Laboratory Performance of Geosynthetic-Stabilized Pavement Sections

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ABSTRACT

Experimental and analytical investigations were performed to evaluate the comparative performance of pavements with and without geosynthetic stabilization. This was accomplished by the testing of a total of 18 pavement sections which could be classified into four different types: one which was constructed without geosynthetics and which served as a control, and three which were stabilized with one of two geotextiles or a geogrid. The pavement sections were constructed to model a typical secondary road in Virginia which is constructed over a silty sand subgrade material. Loading of the pavement sections was accomplished through the use of a computer-controlled pneumatic system which delivered 80 lb/in^2 (552 kPa) through a rigid plate at a frequency of approximately one-half Hertz. The resulting displacement of the pavement surface was monitored by an array of linear variable displacement transducers (LVDTs). The performance of each pavement section was evaluated using the American Association of State Highway and Transportation Officials (AASHTO) flexible pavement design method. Models based on empirical and mechanistic relationships were considered. A theoretical pavement section was also analyzed to assess the influence of the stiffness of a wearing course layer. An economic study was performed to assess the potential cost benefit of geosynthetic stabilization and recommendations have been made for additional research.

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Chapter 1 - Introduction

Improved methods of soil stabilization have been the focus of considerable attention by civil engineers for many years. Over time, new techniques for stabilizing road sections have been developed and applied with significant success. Recently, new techniques have been made possible by the use of geosynthetics: man-made materials which exhibit substantial strength and resiliency, and which may be applied as cost-effective alternatives to conventional methods. However, there remain many questions regarding the most effective use of geosynthetics.

1.1 Background

In the early periods of their use, it was found that little design guidance was required to obtain effective road stabilization with geosynthetics. However, as the frequency of geosynthetic applications increased, it became evident that the use of these materials for road stabilization was not simply intuitive. Improper use could precipitate project failure and waste fiscal resources. Unfortunately, there remained a lack of research information regarding proper geosynthetic design methods until the late 1970s. Since that time, research has helped provide insight to more effective use of these materials. Engineers now have an increased understanding of the soil conditions which can be improved through the use geosynthetics.

Despite this increased understanding, there remain many unresolved questions concerning the methods by which geosynthetics work in stabilization applications, and what types of geosynthetics can provide the optimum solution for a given set of project conditions. Answers to these questions are required to provide engineers with design guidance which will allow them to consistently obtain enhanced road system performance in a cost-effective manner.

Historical research indicates that stabilization technology was employed as early as 3000 BC when logs were lashed together to form a surface onto which soil was placed, facilitating travel over otherwise impassable peat bogs (Dewar 1962). There are numerous examples of how natural materials have been used to provide an improved bearing surface since that time. A relatively modern application of the stabilization concept was used by the South Carolina Highway Department in 1926 when a cotton fabric was used to augment bituminous pavement sections (Beckham and Mills 1962).

While many of the stabilization methods explored in the past were innovative, they generally suffered from similar limitations. The lashings and logs placed over peat bogs would biodegrade over time. Straw, tree limbs, cotton, and other organic materials were also prone to relatively rapid deterioration. Until a practical material which was not subject to rapid decay could be found, it appeared that this type of earth stabilization technology was severely limited.

Progress in earth stabilization technology in recent years may be more the result of improved materials than the evolution of design methods. Modern geosynthetics are extremely durable, demonstrating considerable resistance to the forces of organic and chemical decay. Further, they offer physical properties that are difficult to replicate with natural organic materials. The use of synthetically-manufactured materials has permitted substantial performance improvement of road sections. Where it was previously considered impractical to construct a road, new stabilization materials have provided economical solutions.

Among the synthetic materials most widely used for enhancing road section performance have been those manufactured from polymers. Polymeric materials include polyester, polyethylene, polypropylene, polyvinyl chloride, and nylon. By controlling the molecular construction and combination of polymeric materials, it is possible to manufacture civil engineering products which exhibit considerable resiliency, strength, and durability. When these products are used in geotechnical-related applications, they are commonly referred to as *Geosynthetics*. Included in this broad classification are geotextiles, geogrids, geomembranes, geonets, and geocomposites. Among the specific functions they perform which contribute to soil stabilization are separation, reinforcement, filtration, drainage, and hydraulic barrier.

Two geosynthetics which have been used widely in road construction are geotextiles and geogrids. Geotextiles consist of synthetic fibers which are either woven into flexible, porous sheets or matted together in a random, nonwoven manner. Approximately 65 percent of geotextiles are manufactured from polypropylene, with the majority of the remaining geotextiles constructed with polyester, nylon, or polyethylene (Koerner 1990). Geogrids are usually manufactured from polypropylene, a high-density polyethylene (HDPE), or a high-tenacity polyester. Polypropylene and HDPE geogrid materials are usually manufactured in sheet form, have holes punched through them, and then are stretched uniaxially or biaxially depending on their application. Polyester geogrids are woven with high-tenacity polyester yarns and may be coated with a protective polyolefin or polyvinyl chloride.

