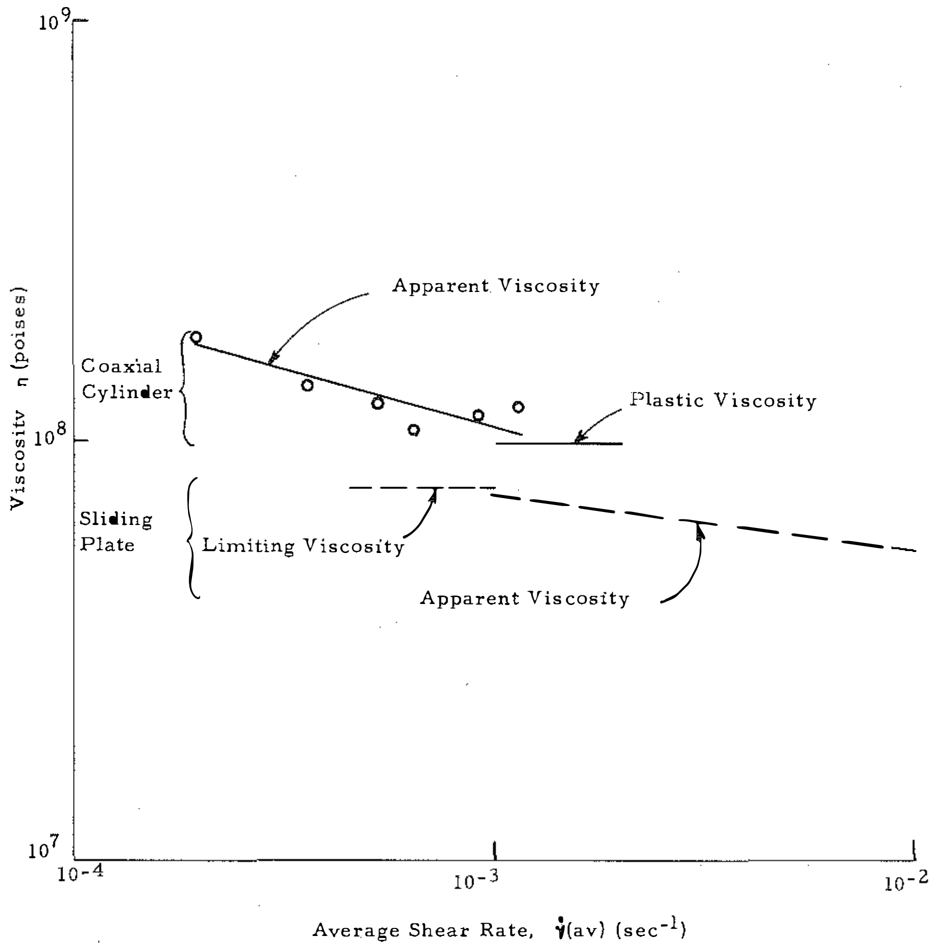


Figure 28. Comparison Between Viscosities Obtained with Rotating Coaxial Cylinder Viscometer and Sliding Plate Viscometer (Asphalt C-10 at 45°F).

they should have been equal. The plastic viscosity was also larger than the limiting viscosity. The preceding rationale would indicate that ideally the limiting viscosity should exceed the plastic viscosity.

The data of Table 12 may also be used to compare the two viscometers. The apparent viscosities at a specified shear rate of 0.001 sec^{-1} are tabulated for each of the three asphalts. Again the coaxial cylinder viscometer generally yielded viscosities in excess of those obtained with the sliding plate

TABLE 12

COMPARISON BETWEEN VISCOSITIES OBTAINED
WITH ROTATING COAXIAL CYLINDER VISCOMETER AND
SLIDING PLATE VISCOMETER

Asphalt Number	Temperature (°F)	Apparent Viscosity (Shear Rate of 0.001 sec^{-1})		Percentage Difference (%)	Limiting Viscosity[1] (megapoises)	Plastic Viscosity (megapoises)
		Sliding Plate[1] (megapoises)	Coaxial Cylinder (megapoises)			
C-10	45	73	107	+47	77	97.7
C-10	60	11.0	11.0	0	11.3	7.1
E-10	39.2	5770	-[2]	-	36,000	45,400
E-10	45	3850	-[2]	-	12,000	22,900
E-10	60	625	625	0	860	1,030
O-10	39.2	950	1200	+26	950	1,150
O-10	45	314	400	+27	315	396
O-10	60	21.5	26.5	+23	22.0	23.0

[1]Obtained from Reference 48.
[2]Extrapolation impossible.

viscometer. The differences between the two types of viscosity measurements, expressed as a percentage of the viscosities obtained with the sliding plate viscometer, are also shown on Table 12. The average percentage difference between the apparent viscosities is 21 percent. Figure 29 compares the plastic viscosities (coaxial cylinder data) with the limiting viscosities (sliding plate data). Again the plastic viscosities are generally in excess of the limiting viscosities.

The data that have been presented definitely indicate a difference in viscosity measurements obtained using the two viscometers. The magnitude of the difference is not excessive, however, and may have been anticipated due to certain fundamental differences between the two viscometers and their operation by different laboratories. Several of these differences are listed in Table 13. The possible effects of these differences are generally unknown at this time.

It is concluded that the rotating coaxial cylinder viscometer can be effectively employed to evaluate apparent viscosities of asphalt cements at relatively low temperatures. Data obtained with this viscometer compare favorably with similar data obatined with the sliding plate viscometer.

TEMPERATURE SUSCEPTIBILITY

Data reported herein are sufficient to compare the susceptibilities of the consistency of the various asphalts to changes in temperature. Three of the techniques for defining the temperature susceptibility of asphalt cements are used in this comparison including the penetration ratio, the penetration index,

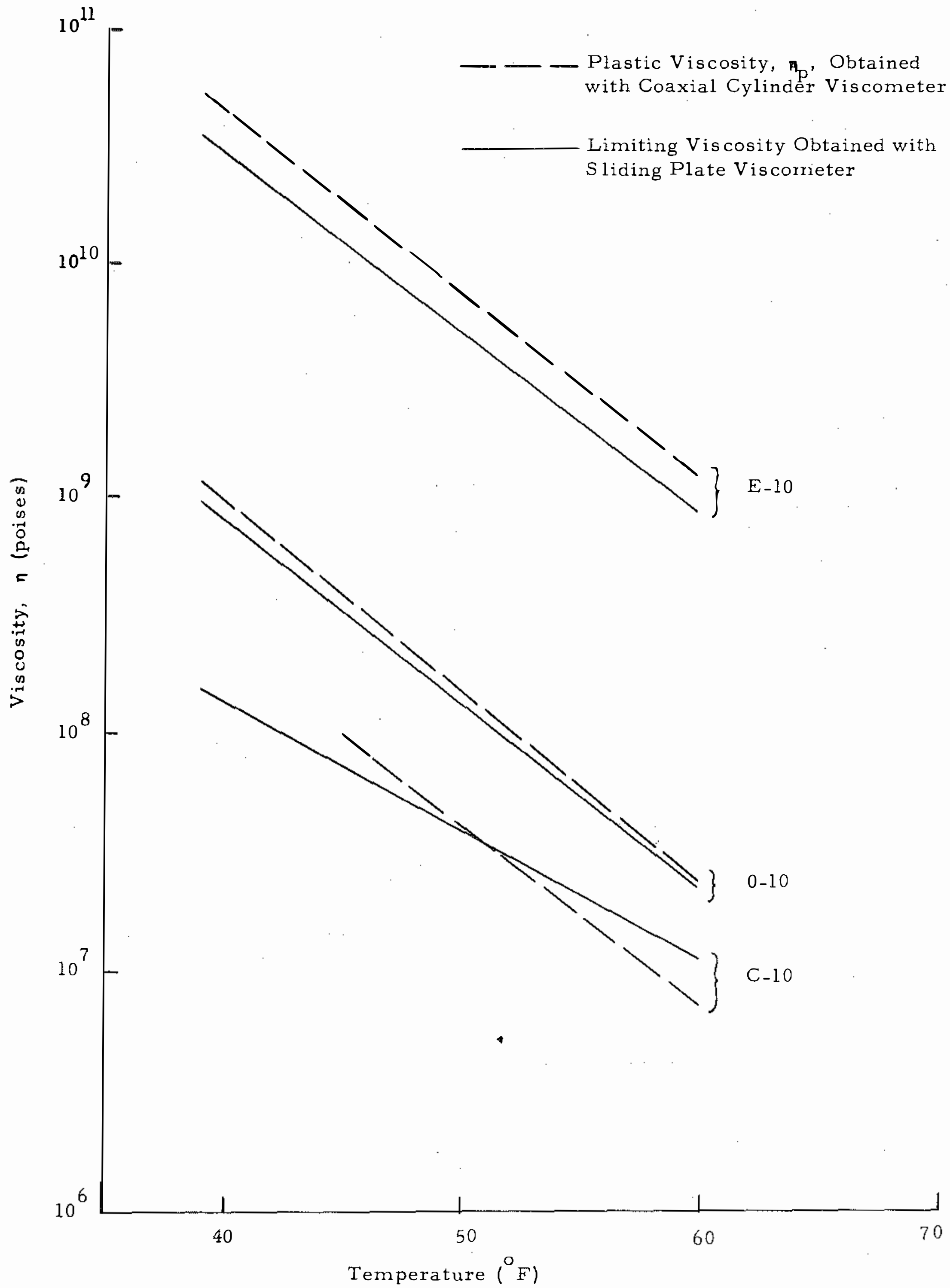


Figure 29. Comparison Between Limiting Viscosity and Plastic Viscosity.

TABLE 13

FUNDAMENTAL DIFFERENCES BETWEEN VISCOMETERS AND TEST PROCEDURES

Variable	Sliding Plate Viscometer	Coaxial Cylinder Viscometer
Film Thickness(in.)	0.01-0.02	0.385
Stress or Strain History	Controlled rate of shear	Creep
Approximate Range in Shear Rates (sec^{-1})	10^{-3}- 10^{-1}	10^{-6}- 10^{-2}
Specimen Preparation		
Approximate Melting Temperature (°F)	260-280	290
Time of Conditioning at Room Temperature (min)	60-90	30
Time to Reach Temperature Equilibrium (min)	25-30	60
Specimen Reuse	Permitted for several shear rates	Not permitted
Basis for Computations	Maximum load	Steady-state flow

and the slope of the viscosity-temperature relationship.

The penetration-ratio technique is based on determining the consistency of an asphalt cement at 39.2°F and 77°F by means of the standard penetration test. The penetration ratio is computed as follows:

$$\text{Pen. Ratio} = \frac{\text{Pen. @ 39.2°F}}{\text{Pen. @ 77°F}} \times 100. \qquad (41)$$

A large temperature susceptibility connotes a low penetration ratio.

The penetration-index technique is based on two different consistency tests: the penetration test is used at the lower temperature (77°F) and the ring-and-ball softening point test is used at the higher temperature. The penetration index is computed as follows:

$$PI = \frac{20 - 500A}{50A + 1} \qquad (42)$$

where PI = penetration index

$A = \frac{1.8 \log(800/Pen)}{\Delta T}$

log = common logarithm

Pen = penetration at 77°F

ΔT = temperature difference (°F) between the ring-and-ball temperature and 77°F.

The penetration index normally varies between -2.5 and +8 (49). A large temperature susceptibility yields a low penetration index.

The slope of the viscosity-temperature relationship may also be used as a measure of temperature susceptibility. This slope is normally determined from a plot of log log viscosity versus log absolute temperature. The following equation has been used in this determination:

$$VTS = \frac{\log \log \eta_{p(1)} - \log \log \eta_{p(2)}}{\log T_2 - \log T_1} \qquad (43)$$

where VTS = viscosity-temperature slope

$\eta_{p(1)}$ = plastic viscosity in poises at T_1

$\eta_{p(2)}$ = plastic viscosity in poises at T_2

T_1 = largest temperature in °R(104°F)

T_2 = smallest temperature in °R(39.2°F).

Naturally a larger slope is associated with an asphalt of higher temperature susceptibility. This technique for evaluating temperature susceptibility is normally employed for a higher temperature range, for example, 140°F to 275°F. However, it may still furnish a useful measure of temperature susceptibility within a lower temperature range such as that employed here (39.2°F to 104°F). This is particularly valid since the plastic viscosities are independent of shear rate at all temperatures.

The results of this analysis are shown in Table 14. With the possible exception of asphalt PR-132[1], there is not a great

TABLE 14

TEMPERATURE SUSCEPTIBILITY

Asphalt Number	Penetration Ratio	Penetration Index	Viscosity-Temperature Slope
3	49	+0.1	4.5
13	35	+0.8	5.0
45	32	-0.8	5.4
53	38	-0.1	5.5
67	46	0.0	4.8
71	25	-1.2	5.5
72	39	-0.7	5.4
91	26	-1.3	5.5
116	32	-1.1	6.1
127	49	-1.2	4.8
200	33	-0.1	5.2
PR-103	35	-1.0	6.0
PR-132	8	-1.2	-

deal of difference among the temperature susceptibilities of the various asphalts. All of the asphalts would be classified by Pfeiffer as normal types on the basis of their penetration indices (-2.0 < PI < 2.0) (49). Asphalts 71 and 91 exhibited

[1]Asphalt PR-132 was not tested at 39.2°F and, hence, the viscosity-temperature slope could not be evaluated. However, it does have a low penetration ratio which would indicate a high temperature susceptibility.

perhaps the largest temperature susceptibilities and asphalt 3, the smallest. The viscosity-temperature relationships for asphalts 3 and 91 are compared on the Walther plot of Figure 30.

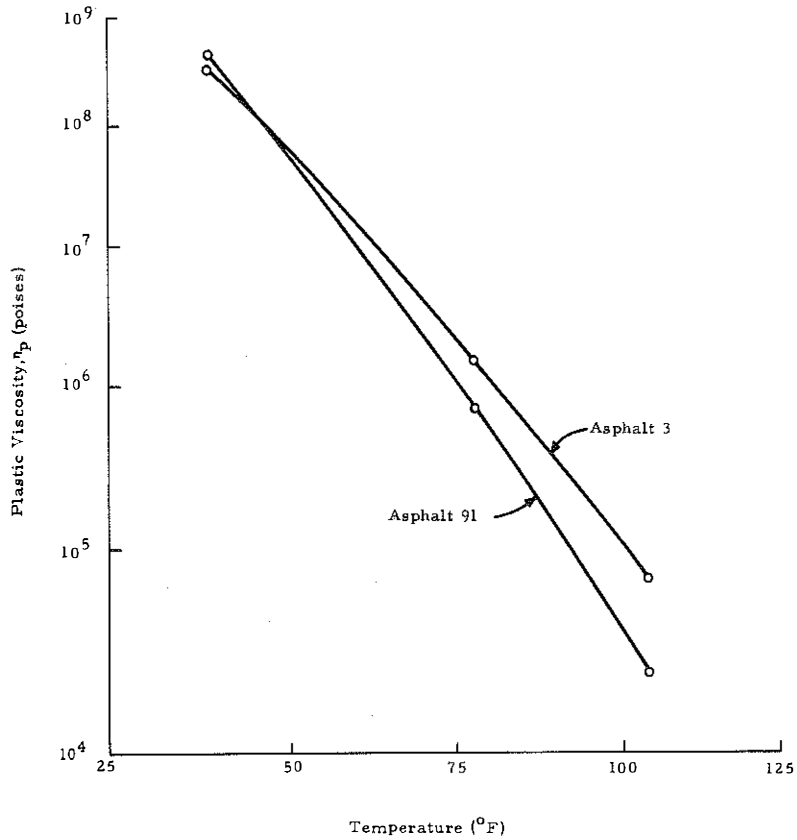


Figure 30. Largest and Smallest Temperature Susceptibilities.

The data of Table 14 are not sufficiently extensive to enable a thorough evaluation of the possible effects of crude source and manufacturing process on temperature susceptibility. The Venezuelan asphalts (asphalts 13, 127, and 200), which differ only in penetration grade, exhibited essentially identical temperature susceptibilities. Asphalts in which air blowing was used (asphalts 53, 72, and 91) were not particularly resistant to changes in temperature. The Californian crude (asphalt 91) and a Midcontinent crude (asphalt 71) exhibited the highest temperature susceptibilities and the Mexican crude (asphalt 3), the lowest. However, since the differences were not large and since only a single asphalt from each crude source was evaluated, a definitive conclusion relative to crude source cannot be drawn on the basis of these data.

VISCOSITY-PENETRATION RELATIONSHIP

Figures 31 and 32 show the relationship between plastic viscosity and penetration at temperatures of 77°F and 39.2°F, respectively. Both figures indicate a clearly defined trend with increasing penetrations corresponding to decreasing viscosities. As expected, the variability is greater with the 39.2°F measurements than with the 77°F measurements. At 39.2°F, the penetrations are relatively small and within the length of the truncated cone portion of the penetration needle.

The viscosity measurements are considerably more sensitive than the penetration measurements both in evaluating the differences among asphalts at a single temperature and in evaluating the effect of temperature for a single asphalt. The variability[1] among asphalts at a given temperature averaged about 84 percent for the penetration measurements and about 250 percent for the viscosity measurements. In going from 77°F to 39.2°F, the mean penetration decreased about 64 percent while the mean viscosity increased about 63,000 percent.

[1]In this case, the variability is expressed as the range of the measurements divided by their average values.

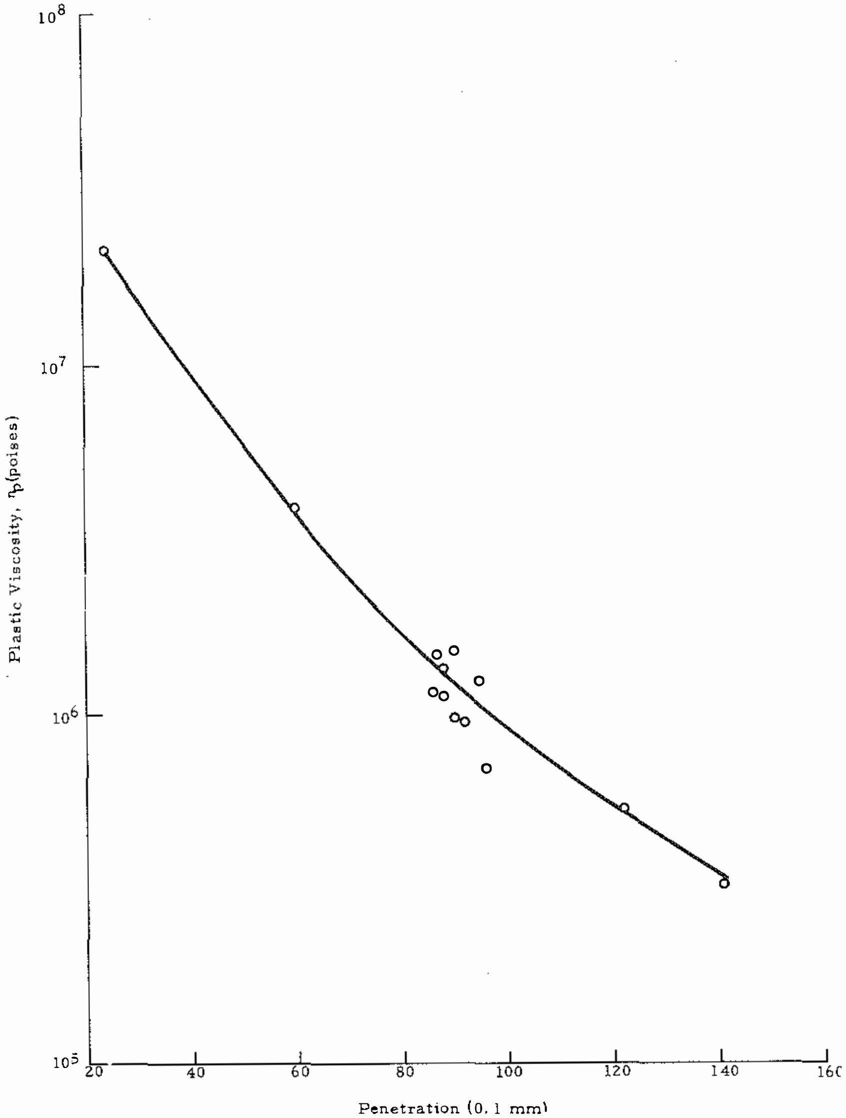


Figure 31. Relationship Between Plastic Viscosity and Penetration (100 g., 5 sec.) at 77°F.

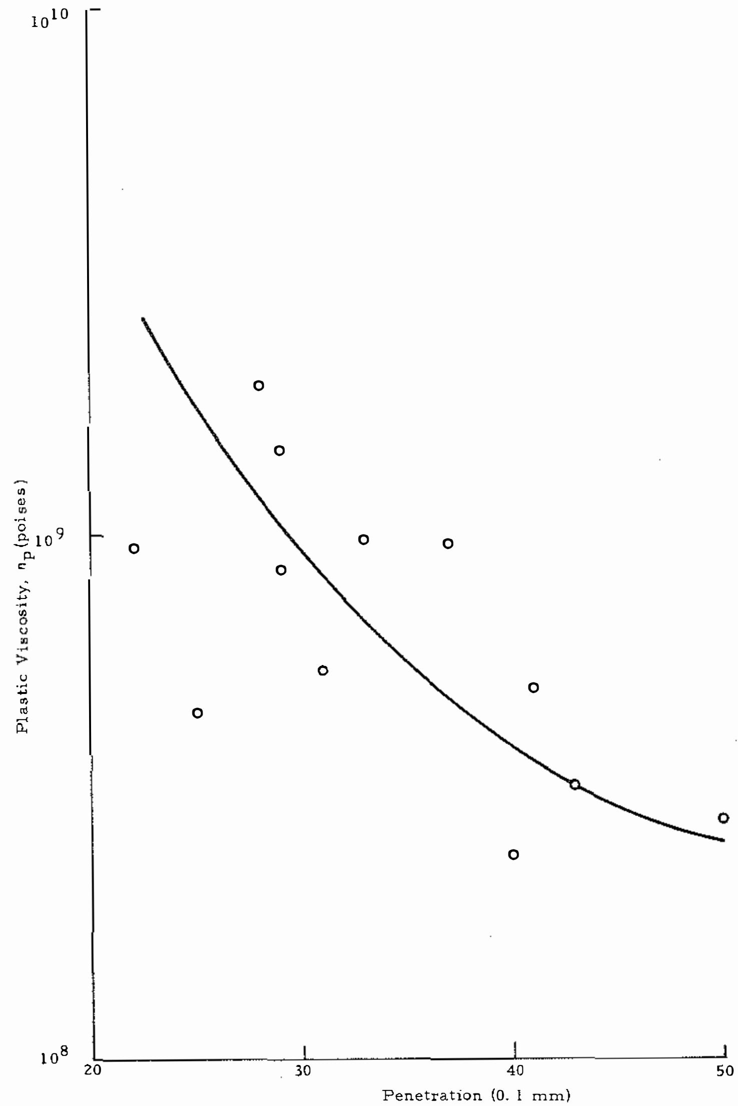


Figure 32. Relationship Between Plastic Viscosity and Penetration (200 g., 60 sec.) at 39.2°F.

TIME-TEMPERATURE SUPERPOSITION

Asphalt 53 was tested at 0°F in addition to the three temperatures which were employed for all of the asphalts. Three levels of shearing stress were applied at this temperature. The duration of each of the three tests was approximately two weeks. The characteristic relationship between angle of rotation and time was observed; that is, elastic, steady-state flow, and viscoelastic processes were all in evidence. The steady-state flow condition was reached after a period of approximately three to nine days depending upon the stress level. The material parameters evaluated at this temperature are summarized on Table 15. The two-element viscoelastic model was found to satisfactorily describe the viscoelastic portion of flow.

TABLE 15

MATERIAL PARAMETERS EVALUATED AT 0°F (ASPHALT 53)

Parameter	Value
Elastic Modulus, G_0	3.46×10^7 dynes/cm^2
Yield Stress, S_y	-
Coefficient of Plastic Viscosity, η_p	1.65×10^{13} poises
Viscoelastic Parameters	
G_1	1.71×10^7 dynes/cm^2
η_1	5.05×10^{12} poises
G_2	3.39×10^7 dynes/cm^2
η_2	0.58×10^{12} poises

The tests using asphalt 53 covered a sufficiently wide range of temperatures and durations of loading to enable investigation of the possible applicability of the time-temperature superposition principle in the low-temperature region. As a basis for this investigation, the average creep function at each of the four temperatures was plotted as shown on Figure 33. The total-angle creep functions, averaged for the three stress levels, are shown on this figure. The averaging process is thought to be valid since no evidence was found that the material is non-linear under the particular test conditions evaluated herein. The average creep function was reduced after the manner discussed by Ferry (50) by multiplying it by the ratio of the absolute value of the test temperature to the absolute value of a suitable reference temperature (in this case 50°F).

The reduced average creep functions of Figure 33 were then shifted horizontally until their overlapping portions were made to coincide. The magnitude of translation is defined as log α_T where α_T is the shift factor. The shift factor was then adjusted to the reference temperature of 50°F; that is, log α_T was adjusted to zero at a temperature of 50°F. The relationship between the shift factor, thus obtained, and the test temperature is shown on Figure 34.

The shift factor may also be computed from the following relationship (50):

$$\alpha_T = (\eta T_o \rho_o)/(\eta_o T \rho) \qquad (44)$$

where α_T = shift factor

η = steady-flow viscosity at temperature, T

η_o = steady-flow viscosity at temperature, T_o

T = any temperature in absolute units

T_o = reference temperature in absolute units

ρ = density at temperature, T

ρ_o = density at temperature, T_o.

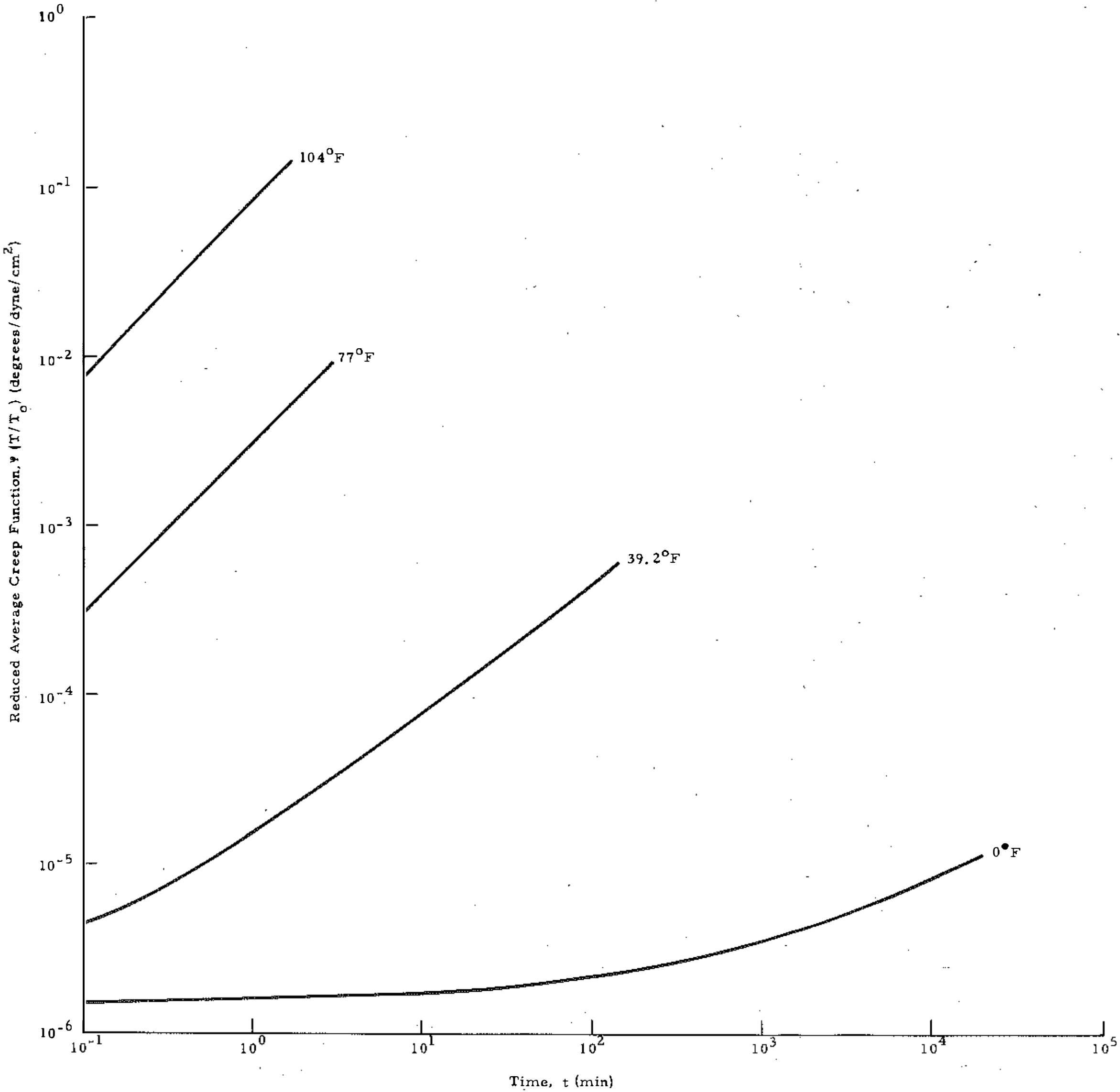


Figure 33. Average Creep Functions for Asphalt 53.

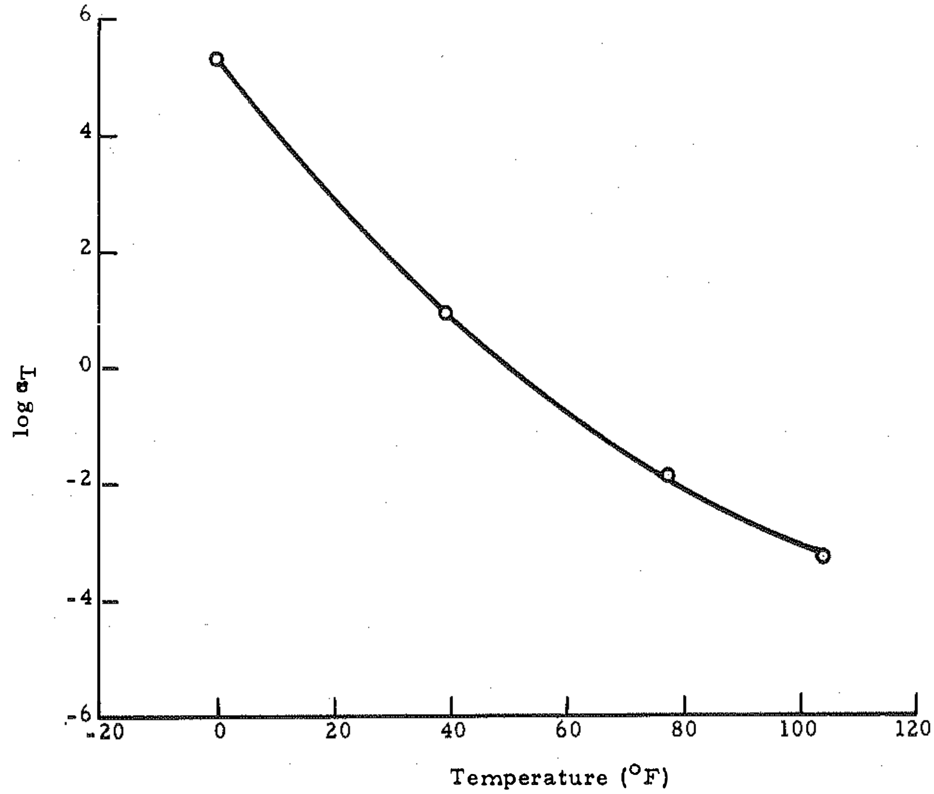


Figure 34. Relationship Between Shift Factor and Temperature.

This expression is theoretically valid for uncross-linked polymers of low molecular weight and, in certain instances, for those of high molecular weight (50). The shift factor was evaluated using Equation 44 which was slightly modified by omitting the density terms because of their minor importance. The coefficients of plastic viscosity were used to represent the viscosity measurements. A comparison between the computed and measured shift factors is given in Table 16. The agreement is relatively surprising even though the range in test temperatures is somewhat limited. The comparison demonstrates that the measured shift

TABLE 16

SHIFT FACTORS

Temperature (°F)	Computed Shift Factor, a_T (Equation 44)	Measured Shift Factor, a_T
0	1.63×10^{5}	2.14×10^{5}
39.2	8.99	8.70
77	0.98×10^{-2}	1.26×10^{-2}
104	2.88×10^{-4}	5.00×10^{-4}

factors are of the proper order of magnitude and are properly related to temperature within the low-temperature range of these tests.

Figure 35 shows the master creep function for asphalt 53 at a reference temperature of 50°F when the experimentally determined shift factors are applied to the data of Figure 33. The master creep function satisfactorily fits the data points obtained at the four different test temperatures.

Ferry (50) lists the following three criteria for determining the applicability of the time-temperature superposition principle (method of reduced variables) to a given set of test data: (1) exact matching of the shapes of adjacent curves obtained at different test temperatures, (2) superposition of the values of the shift factor for different viscoelastic functions, and (3) a reasonable form of the temperature dependence of the shift factor consistent with experience. A study of Figure 35 leads to the conclusion that the first criterion is satisfied for these data. The second criterion cannot be evaluated since only one viscoelastic function is available for comparison, that is, the creep function. The third criterion seems to have been

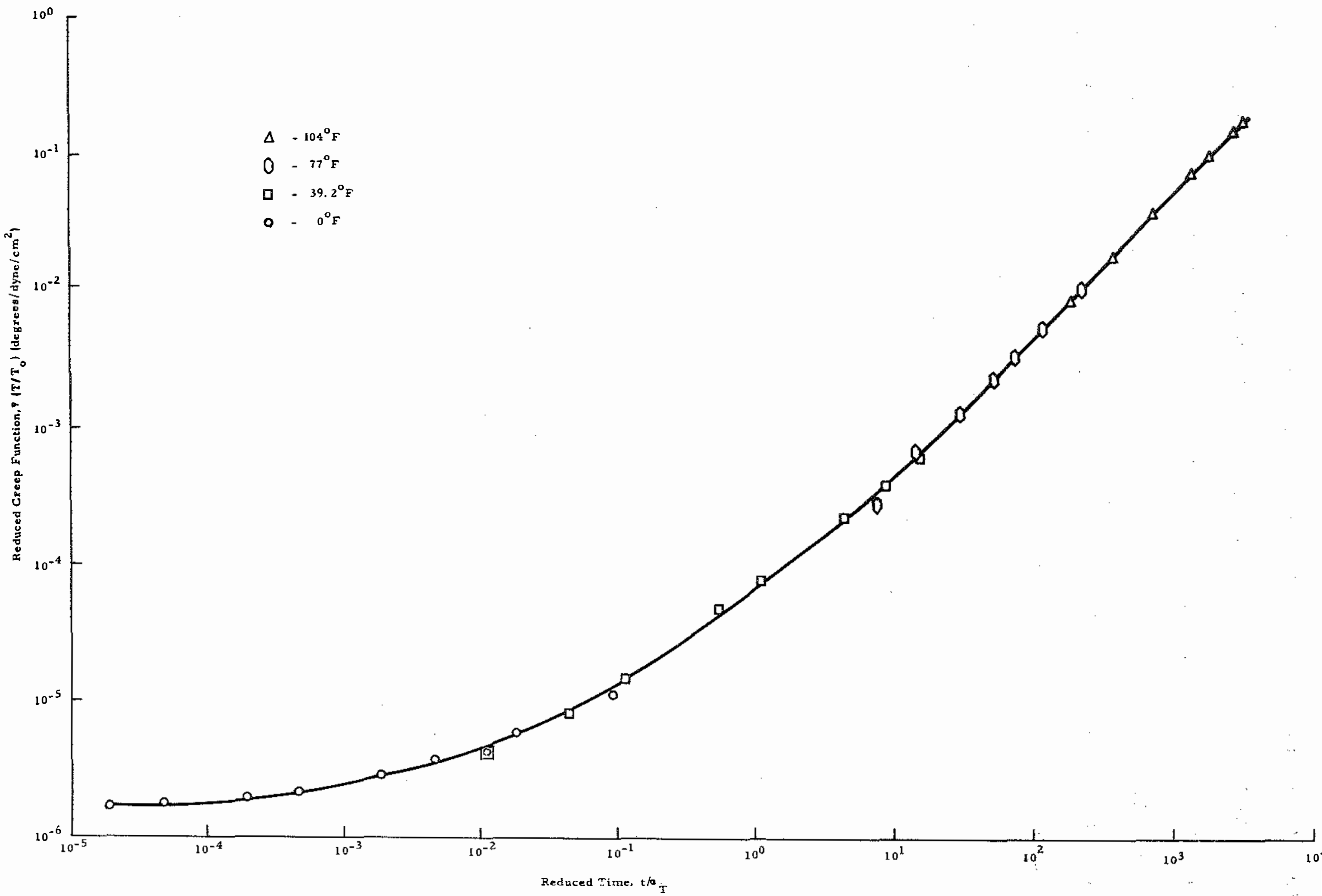


Figure 35. Master Creep Function for Asphalt 53 (Reference Temperature of 50°F).

satisfied by the comparison of Table 16. It is concluded, therefore, that the time-temperature superposition principle is valid for asphalt 53 when tested in the low-temperature range. A cursory evaluation of other of the asphalt cements tends to support the extension of this conclusion to all of the materials of this study.

CONCLUSIONS

The following conclusions are substantiated by the data obtained in this phase of the study:

1. The rotating coaxial cylinder viscometer is a useful research tool for examining the flow behavior of asphalt cements at relatively low temperatures. It may also be effectively employed to evaluate apparent viscosities of these materials.

2. The curve-fitting technique for evaluating the parameters of viscoelastic behavior has proven to be extremely useful and reliable. The principles underlying this technique may be readily extended to other types of equations in which a best fit by the least squares criterion is required.

3. All of the asphalt cements exhibited steady-state flow behavior at 77°F and 104°F. At these temperatures, their flow behavior under creep loading could satisfactorily be characterized by that of a Bingham plastic. At 39.2°F, however, all asphalts exhibited instantaneous and retarded elasticity, steady-state flow, and elastic recovery following load removal. This behavior could satisfactorily be characterized by a generalized model consisting of a series combination of an elastic element (spring), a Bingham element (steady-state liquid), and a viscoelastic body (generalized Voigt body). It follows, then, that the complexity of flow behavior increases as the temperature is reduced.

4. The steady-state flow behavior of each of the asphalt cements in the low-temperature range was found to be similar to

that of a Bingham plastic. The coefficient of plastic viscosity is an appropriate means for defining a shear-independent measure of consistency for classification purposes.

5. Coefficients of plastic viscosity in the range of 10^4 to 10^{13} poises were measured with the rotating coaxial cylinder viscometer. In no case was a discernable relationship observed between the yield stress and the coefficient of plastic viscosity.

6. For the one set of tests conducted at 0°F, steady-state flow was reached after a period of approximately three to nine days. For tests at 39.2°F, approximately one to five hours were necessary to achieve the steady-state condition. This emphasizes the necessity for a long-duration test when evaluating the steady-state flow behavior of asphalt cements at relatively low temperatures.

7. All of the asphalts appeared to behave linearly under the conditions of test employed herein. The tentative nature of this conclusion is emphasized, however, pending the outcome of a more exhaustive set of tests directed specifically to this determination.

8. The time-temperature superposition principle (method of reduced variables) appears to be applicable to the behavior of normal asphalt cements at least in the low-temperature range (0°F to 104°F).

9. A relationship exists between plastic viscosity evaluated with the rotating coaxial cylinder viscometer and the results of standard penetration tests when both types of tests are conducted at identical temperatures. The correlation at 77°F is superior to that at 39.2°F because of the varying nature of the shear strains and shear rates when the penetrations are small as they

were at 39.2°F. The viscosity measurements are considerably more sensitive both to changes in temperature and to changes in material properties than are the penetration measurements.

10. The effect of penetration grade was evaluated using the three asphalts obtained by vacuum and steam distillation from the Venezuelan crude. As anticipated, the viscosities of these asphalts were properly arranged in the order indicated by the penetration grade at all temperatures. The temperature susceptibilities of these asphalts were approximately the same: this indicates that asphalts produced from the same crude source by similar refining processes will have similar temperature susceptibilities.

11. The effect of manufacturing process on the viscosities of materials of the same penetration grade was somewhat indeterminant. Those asphalts in which air blowing was used, namely, asphalts 53, 72, and 91, did not have particularly low temperature susceptibilities. Asphalt 91 had a consistently low viscosity at all temperatures but asphalts 53 and 72 were not significantly different from the other 85-100 penetration materials in this respect.

12. The effect of crude source for materials of the same penetration grade is also difficult to evaluate. The Californian asphalt exhibited a lower viscosity than most of the other asphalts at all temperatures and the highest temperature susceptibility of the group. The Mexican asphalt exhibited relatively high viscosities at the two higher temperatures and the lowest temperature susceptibility of the group. However, since the differences

among asphalts was not large and since only a single asphalt from each of these two crude sources was evaluated, definitive conclusions as to the potential importance of crude source must be withheld.

13. Two of the 85-100 penetration asphalts, namely, asphalts 91 and 116, had significantly lower Saybolt Furol viscosities than the others. This lower consistency at the higher temperatures is reflected in the fact that the plastic viscosities of these asphalts at 104°F were the lowest of the 85-100 penetration grade asphalts. Due to the different temperature susceptibilities of the various asphalts, however, they did not maintain this relatively low ranking at the lower temperatures. Asphalts 91 and 116 were also less viscous at 104°F than the one 120-150 penetration asphalt that was tested. This emphasizes the necessity for specifying the consistency of asphalt cements at more than one temperature level.

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APPENDIX A

TEST PROCEDURE

The following specification describes the procedures for testing with the rotating coaxial cylinder viscometer.

1. Water Bath

Temperature control shall be provided by immersing the specimen and portions of the viscometer in a suitable water bath. The bath shall be sufficiently large to contain the viscometer and to permit the specimen to be submerged to a depth of at least 1 inch below the water surface. The temperature of the bath shall be allowed to vary not more than 0.5°F from the specified test temperature.

2. Preparation of Viscometer

The appropriate cup-and-bob assembly and drive pulley shall be selected. The pulley, scale, and rotary differential transformer shall then be attached to the axle. The upper surfaces of the grooved brass base plate (used with the small cup-and-bob assembly) or the brass ring (used with the large assembly) shall be thoroughly amalgamated with mercury and properly positioned in the viscometer. A sufficient quantity of mercury shall be poured into the annulus of the base plate so that, when the bob and cup are assembled, the level of mercury will be slightly above the lower edge of the bob. The cup shall be rigidly affixed to the base of the viscometer. In a like manner, the bob shall be affixed to the axle of the load system and properly positioned in its bearing receptacle.

3. Special Precautions for Handling Mercury

Due to the possible danger to health if mercury is handled carelessly, the following precautions shall be observed at all times:

a. Mercury shall be stored in a closed jug or other suitable, unbreakable container in a cool place.

b. Extreme care shall be exercised to avoid spilling any mercury.

c. Mercury vapors shall be removed by working under a suitable hood with adequate ventilation.

d. The amalgamated brass plates and other components of the viscometer shall be maintained at normal room temperature except when testing.

4. Weight Attachment

After the cup and bob have been properly assembled on the viscometer, the drive pulley shall be firmly anchored by placing the trip release in the locked position. The idle pulleys shall be aligned with the drive pulley. The weights necessary to produce the desired torque shall then be attached to the drive pulley and suspended over the idle pulleys. The weights shall be attached symmetrically so as to produce a couple and thus eliminate the possibility of introducing bending in the axle. Caution should be exercised at all times to prevent shearing the test material prior to the beginning of a test.

5. Preparation of Test Specimen

A suitable container holding the bituminous material to be tested shall be placed in an oil bath maintained at a temperature of 290°F[1] (plus or minus 5°F). During heating, the sample shall be stirred intermittently to maintain, as well as possible, a uniform temperature distribution within the sample. When the sample has been completely melted, it shall be thoroughly stirred to insure that it is homogenous and free from air bubbles. The assembled viscometer, with weights attached, shall be placed on a perfectly level surface. In filling the annulus formed by the cup and bob, the material shall be poured in a thin stream from two separate containers at points approximately 180° apart. During filling, each container shall be moved back and forth over a 180° segment of the annulus until the annulus is slightly more than level full. The viscometer and test material shall be cooled at room temperature for a period of 30 minutes. They shall then be placed in the water bath maintained at the specified temperature of test for an additional period of 30 minutes. The excess bitumen shall then be struck off with a heated, straight-edged spatula or knife.

6. Establishment of Temperature Equilibrium

After trimming the specimen and prior to testing, the viscometer shall be returned to the water bath and maintained at the specified test temperature for a period of 30 minutes.

7. Testing

The recording equipment shall be started and the test shall

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[1] In no case shall the sample be heated to a temperature greater than 200°F above its softening point, determined in accordance with the Method of Test for Softening Point of Bituminous Materials (Ring-and-Ball Method, ASTM Designation: D36).

begin by actuating the trip release. At subsequent intervals of time, the angle of rotation shall be read directly from the recording equipment. Checks shall be made by noting the angle of rotation from the scale attached to the viscometer. The test shall be allowed to continue until a steady-state or near steady-state condition is reached, that is, until a linear relationship between the angle of rotation and time is observed. After the steady-state condition has been reached, the load shall be instantaneously removed and the rebound, if present, shall be recorded as a function of time. After rebound has been completed, the load shall be quickly applied and removed a number of times to assist in determining the instantaneous angle of rotation.

8. Procedures after Testing

The viscometer shall be disassembled and the height of the specimen determined. The apparatus shall then be cleaned in preparation for subsequent testing.

APPENDIX B

CURVE-FITTING TECHNIQUE

The following discussion describes a method for determining values of the constants, a_k and b_k, in an equation of the form

$$\Psi = \sum_{k=1}^{n} a_k \left[1 - \exp(-b_k t)\right] \qquad \text{(B-1)}$$

to yield the equation of a curve which gives the best fit by least squares criterion for a set of experimental data known to conform to a general equation of this type.

Initial values for the constants, a_k and b_k, say a_k^1 and b_k^1, are assumed. It is preferable that a_k^1 and b_k^1 be close to the best values of a_k and b_k. Equation B-1 is expanded in a Taylor's series about the values a_k^1 and b_k^1 to yield:

$$\Psi_a = f(\Psi_1) + \sum_{k=1}^{n} \left.\frac{\partial \Psi}{\partial a_k}\right|_{a_k^1, b_k^1} \Delta a_k + \sum_{k=1}^{n} \left.\frac{\partial \Psi}{\partial b_k}\right|_{a_k^1, b_k^1} \Delta b_k \qquad \text{(B-2)}$$

where $f(\Psi_1) = \sum_{k=1}^{n} a_k^1 \left[1 - \exp(-b_k^1 t)\right]$ (B-3)

$$\Delta a_k = a_k - a_k^1 \qquad \text{(B-4)}$$

$$\Delta b_k = b_k - b_k^1. \qquad \text{(B-5)}$$

Equation B-2 actually represents an approximation to the Taylor's series expansion because terms containing second and higher order quantities have been neglected.

Performing the operations indicated in Equation B-2 on Equation B-1 yields:

$$\left.\frac{\partial\Psi}{\partial a_k}\right|_{a_k^1,b_k^1} = [1 - \exp(-b_k^1 t)] \quad k=1,2,3\ldots n \tag{B-6}$$

and

$$\left.\frac{\partial\Psi}{\partial b_k}\right|_{a_k^1,b_k^1} = a_k^1 t[\exp(-b_k^1 t)]. \quad k=1,2,3\ldots n \tag{B-7}$$

Substituting the results of Equations B-3, B-6, and B-7 back into Equation B-2 it is seen that

$$\Psi_a = \sum_{k=1}^{n} a_k^1 [1 - \exp(-b_k^1 t)] + \sum_{k=1}^{n} [1 - \exp(-b_k^1 t)]\Delta a_k + \sum_{k=1}^{n} a_k^1 t\ [\exp(-b_k^1 t)]\ \Delta b_k. \tag{B-8}$$

Here the subscript "a" is placed on Ψ to denote an approximation to the true value.

If the set of data points contains r observations, then Equation B-8 may be written:

$$\Psi_{a(i)} = \sum_{k=1}^{n} \Big[a_k^1 [1 - \exp(-b_k^1 t_i)] + [1 - \exp(-b_k^1 t_i)]\ \Delta a_k + a_k^1\ t_i\ [\exp(-b_k^1 t_i)]\ \Delta b_k \Big] \tag{B-9}$$

where $i = 1,2,3\ldots r$.

Thus from Equation B-9, one has r linear equations in Δa_k and Δb_k.

The deviation, δ_i, which represents the difference between the Ψ's calculated by Equation B-9 and the actual or observed Ψ's may be determined from the relationship:

$$\delta_i = \Psi_{a(i)} - \Psi_i = \sum_{k=1}^{n} \Big[a_k^1 [1 - \exp(-b_k^1 t_i)] + [1 - \exp(-b_k^1 t_i)] \, \Delta a_k + a_k^1 \, t_i [\exp(-b_k^1 t_i)] \, \Delta b_k \Big] - \Psi_i . \tag{B-10}$$

The sum of the squares of the deviations, defined by the relationship

$$S = \sum_{i=1}^{r} \delta_i^2 , \tag{B-11}$$

becomes

$$S = \sum_{i=1}^{r} \left[\sum_{k=1}^{n} \Big[a_k^1 [1 - \exp(-b_k^1 t_i)] + [1 - \exp(-b_k^1 t_i)] \, \Delta a_k + a_k^1 \, t_i [\exp(-b_k^1 t_i)] \, \Delta b_k \Big] - \Psi_i \right]^2 . \tag{B-12}$$

Using the least-squares criterion, in order for Equation B-8 to yield a curve which fits the data, it is necessary that the parameters Δa_k and Δb_k be chosen so as to make the sum of the squares of the deviations a minimum. Thus it is necessary that the relationships

$$\frac{\partial S}{\partial(\Delta a_k)} = 0 \text{ and } \frac{\partial S}{\partial(\Delta b_k)} = 0 \tag{B-13}$$

be satisfied.

From Equation B-11, it is seen that

$$\frac{\partial S}{\partial(\Delta a_j)} = 2 \sum_{i=1}^{r} \delta_i \frac{\partial \delta_i}{\partial(\Delta a_j)} . \quad \text{(B-14)}$$

Returning to Equation B-10,

$$\frac{\partial \delta_i}{\partial(\Delta a_j)} = [1 - \exp(-b_j^1 t_i)]. \quad \text{(B-15)}$$

Substitution of this result along with the result from Equation B-10 into Equation B-14 after simplification yields:

$$\sum_{i=1}^{r} \sum_{k=1}^{n} [1 - \exp(-b_k^1 t_i)] [1 - \exp(-b_j^1 t_i)] \Delta a_k$$

$$+ \sum_{i=1}^{r} \sum_{k=1}^{n} a_k^1 t_i [\exp(-b_k^1 t_i)] [1 - \exp(-b_j^1 t_i)] \Delta b_k$$

$$= \sum_{i=1}^{r} \Psi_i [1 - \exp(-b_j^1 t_i)]$$

$$- \sum_{i=1}^{r} \sum_{k=1}^{n} a_k^1 [1 - \exp(-b_k^1 t_i)] [1 - \exp(-b_j^1 t_i)].$$

$$j=1,2,3\ldots n \quad \text{(B-16)}$$

Similarly, by taking the partial derivative of S with respect to Δb_j, it is found that

$$\sum_{i=1}^{r} \sum_{k=1}^{n} [1 - \exp(-b_k^1 t_i)] [a_j^1 t_i \exp(-b_j^1 t_i)] \Delta a_k$$

$$+ \sum_{i=1}^{r} \sum_{k=1}^{n} a_k^1 t_i \exp(-b_k^1 t_i) [a_j^1 t_i \exp(-b_j^1 t_i)] \Delta b_k$$

$$= \sum_{i=1}^{r} \Psi_i [a_j^1 t_i \exp(-b_j^1 t_i)]$$

$$- \sum_{i=1}^{r} \sum_{k=1}^{n} a_k^1 [1 - \exp(-b_k^1 t_i)] [a_j^1 t_i \exp(-b_j^1 t_i)].$$

$$j= 1,2,3\ldots n \quad \text{(B-17)}$$

Simultaneous solution of Equations B-16 and B-17 will yield the Δa_k's and Δb_k's from which the a_k's and b_k's may be calculated using the relationships given by Equations B-4 and B-5. Once a_k and b_k are determined, they are substituted back into Equation B-1 and the sum of the squares of the deviations are calculated using the relationship:

$$S_1 = \sum_{i=1}^{r} \left[\sum_{k=1}^{n} a_k [1 - \exp(-b_k t_i)] - \Psi_i \right]^2 . \qquad \text{(B-18)}$$

If S_1 is too large, the values of a_k and b_k as calculated above are used as new approximations, say a_k^2 and b_k^2, and new values of Δa_k and Δb_k are determined using Equations B-16 and B-17. A new value for the sum of the squares of the deviations, S_2, is calculated which will be less than S_1. Again, if S_2 is too large, the newly determined values of a_k and b_k are used as new approximations, a_k^3 and b_k^3, and new values of Δa_k and Δb_k are determined. This process is repeated until the difference between the sum of the squares of the deviations calculated for two successive approximations is less than or equal to an allowable difference. In equation form, this may be written:

$$S_{b-1} - S_b \leq \Delta S_a \qquad \text{(B-19)}$$

where S_{b-1} and S_b = sum of the squares of the deviations for two successive approximations

ΔS_a = allowable difference.

The accuracy with which Equation B-1 fits a set of experimental data also depends on the value of n, that is, the number of terms used in the summation. Of course, the smaller the number of terms, the simpler the equation; therefore, the first logical value for n would be one. If, after determining the final value for a_k and b_k (for n=1), it is found that the sum of the squares of the deviations (S_b) is greater than some predetermined allowable value, say S_a, then it will be necessary to assume a new value for n in Equation B-1 and determine the corresponding values for the a_k's and b_k's. Since it is desirable that n be as small as possible and still satisfy the condition that

$$S_b \leq S_a \tag{B-20}$$

it is logical that successive determinations be made for n = 2, n = 3, and so forth until Equation B-20 is satisfied.

As stated earlier, in order for this technique to work it is necessary that the assumed values for the a_k's and b_k's be reasonably close to their true values. If this condition is not met, the procedure yields diverging instead of converging values for the parameters. This a paradox which could limit the utility of the technique, particularly if there is no prior knowledge of reasonable values to assume. In order to eliminate this problem, a ratio test is performed which consists of examining the two ratios $\Delta a_k/a_k$ and $\Delta b_k/b_k$ after each iteration. It has been found from experience that the assumed values are close enough to the true values to yield convergence if these ratios are between the limits:

$$-1.0 < \Delta a_k/a_k < 5.0 \tag{B-21}$$

$$-1.0 < \Delta b_k/b_k < 5.0. \tag{B-22}$$

If a ratio falls outside these limits, the new or adjusted value of the parameter for the next iteration is evaluated from one of the following relationships:

$$a_k = a_k^o \pm .40\ a_k^o \qquad \text{(B-23)}$$

$$b_k = b_k^o \pm .40\ b_k^o \qquad \text{(B-24)}$$

where a_k^o and b_k^o = previously assumed values of a_k and b_k.

If the ratio is positive the plus sign is used; if it is negative the minus sign is used. The factor of .40 was found by trial-and-error to be the most satisfactory adjusting factor to use. Of course, if the ratios fall within the limits given by Equations B-21 and B-22, the new or adjusted values for the next iteration are evaluated from Equations B-4 and B-5.

Using this ratio-test technique, results have been obtained using initially assumed parameter values which differed from the true values by as much as one million times. This permits an extremely wide range of "guesses" for the initial values thus increasing the usefulness of the method.

APPENDIX C

COMPUTER PROGRAM FOR VISCOELASTIC ANALYSIS

I. Purpose

The viscoelastic material parameters for asphalts tested in the rotating coaxial viscometer may be evaluated using a computer program. This program was written in FORTRAN IV for processing with the IBM 7040 computer system. The purpose of this program is essentially threefold. First, it computes that portion of the total angle of rotation which may be properly attributed to viscoelastic flow. Equation 37 is used for this computation. Second, it evaluates the constants in Equation B-1 which yield an equation which best fits the viscoelastic portion of flow by the least squares criterion. The techniques which are used in this evaluation are described in Appendix B. The viscoelastic parameters are computed from these constants by means of the following relationships:

$$G_k = 1/a_k \qquad \text{(C-1)}$$

$$\tau_k = 60/b_k \qquad \text{(C-2)}$$

and

$$\eta_k = G_k(\tau_k). \qquad \text{(C-3)}$$

Third, it assesses the degree to which the equation of best fit approximates the experimental data. This is accomplished by calculating the square root of the average squared deviations between the experimental data and the equation of best fit. Such standard deviations are computed with respect to the viscoelastic creep function and the total angles of rotation for each of three stress levels.

II. Limitations

It is necessary to provide, as input, data from the results of three tests, each of which is normally conducted at a different stress level. The number of data points (that is, pairs of observations between time and total angle of rotation) may be any integer not exceeding 120. The same number of points, however, must be provided for each of the three tests. The number of Voigt elements in the viscoelastic model is limited to a maximum of 10. Any number less than 10 may be evaluated.

III. Job Submission

To submit a job to the University of Kentucky IBM 7040 computer system, the following items must be submitted in the order indicated.

A. $JOB Card

B. $IBJOB NOSOURCE Card

C. Viscoelastic Object Deck

D. Matinv Object Deck

E. $ENTRY Card

F. Data Cards for First Asphalt

1. Asphalt Header Card

2. Steady-State Angular Velocities Card

3. Load Header Card (First Load)

4. Data Cards (First Load)

5. Load Header Card (Second Load)

6. Data Cards (Second Load)

7. Load Header Card (Third Load)

8. Data Cards (Third Load)

9. N-Card

10. Voigt Model Cards

G. Data Cards for Other Asphalts as Desired

IV. Input Data Cards

A. Asphalt Header Card

1. Format

Columns	Symbol	Subject	Units	Format
1-3	NØ	Asphalt number	--	I 3
4-7	L1	Smallest load	gms	I 4
8-13	L2	Intermediate load	gms	I 6
14-19	L3	Largest load	gms	I 6
20-24	TEMP	Test temperature	°F	F 5.1
25-32	CT1	Smallest CT product	d/cm^2	F 8.0
33-40	CT2	Intermediate CT product	d/cm^2	F 8.0
41-48	CT3	Largest CT product	d/cm^2	F 8.0
49-62	GØ	Instantaneous elastic shear modulus	d/cm^2	E14.7

2. Use

This card serves to identify the test results under consideration and to transmit the instantaneous elastic shear modulus for internal computations.

3. Remarks

The loads which are indicated are the total loads suspended on both sides of the pulley. The instantaneous elastic shear modulus is the load-independent modulus which has been independently evaluated (see "Presentation of Results").

B. Steady-State Angular Velocities Card

1. Format

Columns	Symbol	Subject	Units	Format
1-14	WØ1	Steady-state angular velocity under smallest load	rad/sec	E 14.7
15-28	WØ2	Steady-state angular velocity under intermediate load	rad/sec	E 14.7
29-42	WØ3	Steady-state angular velocity under largest load	rad/sec	E 14.7

2. Remarks

The steady-state angular velocities under the three test conditions must be evaluated independently prior to the computer run. The techniques for this evaluation are presented in the section entitled "Presentation of Results".

C. Load Header Card

1. Format

Columns	Symbol	Subject	Units	Format
1-15	WØ	Steady-state angular velocity for given load	rad/sec	F 15.0
16-30	CT	CT product for given load	d/cm^2	F 15.0
31-40	T1	Corresponding time to achieve steady-state flow	min	F 10.0
41-50	THETF	Corresponding angle of rotation at T1	degrees	F 10.0
51-54	M	Number of data points	--	I 4

2. Use

This card furnishes the necessary information to enable the computation of the viscoelastic creep function for the given load level. It also specifies the number of data points which follow on the data cards.

3. Remarks

One load header card is necessary for each of the three test conditions.

D. Data Card

1. Format

Columns	Symbol	Subject	Units	Format
1-6	T(I)	Time corresponding to Ith data point	min	F 6.2
7-12	THETA(I,J)	Angle of rotation corresponding to Ith data point and Jth load level	degrees	F 6.2

Times and angles of rotation are alternately punched to and including column 72. Six data points will thus be included on each card except perhaps the last.

2. Use

The basic data for the analysis are transmitted by means of these data cards.

3. Remarks

The data are punched in the order of increasing times. The number of cards necessary will be precisely M/6 if this quotient is an integer or M/6 (expressed as the nearest larger integer) if the quotient is not an integer. The cards must be ordered by increasing times.

E. N-Card

1. Format

Columns	Symbol	Subject	Units	Format
1-3	N	Minimum number of Voigt elements to consider	--	I 3

2. Use

This card establishes the minimum number of Voigt elements in the viscoelastic model. After evaluating the constants for the N-element model, the program proceeds to evaluate an (N + 1)-element model, and so forth until one of the following conditions occurs: (1) the product of one of the assumed B parameters and the time value corresponding to the second data point exceeds 30,(2) 100 iterations are tried for a specific number of elements without convergence, (3) a specified maximum time is exceeded, or (4) the number of Voigt elements exceeds 10. The first condition is provided in order to eliminate the inclusion of numerical quantities greater than those permitted by the computer. The second condition is provided as a means for discontinuing execution if divergence is occurring.

F. Voigt Model Card

1. Format

Columns	Symbol	Subject	Units	Format
1-14	A(K)	Best prior estimate of $1/G_k$ (the reciprocal of the shear modulus of the kth element)	cm^2/d	E 14.7
15-28	B(K)	Best prior estimate of $1/\tau_k$ (the reciprocal of the retardation time of the kth element)	min^{-1}	E 14.7

2. Use

The N, Voigt model cards which are necessary are ordered by increasing element numbers. The estimates of A(K) and B(K) serve as the initial point for the iteration process.

3. Remarks

The estimates of A(K) and B(K) may differ from the true values by a factor as large as 10^6. The program uses an iteration process which evaluates a power series at successive values of A(K) and B(K) until the series converges. However, if the estimates of A(K) and B(K) are greatly in error, the iteration process will not be executed and the program will terminate.

If a value of N = 1 is specified by the N-Card, only one value of A(K) and B(K) must be estimated, that is, A(1) and B(1). For the tests reported herein (asphalt cements at 39.2°F), good estimates of A(1) and B(1) are 0.2×10^{-5} and 0.5×10^{-1}, respectively. The program then computes values of A(1) and B(1) by the iteration process which yield the best fit by the least squares criterion. From these values, G_1 and τ_1 are computed. The program then evaluates a two-element model. It first estimates A(1), B(1), A(2), and B(2) and then, by the iteration process, finds the best values for these four variables. G_1, G_2, τ_1, and τ_2 are then computed. This process is repeated automatically until one of the four conditions of Section IV, E,2 is encountered.

V. Output

All output from this program is in the form of tabular printouts. The section entitled "Presentation of Results" describes the content and format of these printouts. Output data for all of the asphalts tested at 39.2°F are included as Appendix D.