The increasing use of geotextiles and geogrids in civil engineering is reflected by their sales records. Between 1970 and 1987, the annual sales of geotextiles increased from 3 million square yards (2.5 million square meters) to 270 million square yards (226 million square meters). Between 1982, when geogrids were first introduced to North America, and 1987, the annual sales of these materials reached 9 million square yards (7.5 million square meters) (Koerner 1990). According to a market study by the Industrial Fabrics Association International (1994), by 1993 the annual sales of geotextiles reached 398 million square yards (332 million square meters) and the annual sales of geogrids reached 21.5 million square yards (18 million square meters).

Geotextiles have long been recognized as materials which substantially improve the performance of paved and unpaved road sections. They have been found to be especially useful for roads constructed on weak subgrades and have made possible the construction of road sections which would have otherwise been impractical. However, the guidance for their use has been based largely on past experience. The first mechanistic design method for geotextile stabilization of unpaved roads was not published until Giroud and Noiray's paper in 1981, almost 50 years after the first documented application of geotextiles in the United States (Giroud and Noiray 1981).

Until the mid-1980s, there was little guidance for the design of geotextile-stabilized roads. Much of the available documentation was based on field experience only, rather than on scientific research and documented field performance. In 1985, the first comprehensive geotextile-stabilization design guide was published (Christopher and Holtz 1985). However, formal research which may have provided more effective insight to efficient geotextile use in roads was lacking.

Geogrids were originally made in the United Kingdom by Netlon, Ltd., and were introduced to North America in 1980 by the Tensar Corporation. It was not until 1985 that a geogrid stabilization design method based on research results was published (Kennepohl, Kamel, Walls and Hass 1985). Previously, design of paved and unpaved road sections augmented with geogrids was largely based on field results, much as had been done with geotextiles.

1.2 Problem Statement

Reports of field studies have suggested that both geotextiles and geogrids may improve the performance of pavement sections constructed on weak soil. However, it remains difficult to quantify and evaluate the benefits which result from application of these geosynthetics. Further, the mechanism by which geotextiles and geogrids enhance the performance of pavement sections is not clearly understood. Without this understanding, it remains likely that geogrids and geotextiles will be incorrectly specified and applied. While research has indicated that the separation, reinforcement, and filtration functions of geosynthetics are contributors to the overall success of road system stabilization, additional information regarding the specific methods by which the benefits of geotextiles and geogrids are derived is necessary for the development of more effective design methods.

1.3 Research Objectives

The main purpose of this research has been to investigate pavement life cycle improvement when pavement cross sections are augmented with geotextiles or geogrids. As part of an ongoing research project, the objectives of this portion of the investigation, reported herein, was to review the past research regarding the use of geotextiles and geogrids in road sections and to investigate the behavior of stabilized pavement sections in the laboratory. To accomplish the objectives of this study, the following tasks have been performed:

1. A literature review of past research concerning the use of geotextiles and geogrids in the construction of pavement sections was conducted.

2. Four types of pavement sections were constructed and evaluated. These included a control (unstabilized) section modeling a typical secondary road constructed over a weak granular subgrade without geosynthetics, and three similar pavement sections constructed with different types of geosynthetics placed at the interface between the subgrade and base course.

1.4 Research Approach

The overall research program, of which this investigation is a part, is organized around three phases. The initial phase consisted of a review of previous work concerning geosynthetic stabilization of road sections, both paved and unpaved. The second phase consists of the laboratory testing and evaluation of geosynthetic-stabilized pavement sections. The third phase consists of a full-scale field test and evaluation of geosynthetic-stabilized pavement sections.

The first phase of this program has been completed. However, the review of newly published reports requires continued attention. In an effort to narrow the scope of this review, attention has focused on those programs which evaluated either field or laboratory performance of paved or unpaved roads stabilized with either geotextiles or geogrids. Based on the literature review, it was determined that additional investigations were warranted. The review also indicated that modeling of secondary roads and the loading they experience could be performed with the facilities available at Virginia Polytechnic Institute and State University (Virginia Tech).

The laboratory testing portion of second phase has also been completed. The initial efforts of this phase were focused on designing and proving a pavement cross section, loading system, and data acquisition system. This was followed by the testing and evaluation of sections which modeled typical secondary roads constructed in Virginia over weak granular subgrades. Experience was obtained which made it possible to construct pavement sections with a wide range of subgrade strengths, and to apply cyclic loads which can be modeled to simulate vehicular loading. The data acquisition system was refined to enable comprehensive recording and analysis of pavement section performance. This research was reported by Smith (1994) and Lacina (1995). Additional analysis of the collected data has been performed and is presented in this report.

The third phase involving the full-scale field trial began in June 1994. An instrumented test section measuring 450 ft (140 m) in length was opened to traffic in August 1994 and performance data has been collected over the last three years. The final report of this research is expected in 1997.

1.5 Research Scope

This study presents a review of related research in Chapter 2. Specific attention is given to the materials and procedures employed, as well as the findings of each program. The report addresses each aspect of the Virginia Tech laboratory testing program in Chapter 3. This includes the design and construction of the pavement sections and the properties of the materials used, as well as a discussion of the actual testing procedures. Chapter 4 presents the results of testing on each test section using several evaluation methods. Finally, analyses and conclusions based on pavement section performance data and recommendations for continued research are presented in Chapter 5 and Chapter 6, respectively.

Chapter 2 - Literature Review

An extensive literature review of geosynthetics and their applications was conducted. The purpose of the literature review was twofold. First, it provided background information on geosynthetic mechanisms and functions and their role in the stabilization of pavement sections. Second, the literature review provided an opportunity to examine significant previous work, particularly research programs which involved field studies and field-simulated investigations.

2.1 Primary Functions of Geosynthetics in Roadway Stabilization

The two terms which are most frequently used to describe the mechanisms provided by geosynthetics in roadway applications are *separation* and *reinforcement*. When geotextiles are used to stabilize pavement sections, they are generally regarded as being very effective in providing separation, but less effective in providing reinforcement. Conversely, research has shown geogrids to be effective in reinforcement, but not effective in separation.

2.1.1 Separation

A typical secondary road which utilizes a layered system of design comprises a hot-mix asphalt (HMA) wearing surface, an aggregate stone base course, and a soil subgrade. The successful performance of each component is critical to the overall performance of the pavement system. The primary design requirement of the base course in a flexible pavement system is to reduce the stress of traffic loading at the elevation of the underlying subgrade to a level which can be supported by the subgrade (Yoder and Witczak 1975). If the stress reduction function is not accomplished, excessive subgrade deformation may occur, resulting in pavement rutting and other distresses. For the base course to be effective in its role of distributing stress imposed by surface loading, it must remain relatively permeable and its design thickness must be maintained.

Cedergren (1989) has observed that the presence of water in a base course section drastically changes the pattern by which surface loading pressures are distributed. He notes that lateral spreading of surface loads provided by a structurally sound base course can only occur if the base course is well-drained, and that stress distribution occurs as a result of the inter-granular stresses developed. However, when a base course is saturated with incompressible water, the applied surface pressures are transmitted downward to the subgrade with little or no reduction in intensity. Under this saturated condition, the normal stress distribution assumed in initial road design does not occur, and instead subgrade deformation and pavement distress can result. Figures 2.1A and 2.1B are simplistic illustrations these two stress distribution conditions (Cedergren 1989).

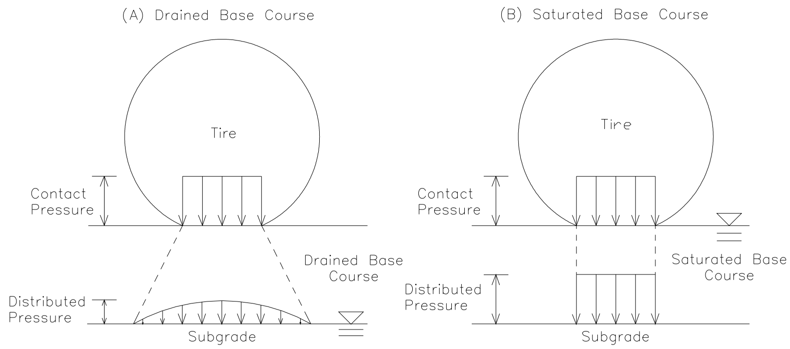


Figure 2.1 Idealized surface load stress distribution through drained aggregate base course and saturated aggregate based course.

Cedergren (1994) maintains that the use of fast-draining open-graded aggregate is the most effective method to prevent the accumulation of water in the base course and corresponding premature pavement section deterioration.