VI. Source Program

A listing of the source program for the viscoelastic analysis is included as Figure C-1. A listing of the source program for the Matinv subprogram is included as Figure C-2. This subprogram, which was obtained from the University of Kentucky Computing Center, is used in the solution of the simultaneous equations (Equations B-16 and B-17).

```
      DIMENSION T(120),THET(120,3),CF(120,3),ADIFF(120)
   30 READ(5,1) NO,L1,L2,L3,TEMP,CT1,CT2,CT3,GO
    1 FORMAT(I3,I4,2I6,F5.1,3F8.0,E14.7)
      READ(5,9)WO1,WO2,WO3,
    9 FORMAT(3E14.7)
      IF(NO) 10,20,10
   10 WRITE(6,8) NO,L1,L2,L3,TEMP,CT1,CT2,CT3
    8 FORMAT (1H1,19X,40H SUMMARY SHEET FOR VISCOELASTIC ANALYSIS,//,9X,
     112H ASPHALT NO-,I3,15X,7H LOADS-,I4,2I6,3H GM,/,9X,11H TEST TEMP-,
     2F5.1,2H F,12X,6H CTS- ,3F8.0,8H DY/SQCM,//, 88H TIME     THETA 1
     3   CF 1          THETA 2        CF 2         THETA 3       CF 3          AVG
     4 CF,/, 89H  MIN       RAD        RA/D/SQCM        RAD        RA/D/SQCM
     5  RAD        RA/D/SQCM     RA/D/SQCM,//)
   40 DO 50 J=1,3
      READ(5,2)WO,CT,T1,THETF,M
    2 FORMAT (2F15.0,2F10.0,I4)
      WO = WO * 60.0
      DO 6 I=1,M,6
    6  READ(5,3) T(I),THET(I,J),T(I+1),THET(I+1,J),T(I+2),THET(I+2,J),T(
     1I+3),THET(I+3,J),T(I+4),THET(I+4,J),T(I+5),THET(I+5,J)
    3 FORMAT (12F6.2)
      DO 50 I= 1,M
      THET (I,J) = THET (I,J) * .0174533
      CF(I,J)=((THET(I,J)-WO*T(I))/CT)-THET(1,J)/CT
   50 CONTINUE
      DO 60 I = 1,M
      ADIFF(I)=(CF(I,1)+CF(I,2)+CF(1,3))/3.
   60 WRITE(6,4) T(I),THET(I,1),CF(I,1),THET(I,2),CF(I,2),THET(I,3),CF(I
     1,3),ADIFF(I)
    4 FORMAT(F8.1,6E12.5,E14.7)
      DIMENSION DIFF(120,10),AA1(10,11,120), BA1(10,120), AA(100,21),
     1A(10), B(10), DELTA(20),RATIO(20),G(10), TAU(10), VISC(10), C(10),
     2D(10),EDIFF(120),S(120),THET1(120),THET2(120),THET3(120),S1(120),
     3S2(120),S3(120)
      READ (5,12) N
   12 FORMAT (I3)
      DO 70 K=1,N
   70 READ(5,13) A(K),B(K)
   13 FORMAT(E14.7,E14.7)
  109 II = 0
   26 N1 = N+1
      II = II+1
      M2=M+1
      L1=2*N
      L2=2*N+1
      TEST=0.0
      TEST2 = 0.0
      DO 16 J=1,L1
      DO 16 I=1,L2
   16 AA(J,I) =0.0
      DO 200 J=1,N
      DO 200 K=1,N1
      DO 200 I=1,M2
  200 AA1(J,K,I)=0.0
      DO 202 J=1,N
      DO 202 K=1,N
      DO 203 I=1,M
      IF (B(K)*T(2).GE.30.0) GO TO 30
      IF (ABS(B(K)*T(I)).GE.30.0) GO TO 204
      X=1./EXP(B(K)*T(I))
```

Figure C-1. Source Program for Viscoelastic Analysis.

```
      GO TO 205
204   X=0.0
205   IF(B(J)*T(2).GE.30.0) GO TO 30
      IF (ABS(B(J)*T(I)).GE.30.0) GO TO 208
      Y=1./EXP(B(J)*T(I))
      GO TO 209
208   Y=0.0
209   AA1(J,K,I)=(1.- X)*(1.-Y)
203   AA1(J,K,M+1)=AA1(J,K,I) + AA1(J,K,M+1)
202   AA(J,K)=AA1(J,K,M+1)
      DO 300 J=1,N
      DO 300 K=1,N1
      DO 300 I=1,M2
300   AA1(J,K,I)=0.0
      DO 302 J=1,N
      DO 302 K=1,N
      DO 303 I=1,M
      IF (ABS(B(K)*T(I)).GE.30.0) GO TO 304
      X=1./EXP(B(K)*T(I))
      GO TO 305
304   X=0.0
305   IF (ABS(B(J)*T(I)).GE.30.0) GO TO 308
      Y=1./EXP(B(J)*T(I))
      GO TO 309
308   Y=0.0
309   AA1(J,K,I) =A(K)*T(I)*( X)*(1.-Y)
303   AA1(J,K,M+1)=AA1(J,K,I) + AA1(J,K,M+1)
      L=N+K
302   AA(J,L)=AA1(J,K,M+1)
      DO 400 J=1,N
      DO 400 K=1,N1
      DO 400 I=1,M2
400   AA1(J,K,I)=0.0
      DO 401 J=1,N
      DO 401 I=1,M2
401   BA1(J,I)=0.0
      DO 408 J=1,N
      DO 407 K=1,N
      DO 406 I=1,M
      IF((B(K)*T(I)).GE.30.0) GO TO 402
      X=1./EXP(B(K)*T(I))
      GO TO 403
402   X=0.0
403   IF((B(J)*T(I)).GE.30.0) GO TO 404
      Y=1./EXP(B(J)*T(I))
      GO TO 405
404   Y=0.0
405   BA1(J,I)=ADIFF(I)*(1.-Y)
      AA1(J,K,I)=A(K)*(1.-X)*(1.-Y)
      BA1(J,M+1)=BA1(J,I)+BA1(J,M+1)
406   AA1(J,K,M+1)=AA1(J,K,I)+AA1(J,K,M+1)
407   AA1(J,N+1,M+1)=AA1(J,K,M+1)+AA1(J,N+1,M+1)
      R=N
408   AA(J,L2)=(BA1(J,M+1)/R)-AA1(J,N+1,M+1)
      DO 500 J=1,N
      DO 500 K=1,N1
      DO 500 I=1,M2
500   AA1(J,K,I)=0.0
      DO 502 J=1,N
      DO 502 K=1,N
```

Figure C-1. Source Program for Viscoelastic Analysis (Cont'd.).

```
      DO 503 I=1,M
      IF (ABS(B(K)*T(I)).GE.30.0) GO TO 504
      X=1./EXP(B(K)*T(I))
      GO TO 505
504   X=0.0
505   IF (ABS(B(J)*T(I)).GE.30.0) GO TO 508
      Y=1./EXP(B(J)*T(I))
      GOTO 509
508   Y=0.0
509   AA1(J,K,I) =(1.- X)*A(J)*T(I)*(Y)
503   AA1(J,K,M+1)=AA1(J,K,I) + AA1(J,K,M+1)
      J2=N+J
502   AA(J2,K)=AA1(J,K,M+1)
      DO 600 J=1,N
      DO 600 K=1,N1
      DO 600 I=1,M2
600   AA1(J,K,I)=0.0
      DO 602 J=1,N
      DO 602 K=1,N
      DO 603 I=1,M
      IF (ABS(B(K)*T(I)).GE.30.0) GO TO 604
      X=1./EXP(B(K)*T(I))
      GO TO 605
604   X=0.0
605   IF (ABS(B(J)*T(I)).GE.30.0) GO TO 608
      Y=1./EXP(B(J)*T(I))
      GO TO 609
608   Y=0.0
609   AA1(J,K,I)    =A(K)*T(I)*( X)*A(J)*T(I)*(Y)
603   AA1(J,K,M+1)=AA1(J,K,I) + AA1(J,K,M+1)
      L=N+K
      J2=N+J
602   AA(J2,L)=AA1(J,K,M+1)
      DO 700 J=1,N
      DO 700 K=1,N1
      DO 700 I=1,M2
700   AA1(J,K,I)=0.0
      DO 701 J=1,N
      DO 701 I=1,M2
701   BA1(J,I)=0.0
      DO 708 J=1,N
      DO 707 K=1,N
      DO 706 I=1,M
      IF((B(K)*T(I)).GE.30.0) GO TO 702
      X=1./EXP(B(K)*T(I))
      GO TO 703
702   X=0.0
703   IF((B(J)*T(I)).GE.30.0) GO TO 704
      Y=1./EXP(B(J)*T(I))
      GO TO 705
704   Y=0.0
705   BA1(J,I)=ADIFF(I)*A(J)*T(I)*(Y)
      AA1(J,K,I)=A(K)*(1.-X)*A(J)*T(I)*(Y)
      BA1(J,M+1)=BA1(J,I)+BA1(J,M+1)
706   AA1(J,K,M+1)=AA1(J,K,I)+AA1(J,K,M+1)
707   AA1(J,N+1,M+1)=AA1(J,K,M+1)+AA1(J,N+1,M+1)
      J2=N+J
      R=N
708   AA(J2,L2)=(BA1(J,M+1)/R)-AA1(J,N+1,M+1)
      DO 43 J=1,L1
```

Figure C-1. Source Program for Viscoelastic Analysis (Cont'd.).

```
 43 DELTA(J)=AA(J,L2)
    CALL MATINV (AA,L1,DELTA,1,DET)
    DO 100 I=1,N
    L=N+I
    RATIO (I) = DELTA(I)/A(I)
100 RATIO(L) = DELTA(L)/B(I)
    DO 106 I=1,N
    L=N+I
    IF (RATIO (I).GT.5.0) GO TO 101
    IF (RATIO (I).LT.(-1.0)) GO TO 102
    GO TO 103
101 A(I)=A(I)+.40*A(I)
    TEST2 = 2.0
    GO TO 103
102 A(I)=A(I)-.40*A(I)
    TEST2 = 2.0
103 IF (RATIO (L).GT.5.0) GO TO 104
    IF (RATIO(L).LT.(-1.0)) GO TO 105
    GOTO 106
104 B(I)=B(I)+.40*B(I)
    TEST2 = 2.0
    GO TO 106
105 B(I)=B(I)-.40*B(I)
    TEST2 = 2.0
106 CONTINUE
    IF (TEST2.EQ.2.0.AND.II.GT.1) GO TO 5
    IF (TEST2.EQ.2.) GO TO 5
    DO 29 K=1,N
    L=N+K
    IF (ABS(DELTA(K)).GE..001*A(K))GO TO 27
    IF (ABS(DELTA(L)).GE..001*B(K))GO TO 27
    GO TO 28
 27 TEST=1.
 28 A(K)=DELTA(K)+A(K)
 29 B(K)=DELTA(L)+B(K)
    IF (TEST.GT.0.0.OR.TEST2.GT.0.0) GO TO 5
    GO TO 7
  5 IF(II.LE.100) GO TO 26
    WRITE (6,31)
 31 FORMAT (1H1)
    DO 900 K=1,N
900 WRITE (6,32) K,DELTA(K),K,A(K),K,RATIO(K)
 32 FORMAT(     4X,6H DELTA,I1,2H =,E14.7,4X,2H A,I1,2H =,E14.7,4X,6H R
   1ATIO,I1,2H =,E14.7)
    DO 901 K=1,N
    L=N+K
901 WRITE (6,42) L,DELTA(L),K,B(K),L,RATIO(L)
 42 FORMAT(4X,6H DELTA,I1,2H =,E14.7,4X,2H B,I1,2H =,E14.7,4X,6H RATIO
   1,I1,2H =,E14.7)
    GO TO 30
  7 DO 107 I=1,N
    G(I) = 1./A(I)
    TAU(I) = 60./B(I)
107 VISC(I)=G(I)*TAU(I)
    WRITE(6,910)
910 FORMAT (1H1)
    WRITE(6,108) (K,(TAU(K)),K,(G(K)),K,(VISC(K)),K=1,N)
108 FORMAT (1H0,10X,4H TAU,I1,2H =,1X,E14.7,4H SEC,6X,2H G,I1,2H =,1X,
   1E14.7,12H DYNES/SQ CM,6X,5H VISC,I1,2H =,1X,E14.7,7H POISES)
    DO 807 I=1,M
```

Figure C-1. Source Program for Viscoelastic Analysis (Cont'd.).

```
      DO 807 J=1,10
807   DIFF(I,J)=0.0
      DO 808 I=1,M
      DO 809 J=1,N
      IF((T(I)*B(J)).GE.30.0) GO TO 812
      Z=1./EXP(T(I)*B(J))
      GOTO 813
812   Z=0.0
813   DIFF(I,J)=(  1. /G(J))*(1.-Z)
809   DIFF(I,N+1)=DIFF(I,N+1)+DIFF(I,J)
      EDIFF(I)=DIFF(I,N+1)
      THET1(I)=(CT1/GO)+(WO1*T(I)*60.)+(CT1*EDIFF(I))
      THET2(I)=(CT2/GO)+(WO2*T(I)*60.)+(CT2*EDIFF(I))
808   THET3(I)=(CT3/GO)+(WO3*T(I)*60.)+(CT3*EDIFF(I))
      WRITE(6,810)
810   FORMAT(1H-,109H TIME     OBSERVED    CALCULATED      OBSERVED    CALCU
     1LATED      OBSERVED    CALCULATED      OBSERVED    CALCULATED ,/,110H
     2(MIN)      THETA 1      THETA 1       THETA 2      THETA 2          THETA
     3 3      THETA 3      CP FUNCTION  CP FUNCTION,/,110H              (RAD)
     4          (RAD)        (RAD)        (RAD)         (RAD)          (RAD)
     5     (RA/D/SQCM)   (RA/D/SQCM),/)
      DO 850 I=1,M
850   WRITE(6,811)T(I),THET(I,1),THET1(I),THET(I,2),THET2(I),THET(I,3),T
     1HET3(I),ADIFF(I),EDIFF(I)
811   FORMAT(F8.1,8E13.5)
      DO 822 I=1,120
      S1(I)=0.0
      S2(I)=0.0
      S3(I)=0.0
822   S(I)=0.0
      DO 820 I=1,M
      S1(I)=(THET(I,1)-THET1(I))**2
      S2(I)=(THET(I,2)-THET2(I))**2
      S3(I)=(THET(I,3)-THET3(I))**2
      S(I)=(ADIFF(I)-EDIFF(I))**2
      S1(M+1)=S1(M+1)+S1(I)
      S2(M+1)=S2(M+1)+S2(I)
      S3(M+1)=S3(M+1)+S3(I)
820   S(M+1)=S(M+1)+S(I)
      H=M
      SD1=(S1(M+1)/H)**.5
      SD2=(S2(M+1)/H)**.5
      SD3=(S3(M+1)/H)**.5
      SD=(S(M+1)/H)**.5
      WRITE(6,821)SD1,SD2,SD3,SD
821   FORMAT(1H-,10H STD DEV =,3X,E12.5,14X,E12.5,14X,E12.5,14X,E12.5)
      A(N+1) = A(N)*.1
      B(N+1) = B(N)*10.
      N=N+1
      GO TO 109
 20   CALL EXIT
      END
```

Figure C-1. Source Program for Viscoelastic Analysis (Cont'd.).

```
C       PROGRAM NO. 13-7040-F4
C       TITLE - MATINV SUBROUTINE
C       SPECIAL MACH REQ - NONE
C       SUBROUTINES REQUIRED - NONE
C       KEY WORKS - SIMULTANEOUS EQUATIONS,DETERMINANT,INVERSE,MATRIX
C
$IBFTC CMV1     FULIST,REF                                          CMV10010
        SUBROUTINE MATINV(A,N,B,M,DETERM)
C       SUBROUTINE MATINV
C       THIS SUBROUTINE COMPUTES THE INVERSE AND DETERMINANT OF MATRIX A,
C       OF ORDER N,BY THE GAUSS-JORDAN METHOD. A-INVERSE REPLACES A ,AND
C       THE DETERMINANT OF A IS PLACED IN DETERM. IF M=1 THE VECTOR B
C       CONTAINS THE CONSTANT VECTOR WHEN MATINV IS CALLED,AND THIS IS
C       REPLACED WITH THE SOLUTION VECTOR IF M=0,NO SIMULTANEOUS
C       EQUATION SOLUTION IS CALLED FOR, AND B IS NOT PERTINENT. N IS NOT
C       TO EXCEED 100.
C       A,N,B,M,AND DETERMIN THE ARGUMENT LIST ARE DUMMY VARIABLES.
        DIMENSIONIPIVOT(100),A(100,100),B(100,100),INDEX(100,2),PIVOT(100)
C       INITIALIZATION
     10 DETERM=1.0
     15 DO 20J=1,N
     20 IPIVOT (J)=0
     30 DO550 I=1,N
C       SEARCH FOR PIVOT ELEMENT
     40 AMAX=0.0
     45 DO 105J=1,N
     50 IF(IPIVOT(J).EQ.1) GO TO 105
     60 DO 100 K=1,N
     70 IF(IPIVOT(K).GT.1) GO TO 740
        IF(IPIVOT(K).EQ.1) GO TO 100
     80 IF(ABS(AMAX).GE.ABS(A(J,K))) GO TO 100
     85 IROW=J
     90 ICOLUM=K
     95 AMAX=A(J,K)
    100 CONTINUE
    105 CONTINUE
    110 IPIVOT(ICOLUM)=IPIVOT(ICOLUM)+1
C       INTERCHANGE ROWS TO PUT PIVOT ELEMENT ON DIAGONAL
    130 IF(IROW.EQ.ICOLUM) GO TO 260
    140 DETERM=-DETERM
    150 DO200 L=1,N
    160 SWAP=A(IROW,L)
    170 A(IROW,L)=A(ICOLUM,L)
    200 A(ICOLUM,L)=SWAP
    205 IF(M.LE.0) GO TO 260
    210 DO250 L=1,M
    220 SWAP=B(IROW,L)
    230 B(IROW,L)=B(ICOLUM,L)
    250 B(ICOLUM,L)=SWAP
    260 INDEX(I,1)=IROW
    270 INDEX(I,2)=ICOLUM
    310 PIVOT(I)=A(ICOLUM,ICOLUM)
    320 DETERM=DETERM*PIVOT(I)
C       DIVIDE PIVOT ROW BY PIVOT ELEMENT
    330 A(ICOLUM,ICOLUM)=1.0
    340 DO350 L=1,N
    350 A(ICOLUM,L)=A(ICOLUM,L)/PIVOT(I)
    355 IF(M.LE.0) GO TO380
    360 DO370L=1,M
```

Figure C-2. Source Program for Matinv Subprogram.

```
  370 B(ICOLUM,L)=B(ICOLUM,L)/PIVOT(I)
C     REDUCE NON-PIVOT ROWS
  380 DO550 L1=1,N
  390 IF(L1.EQ.ICOLUM) GO TO 550
  400 T=A(L1,ICOLUM)
  420 A(L1,ICOLUM)=0.0
  430 DO450 L=1,N
  450 A(L1,L)=A(L1,L)-A(ICOLUM,L)*T
  455 IF(M.LE.0) GO TO 550
  460 DO500 L=1,M
  500 B(L1,L)=B(L1,L)-B(ICOLUM,L)*T
  550 CONTINUE
C     INTERCHANGE COLUMNS
  600 DO710 I=1,N
  610 L=N+1-I
  620 IF(INDEX(L,1).EQ.INDEX(L,2)) GO TO 710
  630 JROW=INDEX(L,1)
  640 JCOLUM=INDEX(L,2)
  650 DO 705 K=1,N
  660 SWAP=A(K,JROW)
  670 A(K,JROW)=A(K,JCOLUM)
  700 A(K,JCOLUM)=SWAP
  705 CONTINUE
  710 CONTINUE
  740 RETURN
      END
```

Figure C-2. Source Program for Matinv Subprogram (Cont'd.).

APPENDIX D

VISCOELASTIC ANALYSIS OF DATA

All of the test data taken at 39.2°F were analyzed using the computer program to evaluate the viscoelastic material parameters. All output from this analysis are summarized herein in tabular form. The format of these figures is described in the section entitled "Presentation of Results".

DATA SHEET

EQUATION OF BEST FIT, n=1

EQUATION OF BEST FIT, n=2

SUMMARY SHEET FOR VISCOELASTIC ANALYSIS

ASPHALT NO. 3 — TEST TEMP- 39.2 F — LOADS- 800 1200 1600 GM — CTS- 34193. 51177. 64886. DY/SQCM

n=1: TAU1 = 0.7958050E 03 SEC — G1 = 0.3370904E 06 DYNES/SQ CM — VISC1 = 0.2841743E 09 POISES

n=2: TAU1 = 0.1116007E 04 SEC — G1 = 0.4083799E 06 DYNES/SQ CM — VISC1 = 0.1701412E 39 POISES; TAU2 = 0.4603129E 02 SEC — G2 = 0.2270442E 07 DYNES/SQ CM — VISC2 = 0.1499333E 09 POISES

TIME MIN	THETA 1 RAD	CF 1 RA/D/SQCM	THETA 2 RAD	CF 2 RA/D/SQCM	THETA 3 RAD	CF 3 RA/D/SQCM	AVG CF. RA/D/SQCM	n=1 OBSERVED THETA 1 (RAD)	n=1 CALCULATED THETA 1 (RAD)	n=1 OBSERVED THETA 2 (RAD)	n=1 CALCULATED THETA 2 (RAD)	n=1 OBSERVED THETA 3 (RAD)	n=1 CALCULATED THETA 3 (RAD)	n=1 OBSERVED CP FUNCTION (RA/D/SQCM)	n=1 CALCULATED CP FUNCTION (RA/D/SQCM)	n=2 OBSERVED THETA 1 (RAD)	n=2 CALCULATED THETA 1 (RAD)	n=2 OBSERVED THETA 2 (RAD)	n=2 CALCULATED THETA 2 (RAD)	n=2 OBSERVED THETA 3 (RAD)	n=2 CALCULATED THETA 3 (RAD)	n=2 OBSERVED CP FUNCTION (RA/D/SQCM)	n=2 CALCULATED CP FUNCTION (RA/D/SQCM)
0.0	0.97266E-03	-0.00000E-38	0.17453E-02	-0.00000E-38	0.26180E-02	-0.00000E-38	-0.0000000E-38	0.87266E-03	0.12830E-02	0.17453E-02	0.19203E-02	0.26180E-02	0.24330E-02	-0.00000E-38	-0.00000E-38	0.87266E-03	0.12830E-02	0.17453E-02	0.19203E-02	0.26180E-02	0.24338E-02	-0.00000E-38	-0.00000E-38
0.1	0.52360E-02	0.11252E-06	0.69813E-02	0.85323E-07	0.92502E-02	0.86634E-07	0.9482520E-07	0.52360E-02	0.25182E-02	0.69813E-02	0.38661E-02	0.92502E-02	0.48110E-02	0.94825E-07	0.21034E-07	0.52360E-02	0.35559E-02	0.69813E-02	0.54193E-02	0.92502E-02	0.67795E-02	0.94825E-07	0.51383E-07
0.2	0.69813E-02	0.14047E-06	0.10472E-01	0.13654E-06	0.13963E-01	0.14367E-06	0.1428946E-06	0.69813E-02	0.37480E-02	0.10472E-01	0.56039E-02	0.13963E-01	0.71779E-02	0.14289E-06	0.41911E-07	0.69813E-02	0.57129E-02	0.10472E-01	0.87447E-02	0.13963E-01	0.10905E-01	0.14289E-06	0.99373E-07
0.3	0.87267E-02	0.18442E-06	0.13963E-01	0.18776E-06	0.17453E-01	0.18187E-06	0.1846856E-06	0.87267E-02	0.49725E-02	0.13963E-01	0.73337E-02	0.17453E-01	0.95347E-02	0.18469E-06	0.62630E-07	0.87267E-02	0.77636E-02	0.13963E-01	0.11911E-01	0.17453E-01	0.14829E-01	0.18469E-06	0.14426E-06
0.4	0.10472E-01	0.22038E-06	0.16581E-01	0.22193E-06	0.21817E-01	0.23353E-06	0.2252773E-06	0.10472E-01	0.61917E-02	0.16581E-01	0.96555E-02	0.21817E-01	0.11881E-01	0.22528E-06	0.83194E-07	0.10472E-01	0.97173E-02	0.16581E-01	0.14932E-01	0.21817E-01	0.18570E-01	0.22528E-06	0.18630E-06
0.5	0.12217E-01	0.25633E-06	0.19722E-01	0.26633E-06	0.24435E-01	0.25827E-06	0.2603101E-06	0.12217E-01	0.74055E-02	0.19722E-01	0.11569E-01	0.24435E-01	0.14218E-01	0.26031E-06	0.10360E-06	0.12217E-01	0.11582E-01	0.19722E-01	0.17821E-01	0.24435E-01	0.22141E-01	0.26031E-06	0.22575E-06
0.6	0.13963E-01	0.29224E-06	0.22340E-01	0.30050E-06	0.27925E-01	0.29647E-06	0.2964171E-06	0.13963E-01	0.86141E-02	0.22340E-01	0.13475E-01	0.27925E-01	0.16545E-01	0.29642E-06	0.12386E-06	0.13963E-01	0.13366E-01	0.22340E-01	0.20587E-01	0.27925E-01	0.25558E-01	0.29642E-06	0.26282E-06
0.7	0.14835E-01	0.30271E-06	0.24435E-01	0.32443E-06	0.30543E-01	0.32122E-06	0.3161220E-06	0.14835E-01	0.98174E-02	0.24435E-01	0.15374E-01	0.30543E-01	0.18862E-01	0.31612E-06	0.14396E-06	0.14835E-01	0.15075E-01	0.24435E-01	0.23242E-01	0.30543E-01	0.28834E-01	0.31612E-06	0.29771E-06
0.8	0.16581E-01	0.33866E-06	0.27402E-01	0.36542E-06	0.33161E-01	0.34597E-06	0.3500180E-06	0.16581E-01	0.11016E-01	0.27402E-01	0.17264E-01	0.33161E-01	0.21169E-01	0.35002E-06	0.16372E-06	0.16581E-01	0.16715E-01	0.27402E-01	0.25795E-01	0.33161E-01	0.31980E-01	0.35002E-06	0.33060E-06
0.9	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1.1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1.2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1.3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1.4	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1.5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1.6	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1.7	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1.8	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1.9	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2.1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2.2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2.3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2.4	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2.5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2.6	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2.7	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2.8	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2.9	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
4.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
5.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
6.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
7.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
8.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
9.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
10.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
105.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
110.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

STD DEV = 0.41038E-02 0.49175E-02 0.16241E-01 0.13681E-06 STD DEV = 0.23725E-02 0.55843E-02 0.13240E-01 0.43529E-07

Figure D-1. Viscoelastic Analysis for Asphalt 3 at 39.2°F.

EQUATION OF BEST FIT, n=3

TAU1 = 0.1174328E 04 SEC	G1 = 0.4254244E 06 DYNES/SQ CM	VISC1 = 0.4995494E 09 POISES
TAU2 = 0.1467554E 03 SEC	G2 = 0.2517864E 07 DYNES/SQ CM	VISC2 = 0.3695103E 09 POISES
TAU3 = 0.1608370E 02 SEC	G3 = 0.6619932E 07 DYNES/SQ CM	VISC3 = 0.1064730E 09 POISES

TIME (MIN)	OBSERVED THETA 1 (RAD)	CALCULATED THETA 1 (RAD)	OBSERVED THETA 2 (RAD)	CALCULATED THETA 2 (RAD)	OBSERVED THETA 3 (RAD)	CALCULATED THETA 3 (RAD)	OBSERVED CP FUNCTION (RA/D/SQCM)	CALCULATED CP FUNCTION (RA/D/SQCM)
0.0	0.87266E-03	0.12830E-02	0.17453E-02	0.19203E-02	0.26180E-02	0.24338E-02	-0.00000E-38	-0.00000E-38
0.1	0.52360E-02	0.43609E-02	0.69813E-02	0.66241E-02	0.92502E-02	0.83005E-02	0.94825E-07	0.74924E-07
0.2	0.69813E-02	0.69141E-02	0.10472E-01	0.10543E-01	0.13963E-01	0.13184E-01	0.14289E-06	0.13451E-06
0.3	0.87267E-02	0.90995E-02	0.13963E-01	0.13911E-01	0.17453E-01	0.17364E-01	0.18469E-06	0.18333E-06
0.4	0.10472E-01	0.11025E-01	0.16581E-01	0.16890E-01	0.21817E-01	0.21051E-01	0.22528E-06	0.22456E-06
0.5	0.12217E-01	0.12766E-01	0.19722E-01	0.19593E-01	0.24435E-01	0.24387E-01	0.26031E-06	0.26038E-06
0.6	0.13963E-01	0.14374E-01	0.22340E-01	0.22096E-01	0.27925E-01	0.27471E-01	0.29642E-06	0.29231E-06
0.7	0.14835E-01	0.15884E-01	0.24435E-01	0.24454E-01	0.30543E-01	0.30370E-01	0.31612E-06	0.32140E-06
0.8	0.16581E-01	0.17322E-01	0.27402E-01	0.26703E-01	0.33161E-01	0.33132E-01	0.35002E-06	0.34836E-06
0.9	0.17453E-01	0.18705E-01	0.29671E-01	0.28870E-01	0.36652E-01	0.35789E-01	0.37534E-06	0.37371E-06
1.0	0.19199E-01	0.20045E-01	0.31416E-01	0.30972E-01	0.39270E-01	0.38365E-01	0.40128E-06	0.39780E-06
1.1	0.20944E-01	0.21350E-01	0.33685E-01	0.33023E-01	0.41888E-01	0.40875E-01	0.43063E-06	0.42088E-06
1.2	0.21817E-01	0.22627E-01	0.35779E-01	0.35031E-01	0.43633E-01	0.43331E-01	0.44585E-06	0.44313E-06
1.3	0.22689E-01	0.23880E-01	0.38048E-01	0.37003E-01	0.46251E-01	0.45741E-01	0.46669E-06	0.46467E-06
1.4	0.24435E-01	0.25111E-01	0.40143E-01	0.38943E-01	0.48869E-01	0.48111E-01	0.49491E-06	0.48560E-06
1.5	0.25307E-01	0.26324E-01	0.41888E-01	0.40856E-01	0.51487E-01	0.50446E-01	0.51234E-06	0.50598E-06
1.6	0.26180E-01	0.27520E-01	0.43982E-01	0.42743E-01	0.54105E-01	0.52749E-01	0.53204E-06	0.52587E-06
1.7	0.27925E-01	0.28700E-01	0.45728E-01	0.44607E-01	0.55851E-01	0.55022E-01	0.55350E-06	0.54530E-06
1.8	0.28798E-01	0.29866E-01	0.47648E-01	0.46449E-01	0.57596E-01	0.57267E-01	0.56758E-06	0.56431E-06
1.9	0.29671E-01	0.31019E-01	0.49567E-01	0.48271E-01	0.60214E-01	0.59487E-01	0.58615E-06	0.58291E-06
2.0	0.31416E-01	0.32158E-01	0.51487E-01	0.50073E-01	0.62832E-01	0.61682E-01	0.61322E-06	0.60114E-06
2.1	0.32289E-01	0.33285E-01	0.53233E-01	0.51857E-01	0.64577E-01	0.63854E-01	0.62617E-06	0.61901E-06
2.2	0.33161E-01	0.34400E-01	0.54978E-01	0.53623E-01	0.66323E-01	0.66003E-01	0.63912E-06	0.63653E-06
2.3	0.34034E-01	0.35504E-01	0.56723E-01	0.55372E-01	0.68941E-01	0.68131E-01	0.65655E-06	0.65372E-06
2.4	0.34907E-01	0.36596E-01	0.58469E-01	0.57105E-01	0.71559E-01	0.70238E-01	0.67398E-06	0.67059E-06
2.5	0.36652E-01	0.37679E-01	0.60214E-01	0.58822E-01	0.73304E-01	0.72326E-01	0.69543E-06	0.68716E-06
2.6	0.37525E-01	0.38751E-01	0.61959E-01	0.60524E-01	0.75922E-01	0.74394E-01	0.71286E-06	0.70343E-06
2.7	0.38397E-01	0.39814E-01	0.63705E-01	0.62212E-01	0.78540E-01	0.76444E-01	0.73029E-06	0.71942E-06
2.8	0.39270E-01	0.40867E-01	0.65450E-01	0.63885E-01	0.80285E-01	0.78476E-01	0.74324E-06	0.73513E-06
2.9	0.40143E-01	0.41912E-01	0.66672E-01	0.65545E-01	0.82031E-01	0.80491E-01	0.75278E-06	0.75058E-06
3.0	0.41015E-01	0.42947E-01	0.68591E-01	0.67192E-01	0.83776E-01	0.82489E-01	0.76686E-06	0.76577E-06
4.0	0.49742E-01	0.52070E-01	0.84125E-01	0.83027E-01	0.10297E 00	0.10167E 00	0.89279E-06	0.90531E-06
5.0	0.59341E-01	0.62190E-01	0.99484E-01	0.97935E-01	0.12130E 00	0.11967E 00	0.10216E-05	0.10267E-05
6.0	0.68068E-01	0.71041E-01	0.11380E 00	0.11215E 00	0.13875E 00	0.13680E 00	0.11306E-05	0.11347E-05
7.0	0.76795E-01	0.79539E-01	0.12741E 00	0.12584E 00	0.15533E 00	0.15326E 00	0.12306E-05	0.12323E-05
8.0	0.84649E-01	0.87795E-01	0.14050E 00	0.13912E 00	0.17279E 00	0.16920E 00	0.13231E-05	0.13210E-05
9.0	0.93375E-01	0.95753E-01	0.15324E 00	0.15205E 00	0.18850E 00	0.18470E 00	0.14129E-05	0.14047E-05
10.0	0.10123E 00	0.10356E 00	0.16598E 00	0.16470E 00	0.20420E 00	0.19984E 00	0.14942E-05	0.14819E-05
11.0	0.10908E 00	0.11119E 00	0.17802E 00	0.17711E 00	0.21991E 00	0.21467E 00	0.15710E-05	0.15544E-05
12.0	0.11694E 00	0.11869E 00	0.19024E 00	0.18929E 00	0.23387E 00	0.22922E 00	0.16399E-05	0.16227E-05
13.0	0.12392E 00	0.12605E 00	0.20246E 00	0.20128E 00	0.24958E 00	0.24353E 00	0.17093E-05	0.16871E-05
14.0	0.13090E 00	0.13329E 00	0.21380E 00	0.21309E 00	0.26267E 00	0.25761E 00	0.17595E-05	0.17480E-05
15.0	0.13875E 00	0.14042E 00	0.22515E 00	0.22474E 00	0.27576E 00	0.27148E 00	0.18183E-05	0.18057E-05
16.0	0.14574E 00	0.14745E 00	0.23649E 00	0.23623E 00	0.28972E 00	0.28515E 00	0.18730E-05	0.18604E-05
17.0	0.15272E 00	0.15439E 00	0.24784E 00	0.24758E 00	0.30194E 00	0.29865E 00	0.19187E-05	0.19123E-05
18.0	0.15970E 00	0.16123E 00	0.25901E 00	0.25880E 00	0.31590E 00	0.31197E 00	0.19723E-05	0.19615E-05
19.0	0.16668E 00	0.16799E 00	0.26878E 00	0.26988E 00	0.32987E 00	0.32513E 00	0.20166E-05	0.20083E-05
20.0	0.17366E 00	0.17467E 00	0.27925E 00	0.28085E 00	0.34383E 00	0.33814E 00	0.20657E-05	0.20527E-05
21.0	0.18064E 00	0.18127E 00	0.28920E 00	0.29170E 00	0.35517E 00	0.35100E 00	0.20980E-05	0.20948E-05
22.0	0.18675E 00	0.18780E 00	0.29898E 00	0.30245E 00	0.36826E 00	0.36373E 00	0.21295E-05	0.21349E-05
23.0	0.19373E 00	0.19426E 00	0.30910E 00	0.31309E 00	0.38048E 00	0.37633E 00	0.21673E-05	0.21730E-05
24.0	0.20071E 00	0.20066E 00	0.31940E 00	0.32363E 00	0.39270E 00	0.38880E 00	0.22063E-05	0.22091E-05
25.0	0.20682E 00	0.20659E 00	0.32899E 00	0.33409E 00	0.40579E 00	0.40116E 00	0.22367E-05	0.22435E-05
26.0	0.21293E 00	0.21327E 00	0.33912E 00	0.34445E 00	0.41801E 00	0.41340E 00	0.22659E-05	0.22761E-05
27.0	0.21991E 00	0.21945E 00	0.34907E 00	0.35473E 00	0.43110E 00	0.42554E 00	0.23071E-05	0.23072E-05
28.0	0.22515E 00	0.22566E 00	0.35779E 00	0.36493E 00	0.44244E 00	0.43758E 00	0.23143E-05	0.23366E-05
29.0	0.23126E 00	0.23178E 00	0.36739E 00	0.37506E 00	0.45553E 00	0.44953E 00	0.23447E-05	0.23646E-05
30.0	0.23736E 00	0.23785E 00	0.37717E 00	0.38512E 00	0.46775E 00	0.46138E 00	0.23717E-05	0.23912E-05
32.0	0.24958E 00	0.24985E 00	0.39706E 00	0.40503E 00	0.49218E 00	0.48483E 00	0.24280E-05	0.24405E-05
34.0	0.26180E 00	0.26167E 00	0.41626E 00	0.42469E 00	0.51575E 00	0.50798E 00	0.24753E-05	0.24851E-05
36.0	0.27402E 00	0.27339E 00	0.43633E 00	0.44414E 00	0.53931E 00	0.53084E 00	0.25282E-05	0.25253E-05
38.0	0.28536E 00	0.28495E 00	0.45588E 00	0.46338E 00	0.56200E 00	0.55345E 00	0.25648E-05	0.25615E-05
40.0	0.29583E 00	0.29639E 00	0.47473E 00	0.48245E 00	0.58469E 00	0.57583E 00	0.25883E-05	0.25943E-05
42.0	0.30718E 00	0.30772E 00	0.49350E 00	0.50135E 00	0.60737E 00	0.59801E 00	0.26203E-05	0.26239E-05
44.0	0.31765E 00	0.31895E 00	0.51278E 00	0.52011E 00	0.63041E 00	0.61999E 00	0.26479E-05	0.26506E-05
46.0	0.32812E 00	0.33010E 00	0.53058E 00	0.53873E 00	0.65275E 00	0.64181E 00	0.26628E-05	0.26747E-05
48.0	0.33859E 00	0.34116E 00	0.54091E 00	0.55723E 00	0.67544E 00	0.66348E 00	0.26829E-05	0.26964E-05
50.0	0.34907E 00	0.35216E 00	0.56723E 00	0.57562E 00	0.69848E 00	0.68501E 00	0.27048E-05	0.27161E-05
52.0	0.36128E 00	0.36308E 00	0.58503E 00	0.59392E 00	0.72082E 00	0.70642E 00	0.27367E-05	0.27339E-05
54.0	0.37176E 00	0.37395E 00	0.60301E 00	0.61213E 00	0.74351E 00	0.72772E 00	0.27545E-05	0.27499E-05
56.0	0.38223E 00	0.38476E 00	0.62273E 00	0.63026E 00	0.76620E 00	0.74891E 00	0.27837E-05	0.27644E-05
58.0	0.39270E 00	0.39553E 00	0.64089E 00	0.64831E 00	0.78889E 00	0.77001E 00	0.28926E-05	0.27774E-05
60.0	0.40317E 00	0.40625E 00	0.65806E 00	0.66630E 00	0.81123E 00	0.79103E 00	0.28187E-05	0.27892E-05
62.0	0.41364E 00	0.41694E 00	0.67632E 00	0.68424E 00	0.83287E 00	0.81198E 00	0.28277E-05	0.27999E-05
64.0	0.42412E 00	0.42759E 00	0.69464E 00	0.70212E 00	0.85521E 00	0.83286E 00	0.28460E-05	0.28095E-05
66.0	0.43459E 00	0.43820E 00	0.71297E 00	0.71995E 00	0.87650E 00	0.85366E 00	0.28509E-05	0.28182E-05
68.0	0.44506E 00	0.44879E 00	0.73042E 00	0.73774E 00	0.89832E 00	0.87444E 00	0.28600E-05	0.28260E-05
70.0	0.45553E 00	0.45935E 00	0.74822E 00	0.75549E 00	0.91979E 00	0.89516E 00	0.28792E-05	0.28331E-05
72.0	0.46600E 00	0.46989E 00	0.76533E 00	0.77320E 00	0.94073E 00	0.91583E 00	0.28824E-05	0.28394E-05
74.0	0.47648E 00	0.48041E 00	0.78191E 00	0.79089E 00	0.96168E 00	0.93646E 00	0.28822E-05	0.28452E-05
76.0	0.48695E 00	0.49091E 00	0.80111E 00	0.80854E 00	0.98262E 00	0.95705E 00	0.28990E-05	0.28504E-05
78.0	0.49742E 00	0.50139E 00	0.81856E 00	0.82617E 00	0.10036E 01	0.97761E 00	0.29044E-05	0.28551E-05
80.0	0.50615E 00	0.51185E 00	0.83601E 00	0.84377E 00	0.10245E 01	0.99814E 00	0.28929E-05	0.28594E-05
82.0	0.51662E 00	0.52230E 00	0.85347E 00	0.86136E 00	0.10437E 01	0.10186E 01	0.28893E-05	0.28632E-05
84.0	0.52883E 00	0.53274E 00	0.86917E 00	0.87892E 00	0.10647E 01	0.10391E 01	0.29004E-05	0.28667E-05
86.0	0.53931E 00	0.54317E 00	0.88663E 00	0.89647E 00	0.10838E 01	0.10596E 01	0.28959E-05	0.28698E-05
88.0	0.54978E 00	0.55359E 00	0.90583E 00	0.91400E 00	0.11048E 01	0.10800E 01	0.29137E-05	0.28726E-05
90.0	0.56025E 00	0.56399E 00	0.92328E 00	0.93152E 00	0.11257E 01	0.11004E 01	0.29191E-05	0.28751E-05
92.0	0.57072E 00	0.57439E 00	0.94073E 00	0.94903E 00	0.11449E 01	0.11209E 01	0.29156E-05	0.28774E-05
94.0	0.58119E 00	0.58478E 00	0.95644E 00	0.96652E 00	0.11641E 01	0.11412E 01	0.29097E-05	0.28795E-05
96.0	0.59167E 00	0.59517E 00	0.97389E 00	0.98401E 00	0.11833E 01	0.11616E 01	0.28972E-05	0.28814E-05
98.0	0.60214E 00	0.60554E 00	0.99309E 00	0.10015E 01	0.12025E 01	0.11820E 01	0.29050E-05	0.28831E-05
100.0	0.61087E 00	0.61592E 00	0.10105E 01	0.10189E 01	0.12217E 01	0.12023E 01	0.28845E-05	0.28846E-05
105.0	0.63705E 00	0.64183E 00	0.10342E 01	0.10626E 01	0.12409E 01	0.12532E 01	0.27277E-05	0.28870E-05
110.0	0.66323E 00	0.66771E 00	0.10978E 01	0.11062E 01	0.12601E 01	0.13040E 01	0.25709E-05	0.28903E-05
STD DEV =		0.24065E-02		0.54870E-02		0.13147E-01		0.41214E-07

EQUATION OF BEST FIT, n=4

TAU1 = 0.1170505E 04 SEC	G1 = 0.4271297E 06 DYNES/SQ CM	VISC1 = 0.5033742E 09 POISES
TAU2 = 0.1666584E 03 SEC	G2 = 0.2716618E 07 DYNES/SQ CM	VISC2 = 0.4527469E 09 POISES
TAU3 = 0.2973151E 02 SEC	G3 = 0.6663046E 07 DYNES/SQ CM	VISC3 = 0.1906970E 09 POISES
TAU4 = 0.2023478E 01 SEC	G4 = 0.2475420E 08 DYNES/SQ CM	VISC4 = 0.5008957E 08 POISES

TIME (MIN)	OBSERVED THETA 1 (RAD)	CALCULATED THETA 1 (RAD)	OBSERVED THETA 2 (RAD)	CALCULATED THETA 2 (RAD)	OBSERVED THETA 3 (RAD)	CALCULATED THETA 3 (RAD)	OBSERVED CP FUNCTION (RA/D/SQCM)	CALCULATED CP FUNCTION (RA/D/SQCM)
0.0	0.87266E-03	0.12830E-02	0.17453E-02	0.19203E-02	0.26180E-02	0.24338E-02	-0.00000E-38	-0.00000E-38
0.1	0.52360E-02	0.48957E-02	0.69813E-02	0.74245E-02	0.92502E-02	0.93211E-02	0.94825E-07	0.90566E-07
0.2	0.69813E-02	0.70772E-02	0.10472E-01	0.10787E-01	0.13963E-01	0.13493E-01	0.14289E-06	0.13927E-06
0.3	0.87267E-02	0.90377E-02	0.13963E-01	0.13818E-01	0.17453E-01	0.17246E-01	0.18469E-06	0.18152E-06
0.4	0.10472E-01	0.10864E-01	0.16581E-01	0.16649E-01	0.21817E-01	0.20745E-01	0.22528E-06	0.21984E-06
0.5	0.12217E-01	0.12501E-01	0.19722E-01	0.19316E-01	0.24435E-01	0.24036E-01	0.26031E-06	0.25496E-06
0.6	0.13963E-01	0.14206E-01	0.22340E-01	0.21845E-01	0.27925E-01	0.27152E-01	0.29642E-06	0.28740E-06
0.7	0.14835E-01	0.15753E-01	0.24435E-01	0.24258E-01	0.30543E-01	0.30122E-01	0.31612E-06	0.31756E-06
0.8	0.16581E-01	0.17235E-01	0.27402E-01	0.26573E-01	0.33161E-01	0.32967E-01	0.35002E-06	0.34581E-06
0.9	0.17453E-01	0.18661E-01	0.29671E-01	0.28805E-01	0.36652E-01	0.35706E-01	0.37534E-06	0.37243E-06
1.0	0.19199E-01	0.20040E-01	0.31416E-01	0.30965E-01	0.39270E-01	0.38355E-01	0.40128E-06	0.39765E-06
1.1	0.20944E-01	0.21377E-01	0.33685E-01	0.33063E-01	0.41888E-01	0.40925E-01	0.43063E-06	0.42166E-06
1.2	0.21817E-01	0.22678E-01	0.35779E-01	0.35108E-01	0.43633E-01	0.43428E-01	0.44585E-06	0.44463E-06
1.3	0.22689E-01	0.23949E-01	0.38048E-01	0.37106E-01	0.46251E-01	0.45872E-01	0.46669E-06	0.46669E-06
1.4	0.24435E-01	0.25192E-01	0.40143E-01	0.39064E-01	0.48869E-01	0.48264E-01	0.49491E-06	0.48796E-06
1.5	0.25307E-01	0.26411E-01	0.41888E-01	0.40985E-01	0.51487E-01	0.50610E-01	0.51234E-06	0.50851E-06
1.6	0.26180E-01	0.27608E-01	0.43982E-01	0.42875E-01	0.54105E-01	0.52915E-01	0.53204E-06	0.52844E-06
1.7	0.27925E-01	0.28786E-01	0.45728E-01	0.44735E-01	0.55851E-01	0.55184E-01	0.55350E-06	0.54780E-06
1.8	0.28798E-01	0.29946E-01	0.47648E-01	0.46569E-01	0.57596E-01	0.57419E-01	0.56758E-06	0.56665E-06
1.9	0.29671E-01	0.31091E-01	0.49567E-01	0.48379E-01	0.60214E-01	0.59624E-01	0.58615E-06	0.58503E-06
2.0	0.31416E-01	0.32221E-01	0.51487E-01	0.50167E-01	0.62832E-01	0.61801E-01	0.61322E-06	0.60298E-06
2.1	0.32289E-01	0.33337E-01	0.53233E-01	0.51935E-01	0.64577E-01	0.63953E-01	0.62617E-06	0.62053E-06
2.2	0.33161E-01	0.34441E-01	0.54978E-01	0.53684E-01	0.66323E-01	0.66081E-01	0.63912E-06	0.63772E-06
2.3	0.34034E-01	0.35533E-01	0.56723E-01	0.55416E-01	0.68941E-01	0.68186E-01	0.65655E-06	0.65457E-06
2.4	0.34907E-01	0.36614E-01	0.58469E-01	0.57131E-01	0.71559E-01	0.70271E-01	0.67398E-06	0.67110E-06
2.5	0.36652E-01	0.37685E-01	0.60214E-01	0.58830E-01	0.73304E-01	0.72336E-01	0.69543E-06	0.68732E-06
2.6	0.37525E-01	0.38745E-01	0.61959E-01	0.60515E-01	0.75922E-01	0.74383E-01	0.71286E-06	0.70326E-06
2.7	0.38397E-01	0.39797E-01	0.63705E-01	0.62186E-01	0.78540E-01	0.76412E-01	0.73029E-06	0.71892E-06
2.8	0.39270E-01	0.40840E-01	0.65450E-01	0.63844E-01	0.80285E-01	0.78424E-01	0.74324E-06	0.73433E-06
2.9	0.40143E-01	0.41874E-01	0.66672E-01	0.65489E-01	0.82031E-01	0.80419E-01	0.75278E-06	0.74948E-06
3.0	0.41015E-01	0.42900E-01	0.68591E-01	0.67122E-01	0.83776E-01	0.82400E-01	0.76686E-06	0.76440E-06
4.0	0.49742E-01	0.52774E-01	0.84125E-01	0.82071E-01	0.10297E 00	0.10147E 00	0.89279E-06	0.90225E-06
5.0	0.59341E-01	0.62078E-01	0.99484E-01	0.97760E-01	0.12130E 00	0.11946E 00	0.10216E-05	0.10235E-05
6.0	0.68068E-01	0.70948E-01	0.11380E 00	0.11201E 00	0.13875E 00	0.13662E 00	0.11306E-05	0.11319E-05
7.0	0.76795E-01	0.79474E-01	0.12741E 00	0.12575E 00	0.15533E 00	0.15314E 00	0.12306E-05	0.12304E-05
8.0	0.84649E-01	0.87723E-01	0.14050E 00	0.13906E 00	0.17279E 00	0.16913E 00	0.13231E-05	0.13207E-05
9.0	0.93375E-01	0.95741E-01	0.15324E 00	0.15203E 00	0.18850E 00	0.18468E 00	0.14129E-05	0.14043E-05
10.0	0.10123E 00	0.10356E 00	0.16598E 00	0.16471E 00	0.20420E 00	0.19985E 00	0.14942E-05	0.14822E-05
11.0	0.10908E 00	0.11121E 00	0.17802E 00	0.17714E 00	0.21991E 00	0.21471E 00	0.15710E-05	0.15551E-05
12.0	0.11694E 00	0.11872E 00	0.19024E 00	0.18934E 00	0.23387E 00	0.22920E 00	0.16399E-05	0.16236E-05
13.0	0.12392E 00	0.12608E 00	0.20246E 00	0.20133E 00	0.24958E 00	0.24360E 00	0.17093E-05	0.16881E-05
14.0	0.13090E 00	0.13333E 00	0.21380E 00	0.21315E 00	0.26267E 00	0.25760E 00	0.17595E-05	0.17491E-05
15.0	0.13875E 00	0.14046E 00	0.22515E 00	0.22480E 00	0.27576E 00	0.27155E 00	0.18183E-05	0.18068E-05
16.0	0.14574E 00	0.14749E 00	0.23649E 00	0.23629E 00	0.28972E 00	0.28522E 00	0.18730E-05	0.18614E-05
17.0	0.15272E 00	0.15442E 00	0.24784E 00	0.24763E 00	0.30194E 00	0.29871E 00	0.19187E-05	0.19133E-05
18.0	0.15970E 00	0.16126E 00	0.25901E 00	0.25884E 00	0.31590E 00	0.31203E 00	0.19723E-05	0.19624E-05
19.0	0.16668E 00	0.16802E 00	0.26878E 00	0.26992E 00	0.32987E 00	0.32518E 00	0.20166E-05	0.20091E-05
20.0	0.17366E 00	0.17469E 00	0.27925E 00	0.28088E 00	0.34383E 00	0.33818E 00	0.20657E-05	0.20534E-05
21.0	0.18064E 00	0.18129E 00	0.28920E 00	0.29173E 00	0.35517E 00	0.35104E 00	0.20980E-05	0.20954E-05
22.0	0.18675E 00	0.18782E 00	0.29898E 00	0.30247E 00	0.36826E 00	0.36376E 00	0.21295E-05	0.21354E-05
23.0	0.19373E 00	0.19428E 00	0.30910E 00	0.31311E 00	0.38048E 00	0.37635E 00	0.21673E-05	0.21733E-05
24.0	0.20071E 00	0.20067E 00	0.31940E 00	0.32365E 00	0.39270E 00	0.38882E 00	0.22063E-05	0.22094E-05
25.0	0.20682E 00	0.20700E 00	0.32899E 00	0.33409E 00	0.40579E 00	0.40117E 00	0.22367E-05	0.22437E-05
26.0	0.21293E 00	0.21327E 00	0.33912E 00	0.34445E 00	0.41801E 00	0.41341E 00	0.22659E-05	0.22762E-05
27.0	0.21991E 00	0.21949E 00	0.34907E 00	0.35473E 00	0.43110E 00	0.42554E 00	0.23071E-05	0.23071E-05
28.0	0.22515E 00	0.22566E 00	0.35779E 00	0.36493E 00	0.44244E 00	0.43758E 00	0.23143E-05	0.23365E-05
29.0	0.23126E 00	0.23177E 00	0.36739E 00	0.37505E 00	0.45553E 00	0.44952E 00	0.23447E-05	0.23645E-05
30.0	0.23736E 00	0.23784E 00	0.37717E 00	0.38511E 00	0.46775E 00	0.46137E 00	0.23717E-05	0.23910E-05
32.0	0.24958E 00	0.24984E 00	0.39706E 00	0.40501E 00	0.49218E 00	0.48481E 00	0.24280E-05	0.24403E-05
34.0	0.26180E 00	0.26160E 00	0.41626E 00	0.42468E 00	0.51575E 00	0.50795E 00	0.24753E-05	0.24847E-05
36.0	0.27402E 00	0.27337E 00	0.43633E 00	0.44412E 00	0.53931E 00	0.53081E 00	0.25282E-05	0.25240E-05
38.0	0.28536E 00	0.28493E 00	0.45588E 00	0.46336E 00	0.56200E 00	0.55342E 00	0.25648E-05	0.25611E-05
40.0	0.29583E 00	0.29637E 00	0.47473E 00	0.48243E 00	0.58469E 00	0.57580E 00	0.25883E-05	0.25938E-05
42.0	0.30718E 00	0.30771E 00	0.49350E 00	0.50133E 00	0.60737E 00	0.59798E 00	0.26203E-05	0.26234E-05
44.0	0.31765E 00	0.31894E 00	0.51278E 00	0.52008E 00	0.63041E 00	0.61976E 00	0.26479E-05	0.26501E-05
46.0	0.32812E 00	0.33008E 00	0.53058E 00	0.53870E 00	0.65275E 00	0.64179E 00	0.26628E-05	0.26743E-05
48.0	0.33859E 00	0.34115E 00	0.54091E 00	0.55721E 00	0.67544E 00	0.66345E 00	0.26829E-05	0.26961E-05
50.0	0.34907E 00	0.35214E 00	0.56723E 00	0.57560E 00	0.69848E 00	0.68479E 00	0.27048E-05	0.27157E-05
52.0	0.36128E 00	0.36307E 00	0.58503E 00	0.59390E 00	0.72082E 00	0.70640E 00	0.27367E-05	0.27335E-05
54.0	0.37176E 00	0.37394E 00	0.60301E 00	0.61211E 00	0.74351E 00	0.72769E 00	0.27545E-05	0.27496E-05
56.0	0.38223E 00	0.38475E 00	0.62273E 00	0.63024E 00	0.76620E 00	0.74889E 00	0.27837E-05	0.27641E-05
58.0	0.39270E 00	0.39552E 00	0.64089E 00	0.64830E 00	0.78889E 00	0.77000E 00	0.28926E-05	0.27772E-05
60.0	0.40317E 00	0.40625E 00	0.65806E 00	0.66629E 00	0.81123E 00	0.79102E 00	0.28187E-05	0.27890E-05
62.0	0.41364E 00	0.41693E 00	0.67632E 00	0.68423E 00	0.83287E 00	0.81197E 00	0.28277E-05	0.27997E-05
64.0	0.42412E 00	0.42758E 00	0.69464E 00	0.70211E 00	0.85521E 00	0.83285E 00	0.28460E-05	0.28093E-05
66.0	0.43459E 00	0.43820E 00	0.71297E 00	0.71994E 00	0.87650E 00	0.85367E 00	0.28509E-05	0.28180E-05
68.0	0.44506E 00	0.44879E 00	0.73042E 00	0.73773E 00	0.89832E 00	0.87444E 00	0.28600E-05	0.28259E-05
70.0	0.45553E 00	0.45935E 00	0.74822E 00	0.75549E 00	0.91979E 00	0.89515E 00	0.28792E-05	0.28330E-05
72.0	0.46600E 00	0.46989E 00	0.76533E 00	0.77320E 00	0.94073E 00	0.91583E 00	0.28824E-05	0.28396E-05
74.0	0.47648E 00	0.48041E 00	0.78191E 00	0.79089E 00	0.96168E 00	0.93646E 00	0.28822E-05	0.28452E-05
76.0	0.48695E 00	0.49091E 00	0.80111E 00	0.80854E 00	0.98262E 00	0.95706E 00	0.28990E-05	0.28505E-05
78.0	0.49742E 00	0.50139E 00	0.81856E 00	0.82617E 00	0.10036E 01	0.97762E 00	0.29044E-05	0.28552E-05
80.0	0.50615E 00	0.51186E 00	0.83601E 00	0.84378E 00	0.10245E 01	0.99815E 00	0.28929E-05	0.28595E-05
82.0	0.51662E 00	0.52231E 00	0.85347E 00	0.86137E 00	0.10437E 01	0.10187E 01	0.28893E-05	0.28633E-05
84.0	0.52883E 00	0.53275E 00	0.86917E 00	0.87893E 00	0.10647E 01	0.10391E 01	0.29004E-05	0.28668E-05
86.0	0.53931E 00	0.54318E 00	0.88663E 00	0.89648E 00	0.10838E 01	0.10596E 01	0.28959E-05	0.28700E-05
88.0	0.54978E 00	0.55359E 00	0.90583E 00	0.91401E 00	0.11048E 01	0.10800E 01	0.29137E-05	0.28728E-05
90.0	0.56025E 00	0.56400E 00	0.92328E 00	0.93153E 00	0.11257E 01	0.11005E 01	0.29191E-05	0.28754E-05
92.0	0.57072E 00	0.57440E 00	0.94073E 00	0.94904E 00	0.11449E 01	0.11209E 01	0.29156E-05	0.28777E-05
94.0	0.58119E 00	0.58479E 00	0.95644E 00	0.96654E 00	0.11641E 01	0.11413E 01	0.29097E-05	0.28798E-05
96.0	0.59167E 00	0.59518E 00	0.97389E 00	0.98402E 00	0.11833E 01	0.11616E 01	0.28972E-05	0.28817E-05
98.0	0.60214E 00	0.60556E 00	0.99309E 00	0.10015E 01	0.12025E 01	0.11820E 01	0.29050E-05	0.28834E-05
100.0	0.61087E 00	0.61593E 00	0.10105E 01	0.10190E 01	0.12217E 01	0.12024E 01	0.28845E-05	0.28849E-05
105.0	0.63705E 00	0.64184E 00	0.10342E 01	0.10626E 01	0.12409E 01	0.12532E 01	0.27277E-05	0.28882E-05
110.0	0.66323E 00	0.66772E 00	0.10978E 01	0.11062E 01	0.12601E 01	0.13040E 01	0.25709E-05	0.28907E-05
STD DEV =		0.24040E-02		0.54855E-02		0.13147E-01		0.41137E-07

Figure D-1. Viscoelastic Analysis for Asphalt 3 at 39.2°F (Cont'd.).