Virtually all design theories of layered pavement systems assume that the construction materials will remain as they are initially placed. However, there are two mechanisms which may effectively reduce the thickness of the base course layer if it is constructed over a soft subgrade soil (Christopher and Holtz 1991). One of these is the tendency for the subgrade fines to move into the voids between the aggregate particles via subgrade pumping, particularly when the soil is wet. If the soil fines are relatively non-plastic, such as with silt or lean clay, the soil particles may be carried upward into the base course aggregate voids as excess pore water pressures dissipate. If the subgrade soil fines are relatively plastic, such as with elastic silt or fat clay, pore water pressure dissipation may occur very slowly and resulting migration of soil fines may be insignificant over a short term period. However, as observed by Bell et al. (1982), contamination by soil fines can still occur as a result of subgrade softening. Water which resides in the base course, infiltrates from the road surface, or results from lateral flow may pool in local depressions or indentations created by compaction of aggregate particles. At these locations, water may combine with the cohesive soil to form a slurry. When surface loads are applied, it may be extruded upward into the aggregate layer. With severe contamination, the soil-water slurry may come into contact with the bottom of the HMA layer or be extruded through cracks to the road surface. The presence of clay may precipitate asphalt emulsification and stripping.

Pumping results in the accumulation of fines beginning near the bottom of the base course and continuing upward. As the fines accumulate in the lower portion of the base course layer, particle-to-particle contact of the aggregate may be reduced and thus the aggregate’s stability and strength may be decreased. The result of this process is a decrease in the effective thickness of the aggregate layer.

The same contamination process which leads to a reduced base course thickness also degrades the drainage capability of the base course. Soil fines which are pumped into a formerly free-draining aggregate result in lower permeability. As the permeability decreases, the time required for water to evacuate from the base course increases. As levels of saturation are reached, the base course becomes less capable of distributing the stress of surface loading, resulting in increased subgrade deformation and pavement distress.

The second mechanism by which the thickness of the base course may be effectively reduced is the penetration of aggregate stone particles into soft subgrade soil as local shear failure of the soil occurs. This process also begins at the bottom of the base course layer and also may lead to reduced particle-to-particle contact of the aggregate. The degradation is greatly accelerated if the aggregate is compacted over a wet subgrade or if the subgrade remains wet for extended periods during road use. Under these wet conditions, soil softening may occur and the resistance to aggregate penetration is reduced. Figure 2.2A and 2.2B illustrate the reduction of base course thickness as a result of soil migration and aggregate penetration.

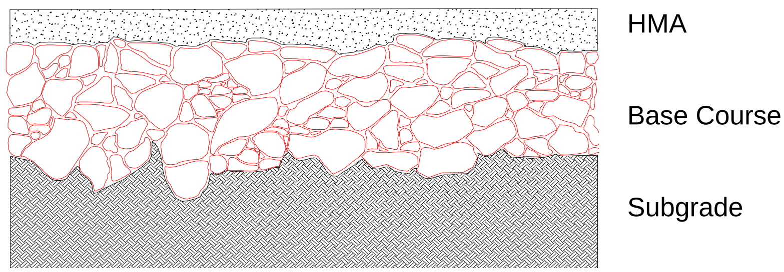


Figure 2.2A Typical subgrade and base course interface before migration of fines or penetration of aggregate.

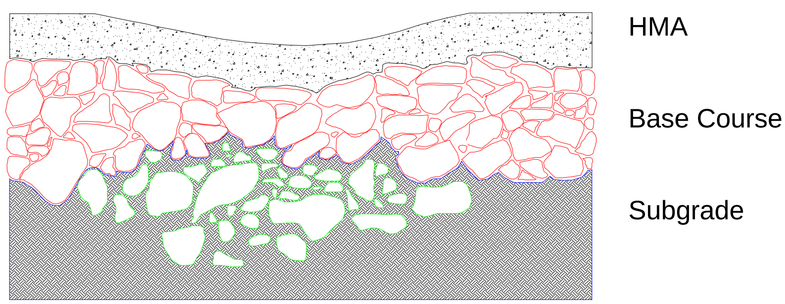


Figure 2.2B Typical subgrade and base course interface showing surface rutting as a result of the migration of fines and penetration of aggregate.

Field and laboratory experience have shown that it is possible to prevent the degradation of the base course by providing a geosynthetic barrier between the base course and the subgrade. The barrier must meet three general criteria if it is to be effective. First, it must meet the requirements for survivability. Survivability has been defined by the Federal Highway Administration (FHWA) as the geosynthetic's resistance to destruction during road construction and initial operation. Survivability requirements have been established by the FHWA as a function of subgrade conditions, cover material, and construction equipment (Christopher and Holtz 1985).

Damage to the geosynthetic may occur as a result of many actions during the construction process. For example, aggregate is often dropped onto the prepared subgrade and then spread to obtain the lift thickness required by the road design. If the aggregate is dropped onto a geosynthetic barrier, the geosynthetic may experience puncture damage. Also, subgrade material which is not completely free of rocks and debris may cause puncture or tearing of the geosynthetic as it is installed and overlying material is compacted. Further, as the aggregate is being spread, it is possible to abrade and tear the surface of the geosynthetic. If the geotextile sustains even localized damage, its ability to serve as an effective barrier in these locations may be compromised, possibly resulting in localized pavement failure.