DATA SHEET

EQUATION OF BEST FIT, n=1

SUMMARY SHEET FOR VISCOELASTIC ANALYSIS

ASPHALT NO- 13
TEST TEMP- 39.2 F

LOADS- 800 1400 2000 GM
CTS- 34193. 59452. 84381. DY/SQCM

TAU1 = 0.1945433E 04 SEC G1 = 0.4285481E 06 DYNES/SQ CM VISC1 = 0.5765830E 09 POISES

TIME MIN	THETA 1 RAD	CF 1 RA/D/SQCM	THETA 2 RAD	CF 2 RA/D/SQCM	THETA 3 RAD	CF 3 RA/D/SQCM	AVG CF RA/D/SQCM	OBSERVED THETA 1 (RAD)	CALCULATED THETA 1 (RAD)	OBSERVED THETA 2 (RAD)	CALCULATED THETA 2 (RAD)	OBSERVED THETA 3 (RAD)	CALCULATED THETA 3 (RAD)	OBSERVED CF FUNCTION (RA/D/SQCM)	CALCULATED CF FUNCTION (RA/D/SQCM)
0.0	0.34907E-03	-0.00000E-38	0.17453E-02	-0.00000E-38	0.17453E-02	-0.00000E-38	-0.0000000E-38	0.34907E-03	0.10682E-02	0.17453E-02	0.18572E-02	0.17453E-02	0.26360E-02	-0.00000E-38	-0.00000E-38
0.1	0.17453E-02	0.32149E-07	0.52360E-02	0.49066E-07	0.10472E-01	0.93422E-07	0.5821223E-07	0.17453E-02	0.17202E-02	0.52360E-02	0.30481E-02	0.10472E-01	0.43557E-02	0.58212E-07	0.10383E-07
0.2	0.34907E-02	0.74506E-07	0.75049E-02	0.77582E-07	0.13963E-01	0.12479E-06	0.9229348E-07	0.34907E-02	0.23706E-02	0.75049E-02	0.42363E-02	0.13963E-01	0.60716E-02	0.92293E-07	0.20720E-07
0.3	0.43633E-02	0.91342E-07	0.95993E-02	0.10316E-06	0.17453E-01	0.15616E-06	0.1168889E-06	0.43633E-02	0.30195E-02	0.95993E-02	0.54217E-02	0.17453E-01	0.77835E-02	0.11689E-06	0.31011E-07
0.4	0.52360E-02	0.10818E-06	0.11170E-01	0.11994E-06	0.20944E-01	0.18753E-06	0.1385487E-06	0.52360E-02	0.36668E-02	0.11170E-01	0.66044E-02	0.20944E-01	0.94914E-02	0.13855E-06	0.41256E-07
0.5	0.64577E-02	0.13522E-06	0.12915E-01	0.13964E-06	0.23736E-01	0.21063E-06	0.1618320E-06	0.64577E-02	0.43126E-02	0.12915E-01	0.77843E-02	0.23736E-01	0.11196E-01	0.16183E-06	0.51455E-07
0.6	0.75049E-02	0.15716E-06	0.14486E-01	0.15642E-06	0.26704E-01	0.23580E-06	0.1831243E-06	0.75049E-02	0.49568E-02	0.14486E-01	0.89616E-02	0.26704E-01	0.12896E-01	0.18312E-06	0.61609E-07
0.7	0.85521E-02	0.17910E-06	0.16057E-01	0.17319E-06	0.27751E-01	0.23821E-06	0.1968335E-06	0.85521E-02	0.55994E-02	0.16057E-01	0.10136E-01	0.27751E-01	0.14593E-01	0.19683E-06	0.71718E-07
0.8	0.92502E-02	0.19083E-06	0.17628E-01	0.18996E-06	0.31416E-01	0.27165E-06	0.2174813E-06	0.92502E-02	0.62405E-02	0.17628E-01	0.11308E-01	0.31416E-01	0.16286E-01	0.21748E-06	0.81782E-07
0.9	0.10472E-01	0.21780E-06	0.19199E-01	0.20674E-06	0.34034E-01	0.29267E-06	0.2390966E-06	0.10472E-01	0.68801E-02	0.19199E-01	0.12477E-01	0.34034E-01	0.17975E-01	0.23910E-06	0.91801E-07
1.0	0.10996E-01	0.22451E-06	0.20769E-01	0.22351E-06	0.36652E-01	0.31370E-06	0.2539061E-06	0.10996E-01	0.75182E-02	0.20769E-01	0.13644E-01	0.36652E-01	0.19660E-01	0.25391E-06	0.10178E-06
1.1	0.12043E-01	0.24645E-06	0.21991E-01	0.23441E-06	0.38746E-01	0.32853E-06	0.2697945E-06	0.12043E-01	0.81547E-02	0.21991E-01	0.14808E-01	0.38746E-01	0.21341E-01	0.26979E-06	0.11171E-06
1.2	0.12741E-01	0.25818E-06	0.23213E-01	0.24531E-06	0.40841E-01	0.34335E-06	0.2822799E-06	0.12741E-01	0.87897E-02	0.23213E-01	0.15969E-01	0.40841E-01	0.23019E-01	0.28228E-06	0.12159E-06
1.3	0.13439E-01	0.26991E-06	0.24435E-01	0.25621E-06	0.43284E-01	0.36231E-06	0.2961443E-06	0.13439E-01	0.94233E-02	0.24435E-01	0.17128E-01	0.43284E-01	0.24693E-01	0.29614E-06	0.13143E-06
1.4	0.14137E-01	0.28164E-06	0.26005E-01	0.27299E-06	0.45379E-01	0.37713E-06	0.3105869E-06	0.14137E-01	0.10055E-01	0.26005E-01	0.18284E-01	0.45379E-01	0.26364E-01	0.31059E-06	0.14123E-06
1.5	0.14835E-01	0.29337E-06	0.27227E-01	0.28389E-06	0.47124E-01	0.38782E-06	0.3216934E-06	0.14835E-01	0.10686E-01	0.27227E-01	0.19438E-01	0.47124E-01	0.28030E-01	0.32169E-06	0.15099E-06
1.6	0.15708E-01	0.31021E-06	0.28274E-01	0.29186E-06	0.49742E-01	0.40885E-06	0.3369701E-06	0.15708E-01	0.11315E-01	0.28274E-01	0.20589E-01	0.49742E-01	0.29693E-01	0.33697E-06	0.16070E-06
1.7	0.16581E-01	0.32704E-06	0.29671E-01	0.30569E-06	0.51487E-01	0.41953E-06	0.3507567E-06	0.16581E-01	0.11942E-01	0.29671E-01	0.21737E-01	0.51487E-01	0.31353E-01	0.35076E-06	0.17036E-06
1.8	0.17453E-01	0.34308E-06	0.30543E-01	0.31072E-06	0.53756E-01	0.43643E-06	0.3636759E-06	0.17453E-01	0.12569E-01	0.30543E-01	0.22883E-01	0.53756E-01	0.33009E-01	0.36368E-06	0.17999E-06
1.9	0.17977E-01	0.35051E-06	0.31765E-01	0.32163E-06	0.55851E-01	0.45125E-06	0.3744599E-06	0.17977E-01	0.13193E-01	0.31765E-01	0.24026E-01	0.55851E-01	0.34661E-01	0.37446E-06	0.18957E-06
2.0	0.18850E-01	0.36734E-06	0.33161E-01	0.33546E-06	0.57596E-01	0.46194E-06	0.3882465E-06	0.18850E-01	0.13816E-01	0.33161E-01	0.25167E-01	0.57596E-01	0.36309E-01	0.38825E-06	0.19911E-06
2.1	0.19548E-01	0.37907E-06	0.34208E-01	0.34343E-06	0.59341E-01	0.47262E-06	0.3983744E-06	0.19548E-01	0.14438E-01	0.34208E-01	0.26305E-01	0.59341E-01	0.37954E-01	0.39837E-06	0.20861E-06
2.2	0.20420E-01	0.39591E-06	0.35081E-01	0.34846E-06	0.61261E-01	0.48538E-06	0.4099147E-06	0.20420E-01	0.15058E-01	0.35081E-01	0.27441E-01	0.61261E-01	0.39596E-01	0.40991E-06	0.21806E-06
2.3	0.20944E-01	0.40254E-06	0.36652E-01	0.36523E-06	0.63006E-01	0.49606E-06	0.4212769E-06	0.20944E-01	0.15677E-01	0.36652E-01	0.28574E-01	0.63006E-01	0.41233E-01	0.42128E-06	0.22748E-06
2.4	0.21642E-01	0.41427E-06	0.37699E-01	0.37320E-06	0.64926E-01	0.50882E-06	0.4320943E-06	0.21642E-01	0.16295E-01	0.37699E-01	0.29705E-01	0.64926E-01	0.42868E-01	0.43209E-06	0.23685E-06
2.5	0.22340E-01	0.42600E-06	0.38397E-01	0.37529E-06	0.66672E-01	0.51950E-06	0.4402652E-06	0.22340E-01	0.16911E-01	0.38397E-01	0.30833E-01	0.66672E-01	0.44499E-01	0.44027E-06	0.24618E-06
2.6	0.23038E-01	0.43773E-06	0.39794E-01	0.38913E-06	0.68591E-01	0.53226E-06	0.4530397E-06	0.23038E-01	0.17525E-01	0.39794E-01	0.31959E-01	0.68591E-01	0.46126E-01	0.45304E-06	0.25546E-06
2.7	0.23911E-01	0.45457E-06	0.40492E-01	0.39123E-06	0.70337E-01	0.54295E-06	0.4629120E-06	0.23911E-01	0.18138E-01	0.40492E-01	0.33082E-01	0.70337E-01	0.47750E-01	0.46291E-06	0.26471E-06
2.8	0.24435E-01	0.46119E-06	0.41888E-01	0.40506E-06	0.72082E-01	0.55363E-06	0.4732956E-06	0.24435E-01	0.18750E-01	0.41888E-01	0.34203E-01	0.72082E-01	0.49370E-01	0.47330E-06	0.27391E-06
2.9	0.24784E-01	0.46272E-06	0.43110E-01	0.41596E-06	0.73653E-01	0.56225E-06	0.4803098E-06	0.24784E-01	0.19360E-01	0.43110E-01	0.35321E-01	0.73653E-01	0.50987E-01	0.48031E-06	0.28308E-06
3.0	0.25656E-01	0.47955E-06	0.43808E-01	0.41806E-06	0.75398E-01	0.57294E-06	0.4901821E-06	0.25656E-01	0.19569E-01	0.43808E-01	0.36437E-01	0.75398E-01	0.52600E-01	0.49018E-06	0.29220E-06
4.0	0.31765E-01	0.57134E-06	0.53756E-01	0.48891E-06	0.92153E-01	0.67153E-06	0.5772608E-06	0.31765E-01	0.25984E-01	0.53756E-01	0.47466E-01	0.92153E-01	0.68549E-01	0.57726E-06	0.38123E-06
5.0	0.38048E-01	0.66824E-06	0.63006E-01	0.54802E-06	0.10821E 00	0.76184E-06	0.6593690E-06	0.38048E-01	0.31865E-01	0.63006E-01	0.58264E-01	0.10821E 00	0.84170E-01	0.65937E-06	0.46638E-06
6.0	0.43633E-01	0.74672E-06	0.72082E-01	0.60420E-06	0.12252E 00	0.83148E-06	0.7267981E-06	0.43633E-01	0.37620E-01	0.72082E-01	0.68842E-01	0.12252E 00	0.99477E-01	0.72680E-06	0.54781E-06
7.0	0.49044E-01	0.81609E-06	0.80809E-01	0.65450E-06	0.13631E 00	0.89490E-06	0.7885002E-06	0.49044E-01	0.43253E-01	0.80809E-01	0.79208E-01	0.13631E 00	0.11448E 00	0.78850E-06	0.62570E-06
8.0	0.54629E-01	0.89257E-06	0.89186E-01	0.69893E-06	0.14992E 00	0.95626E-06	0.8492572E-06	0.54629E-01	0.48769E-01	0.89186E-01	0.89372E-01	0.14992E 00	0.12921E 00	0.84926E-06	0.70010E-06
9.0	0.59690E-01	0.95374E-06	0.97738E-01	0.74630E-06	0.16232E 00	0.10031E-05	0.9010622E-06	0.59690E-01	0.54175E-01	0.97738E-01	0.99344E-01	0.16232E 00	0.14365E 00	0.90106E-06	0.77142E-06
10.0	0.64752E-01	0.10149E-05	0.10612E 00	0.79073E-06	0.17488E 00	0.10521E-05	0.9525780E-06	0.64752E-01	0.59475E-01	0.10612E 00	0.10913E 00	0.17488E 00	0.15784E 00	0.95258E-06	0.83955E-06
11.0	0.69813E-01	0.10761E-05	0.11362E 00	0.82049E-06	0.18762E 00	0.11031E-05	0.9998905E-06	0.69813E-01	0.64673E-01	0.11362E 00	0.11874E 00	0.18762E 00	0.17177E 00	0.99989E-06	0.90470E-06
12.0	0.74526E-01	0.11270E-05	0.12165E 00	0.85905E-06	0.19932E 00	0.11417E-05	0.1042599E-05	0.74526E-01	0.69773E-01	0.12165E 00	0.12818E 00	0.19932E 00	0.18547E 00	0.10426E-05	0.96702E-06
13.0	0.79413E-01	0.11831E-05	0.12915E 00	0.88880E-06	0.21118E 00	0.11824E-05	0.1084763E-05	0.79413E-01	0.74781E-01	0.12915E 00	0.13746E 00	0.21118E 00	0.19893E 00	0.10848E-05	0.10266E-05
14.0	0.84125E-01	0.12340E-05	0.13648E 00	0.91562E-06	0.22253E 00	0.12169E-05	0.1122178E-05	0.84125E-01	0.79700E-01	0.13648E 00	0.14658E 00	0.22253E 00	0.21218E 00	0.11222E-05	0.10836E-05
15.0	0.89012E-01	0.12901E-05	0.14434E 00	0.95125E-06	0.23353E 00	0.12472E-05	0.1162852E-05	0.89012E-01	0.84534E-01	0.14434E 00	0.15556E 00	0.23353E 00	0.22521E 00	0.11629E-05	0.11381E-05
16.0	0.94248E-01	0.13564E-05	0.15167E 00	0.97806E-06	0.24435E 00	0.12755E-05	0.1203303E-05	0.94248E-01	0.89287E-01	0.15167E 00	0.16440E 00	0.24435E 00	0.23805E 00	0.12033E-05	0.11903E-05
17.0	0.98960E-01	0.14073E-05	0.15900E 00	0.10049E-05	0.25499E 00	0.13017E-05	0.1237960E-05	0.98960E-01	0.93962E-01	0.15900E 00	0.17310E 00	0.25499E 00	0.25069E 00	0.12380E-05	0.12401E-05
18.0	0.10350E 00	0.14532E-05	0.16650E 00	0.10346E-05	0.26599E 00	0.13320E-05	0.1273274E-05	0.10350E 00	0.98562E-01	0.16650E 00	0.18167E 00	0.26599E 00	0.26315E 00	0.12733E-05	0.12878E-05
19.0	0.10821E 00	0.15041E-05	0.17453E 00	0.10732E-05	0.27646E 00	0.13561E-05	0.1311156E-05	0.10821E 00	0.10309E 00	0.17453E 00	0.19012E 00	0.27646E 00	0.27544E 00	0.13112E-05	0.13334E-05
20.0	0.11257E 00	0.15449E-05	0.18169E 00	0.10971E-05	0.28676E 00	0.13782E-05	0.1340053E-05	0.11257E 00	0.10755E 00	0.18169E 00	0.19844E 00	0.28676E 00	0.28755E 00	0.13401E-05	0.13770E-05
21.0	0.11694E 00	0.15856E-05	0.18954E 00	0.11327E-05	0.29671E 00	0.13961E-05	0.1371486E-05	0.11694E 00	0.11195E 00	0.18954E 00	0.20666E 00	0.29671E 00	0.29951E 00	0.13715E-05	0.14188E-05
22.0	0.12130E 00	0.16264E-05	0.19705E 00	0.11625E-05	0.30683E 00	0.14161E-05	0.1401650E-05	0.12130E 00	0.11628E 00	0.19705E 00	0.21477E 00	0.30683E 00	0.31131E 00	0.14017E-05	0.14586E-05
23.0	0.12566E 00	0.16671E-05	0.20420E 00	0.11863E-05	0.31643E 00	0.14299E-05	0.1427779E-05	0.12566E 00	0.12056E 00	0.20420E 00	0.22277E 00	0.31643E 00	0.32297E 00	0.14278E-05	0.14968E-05
24.0	0.13003E 00	0.17079E-05	0.21118E 00	0.12073E-05	0.32638E 00	0.14478E-05	0.1454329E-05	0.13003E 00	0.12478E 00	0.21118E 00	0.23068E 00	0.32638E 00	0.33448E 00	0.14543E-05	0.15333E-05
25.0	0.13404E 00	0.17384E-05	0.21817E 00	0.12282E-05	0.33667E 00	0.14699E-05	0.1478845E-05	0.13404E 00	0.12894E 00	0.21817E 00	0.23849E 00	0.33667E 00	0.34586E 00	0.14788E-05	0.15682E-05
26.0	0.13806E 00	0.17690E-05	0.22497E 00	0.12462E-05	0.34645E 00	0.14857E-05	0.1500313E-05	0.13806E 00	0.13305E 00	0.22497E 00	0.24621E 00	0.34645E 00	0.35711E 00	0.15003E-05	0.16016E-05
27.0	0.14259E 00	0.18148E-05	0.23213E 00	0.12701E-05	0.35640E 00	0.15036E-05	0.1529533E-05	0.14259E 00	0.13711E 00	0.23213E 00	0.25384E 00	0.35640E 00	0.36824E 00	0.15295E-05	0.16335E-05
28.0	0.14661E 00	0.18454E-05	0.23911E 00	0.12911E-05	0.36652E 00	0.15236E-05	0.1553359E-05	0.14661E 00	0.14113E 00	0.23911E 00	0.26139E 00	0.36652E 00	0.37926E 00	0.15534E-05	0.16640E-05
29.0	0.15062E 00	0.18759E-05	0.24592E 00	0.13091E-05	0.37699E 00	0.15478E-05	0.1577506E-05	0.15062E 00	0.14509E 00	0.24592E 00	0.26887E 00	0.37699E 00	0.39016E 00	0.15776E-05	0.16932E-05
30.0	0.15499E 00	0.19167E-05	0.25290E 00	0.13300E-05	0.38607E 00	0.15553E-05	0.1600678E-05	0.15499E 00	0.14902E 00	0.25290E 00	0.27626E 00	0.38607E 00	0.40095E 00	0.16007E-05	0.17211E-05
32.0	0.16319E 00	0.19828E-05	0.26704E 00	0.13749E-05	0.40614E 00	0.15933E-05	0.1650321E-05	0.16319E 00	0.15675E 00	0.26704E 00	0.29084E 00	0.40614E 00	0.42223E 00	0.16503E-05	0.17734E-05
34.0	0.17139E 00	0.20490E-05	0.28082E 00	0.14138E-05	0.42551E 00	0.16229E-05	0.1695249E-05	0.17139E 00	0.16432E 00	0.28082E 00	0.30515E 00	0.42551E 00	0.44313E 00	0.16952E-05	0.18212E-05
36.0	0.17994E 00	0.21254E-05	0.29356E 00	0.14352E-05	0.44506E 00	0.16546E-05	0.1738397E-05	0.17994E 00	0.17175E 00	0.29356E 00	0.31922E 00	0.44506E 00	0.46369E 00	0.17384E-05	0.18649E-05
38.0	0.18815E 00	0.21916E-05	0.30665E 00	0.14624E-05	0.46461E 00	0.16863E-05	0.1780100E-05	0.18815E 00	0.17906E 00	0.30665E 00	0.33307E 00	0.46461E 00	0.48394E 00	0.17801E-05	0.19049E-05
40.0	0.19635E 00	0.22578E-05	0.31922E 00	0.14808E-05	0.48346E 00	0.17098E-05	0.1816130E-05	0.19635E 00	0.18625E 00	0.31922E 00	0.34672E 00	0.48346E 00	0.50390E 00	0.18161E-05	0.19414E-05
42.0	0.20420E 00	0.23138E-05	0.33161E 00	0.14963E-05	0.50266E 00	0.17373E-05	0.1849117E-05	0.20420E 00	0.19334E 00	0.33161E 00	0.36018E 00	0.50266E 00	0.52359E 00	0.18491E-05	0.19749E-05
44.0	0.21206E 00	0.23697E-05	0.34435E 00	0.15176E-05	0.52185E 00	0.17649E-05	0.1884081E-05	0.21206E 00	0.20032E 00	0.34435E 00	0.37347E 00	0.52185E 00	0.54305E 00	0.18841E-05	0.20055E-05
46.0	0.21956E 00	0.24155E-05	0.35779E 00	0.15507E-05	0.54035E 00	0.17042E-05	0.1916799E-05	0.21956E 00	0.20722E 00	0.35779E 00	0.38661E 00	0.54035E 00	0.56228E 00	0.19168E-05	0.20335E-05
48.0	0.22724E 00	0.24664E-05	0.37036E 00	0.15691E-05	0.55868E 00	0.18014E-05	0.1945635E-05	0.22724E 00	0.21403E 00	0.37036E 00	0.39960E 00	0.55868E 00	0.58131E 00	0.19456E-05	0.20591E-05
50.0	0.23475E 00	0.25121E-05	0.38345E 00	0.15963E-05	0.57666E 00	0.18145E-05	0.1974327E-05	0.23475E 00	0.22077E 00	0.38345E 00	0.41247E 00	0.57666E 00	0.60016E 00	0.19743E-05	0.20825E-05
52.0	0.24260E 00	0.25681E-05	0.39619E 00	0.16177E-05	0.59516E 00	0.18338E-05	0.2006534E-05	0.24260E 00	0.22745E 00	0.39619E 00	0.42521E 00	0.59516E 00	0.61884E 00	0.20065E-05	0.21039E-05
54.0	0.25045E 00	0.26241E-05	0.40841E 00	0.16302E-05	0.61383E 00	0.18552E-05	0.2036494E-05	0.25045E 00	0.23406E 00	0.40841E 00	0.43785E 00	0.61383E 00	0.63736E 00	0.20365E-05	0.21235E-05
56.0	0.25831E 00	0.26801E-05	0.42150E 00	0.16574E-05	0.63268E 00	0.18786E-05	0.2072036E-05	0.25831E 00	0.24061E 00	0.42150E 00	0.45038E 00	0.63268E 00	0.65575E 00	0.20720E-05	0.21414E-05
58.0	0.26581E 00	0.27258E-05	0.43459E 00	0.16846E-05	0.65171E 00	0.19041E-05	0.2104885E-05	0.26581E 00	0.24711E 00	0.43459E 00	0.46283E 00	0.65171E 00	0.67400E 00	0.21049E-05	0.21578E-05
60.0	0.27314E 00	0.27665E-05	0.44838E 00	0.17236E-05	0.66829E 00	0.19007E-05	0.2130254E-05	0.27314E 00	0.25356E 00	0.44838E 00	0.47519E 00	0.66829E 00	0.69214E 00	0.21303E-05	0.21728E-05
62.0	0.28065E 00	0.28123E-05	0.46094E 00	0.17420E-05	0.68906E 00	0.19469E-05	0.2167042E-05	0.28065E 00	0.25997E 00	0.46094E 00	0.48748E 00	0.68906E 00	0.71017E 00	0.21670E-05	0.21865E-05
64.0	0.28763E 00	0.28427E-05	0.47368E 00	0.17633E-05	0.70860E 00	0.19786E-05	0.2194877E-05	0.28763E 00	0.26634E 00	0.47368E 00	0.49970E 00	0.70860E 00	0.72810E 00	0.21949E-05	0.21990E-05
66.0	0.29479E 00	0.28783E-05	0.48660E 00	0.17876E-05	0.72693E 00	0.19950E-05	0.2220567E-05	0.29479E 00	0.27267E 00	0.48660E 00	0.51185E 00	0.72693E 00	0.74594E 00	0.22206E-05	0.22105E-05
68.0	0.30194E 00	0.29138E-05	0.49916E 00	0.18060E-05	0.74526E 00	0.20130E-05	0.2244299E-05	0.30194E 00	0.27897E 00	0.49916E 00	0.52395E 00	0.74526E 00	0.76369E 00	0.22443E-05	0.22210E-05
70.0	0.30892E 00	0.29443E-05	0.51191E 00	0.18274E-05	0.76358E 00	0.20303E-05	0.2267309E-05	0.30892E 00	0.28524E 00	0.51191E 00	0.53599E 00	0.76358E 00	0.78130E 00	0.22673E-05	0.22306E-05
72.0	0.31608E 00	0.29799E-05	0.52500E 00	0.18546E-05	0.78156E 00	0.20434E-05	0.2292598E-05	0.31608E 00	0.29148E 00	0.52500E 00	0.54798E 00	0.78156E 00	0.79899E 00	0.22926E-05	0.22394E-05
74.0	0.32358E 00	0.30256E-05	0.53669E 00	0.18583E-05	0.79936E 00	0.20544E-05	0.2312772E-05	0.32358E 00	0.29769E 00	0.53669E 00	0.55993E 00	0.79936E 00	0.81654E 00	0.23128E-05	0.22474E-05
76.0	0.32987E 00	0.30357E-05	0.54926E 00	0.18767E-05	0.81612E 00	0.20530E-05	0.2321792E-05	0.32987E 00	0.30388E 00	0.54926E 00	0.57104E 00	0.81612E 00	0.83403E 00	0.23218E-05	0.22547E-05
78.0	0.33685E 00	0.30661E-05	0.56130E 00	0.18863E-05	0.83217E 00	0.20434E-05	0.2331924E-05	0.33685E 00	0.31005E 00	0.56130E 00	0.58371E 00	0.83217E 00	0.85147E 00	0.23319E-05	0.22615E-05
80.0	0.34348E 00	0.30864E-05	0.57352E 00	0.18988E-05	0.84858E 00	0.20378E-05	0.2341011E-05	0.34348E 00	0.31620E 00	0.57352E 00	0.59555E 00	0.84858E 00	0.86886E 00	0.23410E-05	0.22676E-05
82.0	0.35046E 00	0.31168E-05	0.58538E 00	0.19055E-05	0.86499E 00	0.20323E-05	0.2351544E-05	0.35046E 00	0.32234E 00	0.58538E 00	0.60736E 00	0.86499E 00	0.88620E 00	0.23515E-05	0.22732E-05
84.0	0.35622E 00	0.31115E-05	0.59743E 00	0.19151E-05	0.88139E 00	0.20268E-05	0.2351145E-05	0.35622E 00	0.32845E 00	0.59743E 00	0.61913E 00	0.88139E 00	0.90351E 00	0.23511E-05	0.22784E-05
86.0	0.36198E 00	0.31063E-05	0.61017E 00	0.19365E-05	0.89727E 00	0.20151E-05	0.2352592E-05	0.36198E 00	0.33455E 00	0.61017E 00	0.63089E 00	0.89727E 00	0.92078E 00	0.23526E-05	0.22831E-05
88.0	0.36826E 00	0.31163E-05	0.62326E 00	0.19637E-05	0.91281E 00	0.19992E-05	0.2359721E-05	0.36826E 00	0.34064E 00	0.62326E 00	0.64261E 00	0.91281E 00	0.93801E 00	0.23597E-05	0.22874E-05
90.0	0.37402E 00	0.31110E-05	0.63565E 00	0.19791E-05	0.92852E 00	0.19854E-05	0.2358521E-05	0.37402E 00	0.34671E 00	0.63565E 00	0.65432E 00	0.92852E 00	0.95522E 00	0.23585E-05	0.22913E-05
92.0	0.37996E 00	0.31108E-05	0.64804E 00	0.19946E-05	0.94527E 00	0.19840E-05	0.2363160E-05	0.37996E 00	0.35278E 00	0.64804E 00	0.66601E 00	0.94527E 00	0.97239E 00	0.23632E-05	0.22949E-05
94.0	0.38572E 00	0.31056E-05	0.65991E 00	0.20017E-05	0.96255E 00	0.19888E-05	0.2365230E-05	0.38572E 00	0.35883E 00	0.65991E 00	0.67767E 00	0.96255E 00	0.98954E 00	0.23652E-05	0.22982E-05
96.0	0.39148E 00	0.31003E-05	0.67230E 00	0.20167E-05	0.97878E 00	0.19612E-05	0.2366098E-05	0.39148E 00	0.36487E 00	0.67230E 00	0.68932E 00	0.97878E 00	0.10067E 01	0.23661E-05	0.23012E-05
98.0	0.39759E 00	0.31052E-05	0.68469E 00	0.20322E-05	0.99501E 00	0.19737E-05	0.2370370E-05	0.39759E 00	0.37091E 00	0.68469E 00	0.70096E 00	0.99501E 00	0.10238E 01	0.23704E-05	0.23039E-05
100.0	0.40317E 00	0.30948E-05	0.69656E 00	0.20389E-05	0.10114E 01	0.19681E-05	0.2367291E-05	0.40317E 00	0.37693E 00	0.69656E 00	0.71258E 00	0.10114E 01	0.10409E 01	0.23673E-05	0.23065E-05
105.0	0.41853E 00	0.31097E-05	0.72484E 00	0.20321E-05	0.10516E 01	0.19440E-05	0.2361929E-05	0.41853E 00	0.39197E 00	0.72484E 00	0.74158E 00	0.10516E 01	0.10835E 01	0.23619E-05	0.23119E-05
110.0	0.43389E 00	0.31246E-05	0.75451E 00	0.20447E-05	0.10908E 01	0.19095E-05	0.2360949E-05	0.43389E 00	0.40697E 00	0.75451E 00	0.77052E 00	0.10908E 01	0.11260E 01	0.23609E-05	0.23162E-05
115.0	0.44907E 00	0.31344E-05	0.78679E 00	0.21074E-05	0.11371E 01	0.19975E-05	0.2400524E-05	0.44907E 00	0.42193E 00	0.78679E 00	0.79940E 00	0.11371E 01	0.11685E 01	-0.24005E-05	0.23196E-05
							STD DEV =		0.14216E-01		0.17326E-01		0.19338E-01		0.11929E-06

Figure D-2. Viscoelastic Analysis for Asphalt 13 at 39.2°F.

EQUATION OF BEST FIT, n=2

TAU1 = 0.2144699E 04 SEC   G1 = 0.4771426E 06 DYNES/SQ CM   VISC1 = 0.1023327E 10 POISES

TAU2 = 0.1122754E 03 SEC   G2 = 0.2330349E 07 DYNES/SQ CM   VISC2 = 0.2623165E 09 POISES

TIME (MIN)	OBSERVED THETA 1 (RAD)	CALCULATED THETA 1 (RAD)	OBSERVED THETA 2 (RAD)	CALCULATED THETA 2 (RAD)	OBSERVED THETA 3 (RAD)	CALCULATED THETA 3 (RAD)	OBSERVED CP FUNCTION (RA/D/SQCM)	CALCULATED CP FUNCTION (RA/D/SQCM)
0.0	0.34907E-03	[illegible]	0.17453E-02	[illegible]	0.17453E-02	[illegible]	-0.00000E-38	[illegible]
0.1	0.17453E-02	[illegible]	0.52360E-02	[illegible]	0.10472E-01	[illegible]	0.58212E-07	[illegible]
0.2	0.34907E-02	[illegible]	0.75049E-02	[illegible]	0.13963E-01	[illegible]	0.92293E-07	[illegible]
0.3	0.43633E-02	[illegible]	0.95993E-02	[illegible]	0.17453E-01	[illegible]	0.11689E-06	[illegible]
0.4	0.52360E-02	[illegible]	0.11170E-01	[illegible]	0.20944E-01	[illegible]	0.13855E-06	[illegible]
0.5	0.64577E-02	[illegible]	0.12915E-01	[illegible]	0.23736E-01	[illegible]	0.16183E-06	[illegible]
0.6	0.75049E-02	[illegible]	0.14486E-01	[illegible]	0.26704E-01	[illegible]	0.18312E-06	[illegible]
0.7	0.85521E-02	[illegible]	0.16057E-01	[illegible]	0.27751E-01	[illegible]	0.19683E-06	[illegible]
0.8	0.92502E-02	[illegible]	0.17628E-01	[illegible]	0.31416E-01	[illegible]	0.21748E-06	[illegible]
0.9	0.10472E-01	[illegible]	0.19299E-01	[illegible]	0.34034E-01	[illegible]	0.23910E-06	[illegible]
1.0	0.10996E-01	[illegible]	0.20769E-01	[illegible]	0.36652E-01	[illegible]	0.25391E-06	[illegible]
1.1	0.12043E-01	[illegible]	0.21991E-01	[illegible]	0.38746E-01	[illegible]	0.26979E-06	[illegible]
1.2	0.12741E-01	[illegible]	0.23213E-01	[illegible]	0.40841E-01	[illegible]	0.28228E-06	[illegible]
1.3	0.13439E-01	[illegible]	0.24435E-01	[illegible]	0.43284E-01	[illegible]	0.29614E-06	[illegible]
1.4	0.14137E-01	[illegible]	0.26005E-01	[illegible]	0.45379E-01	[illegible]	0.31059E-06	[illegible]
1.5	0.14835E-01	[illegible]	0.27227E-01	[illegible]	0.47124E-01	[illegible]	0.32169E-06	[illegible]
1.6	0.15708E-01	[illegible]	0.28274E-01	[illegible]	0.49742E-01	[illegible]	0.33697E-06	[illegible]
1.7	0.16581E-01	[illegible]	0.29671E-01	[illegible]	0.51487E-01	[illegible]	0.35076E-06	[illegible]
1.8	0.17453E-01	[illegible]	0.30543E-01	[illegible]	0.53756E-01	[illegible]	0.36348E-06	[illegible]
1.9	0.17977E-01	[illegible]	0.31765E-01	[illegible]	0.55851E-01	[illegible]	0.37446E-06	[illegible]
2.0	0.18850E-01	[illegible]	0.33161E-01	[illegible]	0.57596E-01	[illegible]	0.38826E-06	[illegible]
2.1	0.19548E-01	[illegible]	0.34208E-01	[illegible]	0.59341E-01	[illegible]	0.39837E-06	[illegible]
2.2	0.20420E-01	[illegible]	0.35081E-01	[illegible]	0.61261E-01	[illegible]	0.40991E-06	[illegible]
2.3	0.20944E-01	[illegible]	0.36652E-01	[illegible]	0.63006E-01	[illegible]	0.42128E-06	[illegible]
2.4	0.21642E-01	[illegible]	0.37699E-01	[illegible]	0.64926E-01	[illegible]	0.43209E-06	[illegible]
2.5	0.22340E-01	[illegible]	0.38397E-01	[illegible]	0.66672E-01	[illegible]	0.44027E-06	[illegible]
2.6	0.23038E-01	[illegible]	0.39794E-01	[illegible]	0.68591E-01	[illegible]	0.45304E-06	[illegible]
2.7	0.23911E-01	[illegible]	0.40492E-01	[illegible]	0.70337E-01	[illegible]	0.46291E-06	[illegible]
2.8	0.24435E-01	[illegible]	0.41888E-01	[illegible]	0.72082E-01	[illegible]	0.47330E-06	[illegible]
2.9	0.24784E-01	[illegible]	0.43110E-01	[illegible]	0.73653E-01	[illegible]	0.48031E-06	[illegible]
3.0	0.25656E-01	[illegible]	0.43808E-01	[illegible]	0.75398E-01	[illegible]	0.49018E-06	[illegible]
4.0	0.31765E-01	[illegible]	0.53756E-01	[illegible]	0.92153E-01	[illegible]	0.57726E-06	[illegible]
5.0	0.38048E-01	[illegible]	0.63006E-01	[illegible]	0.10821E 00	[illegible]	0.65937E-06	[illegible]
6.0	0.43633E-01	[illegible]	0.72082E-01	[illegible]	0.12252E 00	[illegible]	0.72680E-06	[illegible]
7.0	0.49044E-01	[illegible]	0.80809E-01	[illegible]	0.13631E 00	[illegible]	0.78850E-06	[illegible]
8.0	0.54629E-01	[illegible]	0.89186E-01	[illegible]	0.14992E 00	[illegible]	0.84926E-06	[illegible]
9.0	0.59690E-01	[illegible]	0.97738E-01	[illegible]	0.16232E 00	[illegible]	0.90106E-06	[illegible]
10.0	0.64752E-01	[illegible]	0.10612E 00	[illegible]	0.17488E 00	[illegible]	0.95258E-06	[illegible]
11.0	0.69813E-01	[illegible]	0.11362E 00	[illegible]	0.18762E 00	[illegible]	0.99989E-06	[illegible]
12.0	0.74526E-01	[illegible]	0.12165E 00	[illegible]	0.19932E 00	[illegible]	0.10426E-05	[illegible]
13.0	0.79413E-01	[illegible]	0.12915E 00	[illegible]	0.21118E 00	[illegible]	0.10848E-05	[illegible]
14.0	0.84125E-01	[illegible]	0.13648E 00	[illegible]	0.22253E 00	[illegible]	0.11222E-05	[illegible]
15.0	0.89012E-01	[illegible]	0.14434E 00	[illegible]	0.23353E 00	[illegible]	0.11629E-05	[illegible]
16.0	0.94248E-01	[illegible]	0.15167E 00	[illegible]	0.24435E 00	[illegible]	0.12033E-05	[illegible]
17.0	0.98960E-01	[illegible]	0.15900E 00	[illegible]	0.25499E 00	[illegible]	0.12380E-05	[illegible]
18.0	0.10350E 00	[illegible]	0.16650E 00	[illegible]	0.26594E 00	[illegible]	0.12733E-05	[illegible]
19.0	0.10821E 00	[illegible]	0.17453E 00	[illegible]	0.27646E 00	[illegible]	0.13112E-05	[illegible]
20.0	0.11257E 00	[illegible]	0.18169E 00	[illegible]	0.28676E 00	[illegible]	0.13401E-05	[illegible]
21.0	0.11694E 00	[illegible]	0.18954E 00	[illegible]	0.29671E 00	[illegible]	0.13715E-05	[illegible]
22.0	0.12130E 00	[illegible]	0.19705E 00	[illegible]	0.30683E 00	[illegible]	0.14017E-05	[illegible]
23.0	0.12566E 00	[illegible]	0.20420E 00	[illegible]	0.31643E 00	[illegible]	0.14278E-05	[illegible]
24.0	0.13003E 00	[illegible]	0.21118E 00	[illegible]	0.32638E 00	[illegible]	0.14543E-05	[illegible]
25.0	0.13404E 00	[illegible]	0.21817E 00	[illegible]	0.33667E 00	[illegible]	0.14708E-05	[illegible]
26.0	0.13806E 00	[illegible]	0.22497E 00	[illegible]	0.34645E 00	[illegible]	0.15003E-05	[illegible]
27.0	0.14259E 00	[illegible]	0.23213E 00	[illegible]	0.35640E 00	[illegible]	0.15295E-05	[illegible]
28.0	0.14661E 00	[illegible]	0.23911E 00	[illegible]	0.36652E 00	[illegible]	0.15534E-05	[illegible]
29.0	0.15062E 00	[illegible]	0.24592E 00	[illegible]	0.37699E 00	[illegible]	0.15776E-05	[illegible]
30.0	0.15499E 00	[illegible]	0.25290E 00	[illegible]	0.38607E 00	[illegible]	0.16007E-05	[illegible]
32.0	0.16319E 00	[illegible]	0.26704E 00	[illegible]	0.40614E 00	[illegible]	0.16503E-05	[illegible]
34.0	0.17139E 00	[illegible]	0.28082E 00	[illegible]	0.42551E 00	[illegible]	0.16952E-05	[illegible]
36.0	0.17994E 00	[illegible]	0.29356E 00	[illegible]	0.44506E 00	[illegible]	0.17304E-05	[illegible]
38.0	0.18815E 00	[illegible]	0.30665E 00	[illegible]	0.46461E 00	[illegible]	0.17801E-05	[illegible]
40.0	0.19635E 00	[illegible]	0.31922E 00	[illegible]	0.48346E 00	[illegible]	0.18161E-05	[illegible]
42.0	0.20420E 00	[illegible]	0.33161E 00	[illegible]	0.50266E 00	[illegible]	0.18491E-05	[illegible]
44.0	0.21206E 00	[illegible]	0.34435E 00	[illegible]	0.52185E 00	[illegible]	0.18841E-05	[illegible]
46.0	0.21956E 00	[illegible]	0.35779E 00	[illegible]	0.54035E 00	[illegible]	0.19160E-05	[illegible]
48.0	0.22724E 00	[illegible]	0.37036E 00	[illegible]	0.55868E 00	[illegible]	0.19456E-05	[illegible]
50.0	0.23475E 00	[illegible]	0.38345E 00	[illegible]	0.57666E 00	[illegible]	0.19743E-05	[illegible]
52.0	0.24260E 00	[illegible]	0.39619E 00	[illegible]	0.59516E 00	[illegible]	0.20066E-05	[illegible]
54.0	0.25045E 00	[illegible]	0.40841E 00	[illegible]	0.61383E 00	[illegible]	0.20365E-05	[illegible]
56.0	0.25831E 00	[illegible]	0.42150E 00	[illegible]	0.63268E 00	[illegible]	0.20720E-05	[illegible]
58.0	0.26581E 00	[illegible]	0.43459E 00	[illegible]	0.65171E 00	[illegible]	0.21049E-05	[illegible]
60.0	0.27314E 00	[illegible]	0.44838E 00	[illegible]	0.66829E 00	[illegible]	0.21303E-05	[illegible]
62.0	0.28065E 00	[illegible]	0.46094E 00	[illegible]	0.68906E 00	[illegible]	0.21670E-05	[illegible]
64.0	0.28763E 00	[illegible]	0.47368E 00	[illegible]	0.70860E 00	[illegible]	0.21949E-05	[illegible]
66.0	0.29479E 00	[illegible]	0.48660E 00	[illegible]	0.72693E 00	[illegible]	0.22206E-05	[illegible]
68.0	0.30194E 00	[illegible]	0.49916E 00	[illegible]	0.74526E 00	[illegible]	0.22443E-05	[illegible]
70.0	0.30892E 00	[illegible]	0.51191E 00	[illegible]	0.76358E 00	[illegible]	0.22673E-05	[illegible]
72.0	0.31608E 00	[illegible]	0.52500E 00	[illegible]	0.78156E 00	[illegible]	0.22926E-05	[illegible]
74.0	0.32358E 00	[illegible]	0.53669E 00	[illegible]	0.79936E 00	[illegible]	0.23128E-05	[illegible]
76.0	0.32987E 00	[illegible]	0.54926E 00	[illegible]	0.81612E 00	[illegible]	0.23218E-05	[illegible]
78.0	0.33685E 00	[illegible]	0.56130E 00	[illegible]	0.83217E 00	[illegible]	0.23314E-05	[illegible]
80.0	0.34348E 00	[illegible]	0.57352E 00	[illegible]	0.84858E 00	[illegible]	0.23410E-05	[illegible]
82.0	0.35046E 00	[illegible]	0.58538E 00	[illegible]	0.86499E 00	[illegible]	0.23515E-05	[illegible]
84.0	0.35622E 00	[illegible]	0.59743E 00	[illegible]	0.88139E 00	[illegible]	0.23511E-05	[illegible]
86.0	0.36198E 00	[illegible]	0.61017E 00	[illegible]	0.89727E 00	[illegible]	0.23526E-05	[illegible]
88.0	0.36826E 00	[illegible]	0.62326E 00	[illegible]	0.91281E 00	[illegible]	0.23597E-05	[illegible]
90.0	0.37402E 00	[illegible]	0.63565E 00	[illegible]	0.92852E 00	[illegible]	0.23585E-05	[illegible]
92.0	0.37996E 00	[illegible]	0.64804E 00	[illegible]	0.94527E 00	[illegible]	0.23632E-05	[illegible]
94.0	0.38572E 00	[illegible]	0.65991E 00	[illegible]	0.96255E 00	[illegible]	0.23652E-05	[illegible]
96.0	0.39148E 00	[illegible]	0.67230E 00	[illegible]	0.97878E 00	[illegible]	0.23661E-05	[illegible]
98.0	0.39759E 00	[illegible]	0.68469E 00	[illegible]	0.99501E 00	[illegible]	0.23704E-05	[illegible]
100.0	0.40317E 00	[illegible]	0.69656E 00	[illegible]	0.10116E 01	[illegible]	0.23673E-05	[illegible]
105.0	0.41853E 00	[illegible]	0.72484E 00	[illegible]	0.10516E 01	[illegible]	0.23619E-05	[illegible]
110.0	0.43389E 00	[illegible]	0.75451E 00	[illegible]	0.10908E 01	[illegible]	0.23609E-05	[illegible]
115.0	0.44907E 00	[illegible]	0.78679E 00	[illegible]	0.11371E 01	[illegible]	0.24005E-05	[illegible]

STD DEV = 0.13857E-01   0.16075E-01   0.15635E-01   0.23421E-0[illegible]

EQUATION OF BEST FIT, n=3

TAU1 = 0.2224366E 04 SEC   G1 = 0.4828828E 06 DYNES/SQ CM   VISC1 = 0.1074108E 10 POISES

TAU2 = 0.1713579E 03 SEC   G2 = 0.2591937E 07 DYNES/SQ CM   VISC2 = 0.4441489E 09 POISES

TAU3 = 0.1213109E 02 SEC   G3 = 0.1212291E 08 DYNES/SQ CM   VISC3 = 0.1470642E 09 POISES

TIME (MIN)	OBSERVED THETA 1 (RAD)	CALCULATED THETA 1 (RAD)	OBSERVED THETA 2 (RAD)	CALCULATED THETA 2 (RAD)	OBSERVED THETA 3 (RAD)	CALCULATED THETA 3 (RAD)	OBSERVED CP FUNCTION (RA/D/SQCM)	CALCULATED CP FUNCTION (RA/D/SQCM)
0.0	0.34907E-03	0.10682E-02	0.17453E-02	0.18572E-02	0.17453E-02	0.26360E-02	-0.00000E-38	-0.00000E-38
0.1	0.17453E-02	0.31104E-02	0.52360E-02	0.54652E-02	0.10472E-01	0.77864E-02	0.58212E-07	0.51039E-07
0.2	0.34907E-02	0.47070E-02	0.75049E-02	0.82986E-02	0.13963E-01	0.11837E-01	0.92293E-07	0.89049E-07
0.3	0.43633E-02	0.60262E-02	0.95993E-02	0.10649E-01	0.17453E-01	0.15203E-01	0.11689E-06	0.11894E-06
0.4	0.52360E-02	0.71706E-02	0.11170E-01	0.12697E-01	0.20944E-01	0.18138E-01	0.13855E-06	0.14373E-06
0.5	0.64577E-02	0.82031E-02	0.12915E-01	0.14549E-01	0.23736E-01	0.20797E-01	0.16183E-06	0.16524E-06
0.6	0.75049E-02	0.91621E-02	0.14486E-01	0.16274E-01	0.26704E-01	0.23274E-01	0.18312E-06	0.18460E-06
0.7	0.85521E-02	0.10071E-01	0.16057E-01	0.17912E-01	0.27751E-01	0.25629E-01	0.19683E-06	0.20250E-06
0.8	0.92502E-02	0.10965E-01	0.17628E-01	0.19488E-01	0.31416E-01	0.27896E-01	0.21748E-06	0.21938E-06
0.9	0.10472E-01	0.11793E-01	0.19299E-01	0.21020E-01	0.34034E-01	0.30099E-01	0.23910E-06	0.23548E-06
1.0	0.10996E-01	0.12620E-01	0.20769E-01	0.22515E-01	0.36652E-01	0.32251E-01	0.25391E-06	0.25099E-06
1.1	0.12043E-01	0.13431E-01	0.21991E-01	0.23981E-01	0.38746E-01	0.34361E-01	0.26979E-06	0.26600E-06
1.2	0.12741E-01	0.14226E-01	0.23213E-01	0.25422E-01	0.40841E-01	0.36436E-01	0.28228E-06	0.28059E-06
1.3	0.13439E-01	0.15009E-01	0.24435E-01	0.26840E-01	0.43284E-01	0.38478E-01	0.29614E-06	0.29480E-06
1.4	0.14137E-01	0.15780E-01	0.26005E-01	0.28238E-01	0.45379E-01	0.40491E-01	0.31059E-06	0.30865E-06
1.5	0.14835E-01	0.16540E-01	0.27227E-01	0.29616E-01	0.47124E-01	0.42477E-01	0.32169E-06	0.32219E-06
1.6	0.15708E-01	0.17289E-01	0.28274E-01	0.30976E-01	0.49742E-01	0.44436E-01	0.33697E-06	0.33542E-06
1.7	0.16581E-01	0.18028E-01	0.29671E-01	0.32319E-01	0.51487E-01	0.46372E-01	0.35076E-06	0.34835E-06
1.8	0.17453E-01	0.18758E-01	0.30543E-01	0.33645E-01	0.53756E-01	0.48283E-01	0.36348E-06	0.36101E-06
1.9	0.17977E-01	0.19479E-01	0.31765E-01	0.34955E-01	0.55851E-01	0.50172E-01	0.37446E-06	0.37340E-06
2.0	0.18850E-01	0.20190E-01	0.33161E-01	0.36249E-01	0.57596E-01	0.52039E-01	0.38826E-06	0.38552E-06
2.1	0.19548E-01	0.20893E-01	0.34208E-01	0.37529E-01	0.59341E-01	0.53885E-01	0.39837E-06	0.39740E-06
2.2	0.20420E-01	0.21588E-01	0.35081E-01	0.38794E-01	0.61261E-01	0.55710E-01	0.40991E-06	0.40904E-06
2.3	0.20944E-01	0.22275E-01	0.36652E-01	0.40046E-01	0.63006E-01	0.57516E-01	0.42128E-06	0.42044E-06
2.4	0.21642E-01	0.22954E-01	0.37699E-01	0.41284E-01	0.64926E-01	0.59303E-01	0.43209E-06	0.43162E-06
2.5	0.22340E-01	0.23626E-01	0.38397E-01	0.42509E-01	0.66672E-01	0.61071E-01	0.44027E-06	0.44257E-06
2.6	0.23038E-01	0.24291E-01	0.39794E-01	0.43722E-01	0.68591E-01	0.62821E-01	0.45304E-06	0.45332E-06
2.7	0.23911E-01	0.24948E-01	0.40492E-01	0.44922E-01	0.70337E-01	0.64554E-01	0.46291E-06	0.46386E-06
2.8	0.24435E-01	0.25599E-01	0.41888E-01	0.46111E-01	0.72082E-01	0.66271E-01	0.47330E-06	0.47421E-06
2.9	0.24784E-01	0.26243E-01	0.43110E-01	0.47288E-01	0.73653E-01	0.67971E-01	0.48031E-06	0.48436E-06
3.0	0.25656E-01	0.26881E-01	0.43808E-01	0.48454E-01	0.75398E-01	0.69656E-01	0.49018E-06	0.49433E-06
4.0	0.31765E-01	0.32952E-01	0.53756E-01	0.59582E-01	0.92153E-01	0.85745E-01	0.57726E-06	0.58507E-06
5.0	0.38048E-01	0.38574E-01	0.63006E-01	0.69930E-01	0.10821E 00	0.10073E 00	0.65937E-06	0.66259E-06
6.0	0.43633E-01	0.43868E-01	0.72082E-01	0.79705E-01	0.12252E 00	0.11490E 00	0.72680E-06	0.73054E-06
7.0	0.49044E-01	0.48917E-01	0.80809E-01	0.89057E-01	0.13631E 00	0.12846E 00	0.78850E-06	0.79136E-06
8.0	0.54629E-01	0.53784E-01	0.89186E-01	0.98090E-01	0.14992E 00	0.14158E 00	0.84926E-06	0.84682E-06
9.0	0.59690E-01	0.58509E-01	0.97738E-01	0.10608E 00	0.16232E 00	0.15435E 00	0.90106E-06	0.89816E-06
10.0	0.64752E-01	0.63124E-01	0.10612E 00	0.11547E 00	0.17488E 00	0.16684E 00	0.95258E-06	0.94627E-06
11.0	0.69813E-01	0.67651E-01	0.11362E 00	0.12392E 00	0.18762E 00	0.17912E 00	0.99989E-06	0.99179E-06
12.0	0.74526E-01	0.72104E-01	0.12165E 00	0.13223E 00	0.19932E 00	0.19122E 00	0.10426E-05	0.10352E-05
13.0	0.79413E-01	0.76456E-01	0.12915E 00	0.14044E 00	0.21118E 00	0.20316E 00	0.10848E-05	0.10760E-05
14.0	0.84125E-01	0.80834E-01	0.13648E 00	0.14856E 00	0.22253E 00	0.21497E 00	0.11222E-05	0.11168E-05
15.0	0.89012E-01	0.85125E-01	0.14434E 00	0.15659E 00	0.23353E 00	0.22667E 00	0.11629E-05	0.11554E-05
16.0	0.94248E-01	0.89372E-01	0.15167E 00	0.16455E 00	0.24435E 00	0.23826E 00	0.12033E-05	0.11928E-05
17.0	0.98960E-01	0.93581E-01	0.15900E 00	0.17243E 00	0.25499E 00	0.24975E 00	0.12380E-05	0.12290E-05
18.0	0.10350E 00	0.97752E-01	0.16650E 00	0.18026E 00	0.26594E 00	0.26115E 00	0.12733E-05	0.12641E-05
19.0	0.10821E 00	0.10189E 00	0.17453E 00	0.18802E 00	0.27646E 00	0.27247E 00	0.13112E-05	0.12982E-05
20.0	0.11257E 00	0.10599E 00	0.18169E 00	0.19573E 00	0.28676E 00	0.28370E 00	0.13401E-05	0.13314E-05
21.0	0.11694E 00	0.11007E 00	0.18954E 00	0.20338E 00	0.29671E 00	0.29486E 00	0.13715E-05	0.13636E-05
22.0	0.12130E 00	0.11411E 00	0.19705E 00	0.21098E 00	0.30683E 00	0.30594E 00	0.14017E-05	0.13950E-05
23.0	0.12566E 00	0.11812E 00	0.20420E 00	0.21853E 00	0.31643E 00	0.31695E 00	0.14278E-05	0.14255E-05
24.0	0.13003E 00	0.12210E 00	0.21118E 00	0.22603E 00	0.32638E 00	0.32789E 00	0.14543E-05	0.14552E-05
25.0	0.13404E 00	0.12606E 00	0.21817E 00	0.23349E 00	0.33667E 00	0.33876E 00	0.14708E-05	0.14840E-05
26.0	0.13806E 00	0.12999E 00	0.22497E 00	0.24089E 00	0.34645E 00	0.34957E 00	0.15003E-05	0.15121E-05
27.0	0.14259E 00	0.13390E 00	0.23213E 00	0.24825E 00	0.35640E 00	0.36031E 00	0.15295E-05	0.15395E-05
28.0	0.14661E 00	0.13778E 00	0.23911E 00	0.25557E 00	0.36652E 00	0.37099E 00	0.15534E-05	0.15661E-05
29.0	0.15062E 00	0.14163E 00	0.24592E 00	0.26285E 00	0.37699E 00	0.38161E 00	0.15776E-05	0.15920E-05
30.0	0.15499E 00	0.14547E 00	0.25290E 00	0.27008E 00	0.38607E 00	0.39218E 00	0.16007E-05	0.16172E-05
32.0	0.16319E 00	0.15306E 00	0.26704E 00	0.28443E 00	0.40614E 00	0.41314E 00	0.16503E-05	0.16656E-05
34.0	0.17139E 00	0.16057E 00	0.28082E 00	0.29863E 00	0.42551E 00	0.43388E 00	0.16952E-05	0.17115E-05
36.0	0.17994E 00	0.16800E 00	0.29356E 00	0.31269E 00	0.44506E 00	0.45442E 00	0.17304E-05	0.17550E-05
38.0	0.18815E 00	0.17534E 00	0.30665E 00	0.32661E 00	0.46461E 00	0.47477E 00	0.17801E-05	0.17962E-05
40.0	0.19635E 00	0.18262E 00	0.31922E 00	0.34040E 00	0.48346E 00	0.49493E 00	0.18161E-05	0.18352E-05
42.0	0.20420E 00	0.18982E 00	0.33161E 00	0.35407E 00	0.50266E 00	0.51492E 00	0.18491E-05	0.18722E-05
44.0	0.21206E 00	0.19696E 00	0.34435E 00	0.36763E 00	0.52185E 00	0.53475E 00	0.18841E-05	0.19072E-05
46.0	0.21956E 00	0.20404E 00	0.35779E 00	0.38107E 00	0.54035E 00	0.55442E 00	0.19160E-05	0.19404E-05
48.0	0.22724E 00	0.21105E 00	0.37036E 00	0.39442E 00	0.55868E 00	0.57395E 00	0.19456E-05	0.19718E-05
50.0	0.23475E 00	0.21801E 00	0.38345E 00	0.40766E 00	0.57666E 00	0.59334E 00	0.19743E-05	0.20016E-05
52.0	0.24260E 00	0.22492E 00	0.39619E 00	0.42081E 00	0.59516E 00	0.61259E 00	0.20066E-05	0.20299E-05
54.0	0.25045E 00	0.23177E 00	0.40841E 00	0.43387E 00	0.61383E 00	0.63172E 00	0.20365E-05	0.20566E-05
56.0	0.25831E 00	0.23858E 00	0.42150E 00	0.44685E 00	0.63268E 00	0.65073E 00	0.20720E-05	0.20820E-05
58.0	0.26581E 00	0.24534E 00	0.43459E 00	0.45975E 00	0.65171E 00	0.66963E 00	0.21049E-05	0.21060E-05
60.0	0.27314E 00	0.25206E 00	0.44838E 00	0.47257E 00	0.66829E 00	0.68842E 00	0.21303E-05	0.21287E-05
62.0	0.28065E 00	0.25873E 00	0.46094E 00	0.48533E 00	0.68906E 00	0.70711E 00	0.21670E-05	0.21503E-05
64.0	0.28763E 00	0.26537E 00	0.47368E 00	0.49801E 00	0.70860E 00	0.72571E 00	0.21949E-05	0.21707E-05
66.0	0.29479E 00	0.27197E 00	0.48660E 00	0.51064E 00	0.72693E 00	0.74421E 00	0.22206E-05	0.21901E-05
68.0	0.30194E 00	0.27854E 00	0.49916E 00	0.52320E 00	0.74526E 00	0.76263E 00	0.22443E-05	0.22084E-05
70.0	0.30892E 00	0.28507E 00	0.51191E 00	0.53570E 00	0.76358E 00	0.78097E 00	0.22673E-05	0.22258E-05
72.0	0.31608E 00	0.29158E 00	0.52500E 00	0.54815E 00	0.78156E 00	0.79923E 00	0.22926E-05	0.22422E-05
74.0	0.32358E 00	0.29805E 00	0.53669E 00	0.56055E 00	0.79936E 00	0.81742E 00	0.23128E-05	0.22578E-05
76.0	0.32987E 00	0.30450E 00	0.54926E 00	0.57290E 00	0.81612E 00	0.83554E 00	0.23218E-05	0.22726E-05
78.0	0.33685E 00	0.31091E 00	0.56130E 00	0.58521E 00	0.83217E 00	0.85359E 00	0.23314E-05	0.22866E-05
80.0	0.34348E 00	0.31731E 00	0.57352E 00	0.59747E 00	0.84858E 00	0.87158E 00	0.23410E-05	0.22999E-05
82.0	0.35046E 00	0.32368E 00	0.58538E 00	0.60969E 00	0.86499E 00	0.88951E 00	0.23515E-05	0.23124E-05
84.0	0.35622E 00	0.33002E 00	0.59743E 00	0.62187E 00	0.88139E 00	0.90739E 00	0.23511E-05	0.23243E-05
86.0	0.36198E 00	0.33635E 00	0.61017E 00	0.63401E 00	0.89727E 00	0.92522E 00	0.23526E-05	0.23356E-05
88.0	0.36826E 00	0.34266E 00	0.62326E 00	0.64612E 00	0.91281E 00	0.94299E 00	0.23597E-05	0.23463E-05
90.0	0.37402E 00	0.34894E 00	0.63565E 00	0.65819E 00	0.92852E 00	0.96072E 00	0.23585E-05	0.23565E-05
92.0	0.37996E 00	0.35521E 00	0.64804E 00	0.67024E 00	0.94527E 00	0.97840E 00	0.23632E-05	0.23661E-05
94.0	0.38572E 00	0.36146E 00	0.65991E 00	0.68225E 00	0.96255E 00	0.99604E 00	0.23652E-05	0.23751E-05
96.0	0.39148E 00	0.36770E 00	0.67230E 00	0.69423E 00	0.97878E 00	0.10136E 01	0.23661E-05	0.23838E-05
98.0	0.39759E 00	0.37392E 00	0.68469E 00	0.70619E 00	0.99501E 00	0.10312E 01	0.23704E-05	0.23919E-05
100.0	0.40317E 00	0.38012E 00	0.69656E 00	0.71812E 00	0.10116E 01	0.10487E 01	0.23673E-05	0.23997E-05
105.0	0.41853E 00	0.39557E 00	0.72484E 00	0.74785E 00	0.10516E 01	0.10924E 01	0.23619E-05	0.24173E-05
110.0	0.43389E 00	0.41095E 00	0.75451E 00	0.77744E 00	0.10908E 01	0.11359E 01	0.23609E-05	0.24320E-05
115.0	0.44907E 00	0.42626E 00	0.78679E 00	0.80692E 00	0.11371E 01	0.11792E 01	0.24005E-05	0.24461E-05

STD DEV = 0.13863E-01   0.16055E-01   0.15777E-01   0.20200E-07

Figure D-2. Viscoelastic Analysis for Asphalt 13 at 39.2°F (Cont'd.).

DATA SHEET

EQUATION OF BEST FIT, n=1

EQUATION OF BEST FIT, n=2

SUMMARY SHEET FOR VISCOELASTIC ANALYSIS

ASPHALT NO- 45 LOADS- 800 1400 2000 GM

TEST TEMP- 39.2 F CTS- 32906. 57709. 81921. DY/SQCM

n=1: TAU1 = 0.1152287E 04 SEC G1 = 0.5887139E 06 DYNES/SQ CM VISC1 = 0.6783674E 09 POISES

n=2: TAU1 = 0.1810303E 04 SEC G1 = 0.6527202E 06 DYNES/SQ CM VISC1 = 0.1701412E 39 POISES

TAU2 = 0.1008153E 03 SEC G2 = 0.3339287E 07 DYNES/SQ CM VISC2 = 0.3362478E 09 POISES

TIME MIN	THETA 1 RAD	CF 1 RA/D/SQCM	THETA 2 RAD	CF 2 RA/D/SQCM	THETA 3 RAD	CF 3 RA/D/SQCM	AVG CF RA/D/SQCM
0.0	0.17453E-02	-0.00000E-38	0.17453E-02	-0.00000E-38	0.26180E-02	-0.00000E-38	-0.0000000E-38
0.1	0.43633E-02	0.72401E-07	0.48869E-02	0.47659E-07	0.69813E-02	0.46320E-07	0.5546026E-07
0.2	0.52360E-02	0.91763E-07	0.68323E-02	0.71124E-07	0.95993E-02	0.71335E-07	0.7807377E-07
0.3	0.61087E-02	0.11112E-06	0.83776E-02	0.94588E-07	0.12217E-01	0.96350E-07	0.1006873E-06
0.4	0.69813E-02	0.13049E-06	0.10123E-01	0.11005E-06	0.13963E-01	0.11071E-06	0.1197500E-06
0.5	0.69813E-02	0.12333E-06	0.11345E-01	0.13244E-06	0.15708E-01	0.12506E-06	0.1269482E-06
0.6	0.78540E-02	0.14269E-06	0.12566E-01	0.14683E-06	0.17453E-01	0.13944E-06	0.1429665E-06
0.7	0.87267E-02	0.16205E-06	0.13963E-01	0.16425E-06	0.20071E-01	0.16445E-06	0.1635837E-06
0.8	0.90757E-02	0.16550E-06	0.15533E-01	0.18469E-06	0.20944E-01	0.16816E-06	0.1727834E-06
0.9	0.94248E-02	0.16895E-06	0.16232E-01	0.19001E-06	0.22689E-01	0.18253E-06	0.1804933E-06
1.0	0.10472E-01	0.19361E-06	0.17453E-01	0.20440E-06	0.24435E-01	0.19689E-06	0.1982995E-06
1.1	0.10821E-01	0.19706E-06	0.18850E-01	0.22181E-06	0.26180E-01	0.21125E-06	0.2100420E-06
1.2	0.11345E-01	0.20582E-06	0.19722E-01	0.23015E-06	0.27925E-01	0.22561E-06	0.2205279E-06
1.3	0.12217E-01	0.22518E-06	0.20944E-01	0.24455E-06	0.29671E-01	0.23998E-06	0.2365662E-06
1.4	0.12392E-01	0.22332E-06	0.22166E-01	0.25894E-06	0.30543E-01	0.24369E-06	0.2419816E-06
1.5	0.13090E-01	0.23730E-06	0.22689E-01	0.26123E-06	0.32289E-01	0.25805E-06	0.2522193E-06
1.6	0.13963E-01	0.25674E-06	0.23911E-01	0.27562E-06	0.34034E-01	0.27241E-06	0.2682576E-06
1.7	0.14137E-01	0.25489E-06	0.24784E-01	0.29396E-06	0.34907E-01	0.27612E-06	0.2716568E-06
1.8	0.14486E-01	0.25834E-06	0.26005E-01	0.29835E-06	0.36652E-01	0.29048E-06	0.2823910E-06
1.9	0.15708E-01	0.28831E-06	0.26529E-01	0.30065E-06	0.38397E-01	0.30484E-06	0.2979327E-06
2.0	0.15883E-01	0.28645E-06	0.27576E-01	0.31201E-06	0.39270E-01	0.30855E-06	0.3023400E-06
2.1	0.15883E-01	0.27925E-06	0.28274E-01	0.31733E-06	0.41015E-01	0.32292E-06	0.3065139E-06
2.2	0.16581E-01	0.29535E-06	0.29322E-01	0.32870E-06	0.41888E-01	0.32663E-06	0.3162252E-06
2.3	0.17453E-01	0.31271E-06	0.29845E-01	0.33099E-06	0.43633E-01	0.34099E-06	0.3282309E-06
2.4	0.17453E-01	0.30555E-06	0.30892E-01	0.34236E-06	0.44506E-01	0.34470E-06	0.3308702E-06
2.5	0.17628E-01	0.30370E-06	0.31416E-01	0.34465E-06	0.46251E-01	0.35906E-06	0.3358039E-06
2.6	0.18326E-01	0.31776E-06	0.32463E-01	0.35602E-06	0.47124E-01	0.36277E-06	0.3455152E-06
2.7	0.18500E-01	0.31590E-06	0.33161E-01	0.36133E-06	0.47997E-01	0.36648E-06	0.3479062E-06
2.8	0.19199E-01	0.32996E-06	0.34034E-01	0.36966E-06	0.49742E-01	0.38084E-06	0.3601602E-06
2.9	0.19199E-01	0.32280E-06	0.34907E-01	0.37802E-06	0.50615E-01	0.38455E-06	0.3617914E-06
3.0	0.20071E-01	0.34216E-06	0.35779E-01	0.38636E-06	0.52360E-01	0.39892E-06	0.3768133E-06
4.0	0.24435E-01	0.40318E-06	0.43808E-01	0.45768E-06	0.64577E-01	0.47863E-06	0.4464957E-06
5.0	0.27925E-01	0.43767E-06	0.51836E-01	0.52901E-06	0.75922E-01	0.54768E-06	0.5047872E-06
6.0	0.31416E-01	0.47216E-06	0.59341E-01	0.59126E-06	0.86394E-01	0.60609E-06	0.5565034E-06
7.0	0.34907E-01	0.50666E-06	0.66323E-01	0.64443E-06	0.97738E-01	0.67515E-06	0.6087461E-06
8.0	0.38397E-01	0.54115E-06	0.73304E-01	0.69761E-06	0.10734E 00	0.72290E-06	0.6538871E-06
9.0	0.41888E-01	0.57565E-06	0.80111E-01	0.74776E-06	0.11694E 00	0.77065E-06	0.6980199E-06
10.0	0.45379E-01	0.61014E-06	0.86917E-01	0.79792E-06	0.12654E 00	0.81840E-06	0.7421528E-06
11.0	0.48869E-01	0.64463E-06	0.93201E-01	0.83099E-06	0.13526E 00	0.85550E-06	0.7797104E-06
12.0	0.52360E-01	0.67913E-06	0.99484E-01	0.86007E-06	0.14399E 00	0.89260E-06	0.8172680E-06
13.0	0.54978E-01	0.68710E-06	0.10559E 00	0.91913E-06	0.15272E 00	0.92970E-06	0.8449775E-06
14.0	0.58469E-01	0.72160E-06	0.11170E 00	0.95610E-06	0.16144E 00	0.96680E-06	0.8815269E-06
15.0	0.61959E-01	0.75609E-06	0.11729E 00	0.98516E-06	0.17017E 00	0.10039E-05	0.9150520E-06
16.0	0.65450E-01	0.79059E-06	0.12339E 00	0.10232E-05	0.17802E 00	0.10303E-05	0.9480506E-06
17.0	0.68068E-01	0.79856E-06	0.12915E 00	0.10552E-05	0.18675E 00	0.10674E-05	0.9737438E-06
18.0	0.71559E-01	0.83305E-06	0.13456E 00	0.10812E-05	0.19548E 00	0.11045E-05	0.1006261E-05
19.0	0.75049E-01	0.86755E-06	0.14015E 00	0.11102E-05	0.20246E 00	0.11203E-05	0.1032604E-05
20.0	0.77667E-01	0.87552E-06	0.14556E 00	0.11361E-05	0.21206E 00	0.11661E-05	0.1059912E-05
21.0	0.80285E-01	0.88349E-06	0.15132E 00	0.11581E-05	0.21817E 00	0.11732E-05	0.1074953E-05
22.0	0.83776E-01	0.91799E-06	0.15691E 00	0.11971E-05	0.22515E 00	0.11840E-05	0.1101376E-05
23.0	0.87266E-01	0.95248E-06	0.16232E 00	0.12231E-05	0.23300E 00	0.12155E-05	0.1130342E-05
24.0	0.89884E-01	0.96046E-06	0.16773E 00	0.12490E-05	0.24086E 00	0.12419E-05	0.1150468E-05
25.0	0.92502E-01	0.96843E-06	0.17279E 00	0.12689E-05	0.24784E 00	0.12577E-05	0.1166027E-05
26.0	0.95120E-01	0.97640E-06	0.17959E 00	0.13191E-05	0.25482E 00	0.12735E-05	0.1189667E-05
27.0	0.97738E-01	0.98438E-06	0.18500E 00	0.13450E-05	0.26180E 00	0.12893E-05	0.1206243E-05
28.0	0.10123E 00	0.10189E-05	0.19024E 00	0.13680E-05	0.27053E 00	0.13264E-05	0.1237751E-05
29.0	0.10297E 00	0.10003E-05	0.19565E 00	0.13939E-05	0.27576E 00	0.13249E-05	0.1230105E-05
30.0	0.10647E 00	0.10348E-05	0.20089E 00	0.14169E-05	0.28274E 00	0.13567E-05	0.1262792E-05
32.0	0.11170E 00	0.10508E-05	0.21118E 00	0.14597E-05	0.29583E 00	0.13576E-05	0.1289367E-05
34.0	0.11781E 00	0.10932E-05	0.22131E 00	0.14995E-05	0.30892E 00	0.13786E-05	0.1323774E-05
36.0	0.12305E 00	0.11052E-05	0.23126E 00	0.15363E-05	0.32289E 00	0.14102E-05	0.1351884E-05
38.0	0.12915E 00	0.11517E-05	0.24086E 00	0.15571E-05	0.33510E 00	0.14204E-05	0.1379715E-05
40.0	0.13439E 00	0.11676E-05	0.25133E 00	0.16129E-05	0.34907E 00	0.14520E-05	0.1410850E-05
42.0	0.13963E 00	0.11835E-05	0.26093E 00	0.16437E-05	0.36216E 00	0.14730E-05	0.1433391E-05
44.0	0.14661E 00	0.12525E-05	0.27000E 00	0.16653E-05	0.37525E 00	0.14939E-05	0.1470591E-05
46.0	0.15184E 00	0.12685E-05	0.27890E 00	0.16840E-05	0.38746E 00	0.15042E-05	0.1485550E-05
48.0	0.15708E 00	0.12844E-05	0.28798E 00	0.17056E-05	0.40055E 00	0.15251E-05	0.1505069E-05
50.0	0.16319E 00	0.13269E-05	0.29671E 00	0.17213E-05	0.41364E 00	0.15461E-05	0.1531411E-05
52.0	0.16930E 00	0.13694E-05	0.30526E 00	0.17339E-05	0.42673E 00	0.15670E-05	0.1556745E-05
54.0	0.17453E 00	0.13853E-05	0.31381E 00	0.17465E-05	0.43982E 00	0.15879E-05	0.1573238E-05
56.0	0.17977E 00	0.14013E-05	0.32254E 00	0.17621E-05	0.45117E 00	0.15876E-05	0.1583639E-05
58.0	0.18500E 00	0.14172E-05	0.33091E 00	0.17717E-05	0.46339E 00	0.15979E-05	0.1595574E-05
60.0	0.19024E 00	0.14332E-05	0.34016E 00	0.17963E-05	0.47560E 00	0.16081E-05	0.1612549E-05
62.0	0.19548E 00	0.14491E-05	0.34872E 00	0.18089E-05	0.48782E 00	0.16184E-05	0.1625492E-05
64.0	0.20071E 00	0.14651E-05	0.35727E 00	0.18215E-05	0.50004E 00	0.16287E-05	0.1638435E-05
66.0	0.20682E 00	0.15075E-05	0.36565E 00	0.18311E-05	0.51225E 00	0.16390E-05	0.1659210E-05
68.0	0.21206E 00	0.15235E-05	0.37385E 00	0.18377E-05	0.52447E 00	0.16493E-05	0.1670137E-05
70.0	0.21642E 00	0.15129E-05	0.38223E 00	0.18472E-05	0.53756E 00	0.16702E-05	0.1676783E-05
72.0	0.22166E 00	0.15289E-05	0.39096E 00	0.18679E-05	0.54891E 00	0.16698E-05	0.1687103E-05
74.0	0.22689E 00	0.15448E-05	0.39863E 00	0.18603E-05	0.56025E 00	0.16695E-05	0.1691534E-05
76.0	0.23213E 00	0.15607E-05	0.40701E 00	0.18699E-05	0.57247E 00	0.16798E-05	0.1703469E-05
78.0	0.23736E 00	0.15767E-05	0.41539E 00	0.18795E-05	0.58294E 00	0.16687E-05	0.1708302E-05
80.0	0.24260E 00	0.15926E-05	0.42412E 00	0.18951E-05	0.59603E 00	0.16897E-05	0.1725804E-05
82.0	0.24784E 00	0.16086E-05	0.43232E 00	0.19018E-05	0.60650E 00	0.16787E-05	0.1729630E-05
84.0	0.25307E 00	0.16245E-05	0.44000E 00	0.18991E-05	0.61785E 00	0.16783E-05	0.1733981E-05
86.0	0.25831E 00	0.16405E-05	0.44855E 00	0.19117E-05	0.63006E 00	0.16886E-05	0.1746924E-05
88.0	0.26354E 00	0.16564E-05	0.45710E 00	0.19243E-05	0.64228E 00	0.16989E-05	0.1759867E-05
90.0	0.26965E 00	0.16989E-05	0.46478E 00	0.19210E-05	0.65450E 00	0.17091E-05	0.1776609E-05
92.0	0.27576E 00	0.17414E-05	0.47298E 00	0.19283E-05	0.66672E 00	0.17194E-05	0.1796376E-05
94.0	0.28100E 00	0.17573E-05	0.47997E 00	0.19137E-05	0.67719E 00	0.17084E-05	0.1793144E-05