The second and third criteria the geosynthetic barrier must meet are requirements for filtration and permeability. The openings between the geosynthetic fibers must be such that subgrade soil migration is restricted while an adequate flow of water is permitted. The migration of soil fines must be restricted to prevent the contamination of the base course aggregate. However, the geosynthetic must remain sufficiently permeable to permit the dissipation of excess pore water pressures which may develop under traffic loading. When a geosynthetic can meet both the criteria for filtration and permeability, the mechanisms it provides are referred to as separation and filtration. In literature which discusses soil stabilization, these two mechanisms are often collectively referred to as separation.

Separation is considered to be the primary function of a geotextile. Koerner (1990) defined the separation function of a geotextile as the introduction of a synthetic barrier placed between dissimilar materials so that the integrity and functioning of both materials can remain intact or be improved. He illustrated the significance of separation with "10 pounds of stone placed on 10 pounds of mud results in 20 pounds of mud." A common practice of state Department of Transportation (DOT) engineers when designing roads on weak subgrade soil has been to include an amount of “sacrificial” aggregate in addition to the amount required by standard design methods (FHWA 1989). The reason for this practice is that a significant portion of the aggregate may be lost to the weak subgrade through the two previously discussed mechanisms, effectively reducing the ability of the base course to distribute traffic loading stresses. However, as mentioned, virtually all design theories of layered pavement systems assume that the component materials will remain as placed. A study conducted by Joseph Fluett attempted to quantify the amount of aggregate lost in this manner by surveying state DOT engineers to assess their experience with a range of weak subgrade conditions (FHWA 1989). The survey was performed to assist in the research and preparation of an FHWA design method which uses geotextiles to eliminate base course aggregate loss. The results of the survey are summarized by the diagram in Figure 2.3.

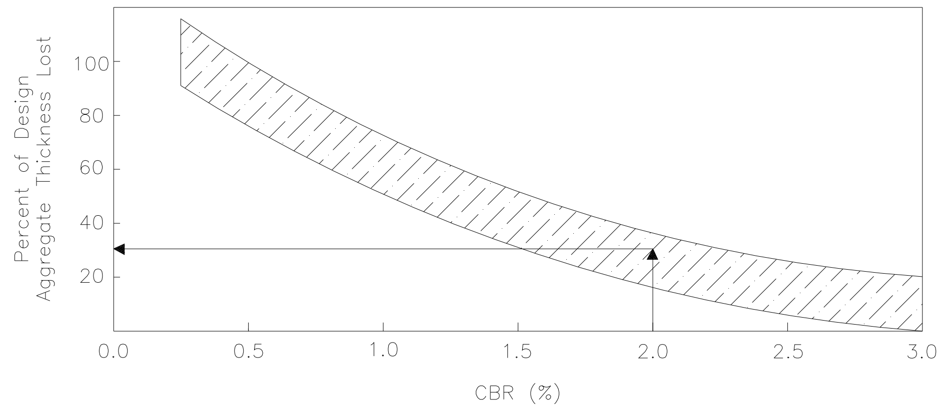


Figure 2.3 Percent of design aggregate thickness lost as a function of subgrade CBR. (FHWA, 1989. *Geotextile Design Examples*, Geoservices, Inc. report to the Federal Highway Administration, Contract No. DTFH-86-R-102, Washington, DC. Used under Fair Use, 1997).

According to the survey results, DOT engineers anticipate significant aggregate loss when the strength of the subgrade soil is equivalent to a California Bearing Ratio (CBR) of 3 percent or less. The amount of aggregate which the engineers expect to lose corresponds to the amount of sacrificial aggregate they have found must be added to the base course thickness prescribed by standard design methods. For example, according to Figure 2.3, if a subgrade has a CBR of 2.0 percent, and standard design methods require a base course thickness of 10 in (250mm), DOT engineers typically add approximately 30 percent more aggregate, obtaining a total base course thickness of 13 in (330mm). This addition is based on the anticipation that approximately 3 in (80mm) of the base course thickness will be lost. In this case, a geotextile may be used to ensure that the originally prescribed thickness of the base course remains constant.