EQUATION OF BEST FIT, n=1

TIME MIN	OBSERVED THETA 1 (RAD)	CALCULATED THETA 1 (RAD)	OBSERVED THETA 2 (RAD)	CALCULATED THETA 2 (RAD)	OBSERVED THETA 3 (RAD)	CALCULATED THETA 3 (RAD)	OBSERVED CP FUNCTION (RA/D/SQCM)	CALCULATED CP FUNCTION (RA/D/SQCM)
0.0	0.17453E-02	0.10814E-02	0.17453E-02	0.18944E-02	0.26180E-02	0.26921E-02	-0.00000E-38	-0.00000E-38
0.1	0.43633E-02	0.16072E-02	0.48869E-02	0.27963E-02	0.69813E-02	0.39835E-02	0.55460E-07	0.88218E-08
0.2	0.52360E-02	0.21316E-02	0.68323E-02	0.36945E-02	0.95993E-02	0.52712E-02	0.78074E-07	0.17598E-07
0.3	0.61087E-02	0.26544E-02	0.83776E-02	0.45895E-02	0.12217E-01	0.65552E-02	0.10069E-06	0.26328E-07
0.4	0.69813E-02	0.31758E-02	0.10123E-01	0.54820E-02	0.13963E-01	0.78356E-02	0.11975E-06	0.35013E-07
0.5	0.69813E-02	0.36956E-02	0.11345E-01	0.63719E-02	0.15708E-01	0.91119E-02	0.12695E-06	0.43653E-07
0.6	0.78540E-02	0.42140E-02	0.12566E-01	0.72591E-02	0.17453E-01	0.10385E-01	0.14299E-06	0.52248E-07
0.7	0.87267E-02	0.47309E-02	0.13963E-01	0.81438E-02	0.20071E-01	0.11654E-01	0.16358E-06	0.60799E-07
0.8	0.90757E-02	0.52464E-02	0.15533E-01	0.90259E-02	0.20944E-01	0.12920E-01	0.17278E-06	0.69305E-07
0.9	0.94248E-02	0.57604E-02	0.16232E-01	0.99055E-02	0.22689E-01	0.14181E-01	0.18049E-06	0.77766E-07
1.0	0.10472E-01	0.62729E-02	0.17453E-01	0.10783E-01	0.24435E-01	0.15440E-01	0.19830E-06	0.86184E-07
1.1	0.10821E-01	0.67841E-02	0.18850E-01	0.11657E-01	0.26180E-01	0.16695E-01	0.21004E-06	0.94559E-07
1.2	0.11345E-01	0.72938E-02	0.19722E-01	0.12529E-01	0.27925E-01	0.17946E-01	0.22053E-06	0.10289E-06
1.3	0.12217E-01	0.78020E-02	0.20944E-01	0.13399E-01	0.29671E-01	0.19193E-01	0.23657E-06	0.11118E-06
1.4	0.12392E-01	0.83089E-02	0.22166E-01	0.14266E-01	0.30543E-01	0.20430E-01	0.24198E-06	0.11942E-06
1.5	0.13090E-01	0.88143E-02	0.22689E-01	0.15130E-01	0.32289E-01	0.21678E-01	0.25222E-06	0.12762E-06
1.6	0.13963E-01	0.93184E-02	0.23911E-01	0.15992E-01	0.34034E-01	0.22915E-01	0.26826E-06	0.13578E-06
1.7	0.14137E-01	0.98210E-02	0.24784E-01	0.16852E-01	0.34907E-01	0.24149E-01	0.27166E-06	0.14390E-06
1.8	0.14486E-01	0.10322E-01	0.26005E-01	0.17709E-01	0.36652E-01	0.25379E-01	0.28230E-06	0.15197E-06
1.9	0.15708E-01	0.10822E-01	0.26529E-01	0.18564E-01	0.38397E-01	0.26606E-01	0.29793E-06	0.16001E-06
2.0	0.15883E-01	0.11321E-01	0.27576E-01	0.19416E-01	0.39270E-01	0.27829E-01	0.30234E-06	0.16800E-06
2.1	0.15883E-01	0.11818E-01	0.28274E-01	0.20266E-01	0.41015E-01	0.29049E-01	0.30651E-06	0.17595E-06
2.2	0.16581E-01	0.12314E-01	0.29322E-01	0.21114E-01	0.41888E-01	0.30266E-01	0.31623E-06	0.18385E-06
2.3	0.17453E-01	0.12808E-01	0.29845E-01	0.21959E-01	0.43633E-01	0.31479E-01	0.32823E-06	0.19172E-06
2.4	0.17453E-01	0.13301E-01	0.30892E-01	0.22802E-01	0.44506E-01	0.32689E-01	0.33087E-06	0.19955E-06
2.5	0.17628E-01	0.13793E-01	0.31416E-01	0.23643E-01	0.46251E-01	0.33895E-01	0.33580E-06	0.20733E-06
2.6	0.18326E-01	0.14283E-01	0.32463E-01	0.24481E-01	0.47124E-01	0.35099E-01	0.34552E-06	0.21508E-06
2.7	0.18500E-01	0.14772E-01	0.33161E-01	0.25317E-01	0.47997E-01	0.36297E-01	0.34791E-06	0.22278E-06
2.8	0.19199E-01	0.15260E-01	0.34034E-01	0.26150E-01	0.49742E-01	0.37495E-01	0.36016E-06	0.23045E-06
2.9	0.19199E-01	0.15747E-01	0.34907E-01	0.26982E-01	0.50615E-01	0.38689E-01	0.36179E-06	0.23807E-06
3.0	0.20071E-01	0.16232E-01	0.35779E-01	0.27811E-01	0.52360E-01	0.39879E-01	0.37581E-06	0.24566E-06
4.0	0.24435E-01	0.21013E-01	0.43808E-01	0.35977E-01	0.64577E-01	0.51605E-01	0.44650E-06	0.31938E-06
5.0	0.27925E-01	0.25672E-01	0.51836E-01	0.43928E-01	0.75922E-01	0.63026E-01	0.50477E-06	0.38936E-06
6.0	0.31416E-01	0.30213E-01	0.59341E-01	0.51675E-01	0.86394E-01	0.74155E-01	0.55650E-06	0.45579E-06
7.0	0.34907E-01	0.34644E-01	0.66323E-01	0.59226E-01	0.97738E-01	0.85008E-01	0.60875E-06	0.51884E-06
8.0	0.38397E-01	0.38969E-01	0.73304E-01	0.66593E-01	0.10734E 00	0.95599E-01	0.65389E-06	0.57870E-06
9.0	0.41888E-01	0.43194E-01	0.80111E-01	0.73785E-01	0.11694E 00	0.10594E 00	0.69802E-06	0.63553E-06
10.0	0.45379E-01	0.47325E-01	0.86917E-01	0.80810E-01	0.12654E 00	0.11605E 00	0.74215E-06	0.68946E-06
11.0	0.48869E-01	0.51365E-01	0.93201E-01	0.87677E-01	0.13526E 00	0.12593E 00	0.77971E-06	0.74067E-06
12.0	0.52360E-01	0.55320E-01	0.99484E-01	0.94395E-01	0.14399E 00	0.13560E 00	0.81727E-06	0.78927E-06
13.0	0.54978E-01	0.59194E-01	0.10559E 00	0.10097E 00	0.15272E 00	0.14507E 00	0.84498E-06	0.83541E-06
14.0	0.58469E-01	0.62591E-01	0.11170E 00	0.10741E 00	0.16144E 00	0.15434E 00	0.88153E-06	0.87921E-06
15.0	0.61959E-01	0.66715E-01	0.11729E 00	0.11372E 00	0.17017E 00	0.16343E 00	0.91505E-06	0.92078E-06
16.0	0.65450E-01	0.70369E-01	0.12339E 00	0.11991E 00	0.17802E 00	0.17236E 00	0.94805E-06	0.96025E-06
17.0	0.68068E-01	0.73957E-01	0.12915E 00	0.12599E 00	0.18675E 00	0.18111E 00	0.97374E-06	0.99771E-06
18.0	0.71559E-01	0.77483E-01	0.13456E 00	0.13195E 00	0.19548E 00	0.18971E 00	0.10063E-05	0.10333E-05
19.0	0.75049E-01	0.80950E-01	0.14015E 00	0.13781E 00	0.20246E 00	0.19817E 00	0.10327E-05	0.10670E-05
20.0	0.77667E-01	0.84360E-01	0.14556E 00	0.14357E 00	0.21206E 00	0.20648E 00	0.10599E-05	0.10991E-05
21.0	0.80285E-01	0.87716E-01	0.15132E 00	0.14924E 00	0.21817E 00	0.21466E 00	0.10750E-05	0.11295E-05
22.0	0.83776E-01	0.91022E-01	0.15691E 00	0.15482E 00	0.22515E 00	0.22271E 00	0.11014E-05	0.11584E-05
23.0	0.87266E-01	0.94280E-01	0.16232E 00	0.16032E 00	0.23300E 00	0.23064E 00	0.11303E-05	0.11858E-05
24.0	0.89884E-01	0.97491E-01	0.16773E 00	0.16573E 00	0.24086E 00	0.23846E 00	0.11505E-05	0.12118E-05
25.0	0.92502E-01	0.10066E 00	0.17279E 00	0.17107E 00	0.24784E 00	0.24617E 00	0.11650E-05	0.12365E-05
26.0	0.95120E-01	0.10379E 00	0.17959E 00	0.17633E 00	0.25482E 00	0.25378E 00	0.11897E-05	0.12600E-05
27.0	0.97738E-01	0.10687E 00	0.18500E 00	0.18153E 00	0.26180E 00	0.26129E 00	0.12062E-05	0.12822E-05
28.0	0.10123E 00	0.10993E 00	0.19024E 00	0.18666E 00	0.27053E 00	0.26871E 00	0.12378E-05	0.13032E-05
29.0	0.10297E 00	0.11294E 00	0.19565E 00	0.19173E 00	0.27576E 00	0.27604E 00	0.12384E-05	0.13234E-05
30.0	0.10647E 00	0.11592E 00	0.20089E 00	0.19674E 00	0.28274E 00	0.28329E 00	0.12629E-05	0.13424E-05
32.0	0.11170E 00	0.12179E 00	0.21118E 00	0.20660E 00	0.29583E 00	0.29755E 00	0.12894E-05	0.13777E-05
34.0	0.11781E 00	0.12755E 00	0.22131E 00	0.21626E 00	0.30892E 00	0.31152E 00	0.13238E-05	0.14094E-05
36.0	0.12305E 00	0.13320E 00	0.23126E 00	0.22573E 00	0.32289E 00	0.32524E 00	0.13519E-05	0.14380E-05
38.0	0.12915E 00	0.13876E 00	0.24086E 00	0.23505E 00	0.33510E 00	0.33873E 00	0.13797E-05	0.14638E-05
40.0	0.13439E 00	0.14424E 00	0.25133E 00	0.24421E 00	0.34907E 00	0.35201E 00	0.14109E-05	0.14870E-05
42.0	0.13963E 00	0.14964E 00	0.26093E 00	0.25325E 00	0.36216E 00	0.36509E 00	0.14334E-05	0.15079E-05
44.0	0.14661E 00	0.15497E 00	0.27000E 00	0.26216E 00	0.37525E 00	0.37801E 00	0.14706E-05	0.15268E-05
46.0	0.15184E 00	0.16024E 00	0.27890E 00	0.27096E 00	0.38746E 00	0.39076E 00	0.14856E-05	0.15438E-05
48.0	0.15708E 00	0.16545E 00	0.28798E 00	0.27967E 00	0.40055E 00	0.40341E 00	0.15051E-05	0.15591E-05
50.0	0.16319E 00	0.17062E 00	0.29671E 00	0.28830E 00	0.41364E 00	0.41592E 00	0.15314E-05	0.15729E-05
52.0	0.16930E 00	0.17574E 00	0.30526E 00	0.29684E 00	0.42673E 00	0.42831E 00	0.15567E-05	0.15853E-05
54.0	0.17453E 00	0.18082E 00	0.31381E 00	0.30531E 00	0.43982E 00	0.44060E 00	0.15732E-05	0.15965E-05
56.0	0.17977E 00	0.18586E 00	0.32254E 00	0.31372E 00	0.45117E 00	0.45280E 00	0.15836E-05	0.16066E-05
58.0	0.18500E 00	0.19087E 00	0.33091E 00	0.32207E 00	0.46339E 00	0.46492E 00	0.15956E-05	0.16157E-05
60.0	0.19024E 00	0.19585E 00	0.34016E 00	0.33037E 00	0.47560E 00	0.47697E 00	0.16125E-05	0.16239E-05
62.0	0.19548E 00	0.20081E 00	0.34872E 00	0.33862E 00	0.48782E 00	0.48895E 00	0.16255E-05	0.16313E-05
64.0	0.20071E 00	0.20574E 00	0.35727E 00	0.34683E 00	0.50004E 00	0.50087E 00	0.16384E-05	0.16380E-05
66.0	0.20682E 00	0.21065E 00	0.36565E 00	0.35500E 00	0.51225E 00	0.51274E 00	0.16592E-05	0.16440E-05
68.0	0.21206E 00	0.21554E 00	0.37385E 00	0.36314E 00	0.52447E 00	0.52455E 00	0.16701E-05	0.16494E-05
70.0	0.21642E 00	0.22041E 00	0.38223E 00	0.37124E 00	0.53756E 00	0.53633E 00	0.16768E-05	0.16542E-05
72.0	0.22166E 00	0.22526E 00	0.39096E 00	0.37932E 00	0.54891E 00	0.54806E 00	0.16872E-05	0.16586E-05
74.0	0.22689E 00	0.23010E 00	0.39863E 00	0.38737E 00	0.56025E 00	0.55976E 00	0.16915E-05	0.16626E-05
76.0	0.23213E 00	0.23493E 00	0.40701E 00	0.39540E 00	0.57247E 00	0.57143E 00	0.17035E-05	0.16662E-05
78.0	0.23736E 00	0.23975E 00	0.41539E 00	0.40341E 00	0.58294E 00	0.58307E 00	0.17083E-05	0.16694E-05
80.0	0.24260E 00	0.24456E 00	0.42412E 00	0.41141E 00	0.59603E 00	0.59468E 00	0.17258E-05	0.16723E-05
82.0	0.24784E 00	0.24935E 00	0.43232E 00	0.41938E 00	0.60650E 00	0.60627E 00	0.17296E-05	0.16749E-05
84.0	0.25307E 00	0.25414E 00	0.44000E 00	0.42736E 00	0.61785E 00	0.61783E 00	0.17340E-05	0.16772E-05
86.0	0.25831E 00	0.25892E 00	0.44855E 00	0.43529E 00	0.63006E 00	0.62938E 00	0.17469E-05	0.16793E-05
88.0	0.26354E 00	0.26370E 00	0.45710E 00	0.44323E 00	0.64228E 00	0.64091E 00	0.17599E-05	0.16812E-05
90.0	0.26965E 00	0.26846E 00	0.46478E 00	0.45115E 00	0.65450E 00	0.65243E 00	0.17766E-05	0.16830E-05
92.0	0.27576E 00	0.27323E 00	0.47298E 00	0.45907E 00	0.66672E 00	0.66393E 00	0.17964E-05	0.16845E-05
94.0	0.28100E 00	0.27798E 00	0.47997E 00	0.46697E 00	0.67719E 00	0.67542E 00	0.17931E-05	0.16859E-05
STD DEV =		0.54311E-02		0.28005E-02		0.72275E-02		0.83975E-07

EQUATION OF BEST FIT, n=2

TIME MIN	OBSERVED THETA 1 (RAD)	CALCULATED THETA 1 (RAD)	OBSERVED THETA 2 (RAD)	CALCULATED THETA 2 (RAD)	OBSERVED THETA 3 (RAD)	CALCULATED THETA 3 (RAD)	OBSERVED CP FUNCTION (RA/D/SQCM)	CALCULATED CP FUNCTION (RA/D/SQCM)
0.0	0.17453E-02	0.10814E-02	0.17453E-02	0.18984E-02	0.26180E-02	0.26921E-02	-0.00000E-38	-0.00000E-38
0.1	0.43633E-02	0.20538E-02	0.48869E-02	0.35799E-02	0.69813E-02	0.50953E-02	0.55460E-07	0.22393E-07
0.2	0.52360E-02	0.29927E-02	0.68323E-02	0.52047E-02	0.95993E-02	0.74151E-02	0.78074E-07	0.43768E-07
0.3	0.61087E-02	0.39001E-02	0.83776E-02	0.67741E-02	0.12217E-01	0.96563E-02	0.10069E-06	0.64103E-07
0.4	0.69813E-02	0.47776E-02	0.10123E-01	0.82912E-02	0.13963E-01	0.11823E-01	0.11975E-06	0.83493E-07
0.5	0.69813E-02	0.56271E-02	0.11345E-01	0.97591E-02	0.15708E-01	0.13920E-01	0.12695E-06	0.10235E-06
0.6	0.78540E-02	0.64500E-02	0.12566E-01	0.11180E-01	0.17453E-01	0.15951E-01	0.14299E-06	0.12020E-06
0.7	0.87267E-02	0.72480E-02	0.13963E-01	0.12558E-01	0.20071E-01	0.17920E-01	0.16358E-06	0.13729E-06
0.8	0.90757E-02	0.80223E-02	0.15533E-01	0.13894E-01	0.20944E-01	0.19830E-01	0.17278E-06	0.15366E-06
0.9	0.94248E-02	0.87745E-02	0.16232E-01	0.15191E-01	0.22689E-01	0.21685E-01	0.18049E-06	0.16936E-06
1.0	0.10472E-01	0.95056E-02	0.17453E-01	0.16452E-01	0.24435E-01	0.23488E-01	0.19830E-06	0.18442E-06
1.1	0.10821E-01	0.10217E-01	0.18850E-01	0.17677E-01	0.26180E-01	0.25241E-01	0.21004E-06	0.19888E-06
1.2	0.11345E-01	0.10909E-01	0.19722E-01	0.18870E-01	0.27925E-01	0.26947E-01	0.22053E-06	0.21277E-06
1.3	0.12217E-01	0.11584E-01	0.20944E-01	0.20032E-01	0.29671E-01	0.28610E-01	0.23657E-06	0.22612E-06
1.4	0.12392E-01	0.12243E-01	0.22166E-01	0.21165E-01	0.30543E-01	0.30231E-01	0.24198E-06	0.23897E-06
1.5	0.13090E-01	0.12885E-01	0.22689E-01	0.22270E-01	0.32289E-01	0.31813E-01	0.25222E-06	0.25134E-06
1.6	0.13963E-01	0.13513E-01	0.23911E-01	0.23349E-01	0.34034E-01	0.33358E-01	0.26826E-06	0.26326E-06
1.7	0.14137E-01	0.14127E-01	0.24784E-01	0.24403E-01	0.34907E-01	0.34868E-01	0.27166E-06	0.27475E-06
1.8	0.14486E-01	0.14727E-01	0.26005E-01	0.25434E-01	0.36652E-01	0.36346E-01	0.28239E-06	0.28584E-06
1.9	0.15708E-01	0.15315E-01	0.26529E-01	0.26444E-01	0.38397E-01	0.37792E-01	0.29793E-06	0.29655E-06
2.0	0.15883E-01	0.15891E-01	0.27576E-01	0.27432E-01	0.39270E-01	0.39209E-01	0.30234E-06	0.30690E-06
2.1	0.15883E-01	0.16456E-01	0.28274E-01	0.28401E-01	0.41015E-01	0.40598E-01	0.30651E-06	0.31691E-06
2.2	0.16581E-01	0.17011E-01	0.29322E-01	0.29352E-01	0.41888E-01	0.41960E-01	0.31623E-06	0.32661E-06
2.3	0.17453E-01	0.17556E-01	0.29845E-01	0.30285E-01	0.43633E-01	0.43298E-01	0.32823E-06	0.33600E-06
2.4	0.17453E-01	0.18091E-01	0.30892E-01	0.31202E-01	0.44506E-01	0.44613E-01	0.33087E-06	0.34510E-06
2.5	0.17628E-01	0.18617E-01	0.31416E-01	0.32103E-01	0.46251E-01	0.45905E-01	0.33580E-06	0.35394E-06
2.6	0.18326E-01	0.19135E-01	0.32463E-01	0.32989E-01	0.47124E-01	0.47177E-01	0.34552E-06	0.36251E-06
2.7	0.18500E-01	0.19645E-01	0.33161E-01	0.33862E-01	0.47997E-01	0.48429E-01	0.34791E-06	0.37085E-06
2.8	0.19199E-01	0.20147E-01	0.34034E-01	0.34721E-01	0.49742E-01	0.49662E-01	0.36016E-06	0.37896E-06
2.9	0.19199E-01	0.20642E-01	0.34907E-01	0.35567E-01	0.50615E-01	0.50877E-01	0.36179E-06	0.38685E-06
3.0	0.20071E-01	0.21131E-01	0.35779E-01	0.36402E-01	0.52360E-01	0.52076E-01	0.37581E-06	0.39454E-06
4.0	0.24435E-01	0.25717E-01	0.43808E-01	0.44226E-01	0.64577E-01	0.63316E-01	0.44650E-06	0.46231E-06
5.0	0.27925E-01	0.29921E-01	0.51036E-01	0.51381E-01	0.75922E-01	0.73605E-01	0.50479E-06	0.51850E-06
6.0	0.31416E-01	0.33895E-01	0.59341E-01	0.58131E-01	0.86394E-01	0.83321E-01	0.55650E-06	0.56767E-06
7.0	0.34907E-01	0.37722E-01	0.66323E-01	0.64625E-01	0.97738E-01	0.92672E-01	0.60875E-06	0.61240E-06
8.0	0.38397E-01	0.41450E-01	0.73304E-01	0.70943E-01	0.10734E 00	0.10177E 00	0.65389E-06	0.65409E-06
9.0	0.41888E-01	0.45104E-01	0.80111E-01	0.77133E-01	0.11694E 00	0.11069E 00	0.69802E-06	0.69355E-06
10.0	0.45379E-01	0.48700E-01	0.86917E-01	0.83221E-01	0.12654E 00	0.11947E 00	0.74215E-06	0.73125E-06
11.0	0.48869E-01	0.52247E-01	0.93201E-01	0.89223E-01	0.13526E 00	0.12812E 00	0.77971E-06	0.76745E-06
12.0	0.52360E-01	0.55750E-01	0.99484E-01	0.95149E-01	0.14399E 00	0.13667E 00	0.81727E-06	0.80233E-06
13.0	0.54978E-01	0.59213E-01	0.10559E 00	0.10100E 00	0.15272E 00	0.14511E 00	0.84498E-06	0.83599E-06
14.0	0.58469E-01	0.62639E-01	0.11170E 00	0.10679E 00	0.16144E 00	0.15347E 00	0.88153E-06	0.86852E-06
15.0	0.61959E-01	0.66029E-01	0.11729E 00	0.11252E 00	0.17017E 00	0.16173E 00	0.91505E-06	0.89995E-06
16.0	0.65450E-01	0.69305E-01	0.12339E 00	0.11819E 00	0.17802E 00	0.16991E 00	0.94005E-06	0.93035E-06
17.0	0.68068E-01	0.72708E-01	0.12915E 00	0.12380E 00	0.18675E 00	0.17800E 00	0.97374E-06	0.95975E-06
18.0	0.71559E-01	0.75999E-01	0.13456E 00	0.12935E 00	0.19549E 00	0.18602E 00	0.10063E-05	0.98818E-06
19.0	0.75049E-01	0.79260E-01	0.14015E 00	0.13485E 00	0.20246E 00	0.19396E 00	0.10327E-05	0.10157E-05
20.0	0.77667E-01	0.82491E-01	0.14556E 00	0.14030E 00	0.21206E 00	0.20183E 00	0.10599E-05	0.10423E-05
21.0	0.80285E-01	0.85694E-01	0.15132E 00	0.14570E 00	0.21817E 00	0.20962E 00	0.10750E-05	0.10680E-05
22.0	0.83776E-01	0.88869E-01	0.15691E 00	0.15105E 00	0.22515E 00	0.21735E 00	0.11014E-05	0.10929E-05
23.0	0.87266E-01	0.92017E-01	0.16232E 00	0.15635E 00	0.23300E 00	0.22501E 00	0.11303E-05	0.11170E-05
24.0	0.89884E-01	0.95140E-01	0.16773E 00	0.16161E 00	0.24086E 00	0.23261E 00	0.11505E-05	0.11403E-05
25.0	0.92502E-01	0.98237E-01	0.17279E 00	0.16682E 00	0.24784E 00	0.24014E 00	0.11650E-05	0.11629E-05
26.0	0.95120E-01	0.10131E 00	0.17959E 00	0.17199E 00	0.25482E 00	0.24762E 00	0.11897E-05	0.11847E-05
27.0	0.97738E-01	0.10436E 00	0.18500E 00	0.17712E 00	0.26180E 00	0.25503E 00	0.12042E-05	0.12058E-05
28.0	0.10123E 00	0.10739E 00	0.19024E 00	0.18221E 00	0.27053E 00	0.26239E 00	0.12378E-05	0.12262E-05
29.0	0.10297E 00	0.11039E 00	0.19565E 00	0.18726E 00	0.27576E 00	0.26970E 00	0.12384E-05	0.12459E-05
30.0	0.10647E 00	0.11338E 00	0.20089E 00	0.19229E 00	0.28274E 00	0.27695E 00	0.12628E-05	0.12650E-05
32.0	0.11170E 00	0.11928E 00	0.21118E 00	0.20220E 00	0.29583E 00	0.29130E 00	0.12894E-05	0.13014E-05
34.0	0.11781E 00	0.12512E 00	0.22131E 00	0.21199E 00	0.30892E 00	0.30546E 00	0.13238E-05	0.13354E-05
36.0	0.12305E 00	0.13087E 00	0.23126E 00	0.22165E 00	0.32289E 00	0.31945E 00	0.13519E-05	0.13673E-05
38.0	0.12915E 00	0.13657E 00	0.24086E 00	0.23120E 00	0.33510E 00	0.33326E 00	0.13797E-05	0.13971E-05
40.0	0.13439E 00	0.14219E 00	0.25133E 00	0.24063E 00	0.34907E 00	0.34692E 00	0.14109E-05	0.14250E-05
42.0	0.13963E 00	0.14776E 00	0.26093E 00	0.24996E 00	0.36216E 00	0.36043E 00	0.14334E-05	0.14511E-05
44.0	0.14661E 00	0.15328E 00	0.27000E 00	0.25920E 00	0.37525E 00	0.37381E 00	0.14706E-05	0.14755E-05
46.0	0.15184E 00	0.15874E 00	0.27890E 00	0.26834E 00	0.38746E 00	0.38706E 00	0.14856E-05	0.14983E-05
48.0	0.15708E 00	0.16416E 00	0.28798E 00	0.27740E 00	0.40055E 00	0.40019E 00	0.15051E-05	0.15197E-05
50.0	0.16319E 00	0.16953E 00	0.29671E 00	0.28638E 00	0.41364E 00	0.41320E 00	0.15314E-05	0.15397E-05
52.0	0.16930E 00	0.17486E 00	0.30526E 00	0.29529E 00	0.42673E 00	0.42611E 00	0.15567E-05	0.15585E-05
54.0	0.17453E 00	0.18014E 00	0.31381E 00	0.30413E 00	0.43982E 00	0.43892E 00	0.15732E-05	0.15760E-05
56.0	0.17977E 00	0.18540E 00	0.32254E 00	0.31290E 00	0.45117E 00	0.45164E 00	0.15836E-05	0.15924E-05
58.0	0.18500E 00	0.19061E 00	0.33091E 00	0.32161E 00	0.46339E 00	0.46427E 00	0.15956E-05	0.16078E-05
60.0	0.19024E 00	0.19580E 00	0.34016E 00	0.33026E 00	0.47560E 00	0.47683E 00	0.16125E-05	0.16222E-05
62.0	0.19548E 00	0.20095E 00	0.34872E 00	0.33887E 00	0.48782E 00	0.48930E 00	0.16255E-05	0.16356E-05
64.0	0.20071E 00	0.20608E 00	0.35727E 00	0.34742E 00	0.50004E 00	0.50171E 00	0.16384E-05	0.16482E-05
66.0	0.20682E 00	0.21117E 00	0.36565E 00	0.35592E 00	0.51225E 00	0.51405E 00	0.16592E-05	0.16600E-05
68.0	0.21206E 00	0.21625E 00	0.37385E 00	0.36438E 00	0.52447E 00	0.52633E 00	0.16701E-05	0.16710E-05
70.0	0.21642E 00	0.22130E 00	0.38223E 00	0.37280E 00	0.53756E 00	0.53855E 00	0.16768E-05	0.16813E-05
72.0	0.22166E 00	0.22633E 00	0.39095E 00	0.38119E 00	0.54891E 00	0.55071E 00	0.16872E-05	0.16910E-05
74.0	0.22689E 00	0.23134E 00	0.39863E 00	0.38953E 00	0.56025E 00	0.56283E 00	0.16915E-05	0.17000E-05
76.0	0.23213E 00	0.23633E 00	0.40701E 00	0.39785E 00	0.57247E 00	0.57489E 00	0.17035E-05	0.17085E-05
78.0	0.23736E 00	0.24130E 00	0.41539E 00	0.40613E 00	0.58294E 00	0.58692E 00	0.17083E-05	0.17164E-05
80.0	0.24260E 00	0.24625E 00	0.42412E 00	0.41438E 00	0.59603E 00	0.59890E 00	0.17258E-05	0.17238E-05
82.0	0.24784E 00	0.25119E 00	0.43232E 00	0.42261E 00	0.60650E 00	0.61084E 00	0.17296E-05	0.17307E-05
84.0	0.25307E 00	0.25612E 00	0.44000E 00	0.43081E 00	0.61785E 00	0.62275E 00	0.17340E-05	0.17372E-05
86.0	0.25831E 00	0.26103E 00	0.44855E 00	0.43898E 00	0.63006E 00	0.63462E 00	0.17469E-05	0.17433E-05
88.0	0.26354E 00	0.26593E 00	0.45710E 00	0.44713E 00	0.64228E 00	0.64646E 00	0.17599E-05	0.17490E-05
90.0	0.26965E 00	0.27081E 00	0.46478E 00	0.45527E 00	0.65450E 00	0.65827E 00	0.17766E-05	0.17543E-05
92.0	0.27576E 00	0.27569E 00	0.47298E 00	0.46338E 00	0.66672E 00	0.67005E 00	0.17964E-05	0.17593E-05
94.0	0.28100E 00	0.28059E 00	0.47997E 00	0.47147E 00	0.67719E 00	0.68181E 00	0.17931E-05	0.17639E-05
STD DEV =		0.41602E-02		0.85371E-02		0.43546E-02		0.14817E-07

Figure D-3. Viscoelastic Analysis for Asphalt 45 at 39.2°F.

EQUATION OF BEST FIT, n=3

TAU1 = 0.2194466E 04 SEC G1 = 0.7838749E 06 DYNES/SQ CM VISC1 = 0.1544630E 10 POISES

TAU2 = 0.3603455E 03 SEC G2 = 0.2925071E 07 DYNES/SQ CM VISC2 = 0.1054036E 10 POISES

TAU3 = 0.2607349E 02 SEC G3 = 0.7923419E 07 DYNES/SQ CM VISC3 = 0.2065912E 09 POISES

TIME (MIN)	OBSERVED THETA 1 (RAD)	CALCULATED THETA 1 (RAD)	OBSERVED THETA 2 (RAD)	CALCULATED THETA 2 (RAD)	OBSERVED THETA 3 (RAD)	CALCULATED THETA 3 (RAD)	OBSERVED CP FUNCTION (RAD/D/SQCM)	CALCULATED CP FUNCTION (RAD/D/SQCM)
0.0	0.17453E-02	0.10814E-02	0.17453E-02	0.18964E-02	0.26180E-02	0.26921E-02	-0.00000E-30	-0.00000E-30
0.1	0.43633E-02	0.24040E-02	0.48869E-02	0.43345E-02	0.69813E-02	0.61664E-02	0.55460E-07	0.35468E-07
0.2	0.52360E-02	0.37078E-02	0.66323E-02	0.64587E-02	0.95993E-02	0.91953E-02	0.78074E-07	0.65499E-07
0.3	0.61087E-02	0.47688E-02	0.83776E-02	0.83327E-02	0.12217E-01	0.11869E-01	0.10669E-06	0.91191E-07
0.4	0.69813E-02	0.57557E-02	0.10123E-01	0.10007E-01	0.13963E-01	0.14250E-01	0.11975E-06	0.11342E-06
0.5	0.69813E-02	0.66314E-02	0.11345E-01	0.11520E-01	0.15708E-01	0.16421E-01	0.12695E-06	0.13287E-06
0.6	0.78540E-02	0.74339E-02	0.12566E-01	0.12906E-01	0.17453E-01	0.18401E-01	0.14299E-06	0.15010E-06
0.7	0.87267E-02	0.81778E-02	0.13963E-01	0.14189E-01	0.20071E-01	0.20235E-01	0.16358E-06	0.16556E-06
0.8	0.90757E-02	0.88744E-02	0.15533E-01	0.15388E-01	0.20944E-01	0.21952E-01	0.17278E-06	0.17956E-06
0.9	0.94248E-02	0.95329E-02	0.16232E-01	0.16521E-01	0.22689E-01	0.23573E-01	0.18049E-06	0.19241E-06
1.0	0.10472E-01	0.10160E-01	0.17453E-01	0.17600E-01	0.24435E-01	0.25110E-01	0.19830E-06	0.20433E-06
1.1	0.10821E-01	0.10763E-01	0.16850E-01	0.18635E-01	0.26180E-01	0.26600E-01	0.21004E-06	0.21548E-06
1.2	0.11345E-01	0.11345E-01	0.19722E-01	0.19634E-01	0.27925E-01	0.28032E-01	0.22653E-06	0.22601E-06
1.3	0.12217E-01	0.11910E-01	0.20944E-01	0.20603E-01	0.29671E-01	0.29421E-01	0.23657E-06	0.23602E-06
1.4	0.12392E-01	0.12461E-01	0.22166E-01	0.21544E-01	0.30543E-01	0.30775E-01	0.24198E-06	0.24561E-06
1.5	0.13090E-01	0.13001E-01	0.22689E-01	0.22472E-01	0.32289E-01	0.32101E-01	0.25222E-06	0.25485E-06
1.6	0.13963E-01	0.13531E-01	0.23911E-01	0.23380E-01	0.34034E-01	0.33403E-01	0.26826E-06	0.26380E-06
1.7	0.14137E-01	0.14052E-01	0.24784E-01	0.24273E-01	0.34907E-01	0.34683E-01	0.27166E-06	0.27249E-06
1.8	0.14486E-01	0.14567E-01	0.26005E-01	0.25153E-01	0.36652E-01	0.35944E-01	0.28239E-06	0.28096E-06
1.9	0.15708E-01	0.15075E-01	0.26529E-01	0.26023E-01	0.38397E-01	0.37194E-01	0.29793E-06	0.28925E-06
2.0	0.15883E-01	0.15578E-01	0.27576E-01	0.26883E-01	0.39270E-01	0.38428E-01	0.30234E-06	0.29738E-06
2.1	0.15883E-01	0.16076E-01	0.28274E-01	0.27734E-01	0.41015E-01	0.39651E-01	0.30651E-06	0.30536E-06
2.2	0.16581E-01	0.16570E-01	0.29322E-01	0.28579E-01	0.41888E-01	0.40862E-01	0.31623E-06	0.31320E-06
2.3	0.17453E-01	0.17060E-01	0.29845E-01	0.29416E-01	0.43633E-01	0.42064E-01	0.32823E-06	0.32094E-06
2.4	0.17453E-01	0.17546E-01	0.30892E-01	0.30247E-01	0.44506E-01	0.43250E-01	0.33087E-06	0.32856E-06
2.5	0.17628E-01	0.18029E-01	0.31416E-01	0.31072E-01	0.46251E-01	0.44443E-01	0.33500E-06	0.33608E-06
2.6	0.18326E-01	0.18509E-01	0.32463E-01	0.31892E-01	0.47124E-01	0.45620E-01	0.34552E-06	0.34351E-06
2.7	0.18500E-01	0.18986E-01	0.33161E-01	0.32707E-01	0.47997E-01	0.46790E-01	0.34791E-06	0.35085E-06
2.8	0.19199E-01	0.19461E-01	0.34034E-01	0.33517E-01	0.49742E-01	0.47953E-01	0.36016E-06	0.35810E-06
2.9	0.19199E-01	0.19933E-01	0.34907E-01	0.34323E-01	0.50615E-01	0.49110E-01	0.36179E-06	0.36520E-06
3.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.37230E-06
4.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.43961E-06
5.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.50091E-06
6.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.55714E-06
7.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.60097E-06
8.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.65496E-06
9.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.70159E-06
10.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.74327E-06
11.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.78234E-06
12.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.81911E-06
13.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.85382E-06
14.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.88669E-06
15.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.91797E-06
16.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.94766E-06
17.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.97606E-06
18.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.10032E-05
19.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.10293E-05
20.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.10543E-05
21.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.10783E-05
22.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.11015E-05
23.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.11238E-05
24.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.11454E-05
25.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.11663E-05
26.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.11864E-05
27.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.12059E-05
28.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.12248E-05
29.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.12431E-05
30.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.12609E-05
32.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.12948E-05
34.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.13268E-05
36.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.13570E-05
38.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.13855E-05
40.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.14124E-05
42.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.14379E-05
44.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.14619E-05
46.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.14847E-05
48.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.15063E-05
50.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.15266E-05
52.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.15459E-05
54.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.15642E-05
56.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.15815E-05
58.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.15978E-05
60.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.16133E-05
62.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.16280E-05
64.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.16419E-05
66.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.16550E-05
68.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.16674E-05
70.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.16792E-05
72.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.16904E-05
74.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.17009E-05
76.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.17109E-05
78.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.17204E-05
80.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.17294E-05
82.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.17378E-05
84.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.17459E-05
86.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.17535E-05
88.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.17607E-05
90.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.17675E-05
92.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.17740E-05
94.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.17801E-05
STD DEV =		0.41050E-02		0.65482E-02		0.41852E-02		0.63854E-08

EQUATION OF BEST FIT, n=4

TAU1 = 0.2313359E 04 SEC G1 = 0.7267543E 06 DYNES/SQ CM VISC1 = 0.1681244E 10 POISES

TAU2 = 0.4674410E 03 SEC G2 = 0.2750099E 07 DYNES/SQ CM VISC2 = 0.1286009E 10 POISES

TAU3 = 0.3035328E 02 SEC G3 = 0.8312123E 07 DYNES/SQ CM VISC3 = 0.4050397E 09 POISES

TAU4 = 0.3381262E 01 SEC G4 = 0.2360821E 08 DYNES/SQ CM VISC4 = 0.7987274E 08 POISES

TIME (MIN)	OBSERVED THETA 1 (RAD)	CALCULATED THETA 1 (RAD)	OBSERVED THETA 2 (RAD)	CALCULATED THETA 2 (RAD)	OBSERVED THETA 3 (RAD)	CALCULATED THETA 3 (RAD)	OBSERVED CP FUNCTION (RAD/D/SQCM)	CALCULATED CP FUNCTION (RAD/D/SQCM)
0.0	0.17453E-02	0.10814E-02	0.17453E-02	0.18964E-02	0.26180E-02	0.26921E-02	-0.00000E-30	-0.00000E-30
0.1	0.43633E-02	0.31308E-02	0.48869E-02	0.54687E-02	0.69813E-02	0.77766E-02	0.55460E-07	0.55123E-07
0.2	0.52360E-02	0.41794E-02	0.66323E-02	0.72858E-02	0.95993E-02	0.10369E-01	0.78074E-07	0.79831E-07
0.3	0.61087E-02	0.50286E-02	0.83776E-02	0.87532E-02	0.12217E-01	0.12466E-01	0.10069E-06	0.98479E-07
0.4	0.69813E-02	0.58171E-02	0.10123E-01	0.10114E-01	0.13963E-01	0.14411E-01	0.11975E-06	0.11526E-06
0.5	0.69813E-02	0.65710E-02	0.11345E-01	0.11414E-01	0.15708E-01	0.16270E-01	0.12695E-06	0.13103E-06
0.6	0.78540E-02	0.72568E-02	0.12566E-01	0.12668E-01	0.17453E-01	0.18060E-01	0.14299E-06	0.14594E-06
0.7	0.87267E-02	0.79779E-02	0.13963E-01	0.13878E-01	0.20071E-01	0.19797E-01	0.16358E-06	0.16008E-06
0.8	0.90757E-02	0.86746E-02	0.15533E-01	0.15041E-01	0.20944E-01	0.21459E-01	0.17278E-06	0.17354E-06
0.9	0.94248E-02	0.93346E-02	0.16232E-01	0.16173E-01	0.22689E-01	0.23079E-01	0.18049E-06	0.18638E-06
1.0	0.10472E-01	0.99738E-02	0.17453E-01	0.17275E-01	0.24435E-01	0.24653E-01	0.19830E-06	0.19865E-06
1.1	0.10821E-01	0.10596E-01	0.16850E-01	0.18342E-01	0.26180E-01	0.26185E-01	0.21004E-06	0.21041E-06
1.2	0.11345E-01	0.11203E-01	0.19722E-01	0.19385E-01	0.27925E-01	0.27678E-01	0.22053E-06	0.22169E-06
1.3	0.12217E-01	0.11796E-01	0.20944E-01	0.20402E-01	0.29671E-01	0.29136E-01	0.23657E-06	0.23254E-06
1.4	0.12392E-01	0.12375E-01	0.22166E-01	0.21397E-01	0.30543E-01	0.30561E-01	0.24198E-06	0.24300E-06
1.5	0.13090E-01	0.12943E-01	0.22689E-01	0.22371E-01	0.32289E-01	0.31957E-01	0.25222E-06	0.25310E-06
1.6	0.13963E-01	0.13500E-01	0.23911E-01	0.23326E-01	0.34034E-01	0.33326E-01	0.26826E-06	0.26286E-06
1.7	0.14137E-01	0.14047E-01	0.24784E-01	0.24263E-01	0.34907E-01	0.34670E-01	0.27166E-06	0.27233E-06
1.8	0.14486E-01	0.14585E-01	0.26005E-01	0.25184E-01	0.36652E-01	0.35991E-01	0.28239E-06	0.28151E-06
1.9	0.15708E-01	0.15114E-01	0.26529E-01	0.26091E-01	0.38397E-01	0.37291E-01	0.29793E-06	0.29044E-06
2.0	0.15883E-01	0.15636E-01	0.27576E-01	0.26984E-01	0.39270E-01	0.38572E-01	0.30234E-06	0.29913E-06
2.1	0.15883E-01	0.16150E-01	0.28274E-01	0.27864E-01	0.41015E-01	0.39835E-01	0.30651E-06	0.30760E-06
2.2	0.16581E-01	0.16658E-01	0.29322E-01	0.28733E-01	0.41888E-01	0.41081E-01	0.31623E-06	0.31588E-06
2.3	0.17453E-01	0.17160E-01	0.29845E-01	0.29591E-01	0.43633E-01	0.42313E-01	0.32823E-06	0.32396E-06
2.4	0.17453E-01	0.17656E-01	0.30892E-01	0.30439E-01	0.44506E-01	0.43530E-01	0.33087E-06	0.33180E-06
2.5	0.17628E-01	0.18146E-01	0.31416E-01	0.31277E-01	0.46251E-01	0.44733E-01	0.33500E-06	0.33963E-06
2.6	0.18326E-01	0.18632E-01	0.32463E-01	0.32107E-01	0.47124E-01	0.45925E-01	0.34552E-06	0.34723E-06
2.7	0.18500E-01	0.19113E-01	0.33161E-01	0.32929E-01	0.47997E-01	0.47105E-01	0.34791E-06	0.35470E-06
2.8	0.19199E-01	0.19590E-01	0.34034E-01	0.33744E-01	0.49742E-01	0.48275E-01	0.36016E-06	0.36203E-06
2.9	0.19199E-01	0.20063E-01	0.34907E-01	0.34551E-01	0.50615E-01	0.49434E-01	0.36179E-06	0.36924E-06
3.0	0.20071E-01	0.20532E-01	0.35779E-01	0.35352E-01	0.52360E-01	0.50584E-01	0.37581E-06	0.37634E-06
4.0	0.24435E-01	0.25057E-01	0.43808E-01	0.43069E-01	0.64577E-01	0.61672E-01	0.44650E-06	0.44226E-06
5.0	0.27925E-01	0.29561E-01	0.51836E-01	0.50400E-01	0.75922E-01	0.72212E-01	0.50479E-06	0.50149E-06
6.0	0.31416E-01	0.33505E-01	0.55941E-01	0.57454E-01	0.86394E-01	0.82360E-01	0.55650E-06	0.55594E-06
7.0	0.34907E-01	0.37529E-01	0.66323E-01	0.64206E-01	0.97738E-01	0.92192E-01	0.60975E-06	0.60653E-06
8.0	0.38397E-01	0.41440E-01	0.73304E-01	0.70927E-01	0.10734E 00	0.10175E 00	0.65389E-06	0.65380E-06
9.0	0.41888E-01	0.45255E-01	0.80111E-01	0.77398E-01	0.11694E 00	0.11107E 00	0.69902E-06	0.69914E-06
10.0	0.45379E-01	0.48985E-01	0.86917E-01	0.83717E-01	0.12654E 00	0.12017E 00	0.74215E-06	0.73984E-06
11.0	0.48869E-01	0.52632E-01	0.93201E-01	0.89899E-01	0.13526E 00	0.12900E 00	0.77971E-06	0.77916E-06
12.0	0.52360E-01	0.56211E-01	0.99484E-01	0.95956E-01	0.14399E 00	0.13781E 00	0.81727E-06	0.81632E-06
13.0	0.54978E-01	0.59724E-01	0.10559E 00	0.10190E 00	0.15272E 00	0.14639E 00	0.84498E-06	0.85152E-06
14.0	0.58469E-01	0.63179E-01	0.11170E 00	0.10774E 00	0.16144E 00	0.15481E 00	0.88153E-06	0.88493E-06
15.0	0.61959E-01	0.66580E-01	0.11729E 00	0.11349E 00	0.17017E 00	0.16310E 00	0.91505E-06	0.91669E-06
16.0	0.65450E-01	0.69932E-01	0.12339E 00	0.11915E 00	0.17802E 00	0.17127E 00	0.94805E-06	0.94696E-06
17.0	0.68068E-01	0.73238E-01	0.12915E 00	0.12472E 00	0.18675E 00	0.17932E 00	0.97374E-06	0.97584E-06
18.0	0.71559E-01	0.76502E-01	0.13456E 00	0.13023E 00	0.19548E 00	0.18727E 00	0.10063E-05	0.10035E-05
19.0	0.75049E-01	0.79727E-01	0.14015E 00	0.13567E 00	0.20246E 00	0.19512E 00	0.10327E-05	0.10294E-05
20.0	0.77667E-01	0.82917E-01	0.14556E 00	0.14104E 00	0.21206E 00	0.20289E 00	0.10599E-05	0.10552E-05
21.0	0.80285E-01	0.86073E-01	0.15132E 00	0.14636E 00	0.21817E 00	0.21057E 00	0.10750E-05	0.10796E-05
22.0	0.83776E-01	0.89159E-01	0.15691E 00	0.15162E 00	0.22515E 00	0.21617E 00	0.11014E-05	0.11030E-05
23.0	0.87266E-01	0.92295E-01	0.16232E 00	0.15684E 00	0.23300E 00	0.22570E 00	0.11303E-05	0.11255E-05
24.0	0.89884E-01	0.95365E-01	0.16773E 00	0.16200E 00	0.24006E 00	0.23317E 00	0.11505E-05	0.11472E-05
25.0	0.92502E-01	0.98408E-01	0.17279E 00	0.16712E 00	0.24704E 00	0.24057E 00	0.11650E-05	0.11681E-05
26.0	0.95120E-01	0.10143E 00	0.17959E 00	0.17220E 00	0.25402E 00	0.24791E 00	0.11897E-05	0.11883E-05
27.0	0.97738E-01	0.10443E 00	0.18500E 00	0.17724E 00	0.26180E 00	0.25520E 00	0.12062E-05	0.12078E-05
28.0	0.10123E 00	0.10740E 00	0.19024E 00	0.18224E 00	0.27053E 00	0.26243E 00	0.12378E-05	0.12266E-05
29.0	0.10297E 00	0.11036E 00	0.19565E 00	0.18720E 00	0.27576E 00	0.26961E 00	0.12384E-05	0.12449E-05
30.0	0.10647E 00	0.11330E 00	0.20069E 00	0.19213E 00	0.28274E 00	0.27674E 00	0.12628E-05	0.12626E-05
32.0	0.11170E 00	0.11912E 00	0.21118E 00	0.20190E 00	0.29583E 00	0.29088E 00	0.12894E-05	0.12963E-05
34.0	0.11781E 00	0.12487E 00	0.22131E 00	0.21156E 00	0.30892E 00	0.30485E 00	0.13236E-05	0.13279E-05
36.0	0.12305E 00	0.13056E 00	0.23126E 00	0.22111E 00	0.32289E 00	0.31867E 00	0.13519E-05	0.13573E-05
38.0	0.12915E 00	0.13620E 00	0.24086E 00	0.23056E 00	0.33510E 00	0.33235E 00	0.13797E-05	0.13850E-05
40.0	0.13439E 00	0.14179E 00	0.25133E 00	0.23991E 00	0.34907E 00	0.34590E 00	0.14109E-05	0.14125E-05
42.0	0.13963E 00	0.14732E 00	0.26093E 00	0.24919E 00	0.36216E 00	0.35934E 00	0.14334E-05	0.14377E-05
44.0	0.14661E 00	0.15282E 00	0.27000E 00	0.25837E 00	0.37525E 00	0.37266E 00	0.14706E-05	0.14614E-05
46.0	0.15184E 00	0.15827E 00	0.27890E 00	0.26751E 00	0.38746E 00	0.38508E 00	0.14856E-05	0.14840E-05
48.0	0.15708E 00	0.16360E 00	0.28798E 00	0.27657E 00	0.40055E 00	0.39900E 00	0.15051E-05	0.15053E-05
50.0	0.16319E 00	0.16906E 00	0.29671E 00	0.28556E 00	0.41364E 00	0.41203E 00	0.15314E-05	0.15255E-05
52.0	0.16930E 00	0.17440E 00	0.30576E 00	0.29449E 00	0.42673E 00	0.42497E 00	0.15567E-05	0.15446E-05
54.0	0.17453E 00	0.17971E 00	0.31381E 00	0.30336E 00	0.43982E 00	0.43784E 00	0.15732E-05	0.15628E-05
56.0	0.17977E 00	0.18499E 00	0.32254E 00	0.31218E 00	0.45117E 00	0.45062E 00	0.15836E-05	0.15800E-05
58.0	0.18500E 00	0.19024E 00	0.33091E 00	0.32095E 00	0.46339E 00	0.46334E 00	0.15956E-05	0.15964E-05
60.0	0.19024E 00	0.19546E 00	0.34016E 00	0.32967E 00	0.47560E 00	0.47598E 00	0.16125E-05	0.16119E-05
62.0	0.19548E 00	0.20065E 00	0.34872E 00	0.33834E 00	0.48782E 00	0.48856E 00	0.16255E-05	0.16266E-05
64.0	0.20071E 00	0.20582E 00	0.35727E 00	0.34697E 00	0.50004E 00	0.50108E 00	0.16384E-05	0.16405E-05
66.0	0.20682E 00	0.21097E 00	0.36565E 00	0.35556E 00	0.51225E 00	0.51354E 00	0.16592E-05	0.16538E-05
68.0	0.21206E 00	0.21609E 00	0.37385E 00	0.36411E 00	0.52447E 00	0.52594E 00	0.16705E-05	0.16663E-05
70.0	0.21642E 00	0.22120E 00	0.38223E 00	0.37263E 00	0.53756E 00	0.53830E 00	0.16768E-05	0.16783E-05
72.0	0.22166E 00	0.22628E 00	0.39095E 00	0.38111E 00	0.54891E 00	0.55060E 00	0.16872E-05	0.16896E-05
74.0	0.22689E 00	0.23135E 00	0.39863E 00	0.38955E 00	0.56025E 00	0.56286E 00	0.16915E-05	0.17004E-05
76.0	0.23213E 00	0.23640E 00	0.40701E 00	0.39797E 00	0.57247E 00	0.57507E 00	0.17035E-05	0.17106E-05
78.0	0.23736E 00	0.24143E 00	0.41539E 00	0.40635E 00	0.58294E 00	0.58724E 00	0.17083E-05	0.17203E-05
80.0	0.24260E 00	0.24644E 00	0.42412E 00	0.41471E 00	0.59603E 00	0.59936E 00	0.17258E-05	0.17295E-05
82.0	0.24784E 00	0.25144E 00	0.43232E 00	0.42304E 00	0.60650E 00	0.61146E 00	0.17296E-05	0.17382E-05
84.0	0.25307E 00	0.25642E 00	0.44000E 00	0.43134E 00	0.61785E 00	0.62351E 00	0.17340E-05	0.17465E-05
86.0	0.25831E 00	0.26139E 00	0.44855E 00	0.43962E 00	0.63006E 00	0.63553E 00	0.17469E-05	0.17544E-05
88.0	0.26354E 00	0.26635E 00	0.45710E 00	0.44788E 00	0.64228E 00	0.64752E 00	0.17599E-05	0.17619E-05
90.0	0.26965E 00	0.27129E 00	0.46478E 00	0.45611E 00	0.65450E 00	0.65947E 00	0.17766E-05	0.17690E-05
92.0	0.27576E 00	0.27623E 00	0.47298E 00	0.46433E 00	0.66672E 00	0.67140E 00	0.17964E-05	0.17757E-05
94.0	0.28100E 00	0.28115E 00	0.47997E 00	0.47252E 00	0.67719E 00	0.68330E 00	0.17931E-05	0.17821E-05
STD DEV =		0.40589E-02		0.65503E-02		0.41795E-02		0.53047E-08

Figure D-3. Viscoelastic Analysis for Asphalt 45 at 39.2°F (Cont'd.).

DATA SHEET

EQUATION OF BEST FIT. n=2

EQUATION OF BEST FIT, n=1

SUMMARY SHEET FOR VISCOELASTIC ANALYSIS

ASPHALT NO- 53 LOADS- 000 1400 2000 GM

TEST TEMP- 39.2 F CTS- 32566. 58017. 84381. DY/SQCM

TAU1 = 0.12047016 04 SEC G1 = 0.60018646 06 DYNES/SQ CM VISC1 = 0.72304526 09 POISES

TAU1 = 0.16109008 04 SEC G1 = 0.67531008 06 DYNES/SQ CM VISC1 = 0.10876628 10 POISES

TAU2 = 0.10897506 03 SEC G2 = 0.63750726 07 DYNES/SQ CM VISC2 = 0.45906578 09 POISES

TIME MIN	THETA 1 RAD	CF 1 RA/D/SQCM	THETA 2 RAD	CF 2 RA/D/SQCM	THETA 3 RAD	CF 3 RA/D/SQCM	AVG CF RA/D/SQCM
0.0	0.26180E-02	-0.00000E-38	0.00000E-38	-0.00000E-36	0.34907E-02	-0.00000E-38	-0.00000E-36
0.1	0.34907E-02	0.22750E-07	0.29671E-02	0.44274E-07	0.61087E-02	0.24377E-07	0.30000E-07
0.2	0.43633E-02	0.41500E-07	0.45379E-02	0.44809E-07	0.78540E-02	0.39612E-07	0.48642E-07
0.3	0.52360E-02	0.62250E-07	0.61087E-02	0.65344E-07	0.95993E-02	0.54247E-07	0.67280E-07
0.4	0.61087E-02	0.83000E-07	0.73304E-02	0.99964E-07	0.10472E-01	0.58540E-07	0.80494E-07
0.5	0.69813E-02	0.10175E-06	0.87267E-02	0.11751E-06	0.12217E-01	0.71175E-07	0.96145E-07
0.6	0.78540E-02	0.12455E-06	0.10297E-01	0.13905E-06	0.13963E-01	0.97010E-07	0.11678E-06
0.7	0.87267E-02	0.14675E-06	0.10995E-01	0.14374E-06	0.14835E-01	0.92103E-07	0.12703E-06
0.8	0.87267E-02	0.13925E-06	0.12392E-01	0.16131E-06	0.15708E-01	0.96376E-07	0.13233E-06
0.9	0.95993E-02	0.15995E-06	0.13788E-01	0.17888E-06	0.17453E-01	0.11103E-06	0.14995E-06
1.0	0.10472E-01	0.18075E-06	0.14486E-01	0.18458E-06	0.18326E-01	0.11553E-06	0.16020E-06
1.1	0.11345E-01	0.20145E-06	0.15865E-01	0.20214E-06	0.19199E-01	0.11962E-06	0.17440E-06
1.2	0.12217E-01	0.22220E-06	0.17104E-01	0.21674E-06	0.20944E-01	0.13425E-06	0.19106E-06
1.3	0.12217E-01	0.21614E-06	0.17628E-01	0.21947E-06	0.21817E-01	0.13854E-06	0.19139E-06
1.4	0.13090E-01	0.23691E-06	0.19199E-01	0.24001E-06	0.22689E-01	0.14254E-06	0.20658E-06
1.5	0.13963E-01	0.25766E-06	0.20071E-01	0.24867E-06	0.24435E-01	0.15747E-06	0.22126E-06
1.6	0.13963E-01	0.25161E-06	0.20944E-01	0.25734E-06	0.25307E-01	0.16177E-06	0.22357E-06

OBSERVED THETA 1 (RAD)	CALCULATED THETA 1 (RAD)	OBSERVED THETA 2 (RAD)	CALCULATED THETA 2 (RAD)	OBSERVED THETA 3 (RAD)	CALCULATED THETA 3 (RAD)	OBSERVED CP FUNCTION (RA/D/SQCM)	CALCULATED CP FUNCTION (RA/D/SQCM)
0.26180E-02	0.12049E-01	0.00000E-38	0.21762E-01	0.34907E-02	0.31220E-01	-0.00000E-38	-0.00000E-38
0.34907E-02	0.12515E-01	0.29671E-02	0.22611E-01	0.61087E-02	0.37429E-01	0.30000E-07	0.82776E-08
0.43633E-02	0.12901E-01	0.45379E-02	0.23459E-01	0.78540E-02	0.33634E-01	0.48640E-07	0.16514E-07
0.52360E-02	0.13344E-01	0.61087E-02	0.24304E-01	0.95993E-02	0.34836E-01	0.67280E-07	0.24710E-07
0.61087E-02	0.13907E-01	0.73304E-02	0.25146E-01	0.10472E-01	0.36035E-01	0.80494E-07	0.32865E-07

STD DEV =	0.39404E-02	0.10939E-01	0.60654E-01	0.63321E-07	STD DEV =	0.51157E-02	0.12980E-01	0.61458E-01	0.15033E-07

Figure D-4. Viscoelastic Analysis for Asphalt 53 at 39.2°F.

EQUATION OF BEST FIT n=3

EQUATION OF BEST FIT, n=4

n=3:

TAU1 = 0.1636700E 04 SEC G1 = 0.6826800E 06 DYNES/SQ CM VISC1 = 0.1117344E 10 POISES

TAU2 = 0.1519764E 03 SEC G2 = 0.4560774E 07 DYNES/SQ CM VISC2 = 0.6934508E 09 POISES

TAU3 = 0.1565937E 02 SEC G3 = 0.2563183E 08 DYNES/SQ CM VISC3 = 0.4013783E 09 POISES

n=4:

TAU1 = 0.1637899E 04 SEC G1 = 0.6831098E 06 DYNES/SQ CM VISC1 = 0.1118865E 10 POISES

TAU2 = 0.1577221E 03 SEC G2 = 0.4607306E 07 DYNES/SQ CM VISC2 = 0.7240816E 09 POISES

TAU3 = 0.2636450E 02 SEC G3 = 0.2731852E 08 DYNES/SQ CM VISC3 = 0.7199601E 09 POISES

TAU4 = 0.2101434E 00 SEC G4 = 0.1061909E 09 DYNES/SQ CM VISC4 = 0.2233121E 08 POISES

TIME (MIN)	OBSERVED THETA 1 (RAD)	CALCULATED THETA 1 (RAD)	OBSERVED THETA 2 (RAD)	CALCULATED THETA 2 (RAD)	OBSERVED THETA 3 (RAD)	CALCULATED THETA 3 (RAD)	OBSERVED CP FUNCTION (RA/D/SQCM)	CALCULATED CP FUNCTION (RA/D/SQCM)	OBSERVED THETA 1 (RAD)	CALCULATED THETA 1 (RAD)	OBSERVED THETA 2 (RAD)	CALCULATED THETA 2 (RAD)	OBSERVED THETA 3 (RAD)	CALCULATED THETA 3 (RAD)	OBSERVED CP FUNCTION (RA/D/SQCM)	CALCULATED CP FUNCTION (RA/D/SQCM)
0.0	0.26180E-02	0.12049E-01	0.00000E-38	0.21762E-01	0.34907E-02	0.31220E-01	-0.00000E-38	-0.00000E-38	0.26180E-02	0.12049E-01	0.00000E-38	0.21762E-01	0.34907E-02	0.31220E-01	-0.00000E-38	-0.00000E-38
0.1	0.34907E-02	0.13101E-01	0.29671E-02	0.23669E-01	0.61087E-02	0.33945E-01	0.30000E-07	0.26251E-07	0.34907E-02	0.13228E-01	0.29671E-02	0.23899E-01	0.61087E-02	0.34276E-01	0.30000E-07	0.30170E-07
0.2	0.43633E-02	0.14013E-01	0.45379E-02	0.25323E-01	0.78540E-02	0.36308E-01	0.49640E-07	0.48202E-07	0.43633E-02	0.14041E-01	0.45379E-02	0.25375E-01	0.78540E-02	0.36383E-01	0.48643E-07	0.49089E-07
0.3	0.52360E-02	0.14026E-01	0.61087E-02	0.26798E-01	0.95993E-02	0.38415E-01	0.67280E-07	0.67123E-07	0.52360E-02	0.14805E-01	0.61087E-02	0.26761E-01	0.95993E-02	0.38362E-01	0.67280E-07	0.66494E-07
0.4	0.61087E-02	0.15568E-01	0.73304E-02	0.28147E-01	0.10472E-01	0.40340E-01	0.80494E-07	0.83065E-07	0.61087E-02	0.15528E-01	0.73304E-02	0.28074E-01	0.10472E-01	0.40235E-01	0.80494E-07	0.82642E-07
0.5	0.69813E-02	0.16260E-01	0.87267E-02	0.29404E-01	0.12217E-01	0.42113E-01	0.98145E-07	0.99064E-07	0.69813E-02	0.16217E-01	0.87267E-02	0.29325E-01	0.12217E-01	0.42019E-01	0.98145E-07	0.97740E-07
0.6	0.78540E-02	0.16914E-01	0.10297E-01	0.30593E-01	0.13963E-01	0.43828E-01	0.11679E-06	0.11313E-06	0.78540E-02	0.16876E-01	0.10297E-01	0.30524E-01	0.13963E-01	0.43729E-01	0.11679E-06	0.11195E-06
0.7	0.87267E-02	0.17541E-01	0.10996E-01	0.31731E-01	0.14835E-01	0.45451E-01	0.12703E-06	0.12631E-06	0.87267E-02	0.17512E-01	0.10996E-01	0.31679E-01	0.14835E-01	0.45379E-01	0.12703E-06	0.12547E-06
0.8	0.87267E-02	0.18145E-01	0.12392E-01	0.32830E-01	0.15708E-01	0.47016E-01	0.13240E-06	0.13881E-06	0.87267E-02	0.18126E-01	0.12392E-01	0.32796E-01	0.15708E-01	0.46968E-01	0.13230E-06	0.13824E-06
0.9	0.95993E-02	0.18731E-01	0.13788E-01	0.33896E-01	0.17453E-01	0.48536E-01	0.14995E-06	0.15077E-06	0.95993E-02	0.18722E-01	0.13788E-01	0.33881E-01	0.17453E-01	0.48513E-01	0.14995E-06	0.15060E-06
1.0	0.10472E-01	0.19303E-01	0.14486E-01	0.34937E-01	0.18326E-01	0.50018E-01	0.16020E-06	0.16229E-06	0.10472E-01	0.19303E-01	0.14486E-01	0.34937E-01	0.18326E-01	0.50018E-01	0.16020E-06	0.16228E-06
1.1	0.11345E-01	0.19863E-01	0.15883E-01	0.35955E-01	0.19199E-01	0.51469E-01	0.17440E-06	0.17343E-06	0.11345E-01	0.19870E-01	0.15883E-01	0.35968E-01	0.19199E-01	0.51486E-01	0.17440E-06	0.17364E-06
1.2	0.12217E-01	0.20412E-01	0.17104E-01	0.36955E-01	0.20944E-01	0.52892E-01	0.19107E-06	0.18425E-06	0.12217E-01	0.20424E-01	0.17104E-01	0.36976E-01	0.20944E-01	0.52923E-01	0.19107E-06	0.18462E-06
1.3	0.12217E-01	0.20952E-01	0.17628E-01	0.37937E-01	0.21817E-01	0.54291E-01	0.19139E-06	0.19470E-06	0.12217E-01	0.20968E-01	0.17628E-01	0.37965E-01	0.21817E-01	0.54332E-01	0.19139E-06	0.19526E-06
1.4	0.13090E-01	0.21484E-01	0.19199E-01	0.38904E-01	0.22689E-01	0.55668E-01	0.20658E-06	0.20505E-06	0.13090E-01	0.21501E-01	0.19199E-01	0.38936E-01	0.22689E-01	0.55714E-01	0.20658E-06	0.20560E-06
1.5	0.13963E-01	0.22007E-01	0.20071E-01	0.39857E-01	0.24435E-01	0.57025E-01	0.22127E-06	0.21530E-06	0.13963E-01	0.22026E-01	0.20071E-01	0.39891E-01	0.24435E-01	0.57073E-01	0.22127E-06	0.21566E-06
1.6	0.13963E-01	0.22523E-01	0.20944E-01	0.40796E-01	0.25307E-01	0.58362E-01	0.22357E-06	0.22448E-06	0.13963E-01	0.22542E-01	0.20944E-01	0.40830E-01	0.25307E-01	0.58411E-01	0.22357E-06	0.22546E-06
1.7	0.14835E-01	0.23032E-01	0.22166E-01	0.41723E-01	0.26180E-01	0.59681E-01	0.23579E-06	0.23446E-06	0.14835E-01	0.23050E-01	0.22166E-01	0.41756E-01	0.26180E-01	0.59729E-01	0.23673E-06	0.23532E-06
1.8	0.15708E-01	0.23535E-01	0.22689E-01	0.42638E-01	0.27053E-01	0.60984E-01	0.24604E-06	0.24389E-06	0.15708E-01	0.23552E-01	0.22689E-01	0.42669E-01	0.27053E-01	0.61028E-01	0.24604E-06	0.24437E-06
1.9	0.15708E-01	0.24031E-01	0.24086E-01	0.43542E-01	0.27925E-01	0.62270E-01	0.25135E-06	0.25304E-06	0.15708E-01	0.24046E-01	0.24086E-01	0.43569E-01	0.27925E-01	0.62310E-01	0.25131E-06	0.25351E-06
2.0	0.16581E-01	0.24521E-01	0.24609E-01	0.44435E-01	0.28798E-01	0.63540E-01	0.26067E-06	0.26205E-06	0.16581E-01	0.24535E-01	0.24609E-01	0.44459E-01	0.28798E-01	0.63575E-01	0.26057E-06	0.26246E-06
2.1	0.16581E-01	0.25006E-01	0.26005E-01	0.45317E-01	0.29671E-01	0.64796E-01	0.26984E-06	0.27009E-06	0.16581E-01	0.25017E-01	0.26006E-01	0.45337E-01	0.29671E-01	0.64825E-01	0.26584E-06	0.27123E-06
2.2	0.17453E-01	0.25485E-01	0.26704E-01	0.46190E-01	0.31416E-01	0.66039E-01	0.27954E-06	0.27955E-06	0.17453E-01	0.25494E-01	0.26704E-01	0.46206E-01	0.31416E-01	0.66061E-01	0.27954E-06	0.27982E-06
2.3	0.18326E-01	0.25959E-01	0.27925E-01	0.47053E-01	0.32289E-01	0.67266E-01	0.29275E-06	0.28835E-06	0.18326E-01	0.25965E-01	0.27925E-01	0.47065E-01	0.32289E-01	0.67282E-01	0.29275E-06	0.28825E-06
2.4	0.18326E-01	0.26428E-01	0.28449E-01	0.47907E-01	0.33161E-01	0.68480E-01	0.29308E-06	0.29640E-06	0.18326E-01	0.26432E-01	0.28449E-01	0.47914E-01	0.33161E-01	0.68491E-01	0.29308E-06	0.29652E-06
2.5	0.19199E-01	0.26892E-01	0.29671E-01	0.48752E-01	0.34034E-01	0.69682E-01	0.30629E-06	0.30459E-06	0.19199E-01	0.26893E-01	0.29671E-01	0.48755E-01	0.34034E-01	0.69687E-01	0.30629E-06	0.30469E-06
2.6	0.20071E-01	0.27350E-01	0.30194E-01	0.49588E-01	0.34907E-01	0.70872E-01	0.31555E-06	0.31254E-06	0.20071E-01	0.27350E-01	0.30194E-01	0.49587E-01	0.34907E-01	0.70871E-01	0.31555E-06	0.31262E-06
2.7	0.20071E-01	0.27805E-01	0.31416E-01	0.50416E-01	0.35779E-01	0.72050E-01	0.31983E-06	0.32055E-06	0.20071E-01	0.27802E-01	0.31416E-01	0.50412E-01	0.35779E-01	0.72043E-01	0.31983E-06	0.32047E-06
2.8	0.20944E-01	0.28255E-01	0.32114E-01	0.51237E-01	0.36652E-01	0.73216E-01	0.33008E-06	0.32837E-06	0.20944E-01	0.28250E-01	0.32114E-01	0.51228E-01	0.36652E-01	0.73204E-01	0.33008E-06	0.32813E-06
2.9	0.20944E-01	0.28701E-01	0.33161E-01	0.52049E-01	0.37525E-01	0.74371E-01	0.33337E-06	0.33597E-06	0.20944E-01	0.28694E-01	0.33161E-01	0.52037E-01	0.37525E-01	0.74354E-01	0.33337E-06	0.33576E-06
3.0	0.21817E-01	0.29142E-01	0.33685E-01	0.52854E-01	0.38397E-01	0.75516E-01	0.34263E-06	0.34346E-06	0.21817E-01	0.29134E-01	0.33685E-01	0.52839E-01	0.38397E-01	0.75494E-01	0.34263E-06	0.34322E-06
4.0	0.26180E-01	0.33361E-01	0.41713E-01	0.60547E-01	0.46251E-01	0.86449E-01	0.40293E-06	0.41256E-06	0.26180E-01	0.33341E-01	0.41713E-01	0.60511E-01	0.46251E-01	0.86397E-01	0.40293E-06	0.41195E-06
5.0	0.30543E-01	0.37293E-01	0.50440E-01	0.67721E-01	0.54978E-01	0.96637E-01	0.47063E-06	0.47291E-06	0.30543E-01	0.37271E-01	0.50440E-01	0.67681E-01	0.54978E-01	0.96580E-01	0.47063E-06	0.47214E-06
6.0	0.34907E-01	0.41014E-01	0.57596E-01	0.74616E-01	0.62632E-01	0.10620E 00	0.52598E-06	0.52664E-06	0.34907E-01	0.40995E-01	0.57596E-01	0.74581E-01	0.62632E-01	0.10623E 00	0.52598E-06	0.52604E-06
7.0	0.39270E-01	0.44579E-01	0.64577E-01	0.81028E-01	0.69813E-01	0.11552E 00	0.57609E-06	0.57562E-06	0.39270E-01	0.44566E-01	0.64577E-01	0.81002E-01	0.69813E-01	0.11540E 00	0.57609E-06	0.57617E-06
8.0	0.42761E-01	0.48023E-01	0.71559E-01	0.87322E-01	0.78540E-01	0.12445E 00	0.62576E-06	0.62092E-06	0.42761E-01	0.48014E-01	0.71559E-01	0.87306E-01	0.78540E-01	0.12442E 00	0.62576E-06	0.62042E-06
9.0	0.46251E-01	0.51372E-01	0.78540E-01	0.93443E-01	0.85521E-01	0.13313E 00	0.66775E-06	0.66328E-06	0.46251E-01	0.51367E-01	0.78540E-01	0.93434E-01	0.85521E-01	0.13311E 00	0.66775E-06	0.66311E-06
10.0	0.49742E-01	0.54642E-01	0.85347E-01	0.99429E-01	0.92502E-01	0.14160E 00	0.70874E-06	0.70323E-06	0.49742E-01	0.54640E-01	0.85347E-01	0.99420E-01	0.92502E-01	0.14160E 00	0.70674E-06	0.70317E-06
11.0	0.53233E-01	0.57847E-01	0.90757E-01	0.10528E 00	0.99484E-01	0.14991E 00	0.74102E-06	0.74115E-06	0.53233E-01	0.57847E-01	0.90757E-01	0.10529E 00	0.99484E-01	0.14991E 00	0.74102E-06	0.74118E-06
12.0	0.56723E-01	0.60993E-01	0.97738E-01	0.11104E 00	0.10647E 00	0.15806E 00	0.78300E-06	0.77731E-06	0.56723E-01	0.60996E-01	0.97738E-01	0.11105E 00	0.10647E 00	0.15807E 00	0.78300E-06	0.77740E-06
13.0	0.60214E-01	0.64089E-01	0.10332E 00	0.11670E 00	0.11345E 00	0.16608E 00	0.81787E-06	0.81189E-06	0.60214E-01	0.64093E-01	0.10332E 00	0.11671E 00	0.11345E 00	0.16609E 00	0.81787E-06	0.81204E-06
14.0	0.63705E-01	0.67138E-01	0.10978E 00	0.12229E 00	0.12043E 00	0.17399E 00	0.85688E-06	0.84505E-06	0.63705E-01	0.67143E-01	0.10978E 00	0.12229E 00	0.12043E 00	0.17400E 00	0.85688E-06	0.84521E-06
15.0	0.66323E-01	0.70144E-01	0.11537E 00	0.12779E 00	0.12566E 00	0.18178E 00	0.87512E-06	0.87690E-06	0.66323E-01	0.70149E-01	0.11537E 00	0.12780E 00	0.12566E 00	0.18179E 00	0.87512E-06	0.87706E-06
16.0	0.69813E-01	0.73110E-01	0.12113E 00	0.13322E 00	0.13265E 00	0.18946E 00	0.91018E-06	0.90751E-06	0.69813E-01	0.73116E-01	0.12113E 00	0.13323E 00	0.13265E 00	0.18946E 00	0.91018E-06	0.90768E-06
17.0	0.72431E-01	0.76039E-01	0.12671E 00	0.13858E 00	0.13963E 00	0.19705E 00	0.93532E-06	0.93697E-06	0.72431E-01	0.76044E-01	0.12671E 00	0.13859E 00	0.13963E 00	0.19707E 00	0.93532E-06	0.93714E-06
18.0	0.75922E-01	0.78932E-01	0.13265E 00	0.14388E 00	0.14661E 00	0.20455E 00	0.97136E-06	0.96513E-06	0.75922E-01	0.78937E-01	0.13265E 00	0.14389E 00	0.14661E 00	0.20456E 00	0.97136E-06	0.96549E-06
19.0	0.78540E-01	0.81790E-01	0.13700E 00	0.14912E 00	0.15272E 00	0.21196E 00	0.99107E-06	0.99265E-06	0.78540E-01	0.81795E-01	0.13700E 00	0.14912E 00	0.15272E 00	0.21197E 00	0.99107E-06	0.99279E-06
20.0	0.82031E-01	0.84616E-01	0.14312E 00	0.15429E 00	0.15970E 00	0.21928E 00	0.10232E-05	0.10190E-05	0.82031E-01	0.84621E-01	0.14312E 00	0.15430E 00	0.15970E 00	0.21930E 00	0.10232E-05	0.10197E-05
21.0	0.84649E-01	0.87411E-01	0.14053E 00	0.15941E 00	0.16493E 00	0.22653E 00	0.10404E-05	0.10443E-05	0.84649E-01	0.87415E-01	0.14053E 00	0.15942E 00	0.16493E 00	0.22654E 00	0.10404E-05	0.10444E-05
22.0	0.87266E-01	0.90176E-01	0.15359E 00	0.16448E 00	0.17192E 00	0.23369E 00	0.10626E-05	0.10687E-05	0.87266E-01	0.90180E-01	0.15359E 00	0.16449E 00	0.17192E 00	0.23370E 00	0.10626E-05	0.10689E-05
23.0	0.90757E-01	0.92912E-01	0.15883E 00	0.16950E 00	0.17715E 00	0.24079E 00	0.10876E-05	0.10923E-05	0.90757E-01	0.92915E-01	0.15883E 00	0.16950E 00	0.17715E 00	0.24079E 00	0.10876E-05	0.10924E-05
24.0	0.93375E-01	0.95621E-01	0.16424E 00	0.17446E 00	0.18413E 00	0.24781E 00	0.11119E-05	0.11150E-05	0.93375E-01	0.95623E-01	0.16424E 00	0.17447E 00	0.18413E 00	0.24781E 00	0.11119E-05	0.11151E-05
25.0	0.95993E-01	0.98305E-01	0.16930E 00	0.17936E 00	0.19024E 00	0.25476E 00	0.11306E-05	0.11369E-05	0.95993E-01	0.98305E-01	0.16930E 00	0.17936E 00	0.19024E 00	0.25476E 00	0.11306E-05	0.11369E-05
26.0	0.99611E-01	0.10096E 00	0.17453E 00	0.18425E 00	0.19635E 00	0.26164E 00	0.11504E-05	0.11580E-05	0.99611E-01	0.10096E 00	0.17453E 00	0.18425E 00	0.19635E 00	0.26164E 00	0.11504E-05	0.11580E-05
27.0	0.10123E 00	0.10359E 00	0.17976E 00	0.18908E 00	0.20246E 00	0.26846E 00	0.11711E-05	0.11783E-05	0.10123E 00	0.10359E 00	0.17976E 00	0.18908E 00	0.20246E 00	0.26846E 00	0.11711E-05	0.11783E-05
28.0	0.10385E 00	0.10620E 00	0.18518E 00	0.19386E 00	0.20944E 00	0.27522E 00	0.11942E-05	0.11979E-05	0.10385E 00	0.10620E 00	0.18518E 00	0.19386E 00	0.20944E 00	0.27522E 00	0.11942E-05	0.11979E-05
29.0	0.10647E 00	0.10878E 00	0.19024E 00	0.19860E 00	0.21468E 00	0.28192E 00	0.12095E-05	0.12169E-05	0.10647E 00	0.10878E 00	0.19024E 00	0.19860E 00	0.21468E 00	0.28192E 00	0.12095E-05	0.12150E-05
30.0	0.10996E 00	0.11134E 00	0.19548E 00	0.20330E 00	0.22073E 00	0.28856E 00	0.12381E-05	0.12350E-05	0.10996E 00	0.11136E 00	0.19548E 00	0.20330E 00	0.22070E 00	0.28856E 00	0.12381E-05	0.12350E-05
32.0	0.11519E 00	0.11641E 00	0.20420E 00	0.21259E 00	0.23307E 00	0.30167E 00	0.12711E-05	0.12695E-05	0.11519E 00	0.11640E 00	0.20420E 00	0.21259E 00	0.23307E 00	0.30167E 00	0.12711E-05	0.12695E-05
34.0	0.12043E 00	0.12139E 00	0.21468E 00	0.22173E 00	0.24435E 00	0.31459E 00	0.13036E-05	0.13015E-05	0.12043E 00	0.12139E 00	0.21468E 00	0.22173E 00	0.24435E 00	0.31459E 00	0.13036E-05	0.13015E-05
36.0	0.12479E 00	0.12630E 00	0.22427E 00	0.23074E 00	0.25656E 00	0.32731E 00	0.13292E-05	0.13313E-05	0.12479E 00	0.12629E 00	0.22427E 00	0.23074E 00	0.25656E 00	0.32730E 00	0.13292E-05	0.13313E-05
38.0	0.13003E 00	0.13113E 00	0.23370E 00	0.23963E 00	0.26791E 00	0.33985E 00	0.13592E-05	0.13590E-05	0.13003E 00	0.13113E 00	0.23370E 00	0.23963E 00	0.26791E 00	0.33985E 00	0.13592E-05	0.13590E-05
40.0	0.13439E 00	0.13591E 00	0.24270E 00	0.24840E 00	0.27925E 00	0.35223E 00	0.13783E-05	0.13847E-05	0.13439E 00	0.13591E 00	0.24270E 00	0.24840E 00	0.27925E 00	0.35222E 00	0.13783E-05	0.13846E-05
42.0	0.13875E 00	0.14063E 00	0.25133E 00	0.25707E 00	0.29060E 00	0.36445E 00	0.13945E-05	0.14086E-05	0.13875E 00	0.14063E 00	0.25133E 00	0.25707E 00	0.29060E 00	0.36445E 00	0.13965E-05	0.14085E-05
44.0	0.14399E 00	0.14529E 00	0.26040E 00	0.26564E 00	0.30194E 00	0.37654E 00	0.14226E-05	0.14320E-05	0.14399E 00	0.14529E 00	0.26040E 00	0.26563E 00	0.30194E 00	0.37653E 00	0.14226E-05	0.14320E-05
46.0	0.14835E 00	0.14990E 00	0.27035E 00	0.27411E 00	0.31241E 00	0.38849E 00	0.14432E-05	0.14514E-05	0.14835E 00	0.14990E 00	0.27035E 00	0.27411E 00	0.31241E 00	0.38849E 00	0.14432E-05	0.14514E-05
48.0	0.15359E 00	0.15446E 00	0.27873E 00	0.28250E 00	0.32289E 00	0.40031E 00	0.14630E-05	0.14706E-05	0.15359E 00	0.15446E 00	0.27873E 00	0.28249E 00	0.32289E 00	0.40031E 00	0.14630E-05	0.14706E-05
50.0	0.15795E 00	0.15898E 00	0.28721E 00	0.29081E 00	0.33336E 00	0.41202E 00	0.14756E-05	0.14894E-05	0.15795E 00	0.15898E 00	0.28721E 00	0.29080E 00	0.33336E 00	0.41202E 00	0.14756E-05	0.14884E-05
52.0	0.16232E 00	0.16346E 00	0.29514E 00	0.29904E 00	0.34383E 00	0.42362E 00	0.14853E-05	0.15050E-05	0.16232E 00	0.16346E 00	0.29514E 00	0.29904E 00	0.34383E 00	0.42362E 00	0.14853E-05	0.15049E-05
54.0	0.16755E 00	0.16790E 00	0.30351E 00	0.30721E 00	0.35605E 00	0.43514E 00	0.15129E-05	0.15204E-05	0.16755E 00	0.16790E 00	0.30351E 00	0.30720E 00	0.35605E 00	0.43513E 00	0.15129E-05	0.15203E-05
56.0	0.17192E 00	0.17230E 00	0.31189E 00	0.31531E 00	0.36652E 00	0.44655E 00	0.15246E-05	0.15347E-05	0.17192E 00	0.17230E 00	0.31189E 00	0.31530E 00	0.36652E 00	0.44655E 00	0.15246E-05	0.15346E-05
58.0	0.17628E 00	0.17667E 00	0.31974E 00	0.32335E 00	0.37874E 00	0.45788E 00	0.15402E-05	0.15480E-05	0.17628E 00	0.17667E 00	0.31974E 00	0.32334E 00	0.37874E 00	0.45788E 00	0.15402E-05	0.15479E-05
60.0	0.18151E 00	0.18101E 00	0.32795E 00	0.33134E 00	0.38921E 00	0.46913E 00	0.15599E-05	0.15603E-05	0.18151E 00	0.18101E 00	0.32795E 00	0.33133E 00	0.38921E 00	0.46913E 00	0.15599E-05	0.15603E-05
62.0	0.18588E 00	0.18533E 00	0.33563E 00	0.33927E 00	0.39968E 00	0.48031E 00	0.15677E-05	0.15710E-05	0.18588E 00	0.18532E 00	0.33563E 00	0.33927E 00	0.39968E 00	0.48031E 00	0.15677E-05	0.15717E-05
64.0	0.19024E 00	0.18961E 00	0.34383E 00	0.34716E 00	0.41015E 00	0.49142E 00	0.15784E-05	0.15825E-05	0.19024E 00	0.18961E 00	0.34383E 00	0.34715E 00	0.41015E 00	0.49141E 00	0.15784E-05	0.15824E-05
66.0	0.19460E 00	0.19387E 00	0.35203E 00	0.35500E 00	0.42237E 00	0.50246E 00	0.15960E-05	0.15924E-05	0.19460E 00	0.19387E 00	0.35203E 00	0.35500E 00	0.42237E 00	0.50246E 00	0.15960E-05	0.15923E-05
68.0	0.19897E 00	0.19811E 00	0.35989E 00	0.36280E 00	0.43459E 00	0.51345E 00	0.16117E-05	0.16016E-05	0.19897E 00	0.19811E 00	0.35989E 00	0.36280E 00	0.43459E 00	0.51345E 00	0.16117E-05	0.16016E-05
70.0	0.20333E 00	0.20233E 00	0.36809E 00	0.37057E 00	0.44506E 00	0.52438E 00	0.16224E-05	0.16132E-05	0.20333E 00	0.20233E 00	0.36809E 00	0.37056E 00	0.44506E 00	0.52438E 00	0.16226E-05	0.16131E-05
72.0	0.20595E 00	0.20653E 00	0.37560E 00	0.37829E 00	0.45553E 00	0.53526E 00	0.16113E-05	0.16181E-05	0.20595E 00	0.20653E 00	0.37560E 00	0.37829E 00	0.45553E 00	0.53526E 00	0.16113E-05	0.16181E-05
74.0	0.21118E 00	0.21071E 00	0.38327E 00	0.38599E 00	0.46775E 00	0.54609E 00	0.16349E-05	0.16255E-05	0.21118E 00	0.21071E 00	0.38327E 00	0.38599E 00	0.46775E 00	0.54609E 00	0.16349E-05	0.16255E-05
76.0	0.21555E 00	0.21487E 00	0.39095E 00	0.39365E 00	0.47822E 00	0.55690E 00	0.16427E-05	0.16324E-05	0.21555E 00	0.21487E 00	0.39095E 00	0.39365E 00	0.47822E 00	0.55688E 00	0.16427E-05	0.16324E-05
78.0	0.21991E 00	0.21901E 00	0.39828E 00	0.40129E 00	0.49044E 00	0.56763E 00	0.16554E-05	0.16388E-05	0.21991E 00	0.21901E 00	0.39828E 00	0.40129E 00	0.49044E 00	0.56763E 00	0.16554E-05	0.16387E-05
80.0	0.22340E 00	0.22315E 00	0.40614E 00	0.40890E 00	0.50091E 00	0.57834E 00	0.16552E-05	0.16447E-05	0.22340E 00	0.22315E 00	0.40614E 00	0.40890E 00	0.50091E 00	0.57834E 00	0.16552E-05	0.16447E-05
82.0	0.22777E 00	0.22726E 00	0.41399E 00	0.41648E 00	0.51138E 00	0.58901E 00	0.16640E-05	0.16502E-05	0.22777E 00	0.22726E 00	0.41399E 00	0.41648E 00	0.51138E 00	0.58901E 00	0.16640E-05	0.16502E-05
84.0	0.23213E 00	0.23137E 00	0.42132E 00	0.42404E 00	0.52360E 00	0.59965E 00	0.16767E-05	0.16553E-05	0.23213E 00	0.23137E 00	0.42132E 00	0.42404E 00	0.52360E 00	0.59965E 00	0.16767E-05	0.16553E-05
86.0	0.23562E 00	0.23546E 00	0.42935E 00	0.43159E 00	0.53582E 00	0.61026E 00	0.16844E-05	0.16601E-05	0.23562E 00	0.23546E 00	0.42935E 00	0.43158E 00	0.53582E 00	0.61026E 00	0.16844E-05	0.16601E-05
88.0	0.23998E 00	0.23955E 00	0.43668E 00	0.43910E 00	0.54803E 00	0.62084E 00	0.16970E-05	0.16645E-05	0.23998E 00	0.23955E 00	0.43668E 00	0.43910E 00	0.54803E 00	0.62084E 00	0.16970E-05	0.16645E-05
90.0	0.24435E 00	0.24362E 00	0.44454E 00	0.44661E 00	0.55851E 00	0.63140E 00	0.17058E-05	0.16686E-05	0.24435E 00	0.24362E 00	0.44454E 00	0.44661E 00	0.55851E 00	0.63140E 00	0.17058E-05	0.16686E-05
92.0	0.24784E 00	0.24768E 00	0.45239E 00	0.45409E 00	0.56898E 00	0.64193E 00	0.17056E-05	0.16725E-05	0.24784E 00	0.24768E 00	0.45239E 00	0.45409E 00	0.56898E 00	0.64193E 00	0.17056E-05	0.16725E-05
94.0	0.25133E 00	0.25173E 00	0.45937E 00	0.46156E 00	0.57858E 00	0.65244E 00	0.16971E-05	0.16760E-05	0.25133E 00	0.25174E 00	0.45937E 00	0.46156E 00	0.57858E 00	0.65244E 00	0.16971E-05	0.16760E-05
96.0	0.25656E 00	0.25578E 00	0.46670E 00	0.46901E 00	0.58818E 00	0.66293E 00	0.17003E-05	0.16793E-05	0.25656E 00	0.25578E 00	0.46670E 00	0.46901E 00	0.58818E 00	0.66293E 00	0.17003E-05	0.16793E-05
98.0	0.26005E 00	0.25982E 00	0.47386E 00	0.47645E 00	0.59865E 00	0.67339E 00	0.17042E-05	0.16824E-05	0.26005E 00	0.25982E 00	0.47386E 00	0.47646E 00	0.59865E 00	0.67339E 00	0.17042E-05	0.16824E-05
100.0	0.26442E 00	0.26385E 00	0.48154E 00	0.48388E 00	0.60737E 00	0.68384E 00	0.17051E-05	0.16852E-05	0.26442E 00	0.26385E 00	0.48154E 00	0.48388E 00	0.60737E 00	0.68384E 00	0.17051E-05	0.16853E-05
105.0	0.27402E 00	0.27390E 00	0.50091E 00	0.50240E 00	0.63181E 00	0.70989E 00	0.17052E-05	0.16915E-05	0.27402E 00	0.27390E 00	0.50091E 00	0.50240E 00	0.63181E 00	0.70989E 00	0.17052E-05	0.16915E-05
110.0	0.28449E 00	0.28392E 00	0.51836E 00	0.52086E 00	0.65450E 00	0.73585E 00	0.16965E-05	0.16967E-05	0.28449E 00	0.28392E 00	0.51836E 00	0.52086E 00	0.65450E 00	0.73586E 00	0.16965E-05	0.16966E-05
115.0	0.29496E 00	0.29390E 00	0.53756E 00	0.53926E 00	0.67981E 00	0.76174E 00	0.17080E-05	0.17011E-05	0.29496E 00	0.29391E 00	0.53756E 00	0.53927E 00	0.67981E 00	0.76175E 00	0.17080E-05	0.17011E-05
120.0	0.30369E 00	0.30387E 00	0.55501E 00	0.55763E 00	0.70511E 00	0.78757E 00	0.16917E-05	0.17047E-05	0.30369E 00	0.30387E 00	0.55501E 00	0.55763E 00	0.70511E 00	0.78757E 00	0.16917E-05	0.17048E-05
125.0	0.31416E 00	0.31381E 00	0.57247E 00	0.57595E 00	0.72955E 00	0.81334E 00	0.16899E-05	0.17077E-05	0.31416E 00	0.31381E 00	0.57247E 00	0.57596E 00	0.72955E 00	0.81335E 00	0.16899E-05	0.17078E-05
130.0	0.32289E 00	0.32374E 00	0.58992E 00	0.59425E 00	0.75573E 00	0.83908E 00	0.16771E-05	0.17102E-05	0.32289E 00	0.32374E 00	0.58992E 00	0.59426E 00	0.75573E 00	0.83908E 00	0.16771E-05	0.17103E-05
135.0	0.33161E 00	0.33365E 00	0.60825E 00	0.61252E 00	0.78191E 00	0.86477E 00	0.16692E-05	0.17123E-05	0.33161E 00	0.33366E 00	0.60825E 00	0.61253E 00	0.78191E 00	0.86478E 00	0.16692E-05	0.17124E-05
140.0	0.34034E 00	0.34356E 00	0.62657E 00	0.63078E 00	0.80807E 00	0.89044E 00	0.16614E-05	0.17141E-05	0.34034E 00	0.34356E 00	0.62657E 00	0.63078E 00	0.80809E 00	0.89045E 00	0.16614E-05	0.17141E-05
145.0	0.35081E 00	0.35345E 00	0.64228E 00	0.64901E 00	0.83252E 00	0.91608E 00	0.16496E-05	0.17156E-05	0.35081E 00	0.35345E 00	0.64228E 00	0.64902E 00	0.83252E 00	0.91609E 00	0.16496E-05	0.17156E-05

STD DEV = 0.51577E-02 0.13045E-01 0.61483E-01 0.14314E-07 0.51599E-02 0.13047E-01 0.61484E-01 0.14309E-07

END-OF-DATA ENCOUNTERED ON SYSTEM INPUT FILE.

Figure D-4. Viscoelastic Analysis for Asphalt 53 at 39.2°F (Cont'd.).

DATA SHEET | EQUATION OF BEST FIT; n=1 | EQUATION OF BEST FIT, n=2

SUMMARY SHEET FOR VISCOELASTIC ANALYSIS

ASPHALT NO- 67 LOADS- 800 1400 2000 GM
TEST TEMP- 39.2 F CFS- 34046. 59597. 82093. DY/SQCM

n=1: TAU1 = 0.1152333E 04 SEC G1 = 0.4126618E 06 DYNES/SQ CM VISC1 = 0.4755240E 09 POISES

n=2: TAU1 = 0.1830286E 04 SEC G1 = 0.4721093E 06 DYNES/SQ CM VISC1 = 0.6640952E 09 POISES
TAU2 = 0.9853921E 02 SEC G2 = 0.2135505E 07 DYNES/SQCM VISC2 = 0.2104310E 09 POISES

TIME MIN	THETA 1 RAD	CF 1 RA/D/SQCM	THETA 2 RAD	CF 2 RA/D/SQCM	THETA 3 RAD	CF 3 RA/D/SQCM	AVG CF RA/D/SQCM	n=1 OBSERVED THETA 1 (RAD)	n=1 CALCULATED THETA 1 (RAD)	n=1 OBSERVED THETA 2 (RAD)	n=1 CALCULATED THETA 2 (RAD)	n=1 OBSERVED THETA 3 (RAD)	n=1 CALCULATED THETA 3 (RAD)	n=1 OBSERVED CF FUNCTION (RA/D/SQCM)	n=1 CALCULATED CF FUNCTION (RA/D/SQCM)	n=2 OBSERVED THETA 1 (RAD)	n=2 CALCULATED THETA 1 (RAD)	n=2 OBSERVED THETA 2 (RAD)	n=2 CALCULATED THETA 2 (RAD)	n=2 OBSERVED THETA 3 (RAD)	n=2 CALCULATED THETA 3 (RAD)	n=2 OBSERVED CF FUNCTION (RA/D/SQCM)	n=2 CALCULATED CF FUNCTION (RA/D/SQCM)
0.0	0.15708E-02	-0.00000E-38	0.17453E-02	-0.00000E-38	0.54105E-02	-0.00000E-38	-0.0000000E-38	0.15708E-02	0.15054E-02	0.17453E-02	0.26175E-02	0.54105E-02	0.36299E-02	-0.00000E-38	-0.00000E-38	0.15708E-02	0.15054E-02	0.17453E-02	0.26175E-02	0.54105E-02	0.36249E-02	-0.00000E-38	-0.00000E-38
0.1	0.36652E-02	0.53903E-07	0.69813E-02	0.79854E-07	0.13265E-01	0.85659E-07	0.7316523E-07	0.36652E-02	0.21904E-02	0.69813E-02	0.38713E-02	0.13265E-01	0.56840E-02	0.73165E-07	0.12585E-07	0.36652E-02	0.24397E-02	0.69813E-02	0.51742E-02	0.13265E-01	0.72910E-02	0.73165E-07	0.34595E-07
0.2	0.52360E-02	0.92596E-07	0.10297E-01	0.12728E-06	0.17453E-01	0.12667E-06	0.1155112E-06	0.52360E-02	0.28731E-02	0.10297E-01	0.51213E-02	0.17453E-01	0.73348E-02	0.11551E-06	0.25104E-07	0.52360E-02	0.43176E-02	0.10297E-01	0.74329E-02	0.17453E-01	0.10910E-01	0.11551E-06	0.67532E-07
0.3	0.69813E-02	0.13632E-06	0.12392E-01	0.15406E-06	0.21118E-01	0.16130E-06	0.1505605E-06	0.69813E-02	0.35536E-02	0.12392E-01	0.63674E-02	0.21118E-01	0.91792E-02	0.15056E-06	0.37559E-07	0.69813E-02	0.56624E-02	0.12392E-01	0.99992E-02	0.21118E-01	0.14216E-01	0.15056E-06	0.98910E-07
0.4	0.78540E-02	0.15441E-06	0.15835E-01	0.18674E-06	0.24435E-01	0.19169E-06	0.1776140E-06	0.78540E-02	0.42319E-02	0.14835E-01	0.76097E-02	0.24435E-01	0.11018E-01	0.17761E-06	0.49949E-07	0.78540E-02	0.67111E-02	0.14835E-01	0.12279E-01	0.24435E-01	0.17443E-01	0.17761E-06	0.12882E-06
0.5	0.89012E-02	0.17764E-06	0.17279E-01	0.21942E-06	0.27751E-01	0.22207E-06	0.2063763E-06	0.89012E-02	0.49081E-02	0.17279E-01	0.88482E-02	0.27751E-01	0.12852E-01	0.20638E-06	0.62274E-07	0.89012E-02	0.81441E-02	0.17279E-01	0.14476E-01	0.27751E-01	0.20647E-01	0.20638E-06	0.15734E-06
0.6	0.10472E-01	0.21625E-06	0.18850E-01	0.23736E-06	0.29845E-01	0.23757E-06	0.2304903E-06	0.10472E-01	0.55820E-02	0.18850E-01	0.10083E-01	0.29845E-01	0.14681E-01	0.23039E-06	0.74536E-07	0.10472E-01	0.93281E-02	0.18850E-01	0.16596E-01	0.29845E-01	0.23713E-01	0.23039E-06	0.18456E-06
0.7	0.10821E-01	0.21896E-06	0.20769E-01	0.26120E-06	0.32987E-01	0.26582E-06	0.2486604E-06	0.10821E-01	0.62578E-02	0.20769E-01	0.11314E-01	0.32987E-01	0.16504E-01	0.24866E-06	0.86733E-07	0.10821E-01	0.10670E-01	0.20769E-01	0.18644E-01	0.32987E-01	0.26669E-01	0.24866E-06	0.21056E-06
0.8	0.12217E-01	0.25246E-06	0.22515E-01	0.28208E-06	0.34907E-01	0.27920E-06	0.2712397E-06	0.12217E-01	0.69235E-02	0.22515E-01	0.12541E-01	0.34907E-01	0.18322E-01	0.27124E-06	0.98868E-07	0.12217E-01	0.11572E-01	0.22515E-01	0.20623E-01	0.34907E-01	0.29510E-01	0.27124E-06	0.23540E-06
0.9	0.12392E-01	0.25003E-06	0.23736E-01	0.29413E-06	0.37350E-01	0.29994E-06	0.2810351E-06	0.12392E-01	0.75909E-02	0.23736E-01	0.13764E-01	0.37350E-01	0.20135E-01	0.28104E-06	0.11094E-06	0.12392E-01	0.12637E-01	0.23736E-01	0.22539E-01	0.37350E-01	0.32302E-01	0.28104E-06	0.25914E-06
1.0	0.13963E-01	0.28063E-06	0.25307E-01	0.31207E-06	0.39794E-01	0.31870E-06	0.3064665E-06	0.13963E-01	0.82563E-02	0.25307E-01	0.14984E-01	0.39794E-01	0.21943E-01	0.30647E-06	0.12295E-06	0.13963E-01	0.13667E-01	0.25307E-01	0.24392E-01	0.39794E-01	0.34909E-01	0.30667E-06	0.26107E-06
1.1 – 115.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

STD DEV = 0.82290E-02 0.10057E-01 0.26851E-01 0.13209E-06 STD DEV = 0.71108E-02 0.59016E-02 0.34458E-01 0.23137E-07

Figure D-5. Viscoelastic Analysis for Asphalt 67 at 39.2°F.

EQUATION OF BEST FIT n=3

TAU1 = 0.1953301E 04 SEC   G1 = 0.4860436E 06 DYNES/SQ CM   VISC1 = 0.9493803E 09 POISES

TAU2 = 0.1932104E 03 SEC   G2 = 0.2377316E 07 DYNES/SQ CM   VISC2 = 0.4593222E 09 POISES

TAU3 = 0.1372152E 02 SEC   G3 = 0.7637873E 07 DYNES/SQ CM   VISC3 = 0.1048032E 09 POISES

TIME (MIN)	OBSERVED THETA 1 (RAD)	CALCULATED THETA 1 (RAD)	OBSERVED THETA 2 (RAD)	CALCULATED THETA 2 (RAD)	OBSERVED THETA 3 (RAD)	CALCULATED THETA 3 (RAD)	OBSERVED CP FUNCTION (RA/D/SQCM)	CALCULATED CP FUNCTION (RA/D/SQCM)
0.0	0.15708E-02	0.15054E-02	0.17453E-02	0.26175E-02	0.54105E-02	0.36299E-02	-0.00000E-38	-0.00000E-38
0.1	0.36652E-02	0.39935E-02	0.69813E-02	0.70065E-02	0.13265E-01	0.98328E-02	0.73165E-07	0.65547E-07
0.2	0.52360E-02	0.59083E-02	0.10297E-01	0.10399E-01	0.17453E-01	0.14653E-01	0.11551E-06	0.11425E-06
0.3	0.69813E-02	0.74693E-02	0.12392E-01	0.13139E-01	0.21118E-01	0.18570E-01	0.15056E-06	0.15195E-06
0.4	0.78540E-02	0.87419E-02	0.14835E-01	0.15451E-01	0.24435E-01	0.21893E-01	0.17761E-06	0.18241E-06
0.5	0.89012E-02	0.98720E-02	0.17279E-01	0.17479E-01	0.27751E-01	0.24821E-01	0.20638E-06	0.20807E-06
0.6	0.10472E-01	0.10892E-01	0.18850E-01	0.19316E-01	0.29845E-01	0.27485E-01	0.23039E-06	0.23051E-06
0.7	0.10821E-01	0.11830E-01	0.20769E-01	0.21023E-01	0.32987E-01	0.29968E-01	0.24866E-06	0.25074E-06
0.8	0.12217E-01	0.12731E-01	0.22515E-01	0.22630E-01	0.34907E-01	0.32325E-01	0.27124E-06	0.26944E-06
0.9	0.12392E-01	0.13586E-01	0.23736E-01	0.24189E-01	0.37350E-01	0.34591E-01	0.28104E-06	0.28793E-06
1.0	0.13963E-01	0.14414E-01	0.25307E-01	0.25690E-01	0.39794E-01	0.36790E-01	0.30647E-06	0.30380E-06
1.1	0.14312E-01	0.15219E-01	0.27053E-01	0.27154E-01	0.41888E-01	0.38936E-01	0.31950E-06	0.31994E-06
1.2	0.15533E-01	0.16008E-01	0.28449E-01	0.28588E-01	0.43982E-01	0.41041E-01	0.33912E-06	0.33555E-06
1.3	0.15883E-01	0.16781E-01	0.29671E-01	0.29995E-01	0.46251E-01	0.43109E-01	0.34991E-06	0.35074E-06
1.4	0.16930E-01	0.17542E-01	0.31416E-01	0.31381E-01	0.48520E-01	0.45147E-01	0.37049E-06	0.36555E-06
1.5	0.17453E-01	0.18291E-01	0.32987E-01	0.32747E-01	0.50615E-01	0.47157E-01	0.38425E-06	0.38002E-06
1.6	0.18326E-01	0.19030E-01	0.33859E-01	0.34094E-01	0.52360E-01	0.49142E-01	0.39608E-06	0.39419E-06
1.7	0.19199E-01	0.19759E-01	0.35256E-01	0.35424E-01	0.54280E-01	0.51103E-01	0.41157E-06	0.40806E-06
1.8	0.19373E-01	0.20478E-01	0.36652E-01	0.36738E-01	0.56200E-01	0.53042E-01	0.42022E-06	0.42167E-06
1.9	0.20595E-01	0.21189E-01	0.38223E-01	0.38037E-01	0.58294E-01	0.54959E-01	0.44082E-06	0.43501E-06
2.0	0.20944E-01	0.21892E-01	0.39095E-01	0.39321E-01	0.60214E-01	0.56856E-01	0.44823E-06	0.44810E-06
2.1	0.21468E-01	0.22586E-01	0.40143E-01	0.40591E-01	0.61959E-01	0.58733E-01	0.45763E-06	0.46096E-06
2.2	0.22515E-01	0.23272E-01	0.41888E-01	0.41847E-01	0.63879E-01	0.60591E-01	0.47679E-06	0.47358E-06
2.3	0.22689E-01	0.23950E-01	0.42761E-01	0.43089E-01	0.65973E-01	0.62431E-01	0.48320E-06	0.48597E-06
2.4	0.23562E-01	0.24621E-01	0.43808E-01	0.44319E-01	0.67893E-01	0.64253E-01	0.49672E-06	0.49815E-06
2.5	0.24435E-01	0.25285E-01	0.45379E-01	0.45537E-01	0.69813E-01	0.66057E-01	0.51319E-06	0.51012E-06
2.6	0.24609E-01	0.25942E-01	0.46600E-01	0.46742E-01	0.71559E-01	0.67845E-01	0.52015E-06	0.52188E-06
2.7	0.25482E-01	0.26593E-01	0.47298E-01	0.47935E-01	0.73129E-01	0.69616E-01	0.53029E-06	0.53344E-06
2.8	0.26180E-01	0.27236E-01	0.48869E-01	0.49117E-01	0.74875E-01	0.71371E-01	0.54434E-06	0.54481E-06
2.9	0.26529E-01	0.27873E-01	0.50266E-01	0.50288E-01	0.76620E-01	0.73111E-01	0.55400E-06	0.55600E-06
3.0	0.27402E-01	0.28504E-01	0.50964E-01	0.51448E-01	0.78365E-01	0.74836E-01	0.56484E-06	0.56699E-06
4.0	0.33161E-01	0.34508E-01	0.62483E-01	0.62515E-01	0.93899E-01	0.91347E-01	0.66203E-06	0.66799E-06
5.0	0.38572E-01	0.40051E-01	0.72955E-01	0.72781E-01	0.10908E 00	0.10675E 00	0.74840E-06	0.75545E-06
6.0	0.44157E-01	0.45242E-01	0.82554E-01	0.82436E-01	0.12305E 00	0.12130E 00	0.82676E-06	0.83760E-06
7.0	0.49044E-01	0.50163E-01	0.92153E-01	0.91621E-01	0.13596E 00	0.13520E 00	0.89396E-06	0.90178E-06
8.0	0.54280E-01	0.54871E-01	0.10140E 00	0.10044E 00	0.14923E 00	0.14859E 00	0.96403E-06	0.96475E-06
9.0	0.59341E-01	0.59412E-01	0.11048E 00	0.10896E 00	0.16197E 00	0.16157E 00	0.10293E-05	0.10228E-05
10.0	0.64054E-01	0.63818E-01	0.11921E 00	0.11725E 00	0.17453E 00	0.17423E 00	0.10884E-05	0.10769E-05
11.0	0.68242E-01	0.68113E-01	0.12706E 00	0.12535E 00	0.18605E 00	0.18662E 00	0.11333E-05	0.11277E-05
12.0	0.73129E-01	0.72315E-01	0.13526E 00	0.13328E 00	0.19809E 00	0.19879E 00	0.11892E-05	0.11758E-05
13.0	0.77318E-01	0.76430E-01	0.14259E 00	0.14108E 00	0.20944E 00	0.21077E 00	0.12303E-05	0.12215E-05
14.0	0.81856E-01	0.80492E-01	0.14992E 00	0.14876E 00	0.22078E 00	0.22258E 00	0.12749E-05	0.12652E-05
15.0	0.85870E-01	0.84484E-01	0.15813E 00	0.15633E 00	0.23126E 00	0.23424E 00	0.13158E-05	0.13072E-05
16.0	0.90059E-01	0.88422E-01	0.16581E 00	0.16380E 00	0.24173E 00	0.24577E 00	0.13554E-05	0.13475E-05
17.0	0.94248E-01	0.92310E-01	0.17349E 00	0.17119E 00	0.25307E 00	0.25718E 00	0.13986E-05	0.13863E-05
18.0	0.97913E-01	0.96152E-01	0.18064E 00	0.17850E 00	0.26354E 00	0.26848E 00	0.14302E-05	0.14238E-05
19.0	0.10228E 00	0.99950E-01	0.18815E 00	0.18573E 00	0.27402E 00	0.27967E 00	0.14705E-05	0.14601E-05
20.0	0.10629E 00	0.10371E 00	0.19548E 00	0.19289E 00	0.28397E 00	0.29077E 00	0.15044E-05	0.14951E-05
21.0	0.10996E 00	0.10743E 00	0.20298E 00	0.19999E 00	0.29374E 00	0.30177E 00	0.15350E-05	0.15290E-05
22.0	0.11362E 00	0.11111E 00	0.20996E 00	0.20702E 00	0.30369E 00	0.31268E 00	0.15635E-05	0.15618E-05
23.0	0.11729E 00	0.11476E 00	0.21694E 00	0.21399E 00	0.31241E 00	0.32351E 00	0.15870E-05	0.15936E-05
24.0	0.12130E 00	0.11837E 00	0.22375E 00	0.22090E 00	0.32201E 00	0.33426E 00	0.16164E-05	0.16244E-05
25.0	0.12531E 00	0.12195E 00	0.23091E 00	0.22776E 00	0.33161E 00	0.34493E 00	0.16479E-05	0.16542E-05
26.0	0.12898E 00	0.12550E 00	0.23736E 00	0.23456E 00	0.34121E 00	0.35552E 00	0.16719E-05	0.16932E-05
27.0	0.13247E 00	0.12902E 00	0.24435E 00	0.24131E 00	0.35168E 00	0.36605E 00	0.17008E-05	0.17112E-05
28.0	0.13631E 00	0.13251E 00	0.25133E 00	0.24800E 00	0.36128E 00	0.37650E 00	0.17296E-05	0.17364E-05
29.0	0.13998E 00	0.13597E 00	0.25779E 00	0.25465E 00	0.37053E 00	0.38688E 00	0.17522E-05	0.17647E-05
30.0	0.14364E 00	0.13941E 00	0.26372E 00	0.26125E 00	0.37961E 00	0.39720E 00	0.17712E-05	0.17903E-05
32.0	0.15045E 00	0.14620E 00	0.27681E 00	0.27432E 00	0.39881E 00	0.41765E 00	0.18152E-05	0.18391E-05
34.0	0.15725E 00	0.15289E 00	0.28972E 00	0.28721E 00	0.41731E 00	0.43785E 00	0.18554E-05	0.18850E-05
36.0	0.16546E 00	0.15949E 00	0.30194E 00	0.29995E 00	0.43546E 00	0.45783E 00	0.19040E-05	0.19281E-05
38.0	0.17226E 00	0.16600E 00	0.31416E 00	0.31252E 00	0.45431E 00	0.47760E 00	0.19417E-05	0.19687E-05
40.0	0.17890E 00	0.17243E 00	0.32707E 00	0.32496E 00	0.47298E 00	0.49718E 00	0.19809E-05	0.20068E-05
42.0	0.18640E 00	0.17878E 00	0.33947E 00	0.33726E 00	0.49166E 00	0.51656E 00	0.20257E-05	0.20527E-05
44.0	0.19268E 00	0.18506E 00	0.35151E 00	0.34944E 00	0.51033E 00	0.53577E 00	0.20565E-05	0.20765E-05
46.0	0.19949E 00	0.19127E 00	0.36390E 00	0.36149E 00	0.52831E 00	0.55482E 00	0.20917E-05	0.21082E-05
48.0	0.20612E 00	0.19742E 00	0.37699E 00	0.37344E 00	0.54664E 00	0.57371E 00	0.21304E-05	0.21380E-05
50.0	0.21310E 00	0.20350E 00	0.38903E 00	0.38527E 00	0.56461E 00	0.59245E 00	0.21653E-05	0.21661E-05
52.0	0.21974E 00	0.20953E 00	0.40108E 00	0.39701E 00	0.58329E 00	0.61106E 00	0.21996E-05	0.21925E-05
54.0	0.22637E 00	0.21551E 00	0.41329E 00	0.40866E 00	0.60074E 00	0.62953E 00	0.22299E-05	0.22173E-05
56.0	0.23230E 00	0.22143E 00	0.42586E 00	0.42022E 00	0.61732E 00	0.64789E 00	0.22518E-05	0.22406E-05
58.0	0.23894E 00	0.22731E 00	0.43878E 00	0.43167E 00	0.63478E 00	0.66613E 00	0.22860E-05	0.22626E-05
60.0	0.24504E 00	0.23314E 00	0.45099E 00	0.44309E 00	0.65223E 00	0.68427E 00	0.23112E-05	0.22832E-05
62.0	0.25150E 00	0.23893E 00	0.46339E 00	0.45442E 00	0.66968E 00	0.70230E 00	0.23408E-05	0.23026E-05
64.0	0.25761E 00	0.24468E 00	0.47473E 00	0.46568E 00	0.68626E 00	0.72024E 00	0.23575E-05	0.23209E-05
66.0	0.26337E 00	0.25040E 00	0.48677E 00	0.47687E 00	0.70337E 00	0.73809E 00	0.23769E-05	0.23381E-05
68.0	0.26878E 00	0.25608E 00	0.49829E 00	0.48800E 00	0.72030E 00	0.75585E 00	0.23892E-05	0.23542E-05
70.0	0.27419E 00	0.26172E 00	0.51051E 00	0.49908E 00	0.73688E 00	0.77354E 00	0.24040E-05	0.23694E-05
72.0	0.27995E 00	0.26734E 00	0.52185E 00	0.51010E 00	0.75311E 00	0.79115E 00	0.24159E-05	0.23837E-05
74.0	0.28589E 00	0.27293E 00	0.53302E 00	0.52107E 00	0.76987E 00	0.80869E 00	0.24306E-05	0.23971E-05
76.0	0.29130E 00	0.27849E 00	0.54384E 00	0.53200E 00	0.78400E 00	0.82617E 00	0.24276E-05	0.24097E-05
78.0	0.29671E 00	0.28402E 00	0.55467E 00	0.54288E 00	0.80023E 00	0.84359E 00	0.24332E-05	0.24216E-05
80.0	0.30194E 00	0.28953E 00	0.56531E 00	0.55372E 00	0.81681E 00	0.86094E 00	0.24374E-05	0.24328E-05
82.0	0.30735E 00	0.29502E 00	0.57596E 00	0.56452E 00	0.83374E 00	0.87824E 00	0.24448E-05	0.24433E-05
84.0	0.31259E 00	0.30048E 00	0.58661E 00	0.57528E 00	0.85032E 00	0.89550E 00	0.24491E-05	0.24531E-05
86.0	0.31800E 00	0.30593E 00	0.59778E 00	0.58601E 00	0.86691E 00	0.91270E 00	0.24580E-05	0.24624E-05
88.0	0.32306E 00	0.31136E 00	0.60825E 00	0.59670E 00	0.88261E 00	0.92985E 00	0.24560E-05	0.24712E-05
90.0	0.32847E 00	0.31677E 00	0.61872E 00	0.60736E 00	0.89919E 00	0.94697E 00	0.24610E-05	0.24794E-05
92.0	0.33441E 00	0.32216E 00	0.62919E 00	0.61800E 00	0.91577E 00	0.96404E 00	0.24711E-05	0.24871E-05
94.0	0.34016E 00	0.32754E 00	0.63984E 00	0.62860E 00	0.93253E 00	0.98108E 00	0.24811E-05	0.24944E-05
96.0	0.34540E 00	0.33290E 00	0.65014E 00	0.63919E 00	0.94894E 00	0.99808E 00	0.24827E-05	0.25012E-05
98.0	0.35011E 00	0.33825E 00	0.66061E 00	0.64974E 00	0.96534E 00	0.10150E 01	0.24802E-05	0.25076E-05
100.0	0.35605E 00	0.34359E 00	0.67108E 00	0.66028E 00	0.98227E 00	0.10320E 01	0.24917E-05	0.25137E-05
105.0	0.36984E 00	0.35687E 00	0.69569E 00	0.68652E 00	0.10259E 01	0.10742E 01	0.25067E-05	0.25272E-05
110.0	0.38223E 00	0.37009E 00	0.72431E 00	0.71266E 00	0.10681E 01	0.11163E 01	0.25250E-05	0.25389E-05
115.0	0.39619E 00	0.38326E 00	0.75049E 00	0.73869E 00	0.11083E 01	0.11582E 01	0.25364E-05	0.25489E-05
120.0								
STD DEV =	0.71230E-02		0.57774E-02		0.24393E-01		0.14948E-07	

EQUATION OF BEST FIT n=4

TAU1 = 0.1955355E 04 SEC   G1 = 0.4863568E 06 DYNES/SQ CM   VISC1 = 0.9510002E 09 POISES

TAU2 = 0.1971886E 03 SEC   G2 = 0.2398847E 07 DYNES/SQ CM   VISC2 = 0.4730253E 09 POISES

TAU3 = 0.1750963E 02 SEC   G3 = 0.8654247E 07 DYNES/SQ CM   VISC3 = 0.1515327E 09 POISES

TAU4 = 0.2364947E 00 SEC   G4 = 0.4800139E 08 DYNES/SQ CM   VISC4 = 0.1137099E 08 POISES

TIME (MIN)	OBSERVED THETA 1 (RAD)	CALCULATED THETA 1 (RAD)	OBSERVED THETA 2 (RAD)	CALCULATED THETA 2 (RAD)	OBSERVED THETA 3 (RAD)	CALCULATED THETA 3 (RAD)	OBSERVED CP FUNCTION (RA/D/SQCM)	CALCULATED CP FUNCTION (RA/D/SQCM)
0.0	0.15708E-02	0.15054E-02	0.17453E-02	0.26175E-02	0.54105E-02	0.36299E-02	-0.00000E-38	-0.00000E-38
0.1	0.36652E-02	0.42512E-02	0.69813E-02	0.74545E-02	0.13265E-01	0.10454E-01	0.73165E-07	0.73115E-07
0.2	0.52360E-02	0.59443E-02	0.10297E-01	0.10461E-01	0.17453E-01	0.14740E-01	0.11551E-06	0.11531E-06
0.3	0.69813E-02	0.73894E-02	0.12392E-01	0.13037E-01	0.21118E-01	0.18428E-01	0.15056E-06	0.15022E-06
0.4	0.78540E-02	0.86549E-02	0.14835E-01	0.15300E-01	0.24435E-01	0.21683E-01	0.17761E-06	0.17986E-06
0.5	0.89012E-02	0.97897E-02	0.17279E-01	0.17336E-01	0.27751E-01	0.24623E-01	0.20638E-06	0.20566E-06
0.6	0.10472E-01	0.10828E-01	0.18850E-01	0.19205E-01	0.29845E-01	0.27331E-01	0.23039E-06	0.22863E-06
0.7	0.10821E-01	0.11796E-01	0.20769E-01	0.20950E-01	0.32987E-01	0.29867E-01	0.24866E-06	0.24952E-06
0.8	0.12217E-01	0.12710E-01	0.22515E-01	0.22602E-01	0.34907E-01	0.32274E-01	0.27124E-06	0.26882E-06
0.9	0.12392E-01	0.13583E-01	0.23736E-01	0.24182E-01	0.37350E-01	0.34583E-01	0.28104E-06	0.28693E-06
1.0	0.13963E-01	0.14423E-01	0.25307E-01	0.25702E-01	0.39794E-01	0.36813E-01	0.30647E-06	0.30409E-06
1.1	0.14312E-01	0.15239E-01	0.27053E-01	0.27188E-01	0.41888E-01	0.38983E-01	0.31950E-06	0.32050E-06
1.2	0.15533E-01	0.16033E-01	0.28449E-01	0.28632E-01	0.43982E-01	0.41102E-01	0.33912E-06	0.33631E-06
1.3	0.15883E-01	0.16810E-01	0.29671E-01	0.30046E-01	0.46251E-01	0.43160E-01	0.34991E-06	0.35160E-06
1.4	0.16930E-01	0.17573E-01	0.31416E-01	0.31434E-01	0.48520E-01	0.45221E-01	0.37049E-06	0.36645E-06
1.5	0.17453E-01	0.18322E-01	0.32987E-01	0.32800E-01	0.50615E-01	0.47231E-01	0.38425E-06	0.38092E-06
1.6	0.18326E-01	0.19059E-01	0.33859E-01	0.34145E-01	0.52360E-01	0.49213E-01	0.39608E-06	0.39505E-06
1.7	0.19199E-01	0.19786E-01	0.35256E-01	0.35472E-01	0.54280E-01	0.51169E-01	0.41157E-06	0.40887E-06
1.8	0.19373E-01	0.20503E-01	0.36652E-01	0.36781E-01	0.56200E-01	0.53101E-01	0.42022E-06	0.42239E-06
1.9	0.20595E-01	0.21211E-01	0.38223E-01	0.38075E-01	0.58294E-01	0.55012E-01	0.44082E-06	0.43565E-06
2.0	0.20944E-01	0.21910E-01	0.39095E-01	0.39353E-01	0.60214E-01	0.56901E-01	0.44823E-06	0.44865E-06
2.1	0.21468E-01	0.22601E-01	0.40143E-01	0.40617E-01	0.61959E-01	0.58770E-01	0.45763E-06	0.46141E-06
2.2	0.22515E-01	0.23284E-01	0.41888E-01	0.41868E-01	0.63879E-01	0.60620E-01	0.47679E-06	0.47393E-06
2.3	0.22689E-01	0.23959E-01	0.42761E-01	0.43105E-01	0.65973E-01	0.62452E-01	0.48320E-06	0.48624E-06
2.4	0.23562E-01	0.24627E-01	0.43808E-01	0.44329E-01	0.67893E-01	0.64267E-01	0.49672E-06	0.49832E-06
2.5	0.24435E-01	0.25288E-01	0.45379E-01	0.45542E-01	0.69813E-01	0.66064E-01	0.51319E-06	0.51020E-06
2.6	0.24609E-01	0.25942E-01	0.46600E-01	0.46742E-01	0.71559E-01	0.67845E-01	0.52015E-06	0.52188E-06
2.7	0.25482E-01	0.26590E-01	0.47298E-01	0.47930E-01	0.73129E-01	0.69610E-01	0.53029E-06	0.53337E-06
2.8	0.26180E-01	0.27231E-01	0.48869E-01	0.49108E-01	0.74875E-01	0.71359E-01	0.54434E-06	0.54466E-06
2.9	0.26529E-01	0.27866E-01	0.50266E-01	0.50275E-01	0.76620E-01	0.73093E-01	0.55400E-06	0.55578E-06
3.0	0.27402E-01	0.28495E-01	0.50964E-01	0.51431E-01	0.78365E-01	0.74813E-01	0.56484E-06	0.56671E-06
4.0	0.33161E-01	0.34484E-01	0.62483E-01	0.62473E-01	0.93899E-01	0.91289E-01	0.66703E-06	0.66728E-06
5.0	0.38572E-01	0.40027E-01	0.72955E-01	0.72732E-01	0.10908E 00	0.10668E 00	0.74848E-06	0.75462E-06
6.0	0.44157E-01	0.45215E-01	0.82554E-01	0.82389E-01	0.12305E 00	0.12123E 00	0.82676E-06	0.83180E-06
7.0	0.49044E-01	0.50139E-01	0.92153E-01	0.91580E-01	0.13596E 00	0.13514E 00	0.89396E-06	0.90110E-06
8.0	0.54280E-01	0.54853E-01	0.10140E 00	0.10041E 00	0.14923E 00	0.14855E 00	0.96403E-06	0.96422E-06
9.0	0.59341E-01	0.59400E-01	0.11048E 00	0.10894E 00	0.16197E 00	0.16156E 00	0.10293E-05	0.10224E-05
10.0	0.64054E-01	0.63810E-01	0.11921E 00	0.11724E 00	0.17453E 00	0.17421E 00	0.10884E-05	0.10766E-05
11.0	0.68242E-01	0.68109E-01	0.12706E 00	0.12534E 00	0.18605E 00	0.18661E 00	0.11333E-05	0.11276E-05
12.0	0.73129E-01	0.72315E-01	0.13526E 00	0.13328E 00	0.19809E 00	0.19879E 00	0.11891E-05	0.11757E-05
13.0	0.77318E-01	0.76440E-01	0.14259E 00	0.14108E 00	0.20944E 00	0.21077E 00	0.12303E-05	0.12216E-05
14.0	0.81856E-01	0.80496E-01	0.14992E 00	0.14876E 00	0.22078E 00	0.22259E 00	0.12749E-05	0.12654E-05
15.0	0.85870E-01	0.84490E-01	0.15813E 00	0.15634E 00	0.23126E 00	0.23425E 00	0.13158E-05	0.13073E-05
16.0	0.90059E-01	0.88429E-01	0.16581E 00	0.16381E 00	0.24173E 00	0.24579E 00	0.13554E-05	0.13477E-05
17.0	0.94248E-01	0.92317E-01	0.17349E 00	0.17120E 00	0.25307E 00	0.25720E 00	0.13986E-05	0.13866E-05
18.0	0.97913E-01	0.96159E-01	0.18064E 00	0.17851E 00	0.26354E 00	0.26850E 00	0.14302E-05	0.14241E-05
19.0	0.10228E 00	0.99957E-01	0.18815E 00	0.18575E 00	0.27402E 00	0.27969E 00	0.14705E-05	0.14603E-05
20.0	0.10629E 00	0.10371E 00	0.19548E 00	0.19291E 00	0.28397E 00	0.29078E 00	0.15044E-05	0.14953E-05
21.0	0.10996E 00	0.10743E 00	0.20298E 00	0.20000E 00	0.29374E 00	0.30179E 00	0.15350E-05	0.15292E-05
22.0	0.11362E 00	0.11112E 00	0.20996E 00	0.20703E 00	0.30369E 00	0.31270E 00	0.15635E-05	0.15620E-05
23.0	0.11729E 00	0.11476E 00	0.21694E 00	0.21400E 00	0.31241E 00	0.32353E 00	0.15870E-05	0.15938E-05
24.0	0.12130E 00	0.11837E 00	0.22375E 00	0.22091E 00	0.32201E 00	0.33427E 00	0.16164E-05	0.16245E-05
25.0	0.12531E 00	0.12195E 00	0.23091E 00	0.22777E 00	0.33161E 00	0.34494E 00	0.16479E-05	0.16544E-05
26.0	0.12898E 00	0.12550E 00	0.23736E 00	0.23457E 00	0.34121E 00	0.35553E 00	0.16719E-05	0.16833E-05
27.0	0.13247E 00	0.12902E 00	0.24435E 00	0.24131E 00	0.35168E 00	0.36605E 00	0.17008E-05	0.17113E-05
28.0	0.13631E 00	0.13251E 00	0.25133E 00	0.24801E 00	0.36128E 00	0.37650E 00	0.17296E-05	0.17385E-05
29.0	0.13998E 00	0.13597E 00	0.25779E 00	0.25466E 00	0.37053E 00	0.38689E 00	0.17522E-05	0.17648E-05
30.0	0.14364E 00	0.13941E 00	0.26372E 00	0.26126E 00	0.37961E 00	0.39720E 00	0.17712E-05	0.17903E-05
32.0	0.15045E 00	0.14620E 00	0.27681E 00	0.27432E 00	0.39881E 00	0.41765E 00	0.18152E-05	0.18391E-05
34.0	0.15725E 00	0.15289E 00	0.28972E 00	0.28721E 00	0.41731E 00	0.43785E 00	0.18554E-05	0.18850E-05
36.0	0.16546E 00	0.15949E 00	0.30194E 00	0.29996E 00	0.43546E 00	0.45783E 00	0.19040E-05	0.19281E-05
38.0	0.17226E 00	0.16600E 00	0.31416E 00	0.31252E 00	0.45431E 00	0.47760E 00	0.19417E-05	0.19686E-05
40.0	0.17890E 00	0.17243E 00	0.32707E 00	0.32496E 00	0.47298E 00	0.49717E 00	0.19809E-05	0.20068E-05
42.0	0.18640E 00	0.17878E 00	0.33947E 00	0.33726E 00	0.49166E 00	0.51656E 00	0.20257E-05	0.20426E-05
44.0	0.19268E 00	0.18506E 00	0.35151E 00	0.34943E 00	0.51033E 00	0.53577E 00	0.20565E-05	0.20764E-05
46.0	0.19949E 00	0.19127E 00	0.36390E 00	0.36149E 00	0.52831E 00	0.55481E 00	0.20917E-05	0.21081E-05
48.0	0.20612E 00	0.19741E 00	0.37699E 00	0.37343E 00	0.54664E 00	0.57370E 00	0.21304E-05	0.21379E-05
50.0	0.21310E 00	0.20350E 00	0.38903E 00	0.38527E 00	0.56461E 00	0.59244E 00	0.21653E-05	0.21660E-05
52.0	0.21974E 00	0.20953E 00	0.40108E 00	0.39701E 00	0.58329E 00	0.61105E 00	0.21996E-05	0.21924E-05
54.0	0.22637E 00	0.21550E 00	0.41329E 00	0.40865E 00	0.60074E 00	0.62953E 00	0.22279E-05	0.22172E-05
56.0	0.23230E 00	0.22143E 00	0.42586E 00	0.42021E 00	0.61732E 00	0.64788E 00	0.22518E-05	0.22405E-05
58.0	0.23894E 00	0.22730E 00	0.43878E 00	0.43169E 00	0.63478E 00	0.66612E 00	0.22860E-05	0.22625E-05
60.0	0.24504E 00	0.23314E 00	0.45099E 00	0.44309E 00	0.65223E 00	0.68426E 00	0.23112E-05	0.22831E-05
62.0	0.25150E 00	0.23893E 00	0.46339E 00	0.45441E 00	0.66968E 00	0.70229E 00	0.23408E-05	0.23025E-05
64.0	0.25761E 00	0.24468E 00	0.47473E 00	0.46567E 00	0.68626E 00	0.72023E 00	0.23575E-05	0.23208E-05
66.0	0.26337E 00	0.25039E 00	0.48677E 00	0.47687E 00	0.70337E 00	0.73808E 00	0.23769E-05	0.23380E-05
68.0	0.26878E 00	0.25607E 00	0.49829E 00	0.48800E 00	0.72030E 00	0.75585E 00	0.23892E-05	0.23541E-05
70.0	0.27419E 00	0.26172E 00	0.51051E 00	0.49908E 00	0.73688E 00	0.77353E 00	0.24040E-05	0.23693E-05
72.0	0.27995E 00	0.26734E 00	0.52185E 00	0.51010E 00	0.75311E 00	0.79115E 00	0.24159E-05	0.23836E-05
74.0	0.28589E 00	0.27293E 00	0.53302E 00	0.52107E 00	0.76987E 00	0.80869E 00	0.24306E-05	0.23970E-05
76.0	0.29130E 00	0.27849E 00	0.54384E 00	0.53200E 00	0.78400E 00	0.82617E 00	0.24276E-05	0.24097E-05
78.0	0.29671E 00	0.28402E 00	0.55467E 00	0.54288E 00	0.80023E 00	0.84358E 00	0.24332E-05	0.24216E-05
80.0	0.30194E 00	0.28953E 00	0.56531E 00	0.55372E 00	0.81681E 00	0.86094E 00	0.24374E-05	0.24327E-05
82.0	0.30735E 00	0.29502E 00	0.57596E 00	0.56452E 00	0.83374E 00	0.87824E 00	0.24448E-05	0.24433E-05
84.0	0.31259E 00	0.30048E 00	0.58661E 00	0.57528E 00	0.85032E 00	0.89550E 00	0.24491E-05	0.24531E-05
86.0	0.31800E 00	0.30593E 00	0.59778E 00	0.58601E 00	0.86691E 00	0.91270E 00	0.24580E-05	0.24624E-05
88.0	0.32306E 00	0.31136E 00	0.60825E 00	0.59670E 00	0.88261E 00	0.92986E 00	0.24560E-05	0.24712E-05
90.0	0.32847E 00	0.31677E 00	0.61872E 00	0.60736E 00	0.89919E 00	0.94697E 00	0.24610E-05	0.24794E-05
92.0	0.33441E 00	0.32216E 00	0.62919E 00	0.61800E 00	0.91577E 00	0.96405E 00	0.24711E-05	0.24871E-05
94.0	0.34016E 00	0.32754E 00	0.63984E 00	0.62861E 00	0.93253E 00	0.98108E 00	0.24811E-05	0.24944E-05
96.0	0.34540E 00	0.33290E 00	0.65014E 00	0.63919E 00	0.94894E 00	0.99808E 00	0.24827E-05	0.25012E-05
98.0	0.35011E 00	0.33825E 00	0.66061E 00	0.64975E 00	0.96534E 00	0.10151E 01	0.24802E-05	0.25077E-05
100.0	0.35605E 00	0.34359E 00	0.67108E 00	0.66028E 00	0.98227E 00	0.10320E 01	0.24917E-05	0.25137E-05
105.0	0.36984E 00	0.35688E 00	0.69569E 00	0.68653E 00	0.10259E 01	0.10742E 01	0.25067E-05	0.25273E-05
110.0	0.38223E 00	0.37010E 00	0.72431E 00	0.71266E 00	0.10681E 01	0.11163E 01	0.25250E-05	0.25390E-05
115.0	0.39619E 00	0.38326E 00	0.75049E 00	0.73870E 00	0.11083E 01	0.11582E 01	0.25364E-05	0.25490E-05
120.0								
STD DEV =	0.71231E-02		0.57772E-02		0.24392E-01		0.14917E-07	

Figure D-5. Viscoelastic Analysis for Asphalt 67 at 39.2°F (Cont'd.).