A geogrid, by virtue of its design, is unable to provide complete separation of base course and subgrade material. For example, the aperture size of Tensar SS1 (also known as BX1100) is reported to be 1.0 in x 1.3 in (25mm x 33mm) in the *1995 Specifier's Guide* (Industrial Fabrics Association International 1994). Placement of the geogrid between the base course and subgrade may restrict penetration into the subgrade of aggregate particles which exceed these dimensions. However, much of the aggregate may still penetrate, and the migration of fines can still occur. Contamination of aggregate base courses in geogrid-stabilized road sections has been documented in field trials (Austin and Coleman 1993) and large-scale laboratory pavement loading tests (Barksdale et al. 1989).

2.1.2 Reinforcement

Reinforcement is described by Koerner (Koerner 1990) as the often synergistic improvement of a total system created by the inclusion of a geosynthetic (that is good in tension) into a soil (that is usually poor in tension) or other disjointed and relatively weak material. When a geosynthetic is placed within the base course or at the bottom of the base course, it is reported to reinforce a road section by two principal methods: tensioned membrane reinforcement and shear type reinforcement (Christoper and Holtz 1991, Koerner 1990). It has also been reported that geosynthetic stiffness is an important characteristic in road reinforcement (Barksdale et al. 1989; Webster 1991b). Tensioned membrane reinforcement occurs when a vertical load is applied to a deformable soil which is reinforced with a geosynthetic. Koerner (1990) described the horizontal stress which may be induced to a geosynthetic by using an equation from Taylor (1948):

$$\sigma_h = -\frac{P}{\pi z^2}\left[3\sin^2\Theta\cos^3\Theta - \frac{(1-2\mu)\cos^2\Theta}{1+\cos\Theta}\right] \tag{2.1}$$

where:

- σ_h = horizontal stress at depth z and angle Θ,
- P = applied vertical load,
- z = depth beneath the surface where is σ_h being calculated,
- μ = Poisson's ratio, and
- Θ = angle from the vertical beneath the surface load P.

Koerner observes that directly beneath the load, where Θ = 0 degrees:

$$\sigma_h = -\frac{P}{\pi z^2}\left(\frac{1}{2} - \mu\right) \tag{2.2}$$

With the exception of some dense sands and over-consolidated clays, μ for soils is less than 0.5. This results in a value for σ_h that is negative, indicating a state of tension in the horizontal plane beneath it; namely, the geosynthetic. As can be seen from Eq. 2.2, the greater the applied vertical load P, the greater the stress in the geosynthetic. Similarly, the smaller the distance, z, between the load and the fabric, the greater the stress in the geosynthetic.

Tensioned membrane reinforcement is characteristic of both geotextiles and geogrids, and is a function of the geosynthetic's tensile modulus. Christopher and Holtz (1985) illustrate the effect of tensioned membrane reinforcement by considering wheel load stresses transmitted to a weak subgrade. If the magnitude of the stresses are high enough, plastic deformation of the subgrade will result. If a geosynthetic is placed above the subgrade, it will also deform under loading. If the geosynthetic has a sufficiently high tensile modulus, an appreciable amount of tensile stress resistance may be developed. The vertical resultant of the membrane resisting stress may act to help support vehicular loading. However, it has been suggested (Christopher and Holtz 1991; Giroud et al. 1984; Holtz and Sivakugan 1987) that the tensioned membrane effect is negligible unless a rut depth of at least 4 in (100mm) is developed. Because of this requirement for a relatively high deformation, tensioned membrane reinforcement is not usually considered to be a significant factor in low deformation road systems such as flexible and rigid pavements (Christopher and Holtz 1991; Koerner 1990).

Shear type reinforcement occurs as a result of shear stresses and strains at the bottom of the base course under surface loading. As shown in triaxial tests by Broms (1977), a geotextile placed within the triaxial specimen permits the application of higher normal stresses compared to those required for equivalent strains in unreinforced specimens. No large-scale tests of geotextile-stabilized road sections have been reported in which the contribution of shear type reinforcement was quantified.

The shear type of reinforcement provided by geogrids is purported to laterally confine base course aggregate. This mode of reinforcement is thought to be the principal mechanism by which geogrids work, and to result in an increase of the section's modulus. The restriction of lateral movement is thought to result from the interlock which occurs when aggregate particles are bound within the geogrid apertures (Kennepohl et al. 1985; Hass et al. 1988).

The efficiency with which the underlying geotextile or geogrid can mobilize horizontal shear strength, and thereby restrict the lateral movement of aggregate, may be quantified by the frictional efficiency between the aggregate and geosynthetic material. The frictional efficiency is often measured by direct shear tests or pullout tests (Koerner 1990; GRI Test Methods and Standards 1993) using the candidate geosynthetic and soil, and may be defined as:

$$E_f = \left(\frac{\tan \delta}{\tan \Phi} \right) \tag{2.3}$$

where:

E_f = frictional efficiency,

δ = interface friction angle between the geosynthetic and soil, and

ϕ = angle of internal friction of the soil.