DATA SHEET

EQUATION OF BEST FIT, n=1

SUMMARY SHEET FOR VISCOELASTIC ANALYSIS

ASPHALT NO- 71
TEST TEMP- 39.2 F

LOADS- 800 1400 2000 GM
CTS- 33026. 57110. 84020. DY/SQCM

TAU1 = 0.1562522E 04 SEC G1 = 0.5974625E 06 DYNES/SQ CM VISC1 = 0.9343293E 09 POISES

TIME MIN	THETA 1 RAD	CF 1 RA/D/SQCM	THETA 2 RAD	CF 2 RA/D/SQCM	THETA 3 RAD	CF 3 RA/D/SQCM	AVG CF RA/D/SQCM	OBSERVED THETA 1 (RAD)	CALCULATED THETA 1 (RAD)	OBSERVED THETA 2 (RAD)	CALCULATED THETA 2 (RAD)	OBSERVED THETA 3 (RAD)	CALCULATED THETA 3 (RAD)	OBSERVED CF FUNCTION (RA/D/SQCM)	CALCULATED CF FUNCTION (RA/D/SQCM)
0.0	0.17453E-02	0.00000E-38	0.17453E-02	0.00000E-38	0.17453E-02	0.00000E-38	0.0000000E-38	0.17453E-02	0.17872E-01	0.17453E-02	0.30174E-01	0.17453E-02	0.44392E-01	-0.00000E-38	-0.00000E-38
0.1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
0.2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
0.3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
0.4	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
0.5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
0.6	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
0.7	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
0.8	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
0.9	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1.1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1.2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1.3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1.4	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1.5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1.6	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1.7	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1.8	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1.9	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2.1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2.2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2.3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2.4	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2.5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2.6	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2.7	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2.8	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2.9	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
4.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
5.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
6.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
7.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
8.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
9.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
10.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
11.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
12.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
13.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
14.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
15.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
16.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
17.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
18.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
19.0	0.62832E-01	0.94742E-06	0.98611E-01	0.77890E-06	0.17418E 00	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
20.0	0.65450E-01	0.87437E-06	0.10297E 00	0.80702E-06	0.18117E 00	0.98086E-06	0.8874193E-06	0.65450E-01	0.82324E-01	0.10297E 00	0.13651E 00	0.18117E 00	0.21672E 00	0.88742E-06	0.89647E-06
21.0	0.68068E-01	0.90137E-06	0.10681E 00	0.82598E-06	0.18815E 00	0.10062E-05	0.9111760E-06	0.68068E-01	0.85019E-01	0.10681E 00	0.14094E 00	0.18815E 00	0.22403E 00	0.91118E-06	0.92570E-06
22.0	0.70686E-01	0.92827E-06	0.11135E 00	0.85767E-06	0.19391E 00	0.10170E-05	0.9341606E-06	0.70686E-01	0.87677E-01	0.11135E 00	0.14530E 00	0.19391E 00	0.23124E 00	0.93416E-06	0.95393E-06
23.0	0.73304E-01	0.95627E-06	0.11519E 00	0.87612E-06	0.20071E 00	0.10403E-05	0.9572246E-06	0.73304E-01	0.90279E-01	0.11519E 00	0.14960E 00	0.20071E 00	0.23847E 00	0.95722E-06	0.98089E-06
24.0	0.75922E-01	0.98217E-06	0.11903E 00	0.89508E-06	0.20752E 00	0.10636E-05	0.9802091E-06	0.75922E-01	0.92886E-01	0.11903E 00	0.15385E 00	0.20752E 00	0.24564E 00	0.98029E-06	0.10069E-05
25.0	0.78540E-01	0.10091E-05	0.12305E 00	0.91710E-06	0.21328E 00	0.10744E-05	0.1000218E-05	0.78540E-01	0.95441E-01	0.12305E 00	0.15804E 00	0.21328E 00	0.25274E 00	0.10002E-05	0.10320E-05
26.0	0.81158E-01	0.10361E-05	0.12706E 00	0.93911E-06	0.21991E 00	0.10956E-05	0.1023608E-05	0.81158E-01	0.97963E-01	0.12706E 00	0.16217E 00	0.21991E 00	0.25934E 00	0.10236E-05	0.10561E-05
27.0	0.83776E-01	0.10630E-05	0.13090E 00	0.95807E-06	0.22602E 00	0.11106E-05	0.1043903E-05	0.83776E-01	0.10046E 00	0.13090E 00	0.16625E 00	0.22602E 00	0.26604E 00	0.10439E-05	0.10793E-05
28.0	0.86394E-01	0.10900E-05	0.13474E 00	0.97703E-06	0.23213E 00	0.11256E-05	0.1064197E-05	0.86394E-01	0.10292E 00	0.13474E 00	0.17029E 00	0.23213E 00	0.27257E 00	0.10642E-05	0.11017E-05
29.0	0.89012E-01	0.11169E-05	0.13893E 00	0.10021E-05	0.23841E 00	0.11426E-05	0.1087222E-05	0.89012E-01	0.10535E 00	0.13893E 00	0.17427E 00	0.23841E 00	0.27942E 00	0.10872E-05	0.11232E-05
30.0	0.91630E-01	0.11439E-05	0.14294E 00	0.10241E-05	0.24452E 00	0.11576E-05	0.1109535E-05	0.91630E-01	0.10776E 00	0.14294E 00	0.17821E 00	0.24452E 00	0.28601E 00	0.11095E-05	0.11439E-05
32.0	0.96866E-01	0.11970E-05	0.15027E 00	0.10559E-05	0.25674E 00	0.11876E-05	0.1147087E-05	0.96866E-01	0.11249E 00	0.15027E 00	0.18596E 00	0.25674E 00	0.29849E 00	0.11471E-05	0.11829E-05
34.0	0.10123E 00	0.12259E-05	0.15770E 00	0.10706E-05	0.26843E 00	0.12113E-05	0.1175961E-05	0.10123E 00	0.11713E 00	0.15770E 00	0.19354E 00	0.26843E 00	0.31174E 00	0.11760E-05	0.12191E-05
36.0	0.10647E 00	0.12798E-05	0.16563E 00	0.11318E-05	0.27943E 00	0.12267E-05	0.1212741E-05	0.10647E 00	0.12167E 00	0.16563E 00	0.20096E 00	0.27943E 00	0.32425E 00	0.12127E-05	0.12526E-05
38.0	0.11118E 00	0.13182E-05	0.17279E 00	0.11605E-05	0.29077E 00	0.12463E-05	0.1241653E-05	0.11118E 00	0.12614E 00	0.17279E 00	0.20825E 00	0.29077E 00	0.33666E 00	0.12417E-05	0.12836E-05
40.0	0.11606E 00	0.13618E-05	0.17994E 00	0.11893E-05	0.30177E 00	0.12617E-05	0.1270849E-05	0.11606E 00	0.13052E 00	0.17994E 00	0.21540E 00	0.30177E 00	0.34867E 00	0.12709E-05	0.13124E-05
42.0	0.12043E 00	0.13899E-05	0.18832E 00	0.12394E-05	0.31241E 00	0.12729E-05	0.1300732E-05	0.12043E 00	0.13483E 00	0.18832E 00	0.22244E 00	0.31241E 00	0.36061E 00	0.13007E-05	0.13390E-05
44.0	0.12479E 00	0.14180E-05	0.19548E 00	0.12681E-05	0.32289E 00	0.12821E-05	0.1322741E-05	0.12479E 00	0.13908E 00	0.19548E 00	0.22936E 00	0.32289E 00	0.37235E 00	0.13227E-05	0.13636E-05
46.0	0.12915E 00	0.14461E-05	0.20263E 00	0.12969E-05	0.33353E 00	0.12934E-05	0.1345443E-05	0.12915E 00	0.14326E 00	0.20263E 00	0.23618E 00	0.33353E 00	0.38400E 00	0.13454E-05	0.13865E-05
48.0	0.13352E 00	0.14742E-05	0.20961E 00	0.13226E-05	0.34418E 00	0.13046E-05	0.1367126E-05	0.13352E 00	0.14739E 00	0.20961E 00	0.24290E 00	0.34418E 00	0.39548E 00	0.13671E-05	0.14076E-05
50.0	0.13788E 00	0.15023E-05	0.21677E 00	0.13513E-05	0.35430E 00	0.13096E-05	0.1387750E-05	0.13788E 00	0.15147E 00	0.21677E 00	0.24953E 00	0.35430E 00	0.40682E 00	0.13878E-05	0.14272E-05
52.0	0.14224E 00	0.15306E-05	0.21502E 00	0.13242E-05	0.36530E 00	0.13261E-05	0.1357883E-05	0.14224E 00	0.15549E 00	0.21502E 00	0.25608E 00	0.36530E 00	0.41805E 00	0.13599E-05	0.14453E-05
54.0	0.14661E 00	0.15585E-05	0.23073E 00	0.14027E-05	0.37577E 00	0.13342E-05	0.1431809E-05	0.14661E 00	0.15947E 00	0.23073E 00	0.26255E 00	0.37577E 00	0.42916E 00	0.14318E-05	0.14621E-05
56.0	0.15097E 00	0.15866E-05	0.23754E 00	0.14254E-05	0.38607E 00	0.13413E-05	0.1451088E-05	0.15097E 00	0.16341E 00	0.23754E 00	0.26895E 00	0.38607E 00	0.44016E 00	0.14510E-05	0.14776E-05
58.0	0.15533E 00	0.16147E-05	0.24435E 00	0.14480E-05	0.39636E 00	0.13404E-05	0.1470368E-05	0.15533E 00	0.16731E 00	0.24435E 00	0.27529E 00	0.39636E 00	0.45107E 00	0.14704E-05	0.14920E-05
60.0	0.15883E 00	0.15170E-05	0.25133E 00	0.14737E-05	0.40666E 00	0.13555E-05	0.1482066E-05	0.15803E 00	0.17118E 00	0.25133E 00	0.28156E 00	0.40566E 00	0.46189E 00	0.14821E-05	0.15053E-05
62.0	0.16319E 00	0.16451E-05	0.25831E 00	0.14994E-05	0.41713E 00	0.13647E-05	0.1503057E-05	0.16319E 00	0.17501E 00	0.25831E 00	0.28778E 00	0.41713E 00	0.47263E 00	0.15031E-05	0.15177E-05
64.0	0.16755E 00	0.16732E-05	0.26474E 00	0.15067E-05	0.42761E 00	0.13739E-05	0.1517935E-05	0.16755E 00	0.17881E 00	0.26474E 00	0.29395E 00	0.42761E 00	0.48329E 00	0.15179E-05	0.15291E-05
66.0	0.17104E 00	0.16755E-05	0.27105E 00	0.15294E-05	0.43773E 00	0.13709E-05	0.1527923E-05	0.17104E 00	0.18258E 00	0.27105E 00	0.30007E 00	0.43773E 00	0.49368E 00	0.15279E-05	0.15397E-05
68.0	0.17541E 00	0.17036E-05	0.27768E 00	0.15490E-05	0.44820E 00	0.13801E-05	0.1546876E-05	0.17541E 00	0.18632E 00	0.27768E 00	0.30614E 00	0.44820E 00	0.50441E 00	0.15469E-05	0.15495E-05
70.0	0.17977E 00	0.17317E-05	0.28327E 00	0.15502E-05	0.45805E 00	0.13994E-05	0.1560410E-05	0.17977E 00	0.19006E 00	0.28327E 00	0.31218E 00	0.45885E 00	0.51487E 00	0.15604E-05	0.15586E-05
72.0	0.18326E 00	0.17340E-05	0.28955E 00	0.15637E-05	0.46914E 00	0.14065E-05	0.1568033E-05	0.18326E 00	0.19374E 00	0.28955E 00	0.31817E 00	0.46914E 00	0.52578E 00	0.15680E-05	0.15670E-05
74.0	0.18675E 00	0.17363E-05	0.29531E 00	0.15680E-05	0.47892E 00	0.14073E-05	0.1570524E-05	0.18675E 00	0.19741E 00	0.29531E 00	0.32413E 00	0.47892E 00	0.53564E 00	0.15705E-05	0.15748E-05
76.0	0.19111E 00	0.17644E-05	0.30049E 00	0.15692E-05	0.48887E 00	0.14103E-05	0.1581288E-05	0.19111E 00	0.20107E 00	0.30089E 00	0.33005E 00	0.48887E 00	0.54594E 00	0.15813E-05	0.15820E-05
78.0	0.19548E 00	0.17926E-05	0.30665E 00	0.15735E-05	0.49916E 00	0.14174E-05	0.1594455E-05	0.19548E 00	0.20471E 00	0.30665E 00	0.33595E 00	0.49916E 00	0.55620E 00	0.15945E-05	0.15887E-05
80.0	0.19897E 00	0.17948E-05	0.31259E 00	0.15809E-05	0.50964E 00	0.14266E-05	0.1600736E-05	0.19897E 00	0.20833E 00	0.31259E 00	0.34182E 00	0.50964E 00	0.56642E 00	0.16007E-05	0.15949E-05
82.0	0.20246E 00	0.17971E-05	0.31800E 00	0.15791E-05	0.52011E 00	0.14397E-05	0.1603757E-05	0.20246E 00	0.21194E 00	0.31800E 00	0.34766E 00	0.52011E 00	0.57661E 00	0.16040E-05	0.16006E-05
84.0	0.20595E 00	0.17994E-05	0.32411E 00	0.15875E-05	0.53023E 00	0.14400E-05	0.1609869E-05	0.20595E 00	0.21553E 00	0.32411E 00	0.35347E 00	0.53023E 00	0.58675E 00	0.16099E-05	0.16059E-05
86.0	0.20944E 00	0.18017E-05	0.33004E 00	0.15968E-05	0.53966E 00	0.14375E-05	0.1611994E-05	0.20944E 00	0.21911E 00	0.33004E 00	0.35927E 00	0.53966E 00	0.59687E 00	0.16120E-05	0.16108E-05
88.0	0.21293E 00	0.18040E-05	0.33563E 00	0.15981E-05	0.54995E 00	0.14446E-05	0.1615543E-05	0.21293E 00	0.22268E 00	0.33563E 00	0.36504E 00	0.54995E 00	0.60695E 00	0.16155E-05	0.16154E-05
90.0	0.21642E 00	0.18063E-05	0.34174E 00	0.16085E-05	0.55938E 00	0.14413E-05	0.1618686E-05	0.21642E 00	0.22623E 00	0.34174E 00	0.37080E 00	0.55938E 00	0.61700E 00	0.16187E-05	0.16196E-05
92.0	0.22166E 00	0.18602E-05	0.34750E 00	0.16120E-05	0.56898E 00	0.14401E-05	0.1637683E-05	0.22166E 00	0.22978E 00	0.34750E 00	0.37653E 00	0.56898E 00	0.62703E 00	0.16377E-05	0.16235E-05
94.0	0.22515E 00	0.18625E-05	0.35271E 00	0.16110E-05	0.57840E 00	0.14368E-05	0.1636751E-05	0.22515E 00	0.23331E 00	0.35271E 00	0.38225E 00	0.57840E 00	0.63704E 00	0.16369E-05	0.16271E-05
96.0	0.22864E 00	0.18648E-05	0.35832E 00	0.16092E-05	0.58818E 00	0.14377E-05	0.1637204E-05	0.22864E 00	0.23684E 00	0.35832E 00	0.38796E 00	0.58818E 00	0.64702E 00	0.16372E-05	0.16304E-05
98.0	0.23213E 00	0.18671E-05	0.36425E 00	0.16165E-05	0.59830E 00	0.14427E-05	0.1642098E-05	0.23213E 00	0.24035E 00	0.36425E 00	0.39365E 00	0.59830E 00	0.65698E 00	0.16421E-05	0.16335E-05
100.0	0.23562E 00	0.18694E-05	0.37001E 00	0.16208E-05	0.60755E 00	0.14373E-05	0.1642512E-05	0.23562E 00	0.24386E 00	0.37001E 00	0.39933E 00	0.60755E 00	0.66692E 00	0.16425E-05	0.16364E-05
105.0	0.24435E 00	0.18752E-05	0.38397E 00	0.16239E-05	0.63181E 00	0.14374E-05	0.1645499E-05	0.24435E 00	0.25261E 00	0.38397E 00	0.41347E 00	0.63181E 00	0.69170E 00	0.16455E-05	0.16427E-05
110.0	0.25395E 00	0.19067E-05	0.39968E 00	0.16576E-05	0.65799E 00	0.14604E-05	0.1674889E-05	0.25395E 00	0.26132E 00	0.39968E 00	0.42755E 00	0.65799E 00	0.71679E 00	0.16749E-05	0.16479E-05
115.0	0.26354E 00	0.19383E-05	0.41364E 00	0.16607E-05	0.68068E 00	0.14418E-05	0.1680244E-05	0.26354E 00	0.26994E 00	0.41364E 00	0.44158E 00	0.68068E 00	0.74100E 00	0.16802E-05	0.16521E-05
120.0	0.27227E 00	0.19440E-05	0.43022E 00	0.17097E-05	0.70511E 00	0.14439E-05	0.1699204E-05	0.27227E 00	0.27864E 00	0.43022E 00	0.45557E 00	0.70511E 00	0.76595E 00	0.16992E-05	0.16557E-05
125.0	0.28100E 00	0.19498E-05	0.44680E 00	0.17586E-05	0.72955E 00	0.14461E-05	0.1710164E-05	0.28100E 00	0.28728E 00	0.44680E 00	0.46952E 00	0.72955E 00	0.79005E 00	0.17182E-05	0.16586E-05
130.0	0.28972E 00	0.19555E-05	0.46077E 00	0.17617E-05	0.75398E 00	0.14483E-05	0.1721843E-05	0.28972E 00	0.29589E 00	0.46077E 00	0.48344E 00	0.75398E 00	0.81430E 00	0.17218E-05	0.16610E-05
135.0	0.29671E 00	0.19097E-05	0.47648E 00	0.17954E-05	0.77842E 00	0.14505E-05	0.1710510E-05	0.29671E 00	0.30449E 00	0.47648E 00	0.49734E 00	0.77842E 00	0.83842E 00	0.17105E-05	0.16630E-05
140.0	0.30543E 00	0.19154E-05	0.48869E 00	0.17679E-05	0.80111E 00	0.14319E-05	0.1705079E-05	0.30543E 00	0.31307E 00	0.48869E 00	0.51122E 00	0.80111E 00	0.86331E 00	0.17051E-05	0.16646E-05
145.0	0.31241E 00	0.18696E-05	0.50178E 00	0.17558E-05	0.82554E 00	0.14340E-05	0.1686466E-05	0.31241E 00	0.32169E 00	0.50178E 00	0.52508E 00	0.82554E 00	0.88767E 00	0.16865E-05	0.16660E-05
STD DEV =									0.14716E-01		0.29371E-01		0.44540E-01		0.49549E-07

Figure D-6. Viscoelastic Analysis for Asphalt 71 at 39.2°F.

EQUATION OF BEST FIT, n=3

TAU1 = 0.1961597E 04 SEC   G1 = 0.6620371E 06 DYNES/SQ CM   VISC1 = 0.1259418E 10 POISES

TAU2 = 0.1061334E 03 SEC   G2 = 0.5823912E 07 DYNES/SQ CM   VISC2 = 0.6181113E 09 POISES

TIME MIN.	OBSERVED THETA 1 (RAD)	CALCULATED THETA 1 (RAD)	OBSERVED THETA 2 (RAD)	CALCULATED THETA 2 (RAD)	OBSERVED THETA 3 (RAD)	CALCULATED THETA 3 (RAD)	OBSERVED CP FUNCTION (RA/D/SQCM)	CALCULATED CP FUNCTION (RA/D/SQCM)
0.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
0.1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
0.2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
0.3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
0.4	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
0.5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
0.6	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
0.7	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
0.8	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
0.9	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1.1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1.2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1.3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1.4	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1.5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1.6	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1.7	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1.8	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1.9	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2.1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2.2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2.3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2.4	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2.5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2.6	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2.7	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2.8	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2.9	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
4.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
5.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
6.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
7.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
8.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
9.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
10.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
11.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
12.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
13.0	0.46251E-01	0.63145E-01	0.72431E-01	0.10500E 00	0.13160E 00	0.16480E 00	0.68836E-06	0.68261E-06
14.0	0.48869E-01	0.65920E-01	0.76795E-01	0.10956E 00	0.13856E 00	0.17230E 00	0.71517E-06	0.71419E-06
15.0	0.52360E-01	0.68661E-01	0.81681E-01	0.11406E 00	0.14626E 00	0.17972E 00	0.75641E-06	0.74479E-06
16.0	0.54978E-01	0.71371E-01	0.85521E-01	0.11852E 00	0.15324E 00	0.18707E 00	0.78017E-06	0.77446E-06
17.0	0.56723E-01	0.74051E-01	0.90408E-01	0.12292E 00	0.16057E 00	0.19434E 00	0.80282E-06	0.80323E-06
18.0	0.59341E-01	0.76701E-01	0.94422E-01	0.12727E 00	0.16738E 00	0.20153E 00	0.82691E-06	0.83113E-06
19.0	0.62832E-01	0.79323E-01	0.98611E-01	0.13157E 00	0.17418E 00	0.20865E 00	0.86061E-06	0.85819E-06
20.0	0.65450E-01	0.81917E-01	0.10297E 00	0.13582E 00	0.18117E 00	0.21571E 00	0.88742E-06	0.88443E-06
21.0	0.68068E-01	0.84484E-01	0.10681E 00	0.14003E 00	0.18815E 00	0.22270E 00	0.91118E-06	0.90980E-06
22.0	0.70686E-01	0.87025E-01	0.11135E 00	0.14420E 00	0.19391E 00	0.22962E 00	0.93416E-06	0.93456E-06
23.0	0.73304E-01	0.89541E-01	0.11519E 00	0.14832E 00	0.20071E 00	0.23648E 00	0.95722E-06	0.95850E-06
24.0	0.75922E-01	0.92033E-01	0.11903E 00	0.15241E 00	0.20752E 00	0.24329E 00	0.98029E-06	0.98172E-06
25.0	0.78540E-01	0.94501E-01	0.12305E 00	0.15645E 00	0.21328E 00	0.25003E 00	0.10002E-05	0.10042E-05
26.0	0.81158E-01	0.96946E-01	0.12706E 00	0.16046E 00	0.21991E 00	0.25671E 00	0.10236E-05	0.10261E-05
27.0	0.83776E-01	0.99369E-01	0.13090E 00	0.16442E 00	0.22602E 00	0.26334E 00	0.10439E-05	0.10473E-05
28.0	0.86394E-01	0.10177E 00	0.13474E 00	0.16835E 00	0.23213E 00	0.26992E 00	0.10642E-05	0.10678E-05
29.0	0.89012E-01	0.10415E 00	0.13893E 00	0.17225E 00	0.23841E 00	0.27644E 00	0.10872E-05	0.10877E-05
30.0	0.91630E-01	0.10651E 00	0.14294E 00	0.17601E 00	0.24452E 00	0.28292E 00	0.11085E-05	0.11071E-05
32.0	0.96866E-01	0.11117E 00	0.15027E 00	0.18373E 00	0.25674E 00	0.29572E 00	0.11471E-05	0.11440E-05
34.0	0.10123E 00	0.11576E 00	0.15779E 00	0.19123E 00	0.26843E 00	0.30834E 00	0.11760E-05	0.11787E-05
36.0	0.10647E 00	0.12028E 00	0.16563E 00	0.19861E 00	0.27943E 00	0.32079E 00	0.12127E-05	0.12114E-05
38.0	0.11118E 00	0.12473E 00	0.17279E 00	0.20588E 00	0.29077E 00	0.33307E 00	0.12417E-05	0.12421E-05
40.0	0.11606E 00	0.12912E 00	0.17994E 00	0.21304E 00	0.30177E 00	0.34520E 00	0.12709E-05	0.12710E-05
42.0	0.12043E 00	0.13345E 00	0.18832E 00	0.22011E 00	0.31241E 00	0.35719E 00	0.13007E-05	0.12982E-05
44.0	0.12479E 00	0.13773E 00	0.19548E 00	0.22708E 00	0.32289E 00	0.36903E 00	0.13227E-05	0.13238E-05
46.0	0.12915E 00	0.14196E 00	0.20263E 00	0.23397E 00	0.33353E 00	0.38076E 00	0.13454E-05	0.13478E-05
48.0	0.13352E 00	0.14614E 00	0.20961E 00	0.24078E 00	0.34418E 00	0.39236E 00	0.13671E-05	0.13705E-05
50.0	0.13788E 00	0.15027E 00	0.21677E 00	0.24751E 00	0.35430E 00	0.40385E 00	0.13878E-05	0.13918E-05
52.0	0.14224E 00	0.15436E 00	0.21502E 00	0.25417E 00	0.36530E 00	0.41523E 00	0.13599E-05	0.14118E-05
54.0	0.14661E 00	0.15841E 00	0.23073E 00	0.26076E 00	0.37577E 00	0.42652E 00	0.14318E-05	0.14306E-05
56.0	0.15097E 00	0.16242E 00	0.23754E 00	0.26728E 00	0.38607E 00	0.43770E 00	0.14511E-05	0.14484E-05
58.0	0.15533E 00	0.16640E 00	0.24435E 00	0.27375E 00	0.39636E 00	0.44881E 00	0.14704E-05	0.14650E-05
60.0	0.15883E 00	0.17034E 00	0.25133E 00	0.28016E 00	0.40666E 00	0.45982E 00	0.14821E-05	0.14807E-05
62.0	0.16319E 00	0.17425E 00	0.25831E 00	0.28651E 00	0.41713E 00	0.47076E 00	0.15031E-05	0.14955E-05
64.0	0.16755E 00	0.17814E 00	0.26424E 00	0.29282E 00	0.42761E 00	0.48163E 00	0.15179E-05	0.15093E-05
66.0	0.17106E 00	0.18199E 00	0.27105E 00	0.29908E 00	0.43773E 00	0.49243E 00	0.15279E-05	0.15224E-05
68.0	0.17541E 00	0.18582E 00	0.27768E 00	0.30529E 00	0.44820E 00	0.50316E 00	0.15469E-05	0.15347E-05
70.0	0.17977E 00	0.18962E 00	0.28327E 00	0.31147E 00	0.45885E 00	0.51383E 00	0.15604E-05	0.15462E-05
72.0	0.18326E 00	0.19340E 00	0.28955E 00	0.31760E 00	0.46914E 00	0.52444E 00	0.15680E-05	0.15571E-05
74.0	0.18675E 00	0.19716E 00	0.29531E 00	0.32370E 00	0.47892E 00	0.53500E 00	0.15705E-05	0.15673E-05
76.0	0.19111E 00	0.20090E 00	0.30089E 00	0.32976E 00	0.48887E 00	0.54551E 00	0.15813E-05	0.15769E-05
78.0	0.19548E 00	0.20462E 00	0.30665E 00	0.33579E 00	0.49916E 00	0.55597E 00	0.15945E-05	0.15859E-05
80.0	0.19897E 00	0.20832E 00	0.31259E 00	0.34179E 00	0.50964E 00	0.56639E 00	0.16007E-05	0.15944E-05
82.0	0.20246E 00	0.21200E 00	0.31800E 00	0.34776E 00	0.52011E 00	0.57676E 00	0.16040E-05	0.16024E-05
84.0	0.20595E 00	0.21567E 00	0.32411E 00	0.35371E 00	0.53023E 00	0.58709E 00	0.16099E-05	0.16100E-05
86.0	0.20944E 00	0.21932E 00	0.33004E 00	0.35962E 00	0.53966E 00	0.59739E 00	0.16120E-05	0.16170E-05
88.0	0.21293E 00	0.22296E 00	0.33563E 00	0.36552E 00	0.54995E 00	0.60765E 00	0.16155E-05	0.16237E-05
90.0	0.21642E 00	0.22658E 00	0.34174E 00	0.37139E 00	0.55938E 00	0.61788E 00	0.16187E-05	0.16300E-05
92.0	0.22166E 00	0.23020E 00	0.34750E 00	0.37724E 00	0.56898E 00	0.62807E 00	0.16377E-05	0.16359E-05
94.0	0.22515E 00	0.23380E 00	0.35291E 00	0.38307E 00	0.57840E 00	0.63824E 00	0.16368E-05	0.16414E-05
96.0	0.22864E 00	0.23738E 00	0.35832E 00	0.38888E 00	0.58818E 00	0.64838E 00	0.16372E-05	0.16466E-05
98.0	0.23213E 00	0.24096E 00	0.36425E 00	0.39468E 00	0.59830E 00	0.65849E 00	0.16421E-05	0.16515E-05
100.0	0.23562E 00	0.24453E 00	0.37001E 00	0.40046E 00	0.60755E 00	0.66858E 00	0.16425E-05	0.16561E-05
105.0	0.24435E 00	0.25341E 00	0.38397E 00	0.41483E 00	0.63181E 00	0.69370E 00	0.16455E-05	0.16665E-05
110.0	0.25395E 00	0.26225E 00	0.39968E 00	0.42913E 00	0.65799E 00	0.71870E 00	0.16749E-05	0.16754E-05
115.0	0.26354E 00	0.27104E 00	0.41364E 00	0.44335E 00	0.68068E 00	0.74360E 00	0.16802E-05	0.16830E-05
120.0	0.27227E 00	0.27979E 00	0.43022E 00	0.45751E 00	0.70511E 00	0.76840E 00	0.16992E-05	0.16896E-05
125.0	0.28100E 00	0.28851E 00	0.44680E 00	0.47161E 00	0.72955E 00	0.79312E 00	0.17102E-05	0.16952E-05
130.0	0.28972E 00	0.29721E 00	0.46077E 00	0.48567E 00	0.75398E 00	0.81770E 00	0.17218E-05	0.17000E-05
135.0	0.29671E 00	0.30588E 00	0.47648E 00	0.49969E 00	0.77842E 00	0.84230E 00	0.17185E-05	0.17042E-05
140.0	0.30543E 00	0.31453E 00	0.48869E 00	0.51368E 00	0.80111E 00	0.86693E 00	0.17051E-05	0.17077E-05
145.0	0.31241E 00	0.32317E 00	0.50178E 00	0.52764E 00	0.82554E 00	0.89144E 00	0.16865E-05	0.17108E-05

STD DEV = 0.14481E-01   0.30392E-01   0.45914E-01   0.94118E-08

EQUATION OF BEST FIT, n=2

TAU1 = 0.1988591E 04 SEC   G1 = 0.6465006E 06 DYNES/SQ CM   VISC1 = 0.1285625E 10 POISES

TAU2 = 0.1556802E 03 SEC   G2 = 0.6494468E 07 DYNES/SQ CM   VISC2 = 0.1011060E 10 POISES

TAU3 = 0.1109121E 02 SEC   G3 = 0.3171536E 08 DYNES/SQ CM   VISC3 = 0.3517617E 09 POISES

TIME MIN.	OBSERVED THETA 1 (RAD)	CALCULATED THETA 1 (RAD)	OBSERVED THETA 2 (RAD)	CALCULATED THETA 2 (RAD)	OBSERVED THETA 3 (RAD)	CALCULATED THETA 3 (RAD)	OBSERVED CP FUNCTION (RA/D/SQCM)	CALCULATED CP FUNCTION (RA/D/SQCM)
0.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
0.1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
0.2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
0.3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
0.4	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
0.5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
0.6	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
0.7	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
0.8	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
0.9	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1.1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1.2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1.3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1.4	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1.5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1.6	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1.7	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1.8	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1.9	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2.1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2.2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2.3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2.4	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2.5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2.6	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2.7	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2.8	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2.9	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
4.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
5.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
6.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
7.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
8.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
9.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
10.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
11.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
12.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
13.0	0.46251E-01	0.63271E-01	0.72431E-01	0.10521E 00	0.13160E 00	0.16511E 00	0.68836E-06	0.68635E-06
14.0	0.48869E-01	0.66039E-01	0.76795E-01	0.10976E 00	0.13856E 00	0.17260E 00	0.71517E-06	0.71773E-06
15.0	0.52360E-01	0.68773E-01	0.81681E-01	0.11425E 00	0.14626E 00	0.18000E 00	0.75641E-06	0.74809E-06
16.0	0.54978E-01	0.71473E-01	0.85521E-01	0.11869E 00	0.15324E 00	0.18732E 00	0.78017E-06	0.77748E-06
17.0	0.56723E-01	0.74143E-01	0.90408E-01	0.12307E 00	0.16057E 00	0.19456E 00	0.80282E-06	0.80595E-06
18.0	0.59341E-01	0.76783E-01	0.94422E-01	0.12740E 00	0.16738E 00	0.20173E 00	0.82691E-06	0.83355E-06
19.0	0.62832E-01	0.79394E-01	0.98611E-01	0.13169E 00	0.17418E 00	0.20883E 00	0.86061E-06	0.86030E-06
20.0	0.65450E-01	0.81978E-01	0.10297E 00	0.13593E 00	0.18117E 00	0.21586E 00	0.88742E-06	0.88625E-06
21.0	0.68068E-01	0.84536E-01	0.10681E 00	0.14012E 00	0.18815E 00	0.22283E 00	0.91118E-06	0.91141E-06
22.0	0.70686E-01	0.87068E-01	0.11135E 00	0.14427E 00	0.19391E 00	0.22973E 00	0.93416E-06	0.93583E-06
23.0	0.73304E-01	0.89575E-01	0.11519E 00	0.14838E 00	0.20071E 00	0.23657E 00	0.95722E-06	0.95951E-06
24.0	0.75922E-01	0.92059E-01	0.11903E 00	0.15245E 00	0.20752E 00	0.24335E 00	0.98029E-06	0.98248E-06
25.0	0.78540E-01	0.94519E-01	0.12305E 00	0.15648E 00	0.21328E 00	0.25007E 00	0.10002E-05	0.10048E-05
26.0	0.81158E-01	0.96957E-01	0.12706E 00	0.16047E 00	0.21991E 00	0.25674E 00	0.10236E-05	0.10264E-05
27.0	0.83776E-01	0.99373E-01	0.13090E 00	0.16443E 00	0.22602E 00	0.26335E 00	0.10439E-05	0.10474E-05
28.0	0.86394E-01	0.10177E 00	0.13474E 00	0.16835E 00	0.23213E 00	0.26991E 00	0.10642E-05	0.10677E-05
29.0	0.89012E-01	0.10414E 00	0.13893E 00	0.17223E 00	0.23841E 00	0.27642E 00	0.10872E-05	0.10875E-05
30.0	0.91630E-01	0.10650E 00	0.14294E 00	0.17608E 00	0.24452E 00	0.28288E 00	0.11085E-05	0.11067E-05
32.0	0.96866E-01	0.11115E 00	0.15027E 00	0.18369E 00	0.25674E 00	0.29566E 00	0.11471E-05	0.11433E-05
34.0	0.10123E 00	0.11573E 00	0.15779E 00	0.19118E 00	0.26843E 00	0.30826E 00	0.11760E-05	0.11778E-05
36.0	0.10647E 00	0.12024E 00	0.16563E 00	0.19854E 00	0.27943E 00	0.32069E 00	0.12127E-05	0.12103E-05
38.0	0.11118E 00	0.12469E 00	0.17279E 00	0.20580E 00	0.29077E 00	0.33296E 00	0.12417E-05	0.12408E-05
40.0	0.11606E 00	0.12907E 00	0.17994E 00	0.21296E 00	0.30177E 00	0.34508E 00	0.12709E-05	0.12696E-05
42.0	0.12043E 00	0.13340E 00	0.18832E 00	0.22002E 00	0.31241E 00	0.35706E 00	0.13007E-05	0.12967E-05
44.0	0.12479E 00	0.13768E 00	0.19548E 00	0.22699E 00	0.32289E 00	0.36890E 00	0.13227E-05	0.13222E-05
46.0	0.12915E 00	0.14190E 00	0.20263E 00	0.23388E 00	0.33353E 00	0.38062E 00	0.13454E-05	0.13462E-05
48.0	0.13352E 00	0.14608E 00	0.20961E 00	0.24068E 00	0.34418E 00	0.39222E 00	0.13671E-05	0.13688E-05
50.0	0.13788E 00	0.15021E 00	0.21677E 00	0.24741E 00	0.35430E 00	0.40371E 00	0.13878E-05	0.13901E-05
52.0	0.14224E 00	0.15430E 00	0.21502E 00	0.25407E 00	0.36530E 00	0.41509E 00	0.13599E-05	0.14102E-05
54.0	0.14661E 00	0.15836E 00	0.23073E 00	0.26066E 00	0.37577E 00	0.42638E 00	0.14318E-05	0.14290E-05
56.0	0.15097E 00	0.16237E 00	0.23754E 00	0.26719E 00	0.38607E 00	0.43757E 00	0.14511E-05	0.14468E-05
58.0	0.15533E 00	0.16635E 00	0.24435E 00	0.27366E 00	0.39636E 00	0.44868E 00	0.14704E-05	0.14635E-05
60.0	0.15883E 00	0.17029E 00	0.25133E 00	0.28007E 00	0.40666E 00	0.45970E 00	0.14821E-05	0.14792E-05
62.0	0.16319E 00	0.17421E 00	0.25831E 00	0.28643E 00	0.41713E 00	0.47065E 00	0.15031E-05	0.14941E-05
64.0	0.16755E 00	0.17809E 00	0.26424E 00	0.29274E 00	0.42761E 00	0.48152E 00	0.15179E-05	0.15080E-05
66.0	0.17106E 00	0.18195E 00	0.27105E 00	0.29901E 00	0.43773E 00	0.49232E 00	0.15279E-05	0.15211E-05
68.0	0.17541E 00	0.18578E 00	0.27768E 00	0.30523E 00	0.44820E 00	0.50306E 00	0.15469E-05	0.15335E-05
70.0	0.17977E 00	0.18959E 00	0.28327E 00	0.31141E 00	0.45885E 00	0.51374E 00	0.15604E-05	0.15452E-05
72.0	0.18326E 00	0.19337E 00	0.28955E 00	0.31755E 00	0.46914E 00	0.52436E 00	0.15680E-05	0.15561E-05
74.0	0.18675E 00	0.19713E 00	0.29531E 00	0.32365E 00	0.47892E 00	0.53493E 00	0.15705E-05	0.15664E-05
76.0	0.19111E 00	0.20087E 00	0.30089E 00	0.32972E 00	0.48887E 00	0.54545E 00	0.15813E-05	0.15761E-05
78.0	0.19548E 00	0.20459E 00	0.30665E 00	0.33576E 00	0.49916E 00	0.55592E 00	0.15945E-05	0.15853E-05
80.0	0.19897E 00	0.20830E 00	0.31259E 00	0.34176E 00	0.50964E 00	0.56634E 00	0.16007E-05	0.15939E-05
82.0	0.20246E 00	0.21199E 00	0.31800E 00	0.34774E 00	0.52011E 00	0.57672E 00	0.16040E-05	0.16020E-05
84.0	0.20595E 00	0.21566E 00	0.32411E 00	0.35369E 00	0.53023E 00	0.58707E 00	0.16099E-05	0.16096E-05
86.0	0.20944E 00	0.21931E 00	0.33004E 00	0.35961E 00	0.53966E 00	0.59737E 00	0.16120E-05	0.16168E-05
88.0	0.21293E 00	0.22295E 00	0.33563E 00	0.36551E 00	0.54995E 00	0.60764E 00	0.16155E-05	0.16236E-05
90.0	0.21642E 00	0.22658E 00	0.34174E 00	0.37139E 00	0.55938E 00	0.61788E 00	0.16187E-05	0.16299E-05
92.0	0.22166E 00	0.23020E 00	0.34750E 00	0.37725E 00	0.56898E 00	0.62808E 00	0.16377E-05	0.16359E-05
94.0	0.22515E 00	0.23380E 00	0.35291E 00	0.38308E 00	0.57840E 00	0.63825E 00	0.16368E-05	0.16416E-05
96.0	0.22864E 00	0.23739E 00	0.35832E 00	0.38888E 00	0.58818E 00	0.64840E 00	0.16372E-05	0.16469E-05
98.0	0.23213E 00	0.24098E 00	0.36425E 00	0.39470E 00	0.59830E 00	0.65852E 00	0.16421E-05	0.16519E-05
100.0	0.23562E 00	0.24455E 00	0.37001E 00	0.40048E 00	0.60755E 00	0.66862E 00	0.16425E-05	0.16566E-05
105.0	0.24435E 00	0.25344E 00	0.38397E 00	0.41487E 00	0.63181E 00	0.69376E 00	0.16455E-05	0.16672E-05
110.0	0.25395E 00	0.26228E 00	0.39968E 00	0.42918E 00	0.65799E 00	0.71878E 00	0.16749E-05	0.16763E-05
115.0	0.26354E 00	0.27108E 00	0.41364E 00	0.44341E 00	0.68068E 00	0.74369E 00	0.16802E-05	0.16842E-05
120.0	0.27227E 00	0.27984E 00	0.43022E 00	0.45758E 00	0.70511E 00	0.76851E 00	0.16992E-05	0.16909E-05
125.0	0.28100E 00	0.28856E 00	0.44680E 00	0.47170E 00	0.72955E 00	0.79325E 00	0.17102E-05	0.16967E-05
130.0	0.28972E 00	0.29726E 00	0.46077E 00	0.48577E 00	0.75398E 00	0.81792E 00	0.17218E-05	0.17017E-05
135.0	0.29671E 00	0.30594E 00	0.47648E 00	0.49980E 00	0.77842E 00	0.84253E 00	0.17185E-05	0.17060E-05
140.0	0.30543E 00	0.31460E 00	0.48869E 00	0.51379E 00	0.80111E 00	0.86709E 00	0.17051E-05	0.17097E-05
145.0	0.31241E 00	0.32324E 00	0.50178E 00	0.52776E 00	0.82554E 00	0.89161E 00	0.16865E-05	0.17128E-05

STD DEV = 0.14509E-01   0.30428E-01   0.45962E-01   0.83345E-08

Figure D-6. Viscoelastic Analysis for Asphalt 71 at 39.2°F (Cont'd.).

DATA SHEET

EQUATION OF BEST FIT, n=1

EQUATION OF BEST FIT, n=2

SUMMARY SHEET FOR VISCOELASTIC ANALYSIS

ASPHALT AC- 72 LOADS- 800 1400 2000 GM

TEST TEMP- 39.2 F CDS- 32560. 58017. 83485. DY/SQCM

TIME MIN	THETA 1 RAD	CF 1 RA/D/SQCM	THETA 2 RAD	CF 2 RA/D/SQCM	THETA 3 RAD	CF 3 RA/D/SQCM	AVG CF RA/D/SQCM
0.0	0.69813E-03	-0.	0.17453E-02	-0.	0.34907E-02	-0.	-0.
0.1	0.20944E-02	0.37333E-07	0.52360E-02	0.54074E-07	0.75025E-02	0.63020E-07	0.514756E-07
0.2	0.33161E-02	0.69306E-07	0.69813E-02	0.70474E-07	0.12043E-01	0.96500E-07	0.796267E-07
0.3	0.38397E-02	0.79043E-07	0.87267E-02	0.10287E-06	0.13963E-01	0.10753E-06	0.967477E-07
0.4	0.50615E-02	0.11182E-06	0.10472E-01	0.12727E-06	0.16057E-01	0.12664E-06	0.121913E-06
0.5	0.52360E-02	0.11163E-06	0.11868E-01	0.14574E-06	0.17977E-01	0.14367E-06	0.133681E-06
0.6	0.59341E-02	0.12759E-06	0.10821E-01	0.12266E-06	0.19897E-01	0.16070E-06	0.136962E-06
0.7	0.66323E-02	0.14342E-06	0.13963E-01	0.17080E-06	0.21642E-01	0.17564E-06	0.163286E-06
0.8	0.69813E-02	0.14860E-06	0.15533E-01	0.19723E-06	0.23213E-01	0.18840E-06	0.176430E-06
0.9	0.75049E-02	0.15914E-06	0.16057E-01	0.19586E-06	0.24784E-01	0.20133E-06	0.185441E-06
1.0	0.93776E-02	0.18639E-06	0.17453E-01	0.21433E-06	0.26529E-01	0.21626E-06	0.203660E-06
1.1	0.87267E-02	0.18557E-06	0.18675E-01	0.22982E-06	0.27925E-01	0.22702E-06	0.214130E-06
1.2	0.90757E-02	0.19075E-06	0.19373E-01	0.23642E-06	0.29496E-01	0.23988E-06	0.222343E-06
1.3	0.95993E-02	0.20128E-06	0.20765E-01	0.25488E-06	0.30892E-01	0.25062E-06	0.235595E-06
1.4	0.10472E-01	0.22254E-06	0.21293E-01	0.25851E-06	0.31940E-01	0.25719E-06	0.246000E-06
1.5	0.10472E-01	0.21694E-06	0.22209E-01	0.27698E-06	0.33161E-01	0.26586E-06	0.253276E-06

Figure D-7. Viscoelastic Analysis for Asphalt 72 at 39.2°F.

EQUATION OF BEST FIT, n=3

TAU1 = 0.2282571E 04 SEC   G1 = 0.6660441E 06 DYNES/SQ CM   VISC1 = 0.1521662E 10 POISES

TAU2 = 0.3563419E 03 SEC   G2 = 0.3058437E 07 DYNES/SQ CM   VISC2 = 0.1089871E 10 POISES

TAU3 = 0.2690058E 02 SEC   G3 = 0.7687294E 07 DYNES/SQ CM   VISC3 = 0.2067953E 09 POISES

TIME (MIN)	OBSERVED THETA 1 (RAD)	CALCULATED THETA 1 (RAD)	OBSERVED THETA 2 (RAD)	CALCULATED THETA 2 (RAD)	OBSERVED THETA 3 (RAD)	CALCULATED THETA 3 (RAD)	OBSERVED CP FUNCTION (RA/D/SQCM)	CALCULATED CP FUNCTION (RA/D/SQCM)
0.0	0.69813E-03	0.15642E-02	0.17453E-02	0.28250E-02	0.34907E-02	0.40098E-02	-0.	-0.
0.1	0.20944E-02	0.28976E-02	0.52360E-02	0.52175E-02	0.92502E-02	0.74639E-02	0.51476E-07	0.35403E-07
0.2	0.33161E-02	0.40584E-02	0.69813E-02	0.72903E-02	0.12043E-01	0.10475E-01	0.79627E-07	0.65506E-07
0.3	0.38397E-02	0.50805E-02	0.87267E-02	0.91285E-02	0.13963E-01	0.13131E-01	0.96748E-07	0.91349E-07
0.4	0.50615E-02	0.59910E-02	0.10472E-01	0.10757E-01	0.16057E-01	0.15501E-01	0.12191E-06	0.11377E-06
0.5	0.52360E-02	0.68116E-02	0.11868E-01	0.12224E-01	0.17977E-01	0.17640E-01	0.13368E-06	0.13942E-06
0.6	0.59341E-02	0.75598E-02	0.10821E-01	0.13559E-01	0.19897E-01	0.19594E-01	0.13635E-06	0.15085E-06
0.7	0.66323E-02	0.82493E-02	0.13963E-01	0.14789E-01	0.21642E-01	0.21397E-01	0.16329E-06	0.16649E-06
0.8	0.69813E-02	0.88915E-02	0.15533E-01	0.15933E-01	0.23213E-01	0.23079E-01	0.17644E-06	0.18066E-06
0.9	0.75049E-02	0.94953E-02	0.16057E-01	0.17007E-01	0.24784E-01	0.24662E-01	0.18544E-06	0.19386E-06
1.0	0.83776E-02	0.10067E-01	0.17453E-01	0.18025E-01	0.26529E-01	0.26175E-01	0.20306E-06	0.20569E-06
1.1	0.87267E-02	0.10614E-01	0.18675E-01	0.18997E-01	0.27925E-01	0.27622E-01	0.21414E-06	0.21693E-06
1.2	0.90757E-02	0.11140E-01	0.19373E-01	0.19930E-01	0.29496E-01	0.28966E-01	0.22734E-06	0.22753E-06
1.3	0.95993E-02	0.11648E-01	0.20769E-01	0.20832E-01	0.30892E-01	0.30374E-01	0.23560E-06	0.23760E-06
1.4	0.10472E-01	0.12142E-01	0.21293E-01	0.21700E-01	0.31940E-01	0.31676E-01	0.24609E-06	0.24722E-06
1.5	0.10472E-01	0.12624E-01	0.22689E-01	0.22503E-01	0.33161E-01	0.32847E-01	0.25328E-06	0.25641E-06
1.6	0.10821E-01	0.13095E-01	0.23562E-01	0.23399E-01	0.34907E-01	0.34142E-01	0.26317E-06	0.26542E-06
1.7	0.11519E-01	0.13555E-01	0.24435E-01	0.24228E-01	0.36303E-01	0.35385E-01	0.27524E-06	0.27409E-06
1.8	0.12217E-01	0.14014E-01	0.25307E-01	0.25027E-01	0.37176E-01	0.36509E-01	0.28522E-06	0.28255E-06
1.9	0.12217E-01	0.14444E-01	0.26180E-01	0.25823E-01	0.38397E-01	0.37756E-01	0.29945E-06	0.29080E-06
2.0	0.13963E-01	0.14907E-01	0.27925E-01	0.26604E-01	0.39968E-01	0.38965E-01	0.29831E-06	0.29890E-06
2.1	0.12918E-01	0.15348E-01	0.27925E-01	0.27388E-01	0.41015E-01	0.40091E-01	0.30751E-06	0.30683E-06
2.2	0.13614E-01	0.15781E-01	0.29147E-01	0.28165E-01	0.42237E-01	0.41240E-01	0.31644E-06	0.31463E-06
2.3	0.13963E-01	0.16211E-01	0.29671E-01	0.28917E-01	0.44331E-01	0.42370E-01	0.32562E-06	0.32230E-06
2.4	0.14137E-01	0.16636E-01	0.30543E-01	0.29672E-01	0.45030E-01	0.43510E-01	0.33231E-06	0.32987E-06
2.5	0.14312E-01	0.17062E-01	0.31416E-01	0.30417E-01	0.46251E-01	0.44641E-01	0.33628E-06	0.33734E-06
2.6	0.15010E-01	0.17482E-01	0.32289E-01	0.31165E-01	0.47124E-01	0.45745E-01	0.34833E-06	0.34470E-06
2.7	0.15533E-01	0.17900E-01	0.33161E-01	0.31903E-01	0.48171E-01	0.46831E-01	0.35722E-06	0.35194E-06
2.8	0.15708E-01	0.18315E-01	0.34034E-01	0.32637E-01	0.49393E-01	0.47908E-01	0.36254E-06	0.35918E-06
2.9	0.15883E-01	0.18727E-01	0.34907E-01	0.33365E-01	0.50440E-01	0.49043E-01	0.36855E-06	0.36630E-06
3.0	0.16406E-01	0.19137E-01	0.35779E-01	0.34090E-01	0.51836E-01	0.50179E-01	0.37845E-06	0.37334E-06
4.0	0.19897E-01	0.23113E-01	0.43458E-01	0.41131E-01	0.60737E-01	0.60690E-01	0.44495E-06	0.44062E-06
5.0	0.23213E-01	0.26901E-01	0.50615E-01	0.47797E-01	0.72431E-01	0.70746E-01	0.50291E-06	0.50091E-06
6.0	0.26267E-01	0.30528E-01	0.56374E-01	0.54170E-01	0.81201E-01	0.80419E-01	0.55982E-06	0.55566E-06
7.0	0.29671E-01	0.34016E-01	0.63705E-01	0.60332E-01	0.91106E-01	0.89710E-01	0.60586E-06	0.60655E-06
8.0	0.32987E-01	0.37303E-01	0.69988E-01	0.66253E-01	0.10053E 00	0.98614E-01	0.65708E-06	0.65452E-06
9.0	0.35605E-01	0.40464E-01	0.76445E-01	0.71897E-01	0.10821E 00	0.10713E 00	0.70036E-06	0.70098E-06
10.0	0.38397E-01	0.43811E-01	0.82205E-01	0.77551E-01	0.11764E 00	0.11549E 00	0.73812E-06	0.74308E-06
11.0	0.41539E-01	0.46807E-01	0.88088E-01	0.82966E-01	0.12601E 00	0.12414E 00	0.78127E-06	0.78241E-06
12.0	0.43982E-01	0.49910E-01	0.94248E-01	0.88050E-01	0.13369E 00	0.13235E 00	0.81572E-06	0.81905E-06
13.0	0.46949E-01	0.52858E-01	0.99658E-01	0.93417E-01	0.14172E 00	0.14014E 00	0.85260E-06	0.85463E-06
14.0	0.49393E-01	0.55348E-01	0.10542E 00	0.98479E-01	0.14940E 00	0.14732E 00	0.89322E-06	0.88764E-06
15.0	0.52360E-01	0.58586E-01	0.11100E 00	0.10345E 00	0.15725E 00	0.15548E 00	0.92265E-06	0.91467E-06
16.0	0.54454E-01	0.61377E-01	0.11589E 00	0.10833E 00	0.16476E 00	0.16310E 00	0.94580E-06	0.94792E-06
17.0	0.57247E-01	0.64126E-01	0.12165E 00	0.11314E 00	0.17209E 00	0.17046E 00	0.98634E-06	0.97894E-06
18.0	0.59516E-01	0.66846E-01	0.12619E 00	0.11787E 00	0.17907E 00	0.17776E 00	0.10012E-05	0.10067E-05
19.0	0.61959E-01	0.69510E-01	0.13125E 00	0.12255E 00	0.18640E 00	0.18447E 00	0.10282E-05	0.10334E-05
20.0	0.64577E-01	0.72101E-01	0.13631E 00	0.12716E 00	0.19338E 00	0.19210E 00	0.10556E-05	0.10591E-05
21.0	0.66846E-01	0.74762E-01	0.14137E 00	0.13172E 00	0.20054E 00	0.19915E 00	0.10802E-05	0.10837E-05
22.0	0.69639E-01	0.77364E-01	0.14643E 00	0.13622E 00	0.20735E 00	0.20613E 00	0.11066E-05	0.11077E-05
23.0	0.71733E-01	0.79901E-01	0.15149E 00	0.14068E 00	0.21415E 00	0.21314E 00	0.11300E-05	0.11308E-05
24.0	0.74700E-01	0.82442E-01	0.15621E 00	0.14510E 00	0.22061E 00	0.21976E 00	0.11569E-05	0.11531E-05
25.0	0.76795E-01	0.84946E-01	0.16074E 00	0.14947E 00	0.22724E 00	0.22607E 00	0.11746E-05	0.11747E-05
26.0	0.79063E-01	0.87427E-01	0.16581E 00	0.15380E 00	0.23335E 00	0.23340E 00	0.11949E-05	0.11957E-05
27.0	0.81856E-01	0.89892E-01	0.17087E 00	0.15810E 00	0.23998E 00	0.24006E 00	0.12227E-05	0.12199E-05
28.0	0.83950E-01	0.92334E-01	0.17471E 00	0.16236E 00	0.24627E 00	0.24672E 00	0.12351E-05	0.12356E-05
29.0	0.86219E-01	0.94764E-01	0.17977E 00	0.16659E 00	0.25237E 00	0.25376E 00	0.12564E-05	0.12547E-05
30.0	0.88837E-01	0.97173E-01	0.18413E 00	0.17077E 00	0.25901E 00	0.25972E 00	0.12775E-05	0.12713E-05
32.0	0.93201E-01	0.10194E 00	0.19373E 00	0.17907E 00	0.27157E 00	0.27275E 00	0.13149E-05	0.13008E-05
34.0	0.97913E-01	0.10664E 00	0.20263E 00	0.18724E 00	0.28362E 00	0.28552E 00	0.13497E-05	0.13423E-05
36.0	0.10228E 00	0.11128E 00	0.21118E 00	0.19531E 00	0.29479E 00	0.29813E 00	0.13755E-05	0.13751E-05
38.0	0.10647E 00	0.11587E 00	0.22009E 00	0.20329E 00	0.30578E 00	0.31061E 00	0.14009E-05	0.14041E-05
40.0	0.11135E 00	0.12041E 00	0.22864E 00	0.21116E 00	0.31695E 00	0.32295E 00	0.14320E-05	0.14325E-05
42.0	0.11519E 00	0.12490E 00	0.23719E 00	0.21895E 00	0.32777E 00	0.33517E 00	0.14611E-05	0.14556E-05
44.0	0.11956E 00	0.12934E 00	0.24574E 00	0.22666E 00	0.34226E 00	0.34727E 00	0.14901E-05	0.14857E-05
46.0	0.12392E 00	0.13374E 00	0.25412E 00	0.23429E 00	0.35343E 00	0.35926E 00	0.15150E-05	0.15093E-05
48.0	0.12793E 00	0.13809E 00	0.26581E 00	0.24184E 00	0.36442E 00	0.37114E 00	0.15543E-05	0.15322E-05
50.0	0.13230E 00	0.14241E 00	0.27402E 00	0.24933E 00	0.37594E 00	0.38293E 00	0.15796E-05	0.15540E-05
52.0	0.13614E 00	0.14669E 00	0.27768E 00	0.25675E 00	0.38677E 00	0.39462E 00	0.15709E-05	0.15747E-05
54.0	0.13998E 00	0.15094E 00	0.28536E 00	0.26410E 00	0.39881E 00	0.40622E 00	0.15899E-05	0.15943E-05
56.0	0.14434E 00	0.15516E 00	0.29304E 00	0.27140E 00	0.40980E 00	0.41774E 00	0.16101E-05	0.16129E-05
58.0	0.14835E 00	0.15934E 00	0.30020E 00	0.27864E 00	0.42080E 00	0.42915E 00	0.16238E-05	0.16305E-05
60.0	0.15237E 00	0.16350E 00	0.30735E 00	0.28583E 00	0.43197E 00	0.44035E 00	0.16361E-05	0.16472E-05
62.0	0.15708E 00	0.16762E 00	0.31433E 00	0.29297E 00	0.44279E 00	0.45104E 00	0.16572E-05	0.16631E-05
64.0	0.16074E 00	0.17172E 00	0.32149E 00	0.30006E 00	0.45413E 00	0.46305E 00	0.16687E-05	0.16702E-05
66.0	0.16493E 00	0.17580E 00	0.32899E 00	0.30710E 00	0.46548E 00	0.47422E 00	0.16875E-05	0.16925E-05
68.0	0.16930E 00	0.17985E 00	0.33650E 00	0.31410E 00	0.47613E 00	0.48512E 00	0.17053E-05	0.17060E-05
70.0	0.17296E 00	0.18388E 00	0.34331E 00	0.32106E 00	0.48677E 00	0.49616E 00	0.17126E-05	0.17189E-05
72.0	0.17767E 00	0.18788E 00	0.34959E 00	0.32799E 00	0.49829E 00	0.50735E 00	0.17299E-05	0.17311E-05
74.0	0.18151E 00	0.19187E 00	0.35657E 00	0.33487E 00	0.50876E 00	0.51923E 00	0.17387E-05	0.17426E-05
76.0	0.18535E 00	0.19584E 00	0.36390E 00	0.34172E 00	0.51941E 00	0.52917E 00	0.17501E-05	0.17536E-05
78.0	0.19007E 00	0.19979E 00	0.37053E 00	0.34854E 00	0.53006E 00	0.54020E 00	0.17666E-05	0.17641E-05
80.0	0.19373E 00	0.20372E 00	0.37717E 00	0.35532E 00	0.54053E 00	0.55080E 00	0.17716E-05	0.17739E-05
82.0	0.19792E 00	0.20763E 00	0.38397E 00	0.36208E 00	0.55083E 00	0.56153E 00	0.17822E-05	0.17833E-05
84.0	0.20228E 00	0.21153E 00	0.39095E 00	0.36881E 00	0.56077E 00	0.57226E 00	0.17943E-05	0.17922E-05
86.0	0.20595E 00	0.21542E 00	0.39759E 00	0.37551E 00	0.57072E 00	0.58293E 00	0.17972E-05	0.18007E-05
88.0	0.20979E 00	0.21929E 00	0.40404E 00	0.38218E 00	0.58067E 00	0.59356E 00	0.18009E-05	0.18087E-05
90.0	0.21380E 00	0.22315E 00	0.41103E 00	0.38883E 00	0.59079E 00	0.60417E 00	0.18101E-05	0.18163E-05
92.0	0.21817E 00	0.22699E 00	0.41801E 00	0.39546E 00	0.60074E 00	0.61476E 00	0.18221E-05	0.18235E-05
94.0	0.22201E 00	0.23082E 00	0.42446E 00	0.40207E 00	0.61069E 00	0.62527E 00	0.18259E-05	0.18303E-05
96.0	0.22602E 00	0.23464E 00	0.43110E 00	0.40865E 00	0.62134E 00	0.63578E 00	0.18351E-05	0.18368E-05
98.0	0.23021E 00	0.23845E 00	0.43825E 00	0.41522E 00	0.63163E 00	0.64620E 00	0.18470E-05	0.18430E-05
100.0	0.23405E 00	0.24225E 00	0.44506E 00	0.42177E 00	0.64141E 00	0.65672E 00	0.18528E-05	0.18480E-05
105.0	0.24435E 00	0.25171E 00	0.46164E 00	0.43806E 00	0.66567E 00	0.68273E 00	0.18693E-05	0.18622E-05
110.0	0.25447E 00	0.26112E 00	0.47822E 00	0.45426E 00	0.69098E 00	0.70864E 00	0.18881E-05	0.18739E-05
115.0	0.26354E 00	0.27047E 00	0.49393E 00	0.47037E 00	0.71559E 00	0.73442E 00	0.18885E-05	0.18841E-05
STD DEV =		0.71513E-02		0.14215E-01		0.67207E-02		0.60614E-08

EQUATION OF BEST FIT, n=4

TAU1 = 0.2505175E 04 SEC   G1 = 0.7150541E 06 DYNES/SQ CM   VISC1 = 0.1791336E 10 POISES

TAU2 = 0.6134365E 03 SEC   G2 = 0.2697040E 07 DYNES/SQ CM   VISC2 = 0.1654463E 10 POISES

TAU3 = 0.9144135E 02 SEC   G3 = 0.6668424E 07 DYNES/SQ CM   VISC3 = 0.6097697E 09 POISES

TAU4 = 0.7540851E 01 SEC   G4 = 0.1694402E 08 DYNES/SQ CM   VISC4 = 0.1277723E 09 POISES

TIME (MIN)	OBSERVED THETA 1 (RAD)	CALCULATED THETA 1 (RAD)	OBSERVED THETA 2 (RAD)	CALCULATED THETA 2 (RAD)	OBSERVED THETA 3 (RAD)	CALCULATED THETA 3 (RAD)	OBSERVED CP FUNCTION (RA/D/SQCM)	CALCULATED CP FUNCTION (RA/D/SQCM)
0.0	0.69813E-03	0.15642E-02	0.17453E-02	0.28250E-02	0.34907E-02	0.40098E-02	-0.	-0.
0.1	0.20944E-02	0.33359E-02	0.52360E-02	0.60092E-02	0.92502E-02	0.85879E-02	0.51476E-07	0.48682E-07
0.2	0.33161E-02	0.45678E-02	0.69813E-02	0.81100E-02	0.12043E-01	0.11623E-01	0.79427E-07	0.79337E-07
0.3	0.38397E-02	0.53580E-02	0.87267E-02	0.97034E-02	0.13963E-01	0.13947E-01	0.96748E-07	0.10712E-06
0.4	0.50615E-02	0.61532E-02	0.10472E-01	0.11050E-01	0.16057E-01	0.15917E-01	0.12191E-06	0.11875E-06
0.5	0.52360E-02	0.69369E-02	0.11868E-01	0.12269E-01	0.17977E-01	0.17705E-01	0.13368E-06	0.13420E-06
0.6	0.59341E-02	0.74801E-02	0.10821E-01	0.13415E-01	0.19897E-01	0.19390E-01	0.13696E-06	0.14841E-06
0.7	0.66323E-02	0.80570E-02	0.13963E-01	0.14513E-01	0.21642E-01	0.21007E-01	0.16329E-06	0.16101E-06
0.8	0.69813E-02	0.86543E-02	0.15533E-01	0.15577E-01	0.23213E-01	0.22574E-01	0.17644E-06	0.17461E-06
0.9	0.75049E-02	0.92756E-02	0.16057E-01	0.16611E-01	0.24784E-01	0.24101E-01	0.18544E-06	0.18692E-06
1.0	0.83776E-02	0.99430E-02	0.17453E-01	0.17620E-01	0.26529E-01	0.25594E-01	0.20366E-06	0.19950E-06
1.1	0.87267E-02	0.10399E-01	0.18675E-01	0.18606E-01	0.27925E-01	0.27048E-01	0.21414E-06	0.21029E-06
1.2	0.90757E-02	0.10941E-01	0.19373E-01	0.19571E-01	0.29496E-01	0.28473E-01	0.22234E-06	0.22162E-06
1.3	0.95993E-02	0.11473E-01	0.20769E-01	0.20516E-01	0.30892E-01	0.29875E-01	0.23560E-06	0.23222E-06
1.4	0.10472E-01	0.11995E-01	0.21293E-01	0.21443E-01	0.31940E-01	0.31248E-01	0.24609E-06	0.24270E-06
1.5	0.10472E-01	0.12507E-01	0.22689E-01	0.22352E-01	0.33161E-01	0.32597E-01	0.25328E-06	0.25263E-06
1.6	0.10821E-01	0.13010E-01	0.23562E-01	0.23244E-01	0.34907E-01	0.33921E-01	0.26317E-06	0.26274E-06
1.7	0.11519E-01	0.13504E-01	0.24435E-01	0.24122E-01	0.36303E-01	0.35222E-01	0.27524E-06	0.27242E-06
1.8	0.12217E-01	0.13990E-01	0.25307E-01	0.24984E-01	0.37176E-01	0.36507E-01	0.28522E-06	0.28181E-06
1.9	0.12217E-01	0.14469E-01	0.26180E-01	0.25833E-01	0.38397E-01	0.37770E-01	0.29945E-06	0.29097E-06
2.0	0.13963E-01	0.14946E-01	0.27925E-01	0.26668E-01	0.39968E-01	0.39014E-01	0.29983E-06	0.29894E-06
2.1	0.12918E-01	0.15405E-01	0.27925E-01	0.27491E-01	0.41015E-01	0.40242E-01	0.30575E-06	0.30862E-06
2.2	0.13614E-01	0.15860E-01	0.29147E-01	0.28308E-01	0.43633E-01	0.41453E-01	0.31649E-06	0.31716E-06
2.3	0.13963E-01	0.16315E-01	0.29671E-01	0.29103E-01	0.43633E-01	0.42644E-01	0.32562E-06	0.32547E-06
2.4	0.14137E-01	0.16761E-01	0.30543E-01	0.29883E-01	0.45030E-01	0.43817E-01	0.33231E-06	0.33365E-06
2.5	0.14312E-01	0.17201E-01	0.31416E-01	0.30649E-01	0.45080E-01	0.44972E-01	0.33628E-06	0.34141E-06
2.6	0.15010E-01	0.17636E-01	0.32289E-01	0.31463E-01	0.47124E-01	0.46140E-01	0.34833E-06	0.34938E-06
2.7	0.15533E-01	0.18066E-01	0.33161E-01	0.32204E-01	0.48171E-01	0.47271E-01	0.35722E-06	0.35710E-06
2.8	0.15708E-01	0.18492E-01	0.34034E-01	0.32957E-01	0.49218E-01	0.48409E-01	0.36254E-06	0.36463E-06
2.9	0.15883E-01	0.18913E-01	0.34907E-01	0.33702E-01	0.50440E-01	0.49526E-01	0.36855E-06	0.37202E-06
3.0	0.16406E-01	0.19330E-01	0.35779E-01	0.34438E-01	0.51836E-01	0.50625E-01	0.37845E-06	0.37938E-06
4.0	0.19897E-01	0.23305E-01	0.43458E-01	0.41441E-01	0.60737E-01	0.61173E-01	0.44495E-06	0.44592E-06
5.0	0.23213E-01	0.27021E-01	0.50615E-01	0.48013E-01	0.72431E-01	0.71023E-01	0.50291E-06	0.50268E-06
6.0	0.26267E-01	0.30596E-01	0.56374E-01	0.54288E-01	0.81201E-01	0.80477E-01	0.55982E-06	0.55725E-06
7.0	0.29671E-01	0.33978E-01	0.63705E-01	0.60249E-01	0.91106E-01	0.89581E-01	0.60586E-06	0.60713E-06
8.0	0.32987E-01	0.37277E-01	0.69988E-01	0.66064E-01	0.10053E 00	0.98417E-01	0.65708E-06	0.65327E-06
9.0	0.35605E-01	0.40494E-01	0.76445E-01	0.71735E-01	0.10821E 00	0.10713E 00	0.70036E-06	0.69677E-06
10.0	0.38397E-01	0.43645E-01	0.82205E-01	0.77291E-01	0.11764E 00	0.11546E 00	0.73812E-06	0.73798E-06
11.0	0.41539E-01	0.46725E-01	0.88488E-01	0.82659E-01	0.12601E 00	0.12371E 00	0.78127E-06	0.77712E-06
12.0	0.43982E-01	0.49743E-01	0.94248E-01	0.87902E-01	0.13369E 00	0.13140E 00	0.81572E-06	0.81436E-06
13.0	0.46949E-01	0.52785E-01	0.99658E-01	0.93141E-01	0.14172E 00	0.13975E 00	0.85260E-06	0.84922E-06
14.0	0.49393E-01	0.55615E-01	0.10542E 00	0.98230E-01	0.14940E 00	0.14757E 00	0.89322E-06	0.88306E-06
15.0	0.52360E-01	0.58477E-01	0.11100E 00	0.10325E 00	0.15725E 00	0.15527E 00	0.92265E-06	0.91632E-06
16.0	0.54454E-01	0.61294E-01	0.11589E 00	0.10818E 00	0.16476E 00	0.16242E 00	0.94580E-06	0.94740E-06
17.0	0.57247E-01	0.64060E-01	0.12165E 00	0.11303E 00	0.17209E 00	0.17031E 00	0.98634E-06	0.97719E-06
18.0	0.59516E-01	0.66834E-01	0.12619E 00	0.11782E 00	0.17907E 00	0.17768E 00	0.10012E-05	0.10068E-05
19.0	0.61959E-01	0.69503E-01	0.13125E 00	0.12253E 00	0.18640E 00	0.18496E 00	0.10282E-05	0.10332E-05
20.0	0.64577E-01	0.72157E-01	0.13621E 00	0.12719E 00	0.19338E 00	0.19214E 00	0.10556E-05	0.10596E-05
21.0	0.66846E-01	0.74739E-01	0.14137E 00	0.13178E 00	0.20054E 00	0.19925E 00	0.10802E-05	0.10850E-05
22.0	0.69639E-01	0.77399E-01	0.14643E 00	0.13632E 00	0.20735E 00	0.20627E 00	0.11066E-05	0.11094E-05
23.0	0.71733E-01	0.79971E-01	0.15149E 00	0.14081E 00	0.21415E 00	0.21332E 00	0.11300E-05	0.11310E-05
24.0	0.74700E-01	0.82516E-01	0.15621E 00	0.14525E 00	0.22061E 00	0.22014E 00	0.11569E-05	0.11557E-05
25.0	0.76795E-01	0.85035E-01	0.16074E 00	0.14964E 00	0.22724E 00	0.22692E 00	0.11746E-05	0.11776E-05
26.0	0.79063E-01	0.87530E-01	0.16581E 00	0.15399E 00	0.23335E 00	0.23367E 00	0.11949E-05	0.11968E-05
27.0	0.81856E-01	0.90001E-01	0.17087E 00	0.15829E 00	0.23998E 00	0.24036E 00	0.12227E-05	0.12193E-05
28.0	0.83950E-01	0.92451E-01	0.17471E 00	0.16256E 00	0.24627E 00	0.24703E 00	0.12351E-05	0.12391E-05
29.0	0.86219E-01	0.94880E-01	0.17977E 00	0.16679E 00	0.25237E 00	0.25351E 00	0.12554E-05	0.12563E-05
30.0	0.88837E-01	0.97209E-01	0.18413E 00	0.17098E 00	0.25901E 00	0.26011E 00	0.12775E-05	0.12768E-05
32.0	0.93201E-01	0.10205E 00	0.19373E 00	0.17927E 00	0.27157E 00	0.27303E 00	0.13149E-05	0.13122E-05
34.0	0.97913E-01	0.10674E 00	0.20263E 00	0.18743E 00	0.28362E 00	0.28570E 00	0.13497E-05	0.13459E-05
36.0	0.10228E 00	0.11137E 00	0.21118E 00	0.19548E 00	0.29479E 00	0.29834E 00	0.13755E-05	0.13764E-05
38.0	0.10647E 00	0.11595E 00	0.22009E 00	0.20342E 00	0.30578E 00	0.31068E 00	0.14009E-05	0.14064E-05
40.0	0.11135E 00	0.12047E 00	0.22864E 00	0.21127E 00	0.31695E 00	0.32315E 00	0.14325E-05	0.14343E-05
42.0	0.11519E 00	0.12494E 00	0.23719E 00	0.21902E 00	0.32777E 00	0.33527E 00	0.14611E-05	0.14607E-05
44.0	0.11956E 00	0.12936E 00	0.24574E 00	0.22670E 00	0.34226E 00	0.34732E 00	0.14901E-05	0.14857E-05
46.0	0.12392E 00	0.13374E 00	0.25412E 00	0.23430E 00	0.35343E 00	0.35927E 00	0.15150E-05	0.15094E-05
48.0	0.12793E 00	0.13808E 00	0.26581E 00	0.24182E 00	0.36442E 00	0.37111E 00	0.15543E-05	0.15319E-05
50.0	0.13230E 00	0.14239E 00	0.27402E 00	0.24920E 00	0.37594E 00	0.38286E 00	0.15796E-05	0.15532E-05
52.0	0.13614E 00	0.14665E 00	0.27768E 00	0.25667E 00	0.38677E 00	0.39457E 00	0.15709E-05	0.15734E-05
54.0	0.13998E 00	0.15089E 00	0.28536E 00	0.26401E 00	0.39881E 00	0.40609E 00	0.15899E-05	0.15927E-05
56.0	0.14434E 00	0.15510E 00	0.29304E 00	0.27125E 00	0.40980E 00	0.41756E 00	0.16101E-05	0.16110E-05
58.0	0.14835E 00	0.15927E 00	0.30020E 00	0.27852E 00	0.42080E 00	0.42900E 00	0.16238E-05	0.16283E-05
60.0	0.15237E 00	0.16342E 00	0.30735E 00	0.28569E 00	0.43197E 00	0.44035E 00	0.16361E-05	0.16449E-05
62.0	0.15708E 00	0.16754E 00	0.31433E 00	0.29282E 00	0.44279E 00	0.45153E 00	0.16572E-05	0.16606E-05
64.0	0.16074E 00	0.17164E 00	0.32149E 00	0.29991E 00	0.45413E 00	0.46205E 00	0.16687E-05	0.16756E-05
66.0	0.16493E 00	0.17571E 00	0.32895E 00	0.30695E 00	0.46548E 00	0.47400E 00	0.16875E-05	0.16898E-05
68.0	0.16930E 00	0.17976E 00	0.33650E 00	0.31395E 00	0.47613E 00	0.48510E 00	0.17053E-05	0.17034E-05
70.0	0.17296E 00	0.18379E 00	0.34331E 00	0.32091E 00	0.48677E 00	0.49615E 00	0.17120E-05	0.17163E-05
72.0	0.17767E 00	0.18780E 00	0.34959E 00	0.32784E 00	0.49829E 00	0.50714E 00	0.17299E-05	0.17286E-05
74.0	0.18151E 00	0.19179E 00	0.35657E 00	0.33473E 00	0.50876E 00	0.51805E 00	0.17387E-05	0.17403E-05
76.0	0.18535E 00	0.19577E 00	0.36390E 00	0.34159E 00	0.51941E 00	0.52894E 00	0.17501E-05	0.17515E-05
78.0	0.19007E 00	0.19972E 00	0.37053E 00	0.34842E 00	0.53006E 00	0.53984E 00	0.17666E-05	0.17621E-05
80.0	0.19373E 00	0.20366E 00	0.37717E 00	0.35522E 00	0.54053E 00	0.55065E 00	0.17716E-05	0.17723E-05
82.0	0.19792E 00	0.20759E 00	0.38397E 00	0.36200E 00	0.55083E 00	0.56147E 00	0.17822E-05	0.17819E-05
84.0	0.20228E 00	0.21150E 00	0.39095E 00	0.36874E 00	0.56077E 00	0.57216E 00	0.17943E-05	0.17913E-05
86.0	0.20595E 00	0.21539E 00	0.39759E 00	0.37546E 00	0.57072E 00	0.58280E 00	0.17972E-05	0.17996E-05
88.0	0.20979E 00	0.21927E 00	0.40404E 00	0.38216E 00	0.58067E 00	0.59359E 00	0.18009E-05	0.18082E-05
90.0	0.21380E 00	0.22314E 00	0.41103E 00	0.38883E 00	0.59079E 00	0.60410E 00	0.18101E-05	0.18162E-05
92.0	0.21817E 00	0.22700E 00	0.41801E 00	0.39548E 00	0.60074E 00	0.61476E 00	0.18221E-05	0.18238E-05
94.0	0.22201E 00	0.23084E 00	0.42446E 00	0.40211E 00	0.61069E 00	0.62535E 00	0.18259E-05	0.18310E-05
96.0	0.22602E 00	0.23466E 00	0.43110E 00	0.40872E 00	0.62134E 00	0.63587E 00	0.18351E-05	0.18379E-05
98.0	0.23021E 00	0.23850E 00	0.43825E 00	0.41531E 00	0.63163E 00	0.64634E 00	0.18470E-05	0.18445E-05
100.0	0.23405E 00	0.24232E 00	0.44506E 00	0.42168E 00	0.64141E 00	0.65684E 00	0.18528E-05	0.18507E-05
105.0	0.24435E 00	0.25191E 00	0.46164E 00	0.43824E 00	0.66567E 00	0.68309E 00	0.18693E-05	0.18657E-05
110.0	0.25447E 00	0.26125E 00	0.47822E 00	0.45450E 00	0.69098E 00	0.70890E 00	0.18881E-05	0.18779E-05
115.0	0.26354E 00	0.27064E 00	0.49393E 00	0.47067E 00	0.71559E 00	0.73444E 00	0.18885E-05	0.18892E-05
STD DEV =		0.71495E-02		0.14216E-01		0.67236E-02		0.50774E-08

END-OF-DATA ENCOUNTERED ON SYSTEM INPUT FILE.

Figure D-7. Viscoelastic Analysis for Asphalt 72 at 39.2°F (Cont'd.).

DATA SHEET

EQUATION OF BEST FIT, n=1

EQUATION OF BEST FIT, n=2

SUMMARY SHEET FOR VISCOELASTIC ANALYSIS.

ASPHALT NO- 91
TEST TEMP- 39.2 F

LOADS- 800 1400 2000 GM
CTS- 32769. 56408. 81413. DY/SQCM

TIME MIN	THETA 1 RAD	CF 1 RA/D/SQCM	THETA 2 RAD	CF 2 RA/D/SQCM	THETA 3 RAD	CF 3 RA/D/SQCM	AVG CF RA/D/SQCM
0.0	0.69813E-03	-0.00000E-38	0.00000E-38	-0.00000E-38	0.52360E-02	-0.00000E-38	-0.0000000E-38
0.1	0.17453E-02	0.20262E-07	0.34907E-02	0.40576E-07	0.71559E-02	0.11079E-07	0.2663899E-07
0.2	0.19199E-02	0.13694E-07	0.43633E-02	0.50740E-07	0.89012E-02	0.20014E-07	0.2821586E-07
0.3	0.26180E-02	0.23504E-07	0.61087E-02	0.68374E-07	0.10647E-01	0.28999E-07	0.4027575E-07
0.4	0.33161E-02	0.33114E-07	0.87267E-02	0.10148E-06	0.12217E-01	0.35740E-07	0.5577790E-07
0.5	0.36652E-02	0.32072E-07	0.10472E-01	0.11911E-06	0.13788E-01	0.42532E-07	0.6457242E-07
0.6	0.43633E-02	0.41682E-07	0.12217E-01	0.13675E-06	0.15533E-01	0.51467E-07	0.7663231E-07
0.7	0.50615E-02	0.51292E-07	0.13090E-01	0.13891E-06	0.16581E-01	0.51876E-07	0.8067694E-07
0.8	0.52360E-02	0.44923E-07	0.14835E-01	0.15655E-06	0.17802E-01	0.54330E-07	0.8526687E-07
0.9	0.55851E-02	0.43881E-07	0.16581E-01	0.17418E-06	0.19199E-01	0.58978E-07	0.9234679E-07
1.0	0.64577E-02	0.58817E-07	0.18326E-01	0.19182E-06	0.20944E-01	0.67913E-07	0.1061821E-06
1.1	0.69813E-02	0.63101E-07	0.19199E-01	0.19399E-06	0.22166E-01	0.70416E-07	0.1091659E-06
1.2	0.69813E-02	0.51407E-07	0.20944E-01	0.21161E-06	0.22864E-01	0.66489E-07	0.1098367E-06
1.3	0.75049E-02	0.55691E-07	0.22689E-01	0.22925E-06	0.24435E-01	0.73280E-07	0.1194066E-06
1.4	0.83776E-02	0.70627E-07	0.24435E-01	0.24688E-06	0.26005E-01	0.80071E-07	0.1325272E-06

TAU1 = 0.3102675E 04 SEC G1 = 0.1168585E 07 DYNES/SQ CM VISC1 = 0.3618292E 10 POISES

TAU1 = 0.5205936E 04 SEC G1 = 0.1090028E 07 DYNES/SQ CM VISC1 = 0.5674637E 10 POISES
TAU2 = 0.2790133E 02 SEC G2 = 0.9541084E 07 DYNES/SQ CM VISC2 = 0.2662089E 09 POISES

	OBSERVED THETA 1 (RAD)	CALCULATED THETA 1 (RAD)	OBSERVED THETA 2 (RAD)	CALCULATED THETA 2 (RAD)	OBSERVED THETA 3 (RAD)	CALCULATED THETA 3 (RAD)	OBSERVED CP FUNCTION (RA/D/SQCM)	CALCULATED CP FUNCTION (RA/D/SQCM)
STD DEV =		0.29106E-02		0.73476E-02		0.12600E-01		0.62441E-07
STD DEV =		0.33048E-02		0.63000E-02		0.11978E-01		0.32968E-07

Figure D-8. Viscoelastic Analysis for Asphalt 91 at 39.2°F.

DATA SHEET

EQUATION OF BEST FIT, n=1

SUMMARY SHEET FOR VISCOELASTIC ANALYSIS

ASPHALT NO=116 LOADS= 600 1400 2000 GM
TEST TEMP= 39.2 F CTS= 33114. 58186. 83842. DY/SQCM

TAU1 = 0.1373814E 04 SEC G1 = 0.7960304E 06 DYNES/SQ CM VISC1 = 0.1093598E 10 POISES

TIME MIN	THETA 1 RAD	CF 1 RA/D/SQCM	THETA 2 RAD	CF 2 RA/D/SQCM	THETA 3 RAD	CF 3 RA/D/SQCM	AVG CF RA/D/SQCM	OBSERVED THETA 1 (RAD)	CALCULATED THETA 1 (RAD)	OBSERVED THETA 2 (RAD)	CALCULATED THETA 2 (RAD)	OBSERVED THETA 3 (RAD)	CALCULATED THETA 3 (RAD)	OBSERVED CF FUNCTION (RA/D/SQCM)	CALCULATED CF FUNCTION (RA/D/SQCM)
0.0	0.17453E-02	0.00000E-38	0.26180E-02	0.00000E-38	0.34907E-02	0.00000E-38	0.0000000E-36	0.17453E-02	0.16240E-02	0.26180E-02	0.26540E-02	0.34907E-02	0.41118E-02	-0.00000E-38	-0.00000E-38
0.1	0.26180E-02	0.23192E-07	0.34907E-02	0.12106E-07	0.57596E-02	0.23940E-07	0.1974611E-07	0.26180E-02	0.19100E-02	0.34907E-02	0.33400E-02	0.57596E-02	0.48325E-02	0.19745E-07	0.54745E-08
0.2	0.31416E-02	0.35842E-07	0.52360E-02	0.39208E-07	0.73304E-02	0.39554E-07	0.3820129E-07	0.31416E-02	0.21952E-02	0.52360E-02	0.38261E-02	0.73304E-02	0.55512E-02	0.38201E-07	0.10925E-07
0.3	0.34907E-02	0.43221E-07	0.61087E-02	0.51315E-07	0.82031E-02	0.46841E-07	0.4712556E-07	0.34907E-02	0.24796E-02	0.61087E-02	0.43100E-02	0.82031E-02	0.62679E-02	0.47126E-07	0.16352E-07
0.4	0.38397E-02	0.50601E-07	0.69813E-02	0.53421E-07	0.90757E-02	0.54128E-07	0.5604983E-07	0.38397E-02	0.27432E-02	0.69813E-02	0.47926E-02	0.90757E-02	0.69827E-02	0.56050E-07	0.21755E-07
0.5	0.43633E-02	0.63251E-07	0.73304E-02	0.66530E-07	0.10123E-01	0.63496E-07	0.6442583E-07	0.43633E-02	0.30460E-02	0.73304E-02	0.52738E-02	0.10123E-01	0.76954E-02	0.64426E-07	0.27135E-07
0.6	0.48869E-02	0.75901E-07	0.78540E-02	0.72638E-07	0.11170E-01	0.72865E-07	0.7380192E-07	0.48869E-02	0.33281E-02	0.78540E-02	0.57536E-02	0.11170E-01	0.84062E-02	0.73802E-07	0.32491E-07
0.7	0.52360E-02	0.83281E-07	0.87267E-02	0.84745E-07	0.12217E-01	0.82233E-07	0.8341969E-07	0.52360E-02	0.36094E-02	0.87267E-02	0.62321E-02	0.12217E-01	0.91151E-02	0.83420E-07	0.37824E-07
0.8	0.55851E-02	0.90660E-07	0.95993E-02	0.96851E-07	0.13090E-01	0.89520E-07	0.9234396E-07	0.55851E-02	0.38899E-02	0.95993E-02	0.67092E-02	0.13090E-01	0.98220E-02	0.92344E-07	0.43134E-07
0.9	0.61087E-02	0.10331E-06	0.10123E-01	0.10296E-06	0.13963E-01	0.96807E-07	0.1010257E-06	0.61087E-02	0.41697E-02	0.10123E-01	0.71850E-02	0.13963E-01	0.10527E-01	0.10103E-06	0.48420E-07
1.0	0.66323E-02	0.11596E-06	0.10472E-01	0.10407E-06	0.14835E-01	0.10409E-06	0.1087079E-06	0.66323E-02	0.44487E-02	0.10472E-01	0.76594E-02	0.14835E-01	0.11230E-01	0.10871E-06	0.53684E-07
1.1	0.69813E-02	0.12334E-06	0.10821E-01	0.10918E-06	0.15708E-01	0.11138E-06	0.1146331E-06	0.69813E-02	0.47269E-02	0.10821E-01	0.81325E-02	0.15708E-01	0.11931E-01	0.11463E-06	0.58929E-07
1.2	0.73304E-02	0.13072E-06	0.11868E-01	0.12428E-06	0.16581E-01	0.11867E-06	0.1245570E-06	0.73304E-02	0.50044E-02	0.11868E-01	0.86043E-02	0.16581E-01	0.12630E-01	0.12456E-06	0.64142E-07
1.3	0.78540E-02	0.14337E-06	0.12217E-01	0.12739E-06	0.17453E-01	0.12595E-06	0.1322391E-06	0.78540E-02	0.52811E-02	0.12217E-01	0.90748E-02	0.17453E-01	0.13328E-01	0.13224E-06	0.69337E-07
1.4	0.83776E-02	0.15602E-06	0.12566E-01	0.13050E-06	0.18151E-01	0.13116E-06	0.1392273E-06	0.83776E-02	0.55571E-02	0.12566E-01	0.95439E-02	0.18151E-01	0.14023E-01	0.13923E-06	0.74510E-07
1.5	0.83776E-02	0.15286E-06	0.13614E-01	0.14561E-06	0.19199E-01	0.14053E-06	0.1463331E-06	0.83776E-02	0.58323E-02	0.13614E-01	0.10012E-01	0.19199E-01	0.14716E-01	0.14633E-06	0.79659E-07
1.6	0.87267E-02	0.16026E-06	0.13963E-01	0.14872E-06	0.19722E-01	0.14365E-06	0.1500680E-06	0.87267E-02	0.61068E-02	0.13963E-01	0.10478E-01	0.19722E-01	0.15408E-01	0.15007E-06	0.84787E-07
1.7	0.90757E-02	0.16762E-06	0.14835E-01	0.16082E-06	0.20595E-01	0.15094E-06	0.1597931E-06	0.90757E-02	0.63806E-02	0.14835E-01	0.10943E-01	0.20595E-01	0.16098E-01	0.15979E-06	0.89892E-07
1.8	0.90757E-02	0.16446E-06	0.15708E-01	0.17293E-06	0.21118E-01	0.15406E-06	0.1638158E-06	0.90757E-02	0.66536E-02	0.15708E-01	0.11407E-01	0.21118E-01	0.16786E-01	0.16382E-06	0.94975E-07
1.9	0.95993E-02	0.17711E-06	0.16057E-01	0.17604E-06	0.21991E-01	0.16135E-06	0.1714979E-06	0.95993E-02	0.69258E-02	0.16057E-01	0.11870E-01	0.21991E-01	0.17472E-01	0.17150E-06	0.10004E-06
2.0	0.10123E-01	0.18976E-06	0.16581E-01	0.18215E-06	0.22689E-01	0.16655E-06	0.1794858E-06	0.10123E-01	0.71974E-02	0.16581E-01	0.12331E-01	0.22689E-01	0.18156E-01	0.17949E-06	0.10507E-06
2.1	0.10123E-01	0.18659E-06	0.17104E-01	0.18826E-06	0.23387E-01	0.17176E-06	0.1822030E-06	0.10123E-01	0.74682E-02	0.17104E-01	0.12791E-01	0.23387E-01	0.18836E-01	0.18220E-06	0.11009E-06
2.2	0.10472E-01	0.19397E-06	0.17453E-01	0.19136E-06	0.24086E-01	0.17696E-06	0.1874344E-06	0.10472E-01	0.77383E-02	0.17453E-01	0.13250E-01	0.24086E-01	0.19519E-01	0.18743E-06	0.11509E-06
2.3	0.10821E-01	0.20135E-06	0.17802E-01	0.19447E-06	0.24784E-01	0.18217E-06	0.1926657E-06	0.10821E-01	0.80077E-02	0.17802E-01	0.13708E-01	0.24784E-01	0.20197E-01	0.19267E-06	0.12006E-06
2.4	0.10821E-01	0.19819E-06	0.18326E-01	0.20058E-06	0.25482E-01	0.18737E-06	0.1953829E-06	0.10821E-01	0.82763E-02	0.18326E-01	0.14164E-01	0.25482E-01	0.20874E-01	0.19538E-06	0.12501E-06
2.5	0.11345E-01	0.21084E-06	0.18850E-01	0.20669E-06	0.26180E-01	0.19250E-06	0.2033708E-06	0.11345E-01	0.85443E-02	0.18850E-01	0.14619E-01	0.26180E-01	0.21549E-01	0.20337E-06	0.12994E-06
2.6	0.11868E-01	0.22349E-06	0.19199E-01	0.20980E-06	0.26878E-01	0.19779E-06	0.2103590E-06	0.11868E-01	0.88115E-02	0.19199E-01	0.15073E-01	0.26878E-01	0.22222E-01	0.21036E-06	0.13485E-06
2.7	0.12217E-01	0.23087E-06	0.19548E-01	0.21291E-06	0.27576E-01	0.20299E-06	0.2155903E-06	0.12217E-01	0.90780E-02	0.19548E-01	0.15525E-01	0.27576E-01	0.22894E-01	0.21559E-06	0.13973E-06
2.8	0.12217E-01	0.22771E-06	0.20071E-01	0.21902E-06	0.28100E-01	0.20611E-06	0.2176137E-06	0.12217E-01	0.93439E-02	0.20071E-01	0.15977E-01	0.28100E-01	0.23563E-01	0.21761E-06	0.14460E-06
2.9	0.12566E-01	0.23509E-06	0.20595E-01	0.22513E-06	0.28798E-01	0.21132E-06	0.2238447E-06	0.12566E-01	0.96090E-02	0.20595E-01	0.16427E-01	0.28798E-01	0.24231E-01	0.22384E-06	0.14944E-06
3.0	0.12566E-01	0.23193E-06	0.20944E-01	0.22824E-06	0.29496E-01	0.21652E-06	0.2255622E-06	0.12566E-01	0.98734E-02	0.20944E-01	0.16875E-01	0.29496E-01	0.24897E-01	0.22556E-06	0.15427E-06
4.0	0.13963E-01	0.24247E-06	0.25307E-01	0.27432E-06	0.35605E-01	0.25817E-06	0.2583217E-06	0.13963E-01	0.12480E-01	0.25307E-01	0.21297E-01	0.35605E-01	0.31463E-01	0.25832E-06	0.20136E-06
5.0	0.18326E-01	0.34262E-06	0.29671E-01	0.32041E-06	0.41888E-01	0.30189E-06	0.3216421E-06	0.18326E-01	0.15020E-01	0.29671E-01	0.25602E-01	0.41888E-01	0.37860E-01	0.32164E-06	0.24644E-06
6.0	0.20071E-01	0.36371E-06	0.33161E-01	0.35150E-06	0.47473E-01	0.33729E-06	0.3500353E-06	0.20071E-01	0.17495E-01	0.33161E-01	0.29794E-01	0.47473E-01	0.44035E-01	0.35008E-06	0.28959E-06
7.0	0.22689E-01	0.41115E-06	0.36652E-01	0.38760E-06	0.53058E-01	0.37269E-06	0.3868129E-06	0.22689E-01	0.19910E-01	0.36652E-01	0.33879E-01	0.53058E-01	0.50175E-01	0.38681E-06	0.33050E-06
8.0	0.24435E-01	0.43226E-06	0.40143E-01	0.41369E-06	0.58294E-01	0.40392E-06	0.4166102E-06	0.24435E-01	0.22267E-01	0.40143E-01	0.37862E-01	0.58294E-01	0.56108E-01	0.41662E-06	0.37044E-06
9.0	0.26180E-01	0.45533E-06	0.43633E-01	0.44478E-06	0.63355E-01	0.43308E-06	0.4437296E-06	0.26180E-01	0.24567E-01	0.43633E-01	0.41746E-01	0.63355E-01	0.61899E-01	0.44373E-06	0.40930E-06
10.0	0.28798E-01	0.50077E-06	0.47124E-01	0.47587E-06	0.68766E-01	0.46639E-06	0.4810133E-06	0.28798E-01	0.26814E-01	0.47124E-01	0.45536E-01	0.68766E-01	0.67554E-01	0.48101E-06	0.44453E-06
11.0	0.30543E-01	0.52186E-06	0.50615E-01	0.50697E-06	0.73653E-01	0.49346E-06	0.5074309E-06	0.30543E-01	0.29010E-01	0.50615E-01	0.49236E-01	0.73653E-01	0.73080E-01	0.50743E-06	0.47922E-06
12.0	0.32289E-01	0.54295E-06	0.53233E-01	0.52306E-06	0.78540E-01	0.52054E-06	0.5288500E-06	0.32289E-01	0.31156E-01	0.53233E-01	0.52849E-01	0.78540E-01	0.78481E-01	0.52885E-06	0.51242E-06
13.0	0.34034E-01	0.56404E-06	0.56723E-01	0.55416E-06	0.83252E-01	0.54553E-06	0.5545736E-06	0.34034E-01	0.33256E-01	0.56723E-01	0.56380E-01	0.83252E-01	0.83763E-01	0.55457E-06	0.54421E-06
14.0	0.35779E-01	0.58513E-06	0.59341E-01	0.57025E-06	0.87965E-01	0.57092E-06	0.5752988E-06	0.35779E-01	0.35311E-01	0.59341E-01	0.59832E-01	0.87965E-01	0.88931E-01	0.57530E-06	0.57464E-06
15.0	0.37525E-01	0.60622E-06	0.62832E-01	0.60135E-06	0.92502E-01	0.59342E-06	0.6003286E-06	0.37525E-01	0.37322E-01	0.62832E-01	0.63209E-01	0.92502E-01	0.93991E-01	0.60033E-06	0.60377E-06
16.0	0.39270E-01	0.62731E-06	0.65450E-01	0.61744E-06	0.97389E-01	0.62050E-06	0.6217477E-06	0.39270E-01	0.39292E-01	0.65450E-01	0.66513E-01	0.97389E-01	0.98946E-01	0.62175E-06	0.63165E-06
17.0	0.41015E-01	0.64839E-06	0.68068E-01	0.63354E-06	0.10175E 00	0.64143E-06	0.6410851E-06	0.41015E-01	0.41223E-01	0.68068E-01	0.69747E-01	0.10175E 00	0.10380E 00	0.64109E-06	0.65834E-06
18.0	0.42761E-01	0.66948E-06	0.71559E-01	0.66463E-06	0.10612E 00	0.66215E-06	0.6654210E-06	0.42761E-01	0.43116E-01	0.71559E-01	0.72915E-01	0.10612E 00	0.10856E 00	0.66542E-06	0.68389E-06
19.0	0.45379E-01	0.71692E-06	0.74177E-01	0.68073E-06	0.11065E 00	0.68506E-06	0.6942367E-06	0.45379E-01	0.44973E-01	0.74177E-01	0.76020E-01	0.11065E 00	0.11323E 00	0.69424E-06	0.70835E-06
20.0	0.47124E-01	0.73801E-06	0.76795E-01	0.69683E-06	0.11502E 00	0.70588E-06	0.7135742E-06	0.47124E-01	0.46796E-01	0.76795E-01	0.79066E-01	0.11502E 00	0.11781E 00	0.71357E-06	0.73175E-06
21.0	0.47997E-01	0.73275E-06	0.79413E-01	0.71292E-06	0.11903E 00	0.72255E-06	0.7227394E-06	0.47997E-01	0.48585E-01	0.79413E-01	0.82049E-01	0.11903E 00	0.12230E 00	0.72274E-06	0.75417E-06
22.0	0.49742E-01	0.75384E-06	0.82031E-01	0.72902E-06	0.12322E 00	0.74129E-06	0.7413029E-06	0.49742E-01	0.50342E-01	0.82031E-01	0.84979E-01	0.12322E 00	0.12672E 00	0.74130E-06	0.77563E-06
23.0	0.51487E-01	0.77493E-06	0.84649E-01	0.74512E-06	0.12723E 00	0.75195E-06	0.7590332E-06	0.51487E-01	0.52069E-01	0.84649E-01	0.87855E-01	0.12723E 00	0.13106E 00	0.75933E-06	0.79617E-06
24.0	0.53233E-01	0.79601E-06	0.87266E-01	0.76122E-06	0.13142E 00	0.77670E-06	0.7779760E-06	0.53233E-01	0.53767E-01	0.87266E-01	0.90681E-01	0.13142E 00	0.13533E 00	0.77798E-06	0.81583E-06
25.0	0.54978E-01	0.81710E-06	0.89884E-01	0.77731E-06	0.13526E 00	0.79128E-06	0.7952318E-06	0.54978E-01	0.55438E-01	0.89884E-01	0.93457E-01	0.13526E 00	0.13952E 00	0.79523E-06	0.83465E-06
26.0	0.56723E-01	0.83817E-06	0.92502E-01	0.79341E-06	0.13910E 00	0.80586E-06	0.8124875E-06	0.56723E-01	0.57081E-01	0.92502E-01	0.96187E-01	0.13910E 00	0.14365E 00	0.81249E-06	0.85266E-06
27.0	0.58469E-01	0.85928E-06	0.95120E-01	0.80951E-06	0.14294E 00	0.82044E-06	0.8297433E-06	0.58469E-01	0.58699E-01	0.95120E-01	0.98872E-01	0.14294E 00	0.14771E 00	0.82974E-06	0.86991E-06
28.0	0.60214E-01	0.88037E-06	0.97738E-01	0.82560E-06	0.14696E 00	0.83710E-06	0.8476929E-06	0.60214E-01	0.60293E-01	0.97738E-01	0.10151E 00	0.14696E 00	0.15171E 00	0.84769E-06	0.88642E-06
29.0	0.61959E-01	0.90146E-06	0.10036E 00	0.84170E-06	0.15062E 00	0.84960E-06	0.8642547E-06	0.61959E-01	0.61863E-01	0.10036E 00	0.10411E 00	0.15062E 00	0.15565E 00	0.86425E-06	0.90222E-06
30.0	0.63705E-01	0.92255E-06	0.10297E 00	0.85780E-06	0.15446E 00	0.86419E-06	0.8815105E-06	0.63705E-01	0.63411E-01	0.10297E 00	0.10668E 00	0.15446E 00	0.15956E 00	0.88151E-06	0.91735E-06
32.0	0.66323E-01	0.93831E-06	0.10734E 00	0.87500E-06	0.16214E 00	0.89335E-06	0.9022391E-06	0.66323E-01	0.66444E-01	0.10734E 00	0.11169E 00	0.16214E 00	0.16715E 00	0.90224E-06	0.94570E-06
34.0	0.68941E-01	0.95419E-06	0.11170E 00	0.89220E-06	0.16930E 00	0.91627E-06	0.9208860E-06	0.68941E-01	0.69398E-01	0.11170E 00	0.11656E 00	0.16930E 00	0.17456E 00	0.92089E-06	0.97157E-06
36.0	0.71559E-01	0.99644E-06	0.11694E 00	0.92439E-06	0.17680E 00	0.94335E-06	0.1287394E-05	0.71559E-01	0.72280E-01	0.11694E 00	0.12131E 00	0.17680E 00	0.18179E 00	0.12874E-05	0.99547E-06
38.0	0.75049E-01	0.10122E-05	0.12217E 00	0.95659E-06	0.18466E 00	0.97459E-06	0.9811245E-06	0.75049E-01	0.75092E-01	0.12217E 00	0.12594E 00	0.18466E 00	0.18886E 00	0.98112E-06	0.10173E-05
40.0	0.77667E-01	0.10280E-05	0.12654E 00	0.97377E-06	0.19181E 00	0.99751E-06	0.9997714E-06	0.77667E-01	0.77852E-01	0.12654E 00	0.13047E 00	0.19181E 00	0.19577E 00	0.99977E-06	0.10373E-05
42.0	0.80285E-01	0.10439E-05	0.13177E 00	0.10060E-05	0.19862E 00	0.10163E-05	0.1022029E-05	0.80285E-01	0.80553E-01	0.13177E 00	0.13490E 00	0.19862E 00	0.20254E 00	0.10220E-05	0.10556E-05
44.0	0.82903E-01	0.10597E-05	0.13614E 00	0.10232E-05	0.20543E 00	0.10350E-05	0.1039786E-05	0.82903E-01	0.83202E-01	0.13614E 00	0.13923E 00	0.20543E 00	0.20918E 00	0.10393E-05	0.10724E-05
46.0	0.85521E-01	0.10755E-05	0.14050E 00	0.10404E-05	0.21118E 00	0.10496E-05	0.1055159E-05	0.85521E-01	0.85806E-01	0.14050E 00	0.14349E 00	0.21118E 00	0.21570E 00	0.10552E-05	0.10877E-05
48.0	0.88139E-01	0.10913E-05	0.14486E 00	0.10576E-05	0.21852E 00	0.10643E-05	0.1071725E-05	0.88139E-01	0.88366E-01	0.14486E 00	0.14767E 00	0.21852E 00	0.22212E 00	0.10717E-05	0.11018E-05
50.0	0.90757E-01	0.11071E-05	0.14923E 00	0.10748E-05	0.22515E 00	0.10830E-05	0.1088290E-05	0.90757E-01	0.90880E-01	0.14923E 00	0.15179E 00	0.22515E 00	0.22843E 00	0.10883E-05	0.11149E-05
52.0	0.92502E-01	0.10966E-05	0.15359E 00	0.10920E-05	0.23108E 00	0.10913E-05	0.1093295E-05	0.92502E-01	0.93374E-01	0.15359E 00	0.15584E 00	0.23108E 00	0.23466E 00	0.10933E-05	0.11266E-05
54.0	0.95120E-01	0.11124E-05	0.15745E 00	0.11092E-05	0.23736E 00	0.11038E-05	0.1108472E-05	0.95120E-01	0.95827E-01	0.15745E 00	0.15983E 00	0.23736E 00	0.24080E 00	0.11085E-05	0.11374E-05
56.0	0.97738E-01	0.11283E-05	0.16232E 00	0.11264E-05	0.24365E 00	0.11163E-05	0.1123650E-05	0.97738E-01	0.98250E-01	0.16232E 00	0.16377E 00	0.24365E 00	0.24687E 00	0.11236E-05	0.11474E-05
58.0	0.99484E-01	0.11177E-05	0.16581E 00	0.11286E-05	0.25011E 00	0.11309E-05	0.1125738E-05	0.99484E-01	0.10065E 00	0.16581E 00	0.16767E 00	0.25011E 00	0.25287E 00	0.11257E-05	0.11565E-05
60.0	0.10210E 00	0.11336E-05	0.16930E 00	0.11300E-05	0.25656E 00	0.11455E-05	0.1136611E-05	0.10210E 00	0.10302E 00	0.16930E 00	0.17151E 00	0.25656E 00	0.25880E 00	0.11366E-05	0.11648E-05
62.0	0.10385E 00	0.11230E-05	0.17279E 00	0.11330E-05	0.26250E 00	0.11538E-05	0.1136618E-05	0.10385E 00	0.10536E 00	0.17279E 00	0.17532E 00	0.26250E 00	0.26468E 00	0.11366E-05	0.11725E-05
64.0	0.10647E 00	0.11388E-05	0.17715E 00	0.11502E-05	0.26913E 00	0.11705E-05	0.1153183E-05	0.10647E 00	0.10769E 00	0.17715E 00	0.17909E 00	0.26913E 00	0.27050E 00	0.11532E-05	0.11795E-05
66.0	0.10856E 00	0.11309E-05	0.18151E 00	0.11674E-05	0.27559E 00	0.11851E-05	0.1163784E-05	0.10856E 00	0.11000E 00	0.18151E 00	0.18283E 00	0.27559E 00	0.27627E 00	0.11638E-05	0.11859E-05
68.0	0.11083E 00	0.11441E-05	0.18500E 00	0.11696E-05	0.28222E 00	0.12018E-05	0.1171837E-05	0.11083E 00	0.11228E 00	0.18500E 00	0.18653E 00	0.28222E 00	0.28200E 00	0.11710E-05	0.11918E-05
70.0	0.11257E 00	0.11335E-05	0.18050E 00	0.11710E-05	0.28798E 00	0.12080E-05	0.1171150E-05	0.11257E 00	0.11456E 00	0.18850E 00	0.19021E 00	0.28798E 00	0.28769E 00	0.11711E-05	0.11972E-05
72.0	0.11519E 00	0.11494E-05	0.19199E 00	0.11745E-05	0.29444E 00	0.12226E-05	0.1182023E-05	0.11519E 00	0.11681E 00	0.19199E 00	0.19386E 00	0.29444E 00	0.29334E 00	0.11820E-05	0.12021E-05
74.0	0.11781E 00	0.11653E-05	0.19548E 00	0.11762E-05	0.30037E 00	0.12310E-05	0.1190814E-05	0.11781E 00	0.11906E 00	0.19548E 00	0.19748E 00	0.30037E 00	0.29895E 00	0.11908E-05	0.12066E-05
76.0	0.11781E 00	0.11020E-05	0.19897E 00	0.11706E-05	0.30648E 00	0.12414E-05	0.1173946E-05	0.11781E 00	0.12129E 00	0.19897E 00	0.20109E 00	0.30648E 00	0.30453E 00	0.11739E-05	0.12108E-05
78.0	0.11956E 00	0.10915E-05	0.20246E 00	0.11806E-05	0.31241E 00	0.12498E-05	0.1173952E-05	0.11956E 00	0.12351E 00	0.20246E 00	0.20467E 00	0.31241E 00	0.31009E 00	0.11740E-05	0.12146E-05
80.0	0.12392E 00	0.11600E-05	0.20595E 00	0.11828E-05	0.31905E 00	0.12664E-05	0.1203088E-05	0.12392E 00	0.12572E 00	0.20595E 00	0.20824E 00	0.31905E 00	0.31561E 00	0.12031E-05	0.12181E-05
82.0	0.12654E 00	0.11758E-05	0.20944E 00	0.11850E-05	0.32463E 00	0.12706E-05	0.1210491E-05	0.12654E 00	0.12792E 00	0.20944E 00	0.21178E 00	0.32463E 00	0.32112E 00	0.12105E-05	0.12213E-05
84.0	0.12863E 00	0.11759E-05	0.21293E 00	0.11872E-05	0.33126E 00	0.12873E-05	0.1216788E-05	0.12863E 00	0.13011E 00	0.21293E 00	0.21532E 00	0.33126E 00	0.32659E 00	0.12168E-05	0.12242E-05
86.0	0.13090E 00	0.11811E-05	0.21642E 00	0.11894E-05	0.33737E 00	0.12977E-05	0.1222759E-05	0.13090E 00	0.13229E 00	0.21642E 00	0.21884E 00	0.33737E 00	0.33205E 00	0.12228E-05	0.12269E-05
88.0	0.13352E 00	0.11970E-05	0.21991E 00	0.11916E-05	0.34348E 00	0.13081E-05	0.1232244E-05	0.13352E 00	0.13447E 00	0.21991E 00	0.22234E 00	0.34348E 00	0.33749E 00	0.12322E-05	0.12293E-05
90.0	0.13526E 00	0.11864E-05	0.22340E 00	0.11930E-05	0.35081E 00	0.13331E-05	0.1237802E-05	0.13526E 00	0.13664E 00	0.22340E 00	0.22583E 00	0.35081E 00	0.34292E 00	0.12378E-05	0.12316E-05
92.0	0.13788E 00	0.12023E-05	0.22689E 00	0.11960E-05	0.35692E 00	0.13436E-05	0.1247287E-05	0.13788E 00	0.13880E 00	0.22689E 00	0.22932E 00	0.35692E 00	0.34832E 00	0.12473E-05	0.12336E-05
94.0	0.14050E 00	0.12181E-05	0.22951E 00	0.11032E-05	0.36268E 00	0.13498E-05	0.1250386E-05	0.14050E 00	0.14096E 00	0.22951E 00	0.23279E 00	0.36268E 00	0.35372E 00	0.12504E-05	0.12355E-05
96.0	0.14224E 00	0.12076E-05	0.23300E 00	0.11854E-05	0.36914E 00	0.13644E-05	0.1252474E-05	0.14224E 00	0.14311E 00	0.23300E 00	0.23625E 00	0.36914E 00	0.35910E 00	0.12525E-05	0.12373E-05
98.0	0.14486E 00	0.12234E-05	0.23649E 00	0.11877E-05	0.37490E 00	0.13707E-05	0.1260572E-05	0.14486E 00	0.14525E 00	0.23649E 00	0.23971E 00	0.37490E 00	0.36446E 00	0.12606E-05	0.12388E-05
100.0	0.14661E 00	0.12129E-05	0.23998E 00	0.11899E-05	0.38083E 00	0.13790E-05	0.1260578E-05	0.14661E 00	0.14740E 00	0.23998E 00	0.24315E 00	0.38083E 00	0.36982E 00	0.12606E-05	0.12403E-05
105.0	0.15184E 00	0.12129E-05	0.24784E 00	0.11804E-05	0.39584E 00	0.14020E-05	0.1265075E-05	0.15184E 00	0.15273E 00	0.24784E 00	0.25174E 00	0.39584E 00	0.38317E 00	0.12651E-05	0.12434E-05
110.0	0.15708E 00	0.12129E-05	0.25656E 00	0.11859E-05	0.41050E 00	0.14208E-05	0.1273163E-05	0.15708E 00	0.15805E 00	0.25656E 00	0.26029E 00	0.41050E 00	0.39647E 00	0.12732E-05	0.12459E-05
115.0	0.16232E 00	0.12129E-05	0.26529E 00	0.11914E-05	0.42604E 00	0.14499E-05	0.1284760E-05	0.16232E 00	0.16335E 00	0.26529E 00	0.26882E 00	0.42604E 00	0.40972E 00	0.12848E-05	0.12480E-05
120.0	0.16755E 00	0.12130E-05	0.27402E 00	0.11969E-05	0.44262E 00	0.14916E-05	0.1300500E-05	0.16755E 00	0.16864E 00	0.27402E 00	0.27732E 00	0.44262E 00	0.42294E 00	0.13005E-05	0.12496E-05
125.0	0.17279E 00	0.12130E-05	0.28100E 00	0.11724E-05	0.45745E 00	0.15125E-05	0.1299304E-05	0.17279E 00	0.17392E 00	0.28100E 00	0.28580E 00	0.45745E 00	0.43614E 00	0.12993E-05	0.12509E-05
130.0	0.17802E 00	0.12130E-05	0.28972E 00	0.11779E-05	0.47124E 00	0.15209E-05	0.1303942E-05	0.17802E 00	0.17919E 00	0.28972E 00	0.29427E 00	0.47124E 00	0.44931E 00	0.13039E-05	0.12519E-05
135.0	0.18326E 00	0.12131E-05	0.29845E 00	0.11834E-05	0.48520E 00	0.15313E-05	0.1309274E-05	0.18326E 00	0.18445E 00	0.29845E 00	0.30272E 00	0.48520E 00	0.46247E 00	0.13093E-05	0.12528E-05
140.0	0.18850E 00	0.12131E-05	0.30718E 00	0.11889E-05	0.49742E 00	0.15210E-05	0.1307667E-05	0.18850E 00	0.18971E 00	0.30716E 00	0.31117E 00	0.49742E 00	0.47561E 00	0.13077E-05	0.12535E-05
145.0	0.19373E 00	0.12131E-05	0.31416E 00	0.11664E-05	0.51051E 00	0.15210E-05	0.1299533E-05	0.19373E 00	0.19496E 00	0.31416E 00	0.31961E 00	0.51051E 00	0.48874E 00	0.12995E-05	0.12540E-05

STD DEV = 0.16835E-02 0.31031E-02 0.70640E-02 0.52409E-07

Figure D-9. Viscoelastic Analysis for Asphalt 116 at 39.2°F.

EQUATION OF BEST FIT n=2

TAU1 = 0.1715820E 04 SEC   G1 = 0.8592630E 06 DYNES/SQ CM   VISC1 = 0.1474306E 10 POISES

TAU2 = 0.8095640E 02 SEC   G2 = 0.7756960E 07 DYNES/SQ CM   VISC2 = 0.6271998E 09 POISES

TIME MIN	OBSERVED THETA 1 (RAD)	CALCULATED THETA 1 (RAD)	OBSERVED THETA 2 (RAD)	CALCULATED THETA 2 (RAD)	OBSERVED THETA 3 (RAD)	CALCULATED THETA 3 (RAD)	OBSERVED CP FUNCTION (RA/D/SQCM)	CALCULATED CP FUNCTION (RA/D/SQCM)
0.0	0.17453E-02	0.16240E-02	0.26180E-02	0.28540E-02	0.34907E-02	0.41118E-02	-0.00000E-38	-0.00000E-38
0.1	0.26180E-02	0.21685E-02	0.34907E-02	0.37952E-02	0.57596E-02	0.54871E-02	0.19746E-07	0.13283E-07
0.2	0.31416E-02	0.26908E-02	0.52360E-02	0.46971E-02	0.73304E-02	0.68060E-02	0.38201E-07	0.25892E-07
0.3	0.34907E-02	0.31922E-02	0.61087E-02	0.55625E-02	0.82031E-02	0.80724E-02	0.47126E-07	0.37874E-07
0.4	0.38397E-02	0.36744E-02	0.69813E-02	0.63942E-02	0.90757E-02	0.92899E-02	0.56050E-07	0.49274E-07
0.5	0.43633E-02	0.41387E-02	0.73304E-02	0.71941E-02	0.10123E-01	0.10462E-01	0.64426E-07	0.60133E-07
0.6	0.48869E-02	0.45863E-02	0.78540E-02	0.79648E-02	0.11170E-01	0.11592E-01	0.73802E-07	0.70487E-07
0.7	0.52360E-02	0.50183E-02	0.87267E-02	0.87082E-02	0.12217E-01	0.12682E-01	0.83420E-07	0.80372E-07
0.8	0.55851E-02	0.54359E-02	0.95993E-02	0.94262E-02	0.13090E-01	0.13736E-01	0.92344E-07	0.89821E-07
0.9	0.61087E-02	0.58401E-02	0.10123E-01	0.10121E-01	0.13963E-01	0.14756E-01	0.10103E-06	0.98864E-07
1.0	0.66323E-02	0.62317E-02	0.10472E-01	0.10793E-01	0.14835E-01	0.15744E-01	0.10871E-06	0.10753E-06
1.1	0.69813E-02	0.66117E-02	0.10821E-01	0.11445E-01	0.15708E-01	0.16703E-01	0.11463E-06	0.11584E-06
1.2	0.73304E-02	0.69808E-02	0.11868E-01	0.12078E-01	0.16581E-01	0.17634E-01	0.12456E-06	0.12383E-06
1.3	0.78540E-02	0.73398E-02	0.12217E-01	0.12693E-01	0.17453E-01	0.18540E-01	0.13224E-06	0.13151E-06
1.4	0.83776E-02	0.76894E-02	0.12566E-01	0.13291E-01	0.18151E-01	0.19422E-01	0.13923E-06	0.13890E-06
1.5	0.83776E-02	0.80302E-02	0.13614E-01	0.13874E-01	0.19199E-01	0.20281E-01	0.14633E-06	0.14603E-06
1.6	0.87267E-02	0.83629E-02	0.13963E-01	0.14443E-01	0.19722E-01	0.21120E-01	0.15087E-06	0.15292E-06
1.7	0.90757E-02	0.86880E-02	0.14835E-01	0.14999E-01	0.20595E-01	0.21940E-01	0.15979E-06	0.15957E-06
1.8	0.90757E-02	0.90059E-02	0.15708E-01	0.15541E-01	0.21118E-01	0.22741E-01	0.16382E-06	0.16601E-06
1.9	0.95993E-02	0.93172E-02	0.16057E-01	0.16073E-01	0.21991E-01	0.23526E-01	0.17150E-06	0.17225E-06
2.0	0.10123E-01	0.96223E-02	0.16581E-01	0.16593E-01	0.22689E-01	0.24296E-01	0.17949E-06	0.17830E-06
2.1	0.10123E-01	0.99217E-02	0.17104E-01	0.17103E-01	0.23387E-01	0.25050E-01	0.18220E-06	0.18418E-06
2.2	0.10472E-01	0.10216E-01	0.17453E-01	0.17604E-01	0.24086E-01	0.25791E-01	0.18743E-06	0.18990E-06
2.3	0.10821E-01	0.10505E-01	0.17802E-01	0.18096E-01	0.24784E-01	0.26519E-01	0.19267E-06	0.19546E-06
2.4	0.10821E-01	0.10789E-01	0.18326E-01	0.18580E-01	0.25482E-01	0.27236E-01	0.19538E-06	0.20088E-06
2.5	0.11345E-01	0.11069E-01	0.18850E-01	0.19055E-01	0.26180E-01	0.27941E-01	0.20337E-06	0.20617E-06
2.6	0.11868E-01	0.11344E-01	0.19199E-01	0.19524E-01	0.26878E-01	0.28635E-01	0.21036E-06	0.21134E-06
2.7	0.12217E-01	0.11616E-01	0.19548E-01	0.19986E-01	0.27576E-01	0.29320E-01	0.21559E-06	0.21639E-06
2.8	0.12217E-01	0.11885E-01	0.20071E-01	0.20442E-01	0.28100E-01	0.29996E-01	0.21761E-06	0.22133E-06
2.9	0.12566E-01	0.12149E-01	0.20595E-01	0.20891E-01	0.28798E-01	0.30664E-01	0.22384E-06	0.22616E-06
3.0	0.12566E-01	0.12411E-01	0.20944E-01	0.21335E-01	0.29496E-01	0.31323E-01	0.22556E-06	0.23091E-06
4.0	0.13963E-01	0.14892E-01	0.25307E-01	0.25537E-01	0.35605E-01	0.37571E-01	0.25832E-06	0.27421E-06
5.0	0.18326E-01	0.17205E-01	0.29671E-01	0.29443E-01	0.41888E-01	0.43394E-01	0.32164E-06	0.31245E-06
6.0	0.20071E-01	0.19419E-01	0.33161E-01	0.33175E-01	0.47473E-01	0.48905E-01	0.35084E-06	0.34768E-06
7.0	0.22689E-01	0.21566E-01	0.36652E-01	0.36789E-01	0.53058E-01	0.54367E-01	0.38881E-06	0.38009E-06
8.0	0.24435E-01	0.23662E-01	0.40143E-01	0.40314E-01	0.58294E-01	0.59641E-01	0.41662E-06	0.41258E-06
9.0	0.26180E-01	0.25716E-01	0.43633E-01	0.43765E-01	0.63355E-01	0.64808E-01	0.44373E-06	0.44299E-06
10.0	0.28798E-01	0.27733E-01	0.47124E-01	0.47150E-01	0.68766E-01	0.69880E-01	0.48101E-06	0.47227E-06
11.0	0.30543E-01	0.29715E-01	0.50615E-01	0.50475E-01	0.73653E-01	0.74864E-01	0.50743E-06	0.50050E-06
12.0	0.32289E-01	0.31664E-01	0.53233E-01	0.53741E-01	0.78540E-01	0.79765E-01	0.52085E-06	0.52775E-06
13.0	0.34034E-01	0.33582E-01	0.56723E-01	0.56953E-01	0.83252E-01	0.84587E-01	0.55457E-06	0.55404E-06
14.0	0.35779E-01	0.35469E-01	0.59341E-01	0.60111E-01	0.87965E-01	0.89333E-01	0.57530E-06	0.57943E-06
15.0	0.37525E-01	0.37328E-01	0.62832E-01	0.63219E-01	0.92502E-01	0.94006E-01	0.60033E-06	0.60395E-06
16.0	0.39270E-01	0.39159E-01	0.65450E-01	0.66278E-01	0.97389E-01	0.98608E-01	0.62175E-06	0.62762E-06
17.0	0.41015E-01	0.40963E-01	0.68068E-01	0.69289E-01	0.10175E 00	0.10314E 00	0.64109E-06	0.65047E-06
18.0	0.42761E-01	0.42741E-01	0.71559E-01	0.72255E-01	0.10612E 00	0.10761E 00	0.66542E-06	0.67254E-06
19.0	0.45379E-01	0.44493E-01	0.74177E-01	0.75176E-01	0.11065E 00	0.11201E 00	0.69424E-06	0.69386E-06
20.0	0.47124E-01	0.46222E-01	0.76795E-01	0.78055E-01	0.11502E 00	0.11636E 00	0.71357E-06	0.71444E-06
21.0	0.47997E-01	0.47927E-01	0.79413E-01	0.80893E-01	0.11903E 00	0.12064E 00	0.72274E-06	0.73431E-06
22.0	0.49742E-01	0.49609E-01	0.82031E-01	0.83691E-01	0.12322E 00	0.12487E 00	0.74138E-06	0.75350E-06
23.0	0.51487E-01	0.51270E-01	0.84649E-01	0.86451E-01	0.12723E 00	0.12904E 00	0.75933E-06	0.77203E-06
24.0	0.53233E-01	0.52909E-01	0.87266E-01	0.89173E-01	0.13142E 00	0.13315E 00	0.77798E-06	0.78992E-06
25.0	0.54978E-01	0.54529E-01	0.89884E-01	0.91860E-01	0.13526E 00	0.13722E 00	0.79523E-06	0.80720E-06
26.0	0.56723E-01	0.56128E-01	0.92502E-01	0.94512E-01	0.13910E 00	0.14124E 00	0.81249E-06	0.82389E-06
27.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
28.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
29.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
30.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
32.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
34.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
36.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
38.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
40.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
42.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
44.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
46.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
48.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
50.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
52.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
54.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
56.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
58.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
60.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
62.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
64.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
66.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
68.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
70.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
72.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
74.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
76.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
78.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
80.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
82.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
84.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
86.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
88.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
90.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
92.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
94.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
96.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
98.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
100.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
105.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
110.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
115.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
120.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
125.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
130.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
135.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
140.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
145.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

STD DEV = 0.11020E-02   0.22925E-02   0.57361E-02   0.34127E-07

EQUATION OF BEST FIT, n=3

TAU1 = 0.1731450E 04 SEC   G1 = 0.8634229E 06 DYNES/SQ CM   VISC1 = 0.1494974E 10 POISES

TAU2 = 0.1040964E 03 SEC   G2 = 0.8404027E 07 DYNES/SQ CM   VISC2 = 0.8748493E 09 POISES

TAU3 = 0.6016047E 01 SEC   G3 = 0.5921601E 08 DYNES/SQ CM   VISC3 = 0.3562463E 09 POISES

OBSERVED THETA 1 (RAD)	CALCULATED THETA 1 (RAD)	OBSERVED THETA 2 (RAD)	CALCULATED THETA 2 (RAD)	OBSERVED THETA 3 (RAD)	CALCULATED THETA 3 (RAD)	OBSERVED CP FUNCTION (RA/D/SQCM)	CALCULATED CP FUNCTION (RA/D/SQCM)
0.17453E-02	0.16240E-02	0.26180E-02	0.28540E-02	0.34907E-02	0.41118E-02	-0.00000E-38	-0.00000E-38
0.26180E-02	0.24950E-02	0.34907E-02	0.42634E-02	0.57596E-02	0.61618E-02	0.19746E-07	0.21329E-07
0.31416E-02	0.30104E-02	0.52360E-02	0.52580E-02	0.73304E-02	0.76134E-02	0.38201E-07	0.35545E-07
0.34907E-02	0.34915E-02	0.61087E-02	0.60885E-02	0.87031E-02	0.88302E-02	0.47126E-07	0.46913E-07
0.38397E-02	0.39309E-02	0.69813E-02	0.68440E-02	0.90757E-02	0.99392E-02	0.56050E-07	0.57019E-07
0.43633E-02	0.43482E-02	0.73304E-02	0.75423E-02	0.10123E-01	0.10992E-01	0.64426E-07	0.66460E-07
0.48869E-02	0.47512E-02	0.78540E-02	0.82546E-02	0.11170E-01	0.12009E-01	0.73802E-07	0.75466E-07
0.52360E-02	0.51429E-02	0.87267E-02	0.89271E-02	0.12217E-01	0.12998E-01	0.83420E-07	0.84133E-07
0.55851E-02	0.55248E-02	0.95993E-02	0.95824E-02	0.13090E-01	0.13961E-01	0.92344E-07	0.92505E-07
0.61087E-02	0.58978E-02	0.10123E-01	0.10222E-01	0.13963E-01	0.14902E-01	0.10103E-06	0.10061E-06
0.66323E-02	0.62625E-02	0.10472E-01	0.10847E-01	0.14835E-01	0.15823E-01	0.10871E-06	0.10846E-06
0.69813E-02	0.66194E-02	0.10821E-01	0.11459E-01	0.15708E-01	0.16723E-01	0.11463E-06	0.11608E-06
0.73304E-02	0.69689E-02	0.11868E-01	0.12057E-01	0.16581E-01	0.17604E-01	0.12456E-06	0.12347E-06
0.78540E-02	0.73114E-02	0.12217E-01	0.12643E-01	0.17453E-01	0.18468E-01	0.13224E-06	0.13065E-06
0.83776E-02	0.76472E-02	0.12566E-01	0.13217E-01	0.18151E-01	0.19315E-01	0.13923E-06	0.13763E-06
0.83776E-02	0.79768E-02	0.13614E-01	0.13780E-01	0.19199E-01	0.20146E-01	0.14633E-06	0.14442E-06
0.87267E-02	0.83004E-02	0.13963E-01	0.14333E-01	0.19722E-01	0.20962E-01	0.15087E-06	0.15103E-06
0.90757E-02	0.86184E-02	0.14835E-01	0.14876E-01	0.20595E-01	0.21764E-01	0.15979E-06	0.15747E-06
0.90757E-02	0.89310E-02	0.15708E-01	0.15410E-01	0.21118E-01	0.22552E-01	0.16382E-06	0.16375E-06
0.95993E-02	0.92385E-02	0.16057E-01	0.15934E-01	0.21991E-01	0.23327E-01	0.17150E-06	0.16988E-06
0.10123E-01	0.95413E-02	0.16581E-01	0.16451E-01	0.22689E-01	0.24090E-01	0.17949E-06	0.17586E-06
0.10123E-01	0.98395E-02	0.17104E-01	0.16959E-01	0.23387E-01	0.24842E-01	0.18220E-06	0.18170E-06
0.10472E-01	0.10133E-01	0.17453E-01	0.17459E-01	0.24086E-01	0.25582E-01	0.18743E-06	0.18741E-06
0.10821E-01	0.10423E-01	0.17802E-01	0.17953E-01	0.24784E-01	0.26313E-01	0.19267E-06	0.19300E-06
0.10821E-01	0.10709E-01	0.18326E-01	0.18439E-01	0.25482E-01	0.27033E-01	0.19538E-06	0.19847E-06
0.11345E-01	0.10991E-01	0.18850E-01	0.18919E-01	0.26180E-01	0.27744E-01	0.20337E-06	0.20383E-06
0.11868E-01	0.11270E-01	0.19199E-01	0.19393E-01	0.26878E-01	0.28446E-01	0.21036E-06	0.20908E-06
0.12217E-01	0.11545E-01	0.19548E-01	0.19860E-01	0.27576E-01	0.29140E-01	0.21559E-06	0.21423E-06
0.12217E-01	0.11817E-01	0.20071E-01	0.20323E-01	0.28100E-01	0.29825E-01	0.21761E-06	0.21928E-06
0.12566E-01	0.12086E-01	0.20595E-01	0.20780E-01	0.28798E-01	0.30503E-01	0.22384E-06	0.22425E-06
0.12566E-01	0.12352E-01	0.20944E-01	0.21232E-01	0.29496E-01	0.31173E-01	0.22556E-06	0.22912E-06
0.13963E-01	0.14883E-01	0.25307E-01	0.25620E-01	0.35605E-01	0.37547E-01	0.25832E-06	0.27392E-06
0.18326E-01	0.17239E-01	0.29671E-01	0.29502E-01	0.41888E-01	0.43479E-01	0.32164E-06	0.31346E-06
0.20071E-01	0.19481E-01	0.33161E-01	0.33204E-01	0.47473E-01	0.49122E-01	0.35084E-06	0.34955E-06
0.22689E-01	0.21643E-01	0.36652E-01	0.36925E-01	0.53058E-01	0.54563E-01	0.38881E-06	0.38324E-06
0.24435E-01	0.23746E-01	0.40143E-01	0.40461E-01	0.58294E-01	0.59853E-01	0.41662E-06	0.41511E-06
0.26180E-01	0.25800E-01	0.43633E-01	0.43913E-01	0.63355E-01	0.65020E-01	0.44373E-06	0.44552E-06
0.28798E-01	0.27813E-01	0.47124E-01	0.47291E-01	0.68766E-01	0.70083E-01	0.48101E-06	0.47469E-06
0.30543E-01	0.29789E-01	0.50615E-01	0.50605E-01	0.73653E-01	0.75053E-01	0.50743E-06	0.50275E-06
0.32289E-01	0.31731E-01	0.53233E-01	0.53860E-01	0.78540E-01	0.79937E-01	0.52085E-06	0.52979E-06
0.34034E-01	0.33642E-01	0.56723E-01	0.57059E-01	0.83252E-01	0.84740E-01	0.55457E-06	0.55587E-06
0.35779E-01	0.35522E-01	0.59341E-01	0.60705E-01	0.87965E-01	0.89468E-01	0.57530E-06	0.58103E-06
0.37525E-01	0.37374E-01	0.62832E-01	0.63300E-01	0.92502E-01	0.94122E-01	0.60033E-06	0.60553E-06
0.39270E-01	0.39198E-01	0.65450E-01	0.66347E-01	0.97389E-01	0.98707E-01	0.62175E-06	0.62800E-06
0.41015E-01	0.40996E-01	0.68068E-01	0.69347E-01	0.10175E 00	0.10322E 00	0.64109E-06	0.65146E-06
0.42761E-01	0.42767E-01	0.71559E-01	0.72302E-01	0.10612E 00	0.10768E 00	0.66542E-06	0.67335E-06
0.45379E-01	0.44516E-01	0.74177E-01	0.75214E-01	0.11065E 00	0.11207E 00	0.69424E-06	0.69450E-06
0.47124E-01	0.46238E-01	0.76795E-01	0.78083E-01	0.11502E 00	0.11640E 00	0.71357E-06	0.71492E-06
0.47997E-01	0.47938E-01	0.79413E-01	0.80919E-01	0.11903E 00	0.12067E 00	0.72274E-06	0.73464E-06
0.49742E-01	0.49616E-01	0.82031E-01	0.83709E-01	0.12322E 00	0.12488E 00	0.74138E-06	0.75370E-06
0.51487E-01	0.51272E-01	0.84649E-01	0.86455E-01	0.12723E 00	0.12904E 00	0.75933E-06	0.77210E-06
0.53233E-01	0.52908E-01	0.87266E-01	0.89171E-01	0.13142E 00	0.13315E 00	0.77798E-06	0.78988E-06
0.54978E-01	0.54524E-01	0.89884E-01	0.91851E-01	0.13526E 00	0.13721E 00	0.79523E-06	0.80705E-06
0.56723E-01	0.56120E-01	0.92502E-01	0.94498E-01	0.13910E 00	0.14121E 00	0.81249E-06	0.82364E-06
0.58469E-01	0.57697E-01	0.95120E-01	0.97111E-01	0.14294E 00	0.14517E 00	0.82974E-06	0.83966E-06
0.60214E-01	0.59257E-01	0.97738E-01	0.99693E-01	0.14696E 00	0.14909E 00	0.84769E-06	0.85514E-06
0.61959E-01	0.60799E-01	0.10036E 00	0.10224E 00	0.15062E 00	0.15276E 00	0.86425E-06	0.87009E-06
0.63705E-01	0.62324E-01	0.10297E 00	0.10477E 00	0.15446E 00	0.15679E 00	0.88151E-06	0.88453E-06
0.66323E-01	0.65326E-01	0.10734E 00	0.10972E 00	0.16214E 00	0.16432E 00	0.90226E-06	0.91195E-06
0.68941E-01	0.68267E-01	0.11170E 00	0.11458E 00	0.16930E 00	0.17170E 00	0.92089E-06	0.93753E-06
0.71559E-01	0.71152E-01	0.11694E 00	0.11933E 00	0.17680E 00	0.17894E 00	0.12874E-05	0.96141E-06
0.75049E-01	0.73984E-01	0.12217E 00	0.12399E 00	0.18466E 00	0.18604E 00	0.98112E-06	0.98368E-06
0.77667E-01	0.76766E-01	0.12654E 00	0.12856E 00	0.19181E 00	0.19302E 00	0.99977E-06	0.10045E-05
0.80285E-01	0.79502E-01	0.13177E 00	0.13305E 00	0.19862E 00	0.19988E 00	0.10220E-05	0.10239E-05
0.82903E-01	0.82195E-01	0.13614E 00	0.13746E 00	0.20543E 00	0.20663E 00	0.10393E-05	0.10419E-05
0.85521E-01	0.84848E-01	0.14050E 00	0.14181E 00	0.21188E 00	0.21328E 00	0.10552E-05	0.10588E-05
0.88139E-01	0.87464E-01	0.14486E 00	0.14609E 00	0.21852E 00	0.21983E 00	0.10717E-05	0.10746E-05
0.90757E-01	0.90044E-01	0.14923E 00	0.15031E 00	0.22515E 00	0.22630E 00	0.10883E-05	0.10893E-05
0.92502E-01	0.92592E-01	0.15359E 00	0.15447E 00	0.23108E 00	0.23268E 00	0.10933E-05	0.11030E-05
0.95120E-01	0.95110E-01	0.15795E 00	0.15857E 00	0.23736E 00	0.23899E 00	0.11085E-05	0.11158E-05
0.97738E-01	0.97599E-01	0.16232E 00	0.16263E 00	0.24365E 00	0.24523E 00	0.11234E-05	0.11277E-05
0.99484E-01	0.10006E 00	0.16581E 00	0.16664E 00	0.25011E 00	0.25139E 00	0.11257E-05	0.11389E-05
0.10210E 00	0.10250E 00	0.16930E 00	0.17061E 00	0.25656E 00	0.25750E 00	0.11366E-05	0.11492E-05
0.10385E 00	0.10492E 00	0.17279E 00	0.17453E 00	0.26250E 00	0.26355E 00	0.11366E-05	0.11589E-05
0.10647E 00	0.10731E 00	0.17715E 00	0.17842E 00	0.26913E 00	0.26954E 00	0.11532E-05	0.11680E-05
0.10856E 00	0.10968E 00	0.18151E 00	0.18228E 00	0.27559E 00	0.27548E 00	0.11638E-05	0.11764E-05
0.11083E 00	0.11204E 00	0.18500E 00	0.18610E 00	0.28222E 00	0.28138E 00	0.11718E-05	0.11843E-05
0.11257E 00	0.11437E 00	0.18850E 00	0.18989E 00	0.28798E 00	0.28723E 00	0.11711E-05	0.11917E-05
0.11519E 00	0.11670E 00	0.19199E 00	0.19365E 00	0.29444E 00	0.29304E 00	0.11820E-05	0.11985E-05
0.11781E 00	0.11900E 00	0.19548E 00	0.19738E 00	0.30037E 00	0.29881E 00	0.11908E-05	0.12049E-05
0.11781E 00	0.12129E 00	0.19897E 00	0.20109E 00	0.30648E 00	0.30454E 00	0.11739E-05	0.12109E-05
0.11956E 00	0.12357E 00	0.20246E 00	0.20478E 00	0.31241E 00	0.31024E 00	0.11740E-05	0.12165E-05
0.12392E 00	0.12584E 00	0.20595E 00	0.20845E 00	0.31905E 00	0.31591E 00	0.12031E-05	0.12216E-05
0.12654E 00	0.12809E 00	0.20944E 00	0.21209E 00	0.32463E 00	0.32155E 00	0.12105E-05	0.12265E-05
0.12863E 00	0.13034E 00	0.21293E 00	0.21572E 00	0.33126E 00	0.32717E 00	0.12168E-05	0.12310E-05
0.13090E 00	0.13257E 00	0.21642E 00	0.21932E 00	0.33737E 00	0.33276E 00	0.12228E-05	0.12352E-05
0.13352E 00	0.13479E 00	0.21991E 00	0.22292E 00	0.34348E 00	0.33832E 00	0.12322E-05	0.12392E-05
0.13526E 00	0.13701E 00	0.22340E 00	0.22649E 00	0.35081E 00	0.34386E 00	0.12378E-05	0.12429E-05
0.13788E 00	0.13922E 00	0.22689E 00	0.23005E 00	0.35692E 00	0.34939E 00	0.12473E-05	0.12463E-05
0.14050E 00	0.14142E 00	0.22951E 00	0.23360E 00	0.36268E 00	0.35489E 00	0.12504E-05	0.12495E-05
0.14224E 00	0.14361E 00	0.23300E 00	0.23714E 00	0.36914E 00	0.36037E 00	0.12525E-05	0.12525E-05
0.14486E 00	0.14580E 00	0.23649E 00	0.24066E 00	0.37490E 00	0.36584E 00	0.12606E-05	0.12553E-05
0.14661E 00	0.14798E 00	0.23998E 00	0.24418E 00	0.38083E 00	0.37129E 00	0.12606E-05	0.12579E-05
0.15184E 00	0.15340E 00	0.24784E 00	0.25292E 00	0.39584E 00	0.38486E 00	0.12651E-05	0.12636E-05
0.15708E 00	0.15880E 00	0.25656E 00	0.26161E 00	0.41050E 00	0.39833E 00	0.12732E-05	0.12685E-05
0.16232E 00	0.16417E 00	0.26529E 00	0.27025E 00	0.42604E 00	0.41178E 00	0.12848E-05	0.12725E-05
0.16755E 00	0.16952E 00	0.27402E 00	0.27885E 00	0.44262E 00	0.42515E 00	0.13005E-05	0.12760E-05
0.17279E 00	0.17485E 00	0.28100E 00	0.28743E 00	0.45745E 00	0.43848E 00	0.12993E-05	0.12788E-05
0.17802E 00	0.18016E 00	0.28972E 00	0.29597E 00	0.47124E 00	0.45177E 00	0.13039E-05	0.12813E-05
0.18326E 00	0.18546E 00	0.29845E 00	0.30450E 00	0.48520E 00	0.46503E 00	0.13093E-05	0.12833E-05
0.18850E 00	0.19076E 00	0.30718E 00	0.31300E 00	0.49742E 00	0.47826E 00	0.13077E-05	0.12850E-05
0.19373E 00	0.19604E 00	0.31416E 00	0.32149E 00	0.51051E 00	0.49146E 00	0.12995E-05	0.12864E-05

STD DEV = 0.11034E-02   0.22978E-02   0.57130E-02   0.34051E-07

Figure D-9. Viscoelastic Analysis for Asphalt 116 at 39.2°F (Cont'd.).

DATA SHEET | EQUATION OF BEST FIT, n=1 | EQUATION OF BEST FIT, n=2

SUMMARY SHEET FOR VISCOELASTIC ANALYSIS

ASPHALT NO=127 LOADS= 600 1400 2000 GM

TEST TEMP= 39.2 F. FTS= 31522. 59?81. 63078. DY/SQCM

Equation of best fit, n=1: TAU1 = 0.1210275E 04 SEC G1 = 0.6776013E 06 DYNES/SQ CM VISC1 = 0.0543516E 09 POISE

Equation of best fit, n=2: TAU1 = 0.1941795E 04 SEC G1 = 0.7842194E 06 DYNES/SQ CM VISC1 = 0.1522793E 10 POISES

TAU2 = 0.3144141E 03 SEC G2 = 0.3478645E 07 DYNES/SQ CM VISC2 = 0.3990065E 09 POISES

TIME MIN	THETA 1 RAD	CP 1 RA7/D/SQCM	THETA 2 RAD	CP 2 RA7/D/SQCM	THETA 3 RAD	CP 3 RA7/D/SQCM	AVG CP RA7/D/SQCM	OBSERVED THETA 1 (RAD)	CALCULATED THETA 1 (RAD)	OBSERVED THETA 2 (RAD)	CALCULATED THETA 2 (RAD)	OBSERVED THETA 3 (RAD)	CALCULATED THETA 3 (RAD)	OBSERVED CP FUNCTION (RA7/D/SQCM)	CALCULATED CP FUNCTION (RA7/D/SQCM)	OBSERVED THETA 1 (RAD)	CALCULATED THETA 1 (RAD)	OBSERVED THETA 2 (RAD)	CALCULATED THETA 2 (RAD)	OBSERVED THETA 3 (RAD)	CALCULATED THETA 3 (RAD)	OBSERVED CP FUNCTION (RA7/D/SQCM)	CALCULATED CP FUNCTION (RA7/D/SQCM)
STD DEV =									0.30858E-02		0.10428E-01		0.16711E-01		0.75316E-07	STD DEV =	0.23785E-02		0.89463E-02		0.91776E-02		0.136756-07

Figure D-10. Viscoelastic Analysis for Asphalt 127 at 39.2°F.

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EQUATION OF BEST FIT, n=3

TAU1 = 0.20881918E 04 SEC   G1 = 0.81431298E 06 DYNES/SQ CM   VISC1 = 0.16841508E 10 POISES

TAU2 = 0.24021746E 03 SEC   G2 = 0.38170181E 07 DYNES/SQ CM   VISC2 = 0.91710466E 09 POISES

TAU3 = 0.17034436E 02 SEC   G3 = 0.12099436E 08 DYNES/SQ CM   VISC3 = 0.20610636E 09 POISES

EQUATION OF BEST FIT, n=4

TAU1 = 0.2112545E 04 SEC   G1 = 0.8295480E 06 DYNES/SQ CM   VISC1 = 0.1752456E 10 POISES

TAU2 = 0.3455950E 03 SEC   G2 = 0.4460651E 07 DYNES/SQ CM   VISC2 = 0.1541371E 10 POISES

TAU3 = 0.7775051E 02 SEC   G3 = 0.1022104E 08 DYNES/SQ CM   VISC3 = 0.7950798E 09 POISES

TAU4 = 0.6972495E 01 SEC   G4 = 0.2090723E 08 DYNES/SQ CM   VISC4 = 0.1457756E 09 POISES

EQUATION OF BEST FIT, n=5

TAU1 = 0.2110839E 04 SEC   G1 = 0.8288098E 06 DYNES/SQ CM   VISC1 = 0.1749484E 10 POISES

TAU2 = 0.3381285E 03 SEC   G2 = 0.4376427E 07 DYNES/SQ CM   VISC2 = 0.1479964E 10 POISES

TAU3 = 0.7216446E 02 SEC   G3 = 0.1056418E 08 DYNES/SQ CM   VISC3 = 0.7623580E 09 POISES

TAU4 = 0.6972495E 01 SEC   G4 = 0.2561291E 08 DYNES/SQ CM   VISC4 = 0.1786277E 09 POISES

TAU5 = 0.2540997E 00 SEC   G5 = 0.1536112E 09 DYNES/SQ CM   VISC5 = 0.3903256E 08 POISES

TIME MIN	OBSERVED THETA 1 (RAD)	CALCULATED THETA 1 (RAD)	OBSERVED THETA 2 (RAD)	CALCULATED THETA 2 (RAD)	OBSERVED THETA 3 (RAD)	CALCULATED THETA 3 (RAD)	OBSERVED CP FUNCTION (RAD/D/SQCM)	CALCULATED CP FUNCTION (RAD/D/SQCM)	OBSERVED THETA 1 (RAD)	CALCULATED THETA 1 (RAD)	OBSERVED THETA 2 (RAD)	CALCULATED THETA 2 (RAD)	OBSERVED THETA 3 (RAD)	CALCULATED THETA 3 (RAD)	OBSERVED CP FUNCTION (RAD/D/SQCM)	CALCULATED CP FUNCTION (RAD/D/SQCM)	OBSERVED THETA 1 (RAD)	CALCULATED THETA 1 (RAD)	OBSERVED THETA 2 (RAD)	CALCULATED THETA 2 (RAD)	OBSERVED THETA 3 (RAD)	CALCULATED THETA 3 (RAD)	OBSERVED CP FUNCTION (RAD/D/SQCM)	CALCULATED CP FUNCTION (RAD/D/SQCM)
0.0	0.698133E-03	0.172608E-02	0.344072E-02	0.326308E-02	0.698136E-02	0.444146E-02	-0.00000E-38	-0.00000E-38	0.698133E-03	0.172608E-02	0.344071E-02	0.326386E-02	0.698136E-02	0.444164E-02	-0.00000E-38	-0.00000E-38	0.698133E-03	0.172608E-02	0.344076E-02	0.326306E-02	0.698136E-02	0.444146E-02	-0.00000E-38	-0.00000E-38
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
160.0	0.23552E 00	0.23563E 00	0.44331E 00	0.43466E 00	0.62308E 00	0.64055E 00	0.15241E-05	0.15009E-05	0.23562E 00	0.23568E 00	0.44331E 00	0.43697E 00	0.62308E 00	0.64069E 00	0.15241E-05	0.15625E-05	0.23562E 00	0.23560E 00	0.44331E 00	0.43696E 00	0.62308E 00	0.64069E 00	0.15241E-05	0.15241E-05
STD DEV =	0.23438E-02		0.89231E-02		0.90960E-02		0.89843E-08		0.23883E-02		0.89235E-02		0.90894E-02		0.87425E-08		0.23883E-02		0.89235E-02		0.90835E-02		0.87401E-08	

Figure D-10. Viscoelastic Analysis for Asphalt 127 at 39.2°F (Cont'd.).