From this equation, it can be seen that the geosynthetic's frictional efficiency is determined by comparing the interface friction angle between the soil and geosynthetic and the internal angle of friction of the soil. Shown in Table 2.1 are the interface friction angles and frictional efficiencies for some woven geotextiles and biaxial geogrids as determined by the use of a direct shear apparatus (Yuan et al. 1994).

Table 2.1 Frictional efficiencies measured for some Amoco geotextiles and Tensar geogrids. (Yuan, Z., Swan, R.H., and Schmertmann, G.R., 1994. *Final Report: Soil Property and Direct Shear Testing*, Report No. GL3506/GEL94041 to Amoco Fabrics and Fibers Co., Atlanta, GA. Used under Fair Use, 1997).

Geosynthetic	Soil[1]	Interface Friction Angle, δ (°)	Efficiency
Amoco 2002	Concrete Sand	25	0.56
Amoco 2006	Concrete Sand	28	0.63
Amoco 2016	Concrete Sand	30	0.69
Amoco 2044	Concrete Sand	32	0.74
Tensar BX1100	Concrete Sand	38	0.93
Tensar BX1200	Concrete Sand	39	0.97
Amoco 2002	AASHTO No. 57 Stone	36	0.90
Amoco 2006	AASHTO No. 57 Stone	36	0.93
Amoco 2016	AASHTO No. 57 Stone	41	0.84
Amoco 2044	AASHTO No. 57 Stone	41	0.84
Tensar BX1100	AASHTO No. 57 Stone	40	1.0
Tensar BX1200	AASHTO No. 57 Stone	41	1.0

Note 1: Peak internal angle of friction of sand was 40° and peak internal angle of friction of stone was 4°.

According to the data in Table 2.1, under direct shear conditions the geogrid appears to mobilize friction with an efficiency between 90 and 100 percent, whereas the geotextile mobilizes friction with an efficiency between 56 and 84 percent. The maximum theoretical frictional efficiency a geosynthetic may have with a soil is 1.0 if the failure plane is to develop at the geosynthetic-soil interface. Efficiencies greater than 1.0 imply that the failure plane will develop within in the soil, as has been shown to occur in geosynthetic pullout tests (Gilbert et al. 1992; Cowell and Sprague 1993). The existence of frictional efficiencies in excess of 1.0 may help to explain the mechanism by which a geogrid is able to impart shear type reinforcement.

2.1.3 Tension Creep

Tension creep is a property of polymeric materials such as polypropylene geotextiles and geogrids. Creep occurs in non-oriented polypropylene as the molecular chains slip along one another within the crystalline regions (Koerner, 1994). It is a function of time, stress, temperature, and other environmental factors, and is usually regarded as an important design consideration in geosynthetic-reinforced earth structures (American Association of State Highway and Transportation Officials 1990; FHWA 1993). When a geosynthetic is used to reinforce soil in retaining walls and steepened slopes, the reinforcement's allowable design strength is obtained by multiplying the geosynthetic's ultimate strength by a creep reduction factor. The creep reduction factor is based on unconfined creep test results (ASTM D 5262). The reduction factor corresponds to a tensile load which induces no more than 10 percent strain at the end of a specified test period. If, for example, the tensile load equals to 30 percent of a specimen's tensile strength, the corresponding reduction factor is 0.30. For polypropylene geosynthetics, the creep reduction factor typically ranges from 0.15 to 0.3 for a 10,000 hour test period.

A geosynthetic which provides tensioned membrane or shear type support to surface loads experiences both constant and dynamic tensile stress. Therefore, creep of the polymeric material must result. The consequence of geosynthetic creep is stress relaxation. Thus, a polypropylene geotextile and geogrid may initially provide reinforcement in a road section, but it logically follows that the significance of the reinforcement diminishes over time. However, no reports of research of this phenomenon have been found.

2.2 Previous Work

A limited number of studies have been conducted which utilized either laboratory models or field trials to evaluate geosynthetic performance under actual or simulated traffic loading. The majority of these programs investigated the influence of geogrids on roadway stabilization, but some studies exploring the effect of geotextiles have been performed as well.

2.2.1 Jorenby and Hicks

Jorenby and Hicks (1986) conducted a laboratory study to illustrate the influence of soil fines on the modulus of an aggregate base course. In conjunction with the laboratory study, the researchers reviewed previous programs which evaluated the efficiency of geotextiles in limiting the migration of subgrade soil fines. By illustrating the effect of base course contamination with soil fines, Jorenby and Hicks sought to quantify the benefits of geotextile separation.