DATA SHEET

EQUATION OF BEST FIT, n=1

EQUATION OF BEST FIT, n=2

SUMMARY SHEET FOR VISCOELASTIC ANALYSIS

ASPHALT NO-200 LOADS- 400 600 800 GM

TEST TEMP-.39.2 F CTS- 16957. 25424. 33254. DY/SQCM

TIME MIN	THETA 1 RAD	CF 1 RA/D/SQCM	THETA 2 RAD	CF 2 RA/D/SQCM	THETA 3 RAD	CF 3 RA/D/SQCM	AVG CF RA/D/SQCM
0.0	0.17453E-02	-0.00000E-38	0.10472E-02	-0.00000E-38	0.17453E-02	-0.00000E-38	-0.0000000E-38
0.1	0.34907E-02	0.78063E-07	0.47124E-02	0.11929E-06	0.52360E-02	0.80788E-07	0.9297999E-07
0.2	0.52360E-02	0.15773E-06	0.69813E-02	0.18366E-06	0.78540E-02	0.13533E-06	0.1589061E-06
0.3	0.61087E-02	0.18516E-06	0.92502E-02	0.24803E-06	0.95993E-02	0.16364E-06	0.1989202E-06
0.4	0.69813E-02	0.21244E-06	0.10996E-01	0.29180E-06	0.12217E-01	0.21810E-06	0.2408169E-06
0.5	0.87267E-02	0.29133E-06	0.12915E-01	0.34244E-06	0.13090E-01	0.22025E-06	0.2846715E-06
0.6	0.95993E-02	0.31870E-06	0.14661E-01	0.38622E-06	0.14835E-01	0.24655E-06	0.3178207E-06
0.7	0.10472E-01	0.34607E-06	0.16232E-01	0.42313E-06	0.16581E-01	0.27685E-06	0.3486016E-06
0.8	0.12217E-01	0.42493E-06	0.17977E-01	0.46690E-06	0.18326E-01	0.30516E-06	0.3989954E-06
0.9	0.13090E-01	0.45230E-06	0.19199E-01	0.49008E-06	0.20071E-01	0.33346E-06	0.4252797E-06
1.0	0.13963E-01	0.47967E-06	0.20944E-01	0.53386E-06	0.21817E-01	0.36176E-06	0.4584209E-06
1.1	0.14835E-01	0.50704E-06	0.22340E-01	0.56390E-06	0.22689E-01	0.36383E-06	0.4782540E-06
1.2	0.15708E-01	0.53440E-06	0.23562E-01	0.58708E-06	0.24435E-01	0.39213E-06	0.5045383E-06
1.3	0.16581E-01	0.56177E-06	0.25133E-01	0.62399E-06	0.25307E-01	0.39419E-06	0.5266510E-06
1.4	0.17453E-01	0.58914E-06	0.26180E-01	0.64031E-06	0.27053E-01	0.42249E-06	0.5506470E-06
1.5	0.19326E-01	0.61651E-06	0.27925E-01	0.68408E-06	0.27925E-01	0.42455E-06	0.5750495E-06

TAU1 = 0.8126739E 03 SEC G1 = 0.3255818E 06 DYNES/SQ CM VISC1 = 0.2645756E 09 POISES

OBSERVED THETA 1 (RAD)	CALCULATED THETA 1 (RAD)	OBSERVED THETA 2 (RAD)	CALCULATED THETA 2 (RAD)	OBSERVED THETA 3 (RAD)	CALCULATED THETA 3 (RAD)	OBSERVED CF FUNCTION (RA/D/SQCM)	CALCULATED CF FUNCTION (RA/D/SQCM)
0.17453E-02	0.10818E-02	0.10472E-02	0.16229E-02	0.17453E-02	0.21227E-02	-0.00000E-38	-0.00000E-38
0.34907E-02	0.18735E-02	0.47124E-02	0.28297E-02	0.52360E-02	0.36782E-02	0.92990E-07	0.22594E-07
0.52360E-02	0.26624E-02	0.69813E-02	0.40323E-02	0.78540E-02	0.52281E-02	0.15891E-06	0.45022E-07
0.61087E-02	0.34446E-02	0.92502E-02	0.52307E-02	0.95993E-02	0.67726E-02	0.19892E-06	0.67286E-07

TAU1 = 0.1542356E 03 SEC G1 = 0.1819554E 07 DYNES/SQ CM VISC1 = 0.1592907E 09 POISES

TAU2 = 0.1597419E 04 SEC G2 = 0.4385649E 06 DYNES/SQ CM VISC2 = 0.7005720E 09 POISES

OBSERVED THETA 1 (RAD)	CALCULATED THETA 1 (RAD)	OBSERVED THETA 2 (RAD)	CALCULATED THETA 2 (RAD)	OBSERVED THETA 3 (RAD)	CALCULATED THETA 3 (RAD)	OBSERVED CF FUNCTION (RA/D/SQCM)	CALCULATED CF FUNCTION (RA/D/SQCM)
0.17453E-02	0.10618E-02	0.10472E-02	0.16229E-02	0.17453E-02	0.21227E-02	-0.00000E-38	-0.00000E-38
0.34907E-02	0.22617E-02	0.47124E-02	0.34121E-02	0.52360E-02	0.44399E-02	0.92980E-07	0.45501E-07
0.52360E-02	0.34175E-02	0.69813E-02	0.51651E-02	0.78540E-02	0.67098E-02	0.15893E-06	0.89578E-07
0.61087E-02	0.45501E-02	0.92502E-02	0.68833E-02	0.95993E-02	0.89340E-02	0.19892E-06	0.13229E-06

STD DEV = 0.84591E-02 0.886056E-02 0.25292E-01 0.11718E-06 STD DEV = 0.79236E-02 0.74457E-02 0.24792E-01 0.44183E-07

Figure D-11. Viscoelastic Analysis for Asphalt 200 at 39.2°F.

EQUATION OF BEST FIT, n=3

TAU1 = 0.3006240E 02 SEC G1 = 0.3713744E 07 DYNES/SQ CM VISC1 = 0.1116447E 09 POISES
TAU2 = 0.2024203E 04 SEC G2 = 0.5268760E 06 DYNES/SQ CM VISC2 = 0.1066403E 10 POISES
TAU3 = 0.4768351E 03 SEC G3 = 0.8696191E 06 DYNES/SQ CM VISC3 = 0.3294427E 09 POISES

EQUATION OF BEST FIT, n=4

TAU1 = 0.4013390E 02 SEC G1 = 0.4100711E 07 DYNES/SQ CM VISC1 = 0.1465366E 09 POISES
TAU2 = 0.2039147E 04 SEC G2 = 0.5282041E 06 DYNES/SQ CM VISC2 = 0.1078739E 10 POISES
TAU3 = 0.3892001E 03 SEC G3 = 0.8740348E 06 DYNES/SQ CM VISC3 = 0.3401744E 09 POISES
TAU4 = 0.2400997E 01 SEC G4 = 0.2286345E 09 DYNES/SQ CM VISC4 = 0.6821550E 09 POISES

TIME (MIN)	OBSERVED THETA 1 (RAD)	CALCULATED THETA 1 (RAD)	OBSERVED THETA 2 (RAD)	CALCULATED THETA 2 (RAD)	OBSERVED THETA 3 (RAD)	CALCULATED THETA 3 (RAD)	OBSERVED CP FUNCTION (RA/D/SQCM)	CALCULATED CP FUNCTION (RA/D/SQCM)	OBSERVED THETA 1 (RAD)	CALCULATED THETA 1 (RAD)	OBSERVED THETA 2 (RAD)	CALCULATED THETA 2 (RAD)	OBSERVED THETA 3 (RAD)	CALCULATED THETA 3 (RAD)	OBSERVED CP FUNCTION (RA/D/SQCM)	CALCULATED CP FUNCTION (RA/D/SQCM)
0.0	0.17453E-02	0.10818E-02	0.10472E-02	0.16229E-02	0.17453E-02	0.21227E-02	-0.00000E-38	-0.50000E-38	0.17453E-02	[illegible]	0.10472E-02	[illegible]	0.17453E-02	[illegible]	-0.00000E-38	[illegible]
0.1	0.34907E-02	0.27177E-02	0.47124E-02	0.40961E-02	0.52360E-02	0.53946E-02	0.92980E-07	0.72486E-07	0.34907E-02	[illegible]	0.47124E-02	[illegible]	0.52360E-02	[illegible]	0.92980E-07	[illegible]
0.2	0.52360E-02	0.41951E-02	0.69813E-02	0.63376E-02	0.79540E-02	0.82434E-02	0.15691E-06	0.13670E-06	0.52360E-02	[illegible]	0.69813E-02	[illegible]	0.79540E-02	[illegible]	0.15691E-06	[illegible]
0.3	0.61087E-02	0.55531E-02	0.92502E-02	0.83860E-02	0.95993E-02	0.10902E-01	0.19892E-06	0.19147E-06	0.61087E-02	[illegible]	0.92502E-02	[illegible]	0.95993E-02	[illegible]	0.19892E-06	[illegible]
0.4	0.69813E-02	0.66020E-02	0.10996E-01	0.10281E-01	0.12217E-01	0.13355E-01	0.24082E-06	0.24104E-06	0.69813E-02	[illegible]	0.10996E-01	[illegible]	0.12217E-01	[illegible]	0.24082E-06	[illegible]
0.5	0.87267E-02	0.79640E-02	0.12915E-01	0.12043E-01	0.13890E-01	0.15637E-01	0.28667E-06	0.28548E-06	0.87267E-02	[illegible]	0.12915E-01	[illegible]	0.13890E-01	[illegible]	0.28667E-06	[illegible]
0.6	0.95993E-02	0.90539E-02	0.14661E-01	0.13697E-01	0.14835E-01	0.17777E-01	0.31782E-06	0.32567E-06	0.95993E-02	[illegible]	0.14661E-01	[illegible]	0.14835E-01	[illegible]	0.31782E-06	[illegible]
0.7	0.10472E-01	0.10084E-01	0.16232E-01	0.15262E-01	0.16581E-01	0.19800E-01	0.34868E-06	0.36233E-06	0.10472E-01	[illegible]	0.16232E-01	[illegible]	0.16581E-01	[illegible]	0.34868E-06	[illegible]
0.8	0.12217E-01	0.11064E-01	0.17977E-01	0.16751E-01	0.18326E-01	0.21726E-01	0.39900E-06	0.39605E-06	0.12217E-01	[illegible]	0.17977E-01	[illegible]	0.18326E-01	[illegible]	0.39900E-06	[illegible]
0.9	0.13090E-01	0.12003E-01	0.19199E-01	0.18179E-01	0.20071E-01	0.23570E-01	0.42520E-06	0.42733E-06	0.13090E-01	[illegible]	0.19199E-01	[illegible]	0.20071E-01	[illegible]	0.42520E-06	[illegible]
1.0	0.13963E-01	0.12907E-01	0.20944E-01	0.19554E-01	0.21817E-01	0.25346E-01	0.45843E-06	0.45565E-06	0.13963E-01	0.12816E-01	0.20944E-01	0.19417E-01	0.21817E-01	0.25167E-01	0.45843E-06	0.45117E-06
1.1	0.14835E-01	0.13782E-01	0.22340E-01	0.20886E-01	0.22689E-01	0.27064E-01	0.47825E-06	0.48405E-06	0.14835E-01	0.13699E-01	0.22340E-01	0.20761E-01	0.22689E-01	0.26902E-01	0.47825E-06	0.47915E-06
1.2	0.15708E-01	0.14632E-01	0.23562E-01	0.22180E-01	0.24435E-01	0.28735E-01	0.50454E-06	0.51009E-06	0.15708E-01	0.14560E-01	0.23562E-01	0.22072E-01	0.24435E-01	0.28593E-01	0.50454E-06	0.50586E-06
1.3	0.16581E-01	0.15462E-01	0.25133E-01	0.23443E-01	0.25307E-01	0.30364E-01	0.52665E-06	0.53489E-06	0.16581E-01	0.15402E-01	0.25133E-01	0.23354E-01	0.25307E-01	0.30247E-01	0.52665E-06	0.53138E-06
1.4	0.17453E-01	0.16273E-01	0.26180E-01	0.24679E-01	0.27053E-01	0.31957E-01	0.55265E-06	0.55864E-06	0.17453E-01	0.16226E-01	0.26180E-01	0.24610E-01	0.27053E-01	0.31866E-01	0.55265E-06	0.55590E-06
1.5	0.18326E-01	0.17069E-01	0.27925E-01	0.25893E-01	0.27925E-01	0.33521E-01	0.57505E-06	0.58149E-06	0.18326E-01	0.17035E-01	0.27925E-01	0.25842E-01	0.27925E-01	0.33455E-01	0.57505E-06	0.57951E-06
1.6	0.19199E-01	0.17852E-01	0.29322E-01	0.27086E-01	0.29671E-01	0.35059E-01	0.60362E-06	0.60355E-06	0.19199E-01	0.17830E-01	0.29322E-01	0.27054E-01	0.29671E-01	0.35018E-01	0.60362E-06	0.60230E-06
1.7	0.20071E-01	0.18623E-01	0.30543E-01	0.28262E-01	0.30543E-01	0.36574E-01	0.62116E-06	0.62493E-06	0.20071E-01	0.18613E-01	0.30543E-01	0.28249E-01	0.30543E-01	0.36556E-01	0.62116E-06	0.62438E-06
1.8	0.20944E-01	0.19354E-01	0.31940E-01	0.29423E-01	0.31416E-01	0.38069E-01	0.64098E-06	0.64572E-06	0.20944E-01	0.19385E-01	0.31940E-01	0.29425E-01	0.31416E-01	0.38072E-01	0.64098E-06	0.64579E-06
1.9	0.21817E-01	0.20136E-01	0.33161E-01	0.30570E-01	0.33161E-01	0.39547E-01	0.66727E-06	0.66597E-06	0.21817E-01	0.20147E-01	0.33161E-01	0.30587E-01	0.33161E-01	0.39569E-01	0.66727E-06	0.66662E-06
2.0	0.22689E-01	0.20890E-01	0.34383E-01	0.31705E-01	0.34034E-01	0.41009E-01	0.68481E-06	0.68575E-06	0.22689E-01	0.20900E-01	0.34383E-01	0.31735E-01	0.34034E-01	0.41047E-01	0.68481E-06	0.68690E-06
2.1	0.23562E-01	0.21627E-01	0.35605E-01	0.32830E-01	0.35779E-01	0.42457E-01	0.71109E-06	0.70511E-06	0.23562E-01	0.21644E-01	0.35605E-01	0.32870E-01	0.35779E-01	0.42510E-01	0.71109E-06	0.70570E-06
2.2	0.24435E-01	0.22347E-01	0.36652E-01	0.33945E-01	0.36652E-01	0.43892E-01	0.72634E-06	0.72408E-06	0.24435E-01	0.22381E-01	0.36652E-01	0.33995E-01	0.36652E-01	0.43957E-01	0.72634E-06	0.72605E-06
2.3	0.25307E-01	0.23072E-01	0.39040E-01	0.35051E-01	0.38397E-01	0.45316E-01	0.75491E-06	0.74270E-06	0.25307E-01	0.23115E-01	0.39040E-01	0.35109E-01	0.38397E-01	0.45391E-01	0.75491E-06	0.74498E-06
2.4	0.26180E-01	0.23791E-01	0.39270E-01	0.36148E-01	0.39270E-01	0.46728E-01	0.77245E-06	0.76100E-06	0.26180E-01	0.23835E-01	0.39270E-01	0.36213E-01	0.39270E-01	0.46812E-01	0.77245E-06	0.76354E-06
2.5	0.27053E-01	0.24504E-01	0.40492E-01	0.37238E-01	0.40143E-01	0.48130E-01	0.78998E-06	0.77899E-06	0.27053E-01	0.24551E-01	0.40492E-01	0.37308E-01	0.40143E-01	0.48222E-01	0.78998E-06	0.78174E-06
2.6	0.27925E-01	0.25213E-01	0.41713E-01	0.38321E-01	0.41015E-01	0.49523E-01	0.80752E-06	0.79670E-06	0.27925E-01	0.25263E-01	0.41713E-01	0.38395E-01	0.41015E-01	0.49620E-01	0.80752E-06	0.79956E-06
2.7	0.27925E-01	0.25916E-01	0.42761E-01	0.39396E-01	0.42761E-01	0.50907E-01	0.81435E-06	0.81414E-06	0.27925E-01	0.25967E-01	0.42761E-01	0.39473E-01	0.42761E-01	0.51008E-01	0.81435E-06	0.81717E-06
2.8	0.28798E-01	0.26616E-01	0.44157E-01	0.40466E-01	0.43633E-01	0.52283E-01	0.83418E-06	0.83133E-06	0.28798E-01	0.26671E-01	0.44157E-01	0.40545E-01	0.43633E-01	0.52387E-01	0.83430E-06	0.83444E-06
2.9	0.29671E-01	0.27314E-01	0.45379E-01	0.41529E-01	0.44506E-01	0.53651E-01	0.85171E-06	0.84828E-06	0.29671E-01	0.27367E-01	0.45379E-01	0.41609E-01	0.44506E-01	0.53756E-01	0.85171E-06	0.85144E-06
3.0	0.30543E-01	0.28006E-01	0.46251E-01	0.42587E-01	0.46251E-01	0.55011E-01	0.87342E-06	0.86500E-06	0.30543E-01	0.28060E-01	0.46251E-01	0.42667E-01	0.46251E-01	0.55116E-01	0.87342E-06	0.86917E-06
4.0	0.37525E-01	0.34739E-01	0.57596E-01	0.52878E-01	0.56723E-01	0.68241E-01	0.10205E-05	0.10210E-05	0.37525E-01	0.34779E-01	0.57596E-01	0.52938E-01	0.56723E-01	0.68320E-01	0.10205E-05	0.10234E-05
5.0	0.44506E-01	0.41170E-01	0.68068E-01	0.62728E-01	0.67195E-01	0.80931E-01	0.11562E-05	0.11598E-05	0.44506E-01	0.41196E-01	0.68068E-01	0.62756E-01	0.67195E-01	0.80931E-01	0.11562E-05	0.11600E-05
6.0	0.50615E-01	0.47370E-01	0.78540E-01	0.72208E-01	0.77667E-01	0.93063E-01	0.12747E-05	0.12839E-05	0.50615E-01	0.47370E-01	0.78540E-01	0.72206E-01	0.77667E-01	0.93063E-01	0.12747E-05	0.12839E-05
7.0	0.57596E-01	0.53349E-01	0.88488E-01	0.81367E-01	0.87266E-01	0.10481E 00	0.13947E-05	0.13954E-05	0.57596E-01	0.53335E-01	0.88488E-01	0.81348E-01	0.87266E-01	0.10479E 00	0.13947E-05	0.13966E-05
8.0	0.65450E-01	0.59121E-01	0.97913E-01	0.90218E-01	0.88314E-01	0.11616E 00	0.14393E-05	0.14960E-05	0.65450E-01	0.59121E-01	0.97913E-01	0.90218E-01	0.88314E-01	0.11616E 00	0.14393E-05	0.14968E-05
9.0	0.69813E-01	0.64776E-01	0.10734E 00	0.98892E-01	0.10734E 00	0.12722E 00	0.15995E-05	0.15972E-05	0.69813E-01	0.64750E-01	0.10734E 00	0.98853E-01	0.10734E 00	0.12722E 00	0.15995E-05	0.15057E-05
10.0	0.75049E-01	0.70270E-01	0.11676E 00	0.10732E 00	0.11781E 00	0.13802E 00	0.16830E-05	0.16702E-05	0.75049E-01	0.70243E-01	0.11676E 00	0.10729E 00	0.11781E 00	0.13800E 00	0.16830E-05	0.16605E-05
11.0	0.81158E-01	0.75643E-01	0.12479E 00	0.11558E 00	0.12566E 00	0.14846E 00	0.17433E-05	0.17459E-05	0.81158E-01	0.75616E-01	0.12479E 00	0.11554E 00	0.12566E 00	0.14858E 00	0.17433E-05	0.17443E-05
12.0	0.87266E-01	0.80909E-01	0.13317E 00	0.12367E 00	0.13526E 00	0.15859E 00	0.18255E-05	0.18154E-05	0.87266E-01	0.80884E-01	0.13317E 00	0.12363E 00	0.13526E 00	0.15894E 00	0.18255E-05	0.18140E-05
13.0	0.92502E-01	0.86082E-01	0.14137E 00	0.13162E 00	0.14312E 00	0.16916E 00	0.18709E-05	0.18779E-05	0.92502E-01	0.86060E-01	0.14137E 00	0.13158E 00	0.14312E 00	0.16911E 00	0.18709E-05	0.18781E-05
14.0	0.97738E-01	0.91174E-01	0.14923E 00	0.13945E 00	0.15272E 00	0.17917E 00	0.19291E-05	0.19367E-05	0.97738E-01	0.91155E-01	0.14923E 00	0.13942E 00	0.15272E 00	0.17913E 00	0.19291E-05	0.19375E-05
15.0	0.10297E 00	0.96194E-01	0.15708E 00	0.14717E 00	0.16232E 00	0.18904E 00	0.19874E-05	0.19935E-05	0.10297E 00	0.96178E-01	0.15708E 00	0.14715E 00	0.16232E 00	0.18901E 00	0.19874E-05	0.19927E-05
16.0	0.10821E 00	0.10115E 00	0.16458E 00	0.15479E 00	0.17017E 00	0.19870E 00	0.20235E-05	0.20448E-05	0.10821E 00	0.10114E 00	0.16458E 00	0.15478E 00	0.17017E 00	0.19876E 00	0.20235E-05	0.20441E-05
17.0	0.11345E 00	0.10605E 00	0.17244E 00	0.16234E 00	0.17977E 00	0.20641E 00	0.20818E-05	0.20927E-05	0.11345E 00	0.10604E 00	0.17244E 00	0.16232E 00	0.17977E 00	0.20840E 00	0.20818E-05	0.20922E-05
18.0	0.11868E 00	0.11090E 00	0.17942E 00	0.16980E 00	0.19024E 00	0.21795E 00	0.21374E-05	0.21375E-05	0.11868E 00	0.11099E 00	0.17942E 00	0.16979E 00	0.19024E 00	0.21794E 00	0.21374E-05	0.21375E-05
19.0	0.12392E 00	0.11570E 00	0.18675E 00	0.17720E 00	0.19984E 00	0.22734E 00	0.21887E-05	0.21798E-05	0.12392E 00	0.11570E 00	0.18675E 00	0.17720E 00	0.19984E 00	0.22739E 00	0.21887E-05	0.21797E-05
20.0	0.12915E 00	0.12047E 00	0.19426E 00	0.18454E 00	0.20944E 00	0.23676E 00	0.22424E-05	0.22197E-05	0.12915E 00	0.12047E 00	0.19426E 00	0.18454E 00	0.20944E 00	0.23676E 00	0.22424E-05	0.22197E-05
21.0	0.13439E 00	0.12520E 00	0.20159E 00	0.19182E 00	0.21904E 00	0.24606E 00	0.22938E-05	0.22574E-05	0.13439E 00	0.12520E 00	0.20159E 00	0.19182E 00	0.21904E 00	0.24606E 00	0.22938E-05	0.22576E-05
22.0	0.13963E 00	0.12989E 00	0.20957E 00	0.19905E 00	0.22689E 00	0.25529E 00	0.23231E-05	0.22932E-05	0.13963E 00	0.12990E 00	0.20957E 00	0.19906E 00	0.22689E 00	0.25530E 00	0.23231E-05	0.22935E-05
23.0	0.14399E 00	0.13456E 00	0.21572E 00	0.20624E 00	0.23649E 00	0.26446E 00	0.23550E-05	0.23273E-05	0.14399E 00	0.13456E 00	0.21572E 00	0.20625E 00	0.23649E 00	0.26448E 00	0.23550E-05	0.23277E-05
24.0	0.14835E 00	0.13919E 00	0.22253E 00	0.21339E 00	0.24522E 00	0.27358E 00	0.23787E-05	0.23597E-05	0.14835E 00	0.13920E 00	0.22253E 00	0.21341E 00	0.24522E 00	0.27360E 00	0.23787E-05	0.23602E-05
25.0	0.15359E 00	0.14381E 00	0.22969E 00	0.22050E 00	0.25395E 00	0.28265E 00	0.24140E-05	0.23907E-05	0.15359E 00	0.14382E 00	0.22969E 00	0.22052E 00	0.25395E 00	0.28267E 00	0.24140E-05	0.23913E-05
26.0	0.15779E 00	0.14840E 00	0.23649E 00	0.22758E 00	0.26267E 00	0.29168E 00	0.24326E-05	0.24204E-05	0.15779E 00	0.14841E 00	0.23649E 00	0.22760E 00	0.26267E 00	0.29170E 00	0.24326E-05	0.24210E-05
27.0	0.16319E 00	0.15297E 00	0.24330E 00	0.23463E 00	0.27140E 00	0.30067E 00	0.24684E-05	0.24487E-05	0.16319E 00	0.15298E 00	0.24330E 00	0.23466E 00	0.27140E 00	0.30069E 00	0.24684E-05	0.24494E-05
28.0	0.16755E 00	0.15752E 00	0.25011E 00	0.24164E 00	0.28100E 00	0.30961E 00	0.24957E-05	0.24760E-05	0.16755E 00	0.15753E 00	0.25011E 00	0.24166E 00	0.28100E 00	0.30964E 00	0.24957E-05	0.24767E-05
29.0	0.17192E 00	0.16205E 00	0.25709E 00	0.24863E 00	0.28885E 00	0.31852E 00	0.25079E-05	0.25027E-05	0.17192E 00	0.16206E 00	0.25709E 00	0.24865E 00	0.28885E 00	0.31855E 00	0.25079E-05	0.25029E-05
30.0	0.17628E 00	0.16656E 00	0.26389E 00	0.25560E 00	0.29758E 00	0.32740E 00	0.25265E-05	0.25273E-05	0.17628E 00	0.16658E 00	0.26389E 00	0.25562E 00	0.29758E 00	0.32743E 00	0.25265E-05	0.25281E-05
32.0	0.18500E 00	0.17555E 00	0.27786E 00	0.26946E 00	0.31416E 00	0.34507E 00	0.25767E-05	0.25749E-05	0.18500E 00	0.17556E 00	0.27786E 00	0.26947E 00	0.31416E 00	0.34507E 00	0.25767E-05	0.25756E-05
34.0	0.19548E 00	0.18448E 00	0.29013E 00	0.28323E 00	0.33161E 00	0.36262E 00	0.26288E-05	0.26199E-05	0.19548E 00	0.18449E 00	0.29130E 00	0.28325E 00	0.33161E 00	0.36265E 00	0.26288E-05	0.26199E-05
36.0	0.20333E 00	0.19336E 00	0.30281E 00	0.29693E 00	0.34819E 00	0.38008E 00	0.26126E-05	0.26625E-05	0.20333E 00	0.19336E 00	0.30281E 00	0.29694E 00	0.34819E 00	0.38010E 00	0.26126E-05	0.26611E-05
38.0	0.21206E 00	0.20219E 00	0.31765E 00	0.31056E 00	0.36477E 00	0.39746E 00	0.26571E-05	0.26997E-05	0.21206E 00	0.20219E 00	0.31765E 00	0.31057E 00	0.36477E 00	0.39746E 00	0.26571E-05	0.26997E-05
40.0	0.22078E 00	0.21097E 00	0.33161E 00	0.32413E 00	0.38223E 00	0.41475E 00	0.26989E-05	0.27353E-05	0.22078E 00	0.21098E 00	0.33161E 00	0.32414E 00	0.38223E 00	0.41475E 00	0.26989E-05	0.27358E-05
42.0	0.22951E 00	0.21973E 00	0.34505E 00	0.33765E 00	0.39968E 00	0.43195E 00	0.27339E-05	0.27693E-05	0.22951E 00	0.21973E 00	0.34505E 00	0.33765E 00	0.39968E 00	0.43195E 00	0.27339E-05	0.27696E-05
44.0	0.23824E 00	0.22844E 00	0.35884E 00	0.35110E 00	0.41713E 00	0.44908E 00	0.27734E-05	0.28011E-05	0.23824E 00	0.22846E 00	0.35884E 00	0.35110E 00	0.41713E 00	0.44909E 00	0.27734E-05	0.28014E-05
46.0	0.24609E 00	0.23713E 00	0.37245E 00	0.36450E 00	0.43459E 00	0.46616E 00	0.27934E-05	0.28313E-05	0.24609E 00	0.23714E 00	0.37245E 00	0.36451E 00	0.43459E 00	0.46617E 00	0.27934E-05	0.28313E-05
48.0	0.25482E 00	0.24578E 00	0.38572E 00	0.37787E 00	0.45204E 00	0.48318E 00	0.28260E-05	0.28592E-05	0.25482E 00	0.24579E 00	0.38572E 00	0.37787E 00	0.45204E 00	0.48319E 00	0.28260E-05	0.28594E-05
50.0	0.26354E 00	0.25441E 00	0.39846E 00	0.39119E 00	0.46949E 00	0.50014E 00	0.28518E-05	0.28857E-05	0.26354E 00	0.25441E 00	0.39846E 00	0.39119E 00	0.46949E 00	0.50015E 00	0.28518E-05	0.28858E-05
52.0	0.27227E 00	0.26301E 00	0.41190E 00	0.40447E 00	0.48607E 00	0.51706E 00	0.28780E-05	0.29107E-05	0.27227E 00	0.26301E 00	0.41190E 00	0.40447E 00	0.48607E 00	0.51706E 00	0.28780E-05	0.29107E-05
54.0	0.28100E 00	0.27158E 00	0.42481E 00	0.41772E 00	0.50266E 00	0.53392E 00	0.28973E-05	0.29341E-05	0.28100E 00	0.27158E 00	0.42481E 00	0.41772E 00	0.50266E 00	0.53392E 00	0.28973E-05	0.29341E-05
56.0	0.29860E 00	[illegible]	0.43860E 00	[illegible]	0.51974E 00	[illegible]	0.29452E-05	0.29562E-05	0.29860E 00	0.28013E 00	0.43860E 00	0.43092E 00	0.51974E 00	0.55073E 00	0.29452E-05	0.29562E-05
58.0	0.29932E 00	[illegible]	0.45204E 00	[illegible]	0.53582E 00	[illegible]	0.29714E-05	0.29771E-05	0.29932E 00	0.28860E 00	0.45204E 00	0.44410E 00	0.53582E 00	0.56751E 00	0.29714E-05	0.29769E-05
60.0	0.30805E 00	[illegible]	0.46565E 00	[illegible]	0.55240E 00	[illegible]	0.29994E-05	0.29967E-05	0.30805E 00	0.29712E 00	0.46565E 00	0.45725E 00	0.55240E 00	0.58424E 00	0.29994E-05	0.29965E-05
62.0	0.31678E 00	[illegible]	0.47357E 00	[illegible]	0.56898E 00	[illegible]	0.30192E-05	0.30152E-05	0.31678E 00	0.30566E 00	0.47357E 00	0.47036E 00	0.56898E 00	0.60094E 00	0.30192E-05	0.30150E-05
64.0	0.32463E 00	[illegible]	0.49201E 00	[illegible]	0.58730E 00	[illegible]	0.30457E-05	0.30326E-05	0.32463E 00	0.31413E 00	0.49201E 00	0.48345E 00	0.58730E 00	0.61760E 00	0.30457E-05	0.30324E-05
66.0	0.33336E 00	[illegible]	0.50492E 00	[illegible]	0.60388E 00	[illegible]	0.30650E-05	0.30490E-05	0.33336E 00	0.32258E 00	0.50492E 00	0.49652E 00	0.60388E 00	0.63422E 00	0.30650E-05	0.30487E-05
68.0	0.34208E 00	[illegible]	0.51836E 00	[illegible]	0.61959E 00	[illegible]	0.30825E-05	0.30644E-05	0.34208E 00	0.33102E 00	0.51836E 00	0.50956E 00	0.61959E 00	0.65082E 00	0.30825E-05	0.30647E-05
70.0	0.35081E 00	[illegible]	0.53180E 00	[illegible]	0.63530E 00	[illegible]	0.30999E-05	0.30790E-05	0.35081E 00	0.33943E 00	0.53180E 00	0.52258E 00	0.63530E 00	0.66739E 00	0.30999E-05	0.30787E-05
72.0	0.35867E 00	[illegible]	0.54524E 00	[illegible]	0.65650E 00	[illegible]	0.31352E-05	0.30927E-05	0.35867E 00	0.34782E 00	0.54524E 00	0.53557E 00	0.65650E 00	0.68393E 00	0.31352E-05	0.30925E-05
74.0	0.36652E 00	[illegible]	0.55851E 00	[illegible]	0.67[illegible]E 00	[illegible]	0.31906E-05	0.31056E-05	0.36652E 00	0.35625E 00	0.55851E 00	0.54855E 00	0.67[illegible]E 00	0.70044E 00	0.31906E-05	0.31054E-05
76.0	0.37525E 00	[illegible]	0.57125E 00	[illegible]	[illegible]	[illegible]	0.31584E-05	0.31178E-05	0.37525E 00	0.36463E 00	0.57125E 00	0.56151E 00	[illegible]	0.71693E 00	0.31584E-05	0.31176E-05
78.0	0.38310E 00	[illegible]	0.58416E 00	[illegible]	0.70152E 00	[illegible]	0.31348E-05	0.31293E-05	0.38310E 00	0.37301E 00	0.58416E 00	0.57445E 00	0.70152E 00	0.73339E 00	0.31348E-05	0.31291E-05
80.0	0.39095E 00	[illegible]	0.59690E 00	[illegible]	0.71733E 00	[illegible]	0.31259E-05	0.31401E-05	0.39095E 00	0.38137E 00	0.59690E 00	0.58737E 00	0.71733E 00	0.74983E 00	0.31259E-05	0.31399E-05
82.0	0.39968E 00	[illegible]	0.60982E 00	[illegible]	0.73391E 00	[illegible]	0.31463E-05	0.31503E-05	0.39968E 00	0.38972E 00	0.60982E 00	0.60020E 00	0.73391E 00	0.76626E 00	0.31463E-05	0.31502E-05
84.0	0.40841E 00	[illegible]	0.62308E 00	[illegible]	0.75049E 00	[illegible]	0.31691E-05	0.31600E-05	0.40841E 00	0.39806E 00	0.62308E 00	0.61317E 00	0.75049E 00	0.78266E 00	0.31691E-05	0.31598E-05
86.0	0.41626E 00	[illegible]	0.63600E 00	[illegible]	0.76795E 00	[illegible]	0.31900E-05	0.31690E-05	0.41626E 00	0.40639E 00	0.63600E 00	0.62605E 00	0.76795E 00	0.79904E 00	0.31900E-05	0.31689E-05
88.0	0.42586E 00	[illegible]	0.64856E 00	[illegible]	0.78540E 00	[illegible]	0.32207E-05	0.31776E-05	0.42586E 00	0.41471E 00	0.64856E 00	0.63892E 00	0.78540E 00	0.81541E 00	0.32207E-05	0.31774E-05
90.0	0.43284E 00	[illegible]	0.66131E 00	[illegible]	0.79936E 00	[illegible]	0.31772E-05	0.31856E-05	0.43284E 00	0.42302E 00	0.66131E 00	0.65177E 00	0.79936E 00	0.83176E 00	0.31772E-05	0.31855E-05
92.0	0.44157E 00	[illegible]	0.67370E 00	[illegible]	0.81594E 00	[illegible]	0.31896E-05	0.31932E-05	0.44157E 00	0.43133E 00	0.67370E 00	0.66461E 00	0.81594E 00	0.84810E 00	0.31896E-05	0.31931E-05
94.0	0.45030E 00	[illegible]	0.68679E 00	[illegible]	0.83252E 00	[illegible]	0.32112E-05	0.32003E-05	0.45030E 00	0.43963E 00	0.68679E 00	0.67744E 00	0.83252E 00	0.86442E 00	0.32112E-05	0.32003E-05
96.0	0.45902E 00	[illegible]	0.69953E 00	[illegible]	0.84910E 00	[illegible]	0.32202E-05	0.32071E-05	0.45902E 00	0.44792E 00	0.69953E 00	0.69026E 00	0.84910E 00	0.88072E 00	0.32202E-05	0.32070E-05
98.0	0.46775E 00	[illegible]	0.71262E 00	[illegible]	0.86481E 00	[illegible]	0.32411E-05	0.32134E-05	0.46775E 00	0.45620E 00	0.71262E 00	0.70307E 00	0.86481E 00	0.89702E 00	0.32411E-05	0.32134E-05
100.0	0.47648E 00	[illegible]	0.72606E 00	[illegible]	0.88226E 00	[illegible]	0.32760E-05	0.32194E-05	0.47648E 00	0.46448E 00	0.72606E 00	0.71587E 00	0.88226E 00	0.91330E 00	0.32760E-05	0.32194E-05
105.0	0.49742E 00	[illegible]	0.75747E 00	[illegible]	0.92153E 00	[illegible]	0.32738E-05	0.32329E-05	0.49742E 00	0.49515E 00	0.75747E 00	0.74784E 00	0.92153E 00	0.95396E 00	0.32738E-05	0.32330E-05
110.0	0.51662E 00	[illegible]	0.78924E 00	[illegible]	0.96160E 00	[illegible]	0.32506E-05	0.32445E-05	0.51662E 00	0.50574E 00	0.78924E 00	0.77976E 00	0.96160E 00	0.99455E 00	0.32506E-05	0.32447E-05
115.0	0.53756E 00	[illegible]	0.82222E 00	[illegible]	0.10036E 01	[illegible]	0.32953E-05	0.32544E-05	0.53756E 00	0.52641E 00	0.82222E 00	0.81163E 00	0.10036E 01	0.10351E 01	0.32953E-05	0.32548E-05
120.0	0.55763E 00	[illegible]	0.85347E 00	[illegible]	0.10437E 01	[illegible]	0.32824E-05	0.32632E-05	0.55763E 00	0.54700E 00	0.85347E 00	0.84347E 00	0.10437E 01	0.10756E 01	0.32824E-05	0.32635E-05
125.0	0.57770E 00	[illegible]	0.88418E 00	[illegible]	0.10838E 01	[illegible]	0.32626E-05	0.32707E-05	0.57770E 00	0.56757E 00	0.88418E 00	0.87529E 00	0.10838E 01	0.11160E 01	0.32626E-05	0.32710E-05
130.0	0.59869E 00	[illegible]	0.91351E 00	[illegible]	0.11240E 01	[illegible]	0.32417E-05	0.32771E-05	0.59869E 00	0.58812E 00	0.91351E 00	0.90707E 00	0.11240E 01	0.11565E 01	0.32417E-05	0.32775E-05
135.0	0.61872E 00	[illegible]	0.94213E 00	[illegible]	0.11528E 01	[illegible]	0.30808E-05	0.32826E-05	0.61872E 00	0.60865E 00	0.94213E 00	0.93883E 00	0.11528E 01	0.11969E 01	0.30808E-05	0.32831E-05
STD DEV =		0.789922E-02		0.737722E-02		0.247936E-01		0.291746E-07		0.789106E-02		0.737196E-02		0.347936E-01		0.289458E-07

END-OF-DATA ENCOUNTERED ON SYSTEM INPUT FILE.

Figure D-11. Viscoelastic Analysis for Asphalt 200 at 39.2°F (Cont'd.).

DATA SHEET

EQUATION OF BEST FIT, n=1

SUMMARY SHEET FOR VISCOELASTIC ANALYSIS

ASPHALT PR-103 LOADS- 800 1400 2000 GM
TEST TEMP- 39.2 F CTS- 33826. 58692. 84028. DY/SQCM

TAU1 = 0.4355672E 03 SEC G1 = 0.3169046E 07 DYNES/SQ CM VISC1 = 0.1380333E 10 POISES

TIME MIN	THETA 1 RAD	CF 1 RA/D/SQCM	THETA 2 RAD	CF 2 RA/D/SQCM	THETA 3 RAD	CF 3 RA/D/SQCM	AVG CF RA/D/SQCM	OBSERVED THETA 1 (RAD)	CALCULATED THETA 1 (RAD)	OBSERVED THETA 2 (RAD)	CALCULATED THETA 2 (RAD)	OBSERVED THETA 3 (RAD)	CALCULATED THETA 3 (RAD)	OBSERVED CP FUNCTION (RA/D/SQCM)	CALCULATED CP FUNCTION (RA/D/SQCM)
0.0	0.26180E-02	-0.00000E-38	0.26180E-02	-0.00000E-38	0.34907E-02	-0.00000E-38	-0.0000000E-38	0.26180E-02	0.21780E-02	0.26180E-02	0.37790E-02	0.34907E-02	0.54098E-02	-0.00000E-38	-0.00000E-38
0.1	0.34907E-02	[illegible]	0.52360E-02	[illegible]	0.69813E-02	[illegible]	[illegible]	0.34907E-02	0.30320E-02	0.52360E-02	0.53116E-02	0.69813E-02	0.75231E-02	0.16122E-07	0.43170E-08
0.2	0.43633E-02	[illegible]	0.69813E-02	[illegible]	0.87267E-02	[illegible]	[illegible]	0.43633E-02	0.38840E-02	0.69813E-02	0.68407E-02	0.87267E-02	0.96355E-02	0.20363E-07	0.85749E-08
0.3	0.52360E-02	[illegible]	0.87267E-02	[illegible]	0.10472E-01	[illegible]	[illegible]	0.52360E-02	0.47341E-02	0.87267E-02	0.83664E-02	0.10472E-01	0.11741E-01	0.24604E-07	0.12775E-07
0.4	0.52360E-02	[illegible]	0.10472E-01	[illegible]	0.12741E-01	[illegible]	[illegible]	0.52360E-02	0.55822E-02	0.10472E-01	0.98807E-02	0.12741E-01	0.13862E-01	0.22323E-07	0.16917E-07
0.5	0.61087E-02	[illegible]	0.12217E-01	[illegible]	0.14835E-01	[illegible]	[illegible]	0.61087E-02	0.64284E-02	0.12217E-01	0.11408E-01	0.14835E-01	0.15917E-01	0.27949E-07	0.21002E-07
0.6	0.69813E-02	[illegible]	0.13090E-01	[illegible]	0.16581E-01	[illegible]	[illegible]	0.69813E-02	0.72727E-02	0.13090E-01	0.12923E-01	0.16581E-01	0.18079E-01	0.27234E-07	0.25032E-07
0.7	0.78540E-02	[illegible]	0.13963E-01	[illegible]	0.18326E-01	[illegible]	[illegible]	0.78540E-02	0.81151E-02	0.13963E-01	0.14436E-01	0.18326E-01	0.20115E-01	0.26519E-07	0.29006E-07
0.8	0.95993E-02	[illegible]	0.15708E-01	[illegible]	0.21817E-01	[illegible]	[illegible]	0.95993E-02	0.89557E-02	0.15708E-01	0.15945E-01	0.21817E-01	0.22177E-01	0.46284E-07	0.32927E-07
0.9	0.95993E-02	[illegible]	0.17453E-01	[illegible]	0.23562E-01	[illegible]	[illegible]	0.95993E-02	0.97945E-02	0.17453E-01	0.17451E-01	0.23562E-01	0.24275E-01	0.41925E-07	0.36793E-07
1.0	0.10472E-01	[illegible]	0.19199E-01	[illegible]	0.25307E-01	[illegible]	[illegible]	0.10472E-01	0.10632E-01	0.19199E-01	0.18954E-01	0.25307E-01	0.26390E-01	0.46166E-07	0.40607E-07
1.1	0.11345E-01	[illegible]	0.20944E-01	[illegible]	0.27053E-01	[illegible]	[illegible]	0.11345E-01	0.11467E-01	0.20944E-01	0.20454E-01	0.27053E-01	0.28416E-01	0.50408E-07	0.44368E-07
1.2	0.12217E-01	[illegible]	0.22689E-01	[illegible]	0.27925E-01	[illegible]	[illegible]	0.12217E-01	0.12300E-01	0.22689E-01	0.21951E-01	0.27925E-01	0.30441E-01	0.51157E-07	0.48078E-07
1.3	0.13090E-01	[illegible]	0.24435E-01	[illegible]	0.31416E-01	[illegible]	[illegible]	0.13090E-01	0.13132E-01	0.24435E-01	0.23445E-01	0.31416E-01	0.32561E-01	0.62352E-07	0.51737E-07
1.4	0.13963E-01	[illegible]	0.26180E-01	[illegible]	0.33161E-01	[illegible]	[illegible]	0.13963E-01	0.13962E-01	0.26180E-01	0.24936E-01	0.33161E-01	0.34596E-01	0.66593E-07	0.55347E-07
1.5	0.13963E-01	[illegible]	0.27925E-01	[illegible]	0.34907E-01	[illegible]	[illegible]	0.13963E-01	0.14791E-01	0.27925E-01	0.26424E-01	0.34907E-01	0.36648E-01	0.62235E-07	0.58906E-07
1.6	0.14835E-01	[illegible]	0.29671E-01	[illegible]	0.36652E-01	[illegible]	[illegible]	0.14835E-01	0.15617E-01	0.29671E-01	0.27910E-01	0.36652E-01	0.38676E-01	0.66676E-07	0.62418E-07
1.7	0.15708E-01	[illegible]	0.30543E-01	[illegible]	0.38397E-01	[illegible]	[illegible]	0.15708E-01	0.16442E-01	0.30543E-01	0.29392E-01	0.38397E-01	0.40719E-01	0.65761E-07	0.65881E-07
1.8	0.16581E-01	[illegible]	0.31416E-01	[illegible]	0.41888E-01	[illegible]	[illegible]	0.16581E-01	0.17266E-01	0.31416E-01	0.30872E-01	0.41888E-01	0.42779E-01	0.71970E-07	0.69296E-07
1.9	0.17453E-01	[illegible]	0.33161E-01	[illegible]	0.43633E-01	[illegible]	[illegible]	0.17453E-01	0.18088E-01	0.33161E-01	0.32349E-01	0.43633E-01	0.44815E-01	0.76711E-07	0.72665E-07
2.0	0.18326E-01	[illegible]	0.34907E-01	[illegible]	0.45379E-01	[illegible]	[illegible]	0.18326E-01	0.18908E-01	0.34907E-01	0.33823E-01	0.45379E-01	0.46846E-01	0.80452E-07	0.75908E-07
2.1	0.19199E-01	[illegible]	0.36652E-01	[illegible]	0.47124E-01	[illegible]	[illegible]	0.19199E-01	0.19727E-01	0.36652E-01	0.35294E-01	0.47124E-01	0.48874E-01	0.84694E-07	0.79265E-07
2.2	0.20071E-01	[illegible]	0.38397E-01	[illegible]	0.50615E-01	[illegible]	[illegible]	0.20071E-01	0.20545E-01	0.38397E-01	0.36763E-01	0.50615E-01	0.50899E-01	0.95859E-07	0.82498E-07
2.3	0.20595E-01	[illegible]	0.40143E-01	[illegible]	0.52360E-01	[illegible]	[illegible]	0.20595E-01	0.21360E-01	0.40143E-01	0.38230E-01	0.52360E-01	0.52919E-01	0.96660E-07	0.85686E-07
2.4	0.20944E-01	[illegible]	0.41015E-01	[illegible]	0.54105E-01	[illegible]	[illegible]	0.20944E-01	0.22175E-01	0.41015E-01	0.39693E-01	0.54105E-01	0.54916E-01	0.90785E-07	0.88931E-07
2.5	0.21817E-01	[illegible]	0.41888E-01	[illegible]	0.55851E-01	[illegible]	[illegible]	0.21817E-01	0.22988E-01	0.41888E-01	0.41155E-01	0.55851E-01	0.56949E-01	0.90070E-07	0.91933E-07
2.6	0.22689E-01	[illegible]	0.43633E-01	[illegible]	0.57596E-01	[illegible]	[illegible]	0.22689E-01	0.23799E-01	0.43633E-01	0.42613E-01	0.57596E-01	0.58939E-01	0.94312E-07	0.94992E-07
2.7	0.23562E-01	[illegible]	0.45379E-01	[illegible]	0.59341E-01	[illegible]	[illegible]	0.23562E-01	0.24609E-01	0.45379E-01	0.44070E-01	0.59341E-01	0.60946E-01	0.98553E-07	0.98010E-07
2.8	0.24435E-01	[illegible]	0.47124E-01	[illegible]	0.61087E-01	[illegible]	[illegible]	0.24435E-01	0.25418E-01	0.47124E-01	0.45524E-01	0.61087E-01	0.62947E-01	0.10279E-06	0.10099E-06
2.9	0.24784E-01	[illegible]	0.48869E-01	[illegible]	0.62832E-01	[illegible]	[illegible]	0.24784E-01	0.26225E-01	0.48869E-01	0.46975E-01	0.62832E-01	0.64947E-01	0.10108E-06	0.10392E-06
3.0	0.25307E-01	[illegible]	0.49742E-01	[illegible]	0.64577E-01	[illegible]	[illegible]	0.25307E-01	0.27031E-01	0.49742E-01	0.48424E-01	0.64577E-01	0.66943E-01	0.97720E-07	0.10683E-06
4.0	0.33161E-01	[illegible]	0.65450E-01	[illegible]	0.83776E-01	[illegible]	[illegible]	0.33161E-01	0.35020E-01	0.65450E-01	0.62793E-01	0.83776E-01	0.86745E-01	0.12854E-06	0.13368E-06
5.0	0.40143E-01	[illegible]	0.78540E-01	[illegible]	0.10210E 00	[illegible]	[illegible]	0.40143E-01	0.42891E-01	0.78540E-01	0.76998E-01	0.10210E 00	0.10624E 00	0.13244E-06	0.15700E-06
6.0	0.47124E-01	[illegible]	0.92502E-01	[illegible]	0.12043E 00	[illegible]	[illegible]	0.47124E-01	0.50661E-01	0.92502E-01	0.90947E-01	0.12043E 00	0.12548E 00	0.14129E-06	0.17747E-06
7.0	0.55851E-01	[illegible]	0.10647E 00	[illegible]	0.13875E 00	[illegible]	[illegible]	0.55851E-01	0.58342E-01	0.10647E 00	0.10478E 00	0.13875E 00	0.14430E 00	0.16734E-06	0.19524E-06
8.0	0.64577E-01	[illegible]	0.12043E 00	[illegible]	0.15883E 00	[illegible]	[illegible]	0.64577E-01	0.65946E-01	0.12043E 00	0.11848E 00	0.15883E 00	0.16332E 00	0.20031E-06	0.21073E-06
9.0	0.69813E-01	[illegible]	0.13526E 00	[illegible]	0.17715E 00	[illegible]	[illegible]	0.69813E-01	0.73402E-01	0.13526E 00	0.13207E 00	0.17715E 00	0.18178E 00	0.19692E-06	0.22521E-06
10.0	0.77667E-01	[illegible]	0.14835E 00	[illegible]	0.19373E 00	[illegible]	[illegible]	0.77667E-01	0.80960E-01	0.14835E 00	0.14555E 00	0.19373E 00	0.20050E 00	0.20249E-06	0.23597E-06
11.0	0.85521E-01	[illegible]	0.16319E 00	[illegible]	0.21206E 00	[illegible]	[illegible]	0.85521E-01	0.88386E-01	0.16319E 00	0.15894E 00	0.21206E 00	0.21898E 00	0.22489E-06	0.24621E-06
12.0	0.92502E-01	[illegible]	0.17628E 00	[illegible]	0.23038E 00	[illegible]	[illegible]	0.92502E-01	0.95768E-01	0.17628E 00	0.17226E 00	0.23038E 00	0.23716E 00	0.22870E-06	0.25513E-06
13.0	0.99484E-01	[illegible]	0.18937E 00	[illegible]	0.24958E 00	[illegible]	[illegible]	0.99484E-01	0.10311E 00	0.18937E 00	0.18551E 00	0.24958E 00	0.25534E 00	0.23614E-06	0.26291E-06
14.0	0.10821E 00	[illegible]	0.20246E 00	[illegible]	0.26616E 00	[illegible]	[illegible]	0.10821E 00	0.11042E 00	0.20246E 00	0.19870E 00	0.26616E 00	0.27343E 00	0.25031E-06	0.26968E-06
15.0	0.11519E 00	[illegible]	0.21817E 00	[illegible]	0.28623E 00	[illegible]	[illegible]	0.11519E 00	0.11770E 00	0.21817E 00	0.21183E 00	0.28623E 00	0.29145E 00	0.27600E-06	0.27559E-06
16.0	0.12217E 00	[illegible]	0.23038E 00	[illegible]	0.30281E 00	[illegible]	[illegible]	0.12217E 00	0.12495E 00	0.23038E 00	0.22493E 00	0.30281E 00	0.30941E 00	0.26801E-06	0.28073E-06
17.0	0.13003E 00	[illegible]	0.24435E 00	[illegible]	0.32289E 00	[illegible]	[illegible]	0.13003E 00	0.13219E 00	0.24435E 00	0.23798E 00	0.32289E 00	0.32732E 00	0.29238E-06	0.28521E-06
18.0	0.13788E 00	[illegible]	0.25744E 00	[illegible]	0.34246E 00	[illegible]	[illegible]	0.13788E 00	0.13940E 00	0.25744E 00	0.25100E 00	0.34246E 00	0.34517E 00	0.31180E-06	0.28911E-06
19.0	0.14486E 00	[illegible]	0.27053E 00	[illegible]	0.36128E 00	[illegible]	[illegible]	0.14486E 00	0.14659E 00	0.27053E 00	0.26400E 00	0.36128E 00	0.36278E 00	0.31567E-06	0.29252E-06
20.0	0.15184E 00	[illegible]	0.28274E 00	[illegible]	0.37961E 00	[illegible]	[illegible]	0.15184E 00	0.15377E 00	0.28274E 00	0.27696E 00	0.37961E 00	0.38076E 00	0.31463E-06	0.29548E-06
21.0	0.15883E 00	[illegible]	0.29671E 00	[illegible]	0.39968E 00	[illegible]	[illegible]	0.15883E 00	0.16094E 00	0.29671E 00	0.28990E 00	0.39968E 00	0.39850E 00	0.33040E-06	0.29806E-06
22.0	0.16755E 00	[illegible]	0.30892E 00	[illegible]	0.41975E 00	[illegible]	[illegible]	0.16755E 00	0.16810E 00	0.30892E 00	0.30283E 00	0.41975E 00	0.41621E 00	0.35346E-06	0.30031E-06
23.0	0.17453E 00	[illegible]	0.32114E 00	[illegible]	0.43808E 00	[illegible]	[illegible]	0.17453E 00	0.17524E 00	0.32114E 00	0.31574E 00	0.43808E 00	0.43390E 00	0.35240E-06	0.30228E-06
24.0	0.18151E 00	[illegible]	0.33336E 00	[illegible]	0.45640E 00	[illegible]	[illegible]	0.18151E 00	0.18238E 00	0.33336E 00	0.32863E 00	0.45640E 00	0.45157E 00	0.35134E-06	0.30396E-06
25.0	0.18850E 00	[illegible]	0.34558E 00	[illegible]	0.47473E 00	[illegible]	[illegible]	0.18850E 00	0.18951E 00	0.34558E 00	0.34151E 00	0.47473E 00	0.46923E 00	0.35020E-06	0.30547E-06
26.0	0.19548E 00	[illegible]	0.35779E 00	[illegible]	0.49306E 00	[illegible]	[illegible]	0.19548E 00	0.19663E 00	0.35779E 00	0.35438E 00	0.49306E 00	0.48686E 00	0.34921E-06	0.30677E-06
27.0	0.20420E 00	[illegible]	0.37001E 00	[illegible]	0.51138E 00	[illegible]	[illegible]	0.20420E 00	0.20375E 00	0.37001E 00	0.36723E 00	0.51138E 00	0.50448E 00	0.36535E-06	0.30790E-06
28.0	0.21118E 00	[illegible]	0.38223E 00	[illegible]	0.52971E 00	[illegible]	[illegible]	0.21118E 00	0.21087E 00	0.38223E 00	0.38009E 00	0.52971E 00	0.52209E 00	0.36429E-06	0.30888E-06
29.0	0.21817E 00	[illegible]	0.39444E 00	[illegible]	0.54803E 00	[illegible]	[illegible]	0.21817E 00	0.21798E 00	0.39444E 00	0.39293E 00	0.54803E 00	0.53969E 00	0.36323E-06	0.30974E-06
30.0	0.22515E 00	[illegible]	0.40841E 00	[illegible]	0.56549E 00	[illegible]	[illegible]	0.22515E 00	0.22508E 00	0.40841E 00	0.40576E 00	0.56549E 00	0.55728E 00	0.34861E-06	0.31049E-06
32.0	0.23911E 00	[illegible]	0.43284E 00	[illegible]	0.60214E 00	[illegible]	[illegible]	0.23911E 00	0.23928E 00	0.43284E 00	0.43142E 00	0.60214E 00	0.59243E 00	0.36649E-06	0.31171E-06
34.0	0.25482E 00	[illegible]	0.45728E 00	[illegible]	0.63530E 00	[illegible]	[illegible]	0.25482E 00	0.25347E 00	0.45728E 00	0.45706E 00	0.63530E 00	0.62756E 00	0.36771E-06	0.31263E-06
36.0	0.26878E 00	[illegible]	0.48346E 00	[illegible]	0.66846E 00	[illegible]	[illegible]	0.26878E 00	0.26766E 00	0.48346E 00	0.48268E 00	0.66846E 00	0.66267E 00	0.35165E-06	0.31334E-06
38.0	0.28274E 00	[illegible]	0.50789E 00	[illegible]	0.70424E 00	[illegible]	[illegible]	0.28274E 00	0.28183E 00	0.50789E 00	0.50830E 00	0.70424E 00	0.69777E 00	0.35607E-06	0.31387E-06
40.0	0.29671E 00	[illegible]	0.53233E 00	[illegible]	0.73740E 00	[illegible]	[illegible]	0.29671E 00	0.29601E 00	0.53233E 00	0.53390E 00	0.73740E 00	0.73286E 00	0.34009E-06	0.31428E-06
42.0	0.31067E 00	[illegible]	0.55676E 00	[illegible]	0.77405E 00	[illegible]	[illegible]	0.31067E 00	0.31016E 00	0.55676E 00	0.55951E 00	0.77405E 00	0.76793E 00	0.33797E-06	0.31458E-06
44.0	0.32463E 00	[illegible]	0.58119E 00	[illegible]	0.80722E 00	[illegible]	[illegible]	0.32463E 00	0.32435E 00	0.58119E 00	0.58510E 00	0.80722E 00	0.80300E 00	0.32149E-06	0.31482E-06
46.0	0.33685E 00	[illegible]	0.60737E 00	[illegible]	0.84125E 00	[illegible]	[illegible]	0.33685E 00	0.33851E 00	0.60737E 00	0.61070E 00	0.84125E 00	0.83807E 00	0.30219E-06	0.31499E-06
48.0	0.34907E 00	[illegible]	0.63181E 00	[illegible]	0.87877E 00	[illegible]	[illegible]	0.34907E 00	0.35268E 00	0.63181E 00	0.63629E 00	0.87877E 00	0.87313E 00	0.28633E-06	0.31513E-06
50.0	0.36303E 00	[illegible]	0.65799E 00	[illegible]	0.91281E 00	[illegible]	[illegible]	0.36303E 00	0.36684E 00	0.65799E 00	0.66188E 00	0.91281E 00	0.90820E 00	0.28373E-06	0.31523E-06
52.0	0.37874E 00	[illegible]	0.68417E 00	[illegible]	0.94597E 00	[illegible]	[illegible]	0.37874E 00	0.38100E 00	0.68417E 00	0.68747E 00	0.94597E 00	0.94325E 00	0.29487E-06	0.31531E-06
54.0	0.39270E 00	[illegible]	0.70860E 00	[illegible]	0.98262E 00	[illegible]	[illegible]	0.39270E 00	0.39517E 00	0.70860E 00	0.71306E 00	0.98262E 00	0.97831E 00	0.29275E-06	0.31537E-06
56.0	0.40666E 00	[illegible]	0.73653E 00	[illegible]	0.10184E 01	[illegible]	[illegible]	0.40666E 00	0.40933E 00	0.73653E 00	0.73864E 00	0.10184E 01	0.10134E 01	0.30690E-06	0.31541E-06
58.0	0.42082E 00	[illegible]	0.76096E 00	[illegible]	0.10516E 01	[illegible]	[illegible]	0.42082E 00	0.42349E 00	0.76096E 00	0.76423E 00	0.10516E 01	0.10484E 01	0.29101E-06	0.31545E-06
60.0	0.43459E 00	[illegible]	0.78889E 00	[illegible]	0.10873E 01	[illegible]	[illegible]	0.43459E 00	0.43765E 00	0.78889E 00	0.78981E 00	0.10873E 01	0.10835E 01	0.30525E-06	0.31547E-06
62.0	0.44855E 00	[illegible]	0.81507E 00	[illegible]	0.11205E 01	[illegible]	[illegible]	0.44855E 00	0.45181E 00	0.81507E 00	0.81540E 00	0.11205E 01	0.11185E 01	0.29419E-06	0.31549E-06
64.0	0.46251E 00	[illegible]	0.83950E 00	[illegible]	0.11537E 01	[illegible]	[illegible]	0.46251E 00	0.46597E 00	0.83950E 00	0.84098E 00	0.11537E 01	0.11536E 01	0.28322E-06	0.31551E-06
66.0	0.47648E 00	[illegible]	0.86568E 00	[illegible]	0.11886E 01	[illegible]	[illegible]	0.47648E 00	0.48013E 00	0.86568E 00	0.86657E 00	0.11886E 01	0.11886E 01	0.28407E-06	0.31552E-06
68.0	0.49218E 00	[illegible]	0.89012E 00	[illegible]	0.12217E 01	[illegible]	[illegible]	0.49218E 00	0.49429E 00	0.89012E 00	0.89215E 00	0.12217E 01	0.12237E 01	0.28530E-06	0.31553E-06
70.0	0.50615E 00	[illegible]	0.91630E 00	[illegible]	0.12558E 01	[illegible]	[illegible]	0.50615E 00	0.50845E 00	0.91630E 00	0.91774E 00	0.12558E 01	0.12587E 01	0.28270E-06	0.31553E-06
72.0	0.52185E 00	[illegible]	0.94248E 00	[illegible]	0.12884E 01	[illegible]	[illegible]	0.52185E 00	0.52261E 00	0.94248E 00	0.94332E 00	0.12884E 01	0.12938E 01	0.29384E-06	0.31554E-06
74.0	0.53756E 00	[illegible]	0.96691E 00	[illegible]	0.13238E 01	[illegible]	[illegible]	0.53756E 00	0.53677E 00	0.96691E 00	0.96891E 00	0.13238E 01	0.13288E 01	0.30179E-06	0.31554E-06
76.0	0.55152E 00	[illegible]	0.99309E 00	[illegible]	0.13579E 01	[illegible]	[illegible]	0.55152E 00	0.55093E 00	0.99309E 00	0.99449E 00	0.13579E 01	0.13639E 01	0.29939E-06	0.31554E-06
78.0	0.56549E 00	[illegible]	0.10193E 01	[illegible]	0.13925E 01	[illegible]	[illegible]	0.56549E 00	0.56509E 00	0.10193E 01	0.10201E 01	0.13925E 01	0.13994E 01	0.30325E-06	0.31555E-06
80.0	0.57945E 00	[illegible]	0.10455E 01	[illegible]	0.14277E 01	[illegible]	[illegible]	0.57945E 00	0.57925E 00	0.10455E 01	0.10457E 01	0.14277E 01	0.14340E 01	0.30111E-06	0.31555E-06
82.0	0.59341E 00	[illegible]	0.10716E 01	[illegible]	0.14664E 01	[illegible]	[illegible]	0.59341E 00	0.59341E 00	0.10716E 01	0.10712E 01	0.14664E 01	0.14691E 01	0.30090E-06	0.31555E-06
84.0	0.60737E 00	[illegible]	0.10943E 01	[illegible]	0.15010E 01	[illegible]	[illegible]	0.60737E 00	0.60757E 00	0.10943E 01	0.10968E 01	0.15010E 01	0.15041E 01	0.29686E-06	0.31555E-06
86.0	0.62134E 00	[illegible]	0.11108E 01	[illegible]	0.15368E 01	[illegible]	[illegible]	0.62134E 00	0.62173E 00	0.11108E 01	0.11224E 01	0.15368E 01	0.15392E 01	0.29128E-06	0.31555E-06
88.0	0.63530E 00	[illegible]	0.11432E 01	[illegible]	0.15734E 01	[illegible]	[illegible]	0.63530E 00	0.63589E 00	0.11432E 01	0.11480E 01	0.15734E 01	0.15742E 01	0.28915E-06	0.31555E-06
90.0	0.64926E 00	[illegible]	0.11694E 01	[illegible]	0.16101E 01	[illegible]	[illegible]	0.64926E 00	0.65005E 00	0.11694E 01	0.11736E 01	0.16101E 01	0.16093E 01	0.29696E-06	0.31555E-06
92.0	0.66323E 00	[illegible]	0.11938E 01	[illegible]	0.16502E 01	[illegible]	[illegible]	0.66323E 00	0.66421E 00	0.11938E 01	0.11992E 01	0.16502E 01	0.16443E 01	0.30866E-06	0.31555E-06
94.0	0.67719E 00	[illegible]	0.12187E 01	[illegible]	0.16816E 01	[illegible]	[illegible]	0.67719E 00	0.67837E 00	0.12187E 01	0.12247E 01	0.16816E 01	0.16794E 01	0.28576E-06	0.31555E-06
96.0	0.69115E 00	[illegible]	0.12427E 01	[illegible]	0.17174E 01	[illegible]	[illegible]	0.69115E 00	0.69253E 00	0.12427E 01	0.12503E 01	0.17174E 01	0.17144E 01	0.28018E-06	0.31555E-06
98.0	0.70511E 00	[illegible]	0.12654E 01	[illegible]	0.17541E 01	[illegible]	[illegible]	0.70511E 00	0.70669E 00	0.12654E 01	0.12759E 01	0.17541E 01	0.17495E 01	0.28014E-06	0.31555E-06
100.0	0.71908E 00	[illegible]	0.12933E 01	[illegible]	0.17907E 01	[illegible]	[illegible]	0.71908E 00	0.72085E 00	0.12933E 01	0.13015E 01	0.17907E 01	0.17845E 01	0.28584E-06	0.31555E-06
105.0	0.75398E 00	[illegible]	0.13561E 01	[illegible]	0.18806E 01	[illegible]	[illegible]	0.75398E 00	0.75625E 00	0.13561E 01	0.13655E 01	0.18806E 01	0.18722E 01	0.28351E-06	0.31555E-06
110.0	0.79238E 00	[illegible]	0.14242E 01	[illegible]	0.19644E 01	[illegible]	[illegible]	0.79238E 00	0.79165E 00	0.14242E 01	0.14294E 01	0.19644E 01	0.19598E 01	0.32109E-06	0.31555E-06
115.0	0.82729E 00	[illegible]	0.14923E 01	[illegible]	0.20525E 01	[illegible]	[illegible]	0.82729E 00	0.82705E 00	0.14923E 01	0.14934E 01	0.20525E 01	0.20474E 01	0.34158E-06	0.31555E-06

STD DEV = 0.17124E-02 0.34928E-02 0.43009E-02 0.26013E-07

END-OF-DATA ENCOUNTERED ON SYSTEM INPUT FILE.

Figure D-12. Viscoelastic Analysis for Asphalt PR-103 at 39.2°F.