An aggregate meeting Unified Soil Classification System (USCS) criteria for classification as a well-graded gravel (GW) was used as the control base course material. The gradation of the aggregate represented the middle of the specification range allowed by 1979 U.S. Forest Service Standard Specifications. The maximum particle size was 1.0 in (25.0mm) and 5.5 percent passed the No. 200 U.S. Standard Sieve (0.075mm). The material used as soil fines consisted of a soil meeting USCS criteria for classification as a lean clay (CL).

The test procedure included blending the clay with the aggregate to represent specific levels of contamination with soil fines. The percent increase in fine content of the aggregate was designated as “S”. Levels of S equal to 0, 2, 4, 6, 8, and 19.5 percent were evaluated. The contamination level represented by S equal to 19.5 percent was chosen because Walter (1982) found that this condition would develop in a base course when a geotextile separator is not used. The lower levels of contamination were chosen because they represent a range of added fines found in other laboratory tests where geotextile separators were used (Walter 1982; Hoare 1982; Bell et al. 1982). Jorenby and Hicks noted that the level of contamination would be a function of several factors, including geotextile and soil variations.

The blended aggregate was compacted to 95 percent of its maximum density in a 4.0 in (100mm) diameter mold. Next, the resilient modulus (E_2) of the aggregate sample was evaluated with the use of a triaxial cell and an MTS testing machine. The relationship between state of stress and resilient modulus was characterized using bulk stress parameters:

$$\theta = \sigma_1 + \sigma_2 + \sigma_3 \tag{2.4}$$

where:

θ = bulk stress,
σ_1 = major principal stress or total vertical stress, and
σ_2 and σ_3 = minor principal stress.

The resilient modulus was determined at four levels of bulk stress: 10, 20, 35, and 95 lb/in^2 (69, 138, 241, and 655 kPa). The bulk stress of 35 lb/in^2 (241 kPa) represented the stress state in the base course and 20 lb/in^2 (138 kPa) represented the stress state in the subgrade.

In general, it was found that the resilient modulus increased until the added fine content reached 6 percent. Because the fine content of the original aggregate mixture was 5.5 percent, an increase of 6 percent represented a total fine content of 11.5 percent. An increase in fines beyond this amount was found to result in a sudden and significant decrease in the base course's resilient modulus. The relationship between resilient modulus, bulk stress, and fine content established by Jorenby and Hicks is shown in Figure 2.4.

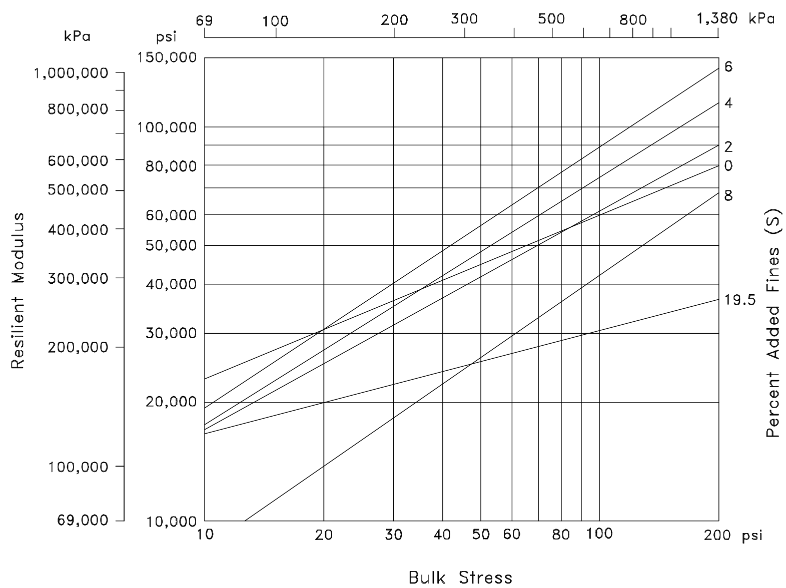


Figure 2.4 Resilient modulus versus bulk stress for various fine contents. (Jorenby, B. N. and Hicks, R. G., 1986. "Base Course Contamination Limits," *Transportation Research Record 1095*, Washington, DC. Used under Fair Use, 1997).

The relationship between resilient modulus and the fine content of the base course is further illustrated in Figure 2.5. It can be seen that the stiffness of the base course reaches a maximum when S equals 6 percent for all levels of bulk stress, and that additional added fines leads to a sharp decrease in resilient modulus. Accordingly, these results suggest that designs based on stiffness criteria should limit the intrusion of soil fines such that the total fine content of the base course remains below 11.5 percent. However, it should be noted that in the aggregate-fine soil mixtures the researchers tested, the fine soil was fairly uniformly distributed among the aggregate particles. Under field conditions, subgrade soil fines which migrate into a base course aggregate are not uniformly distributed.

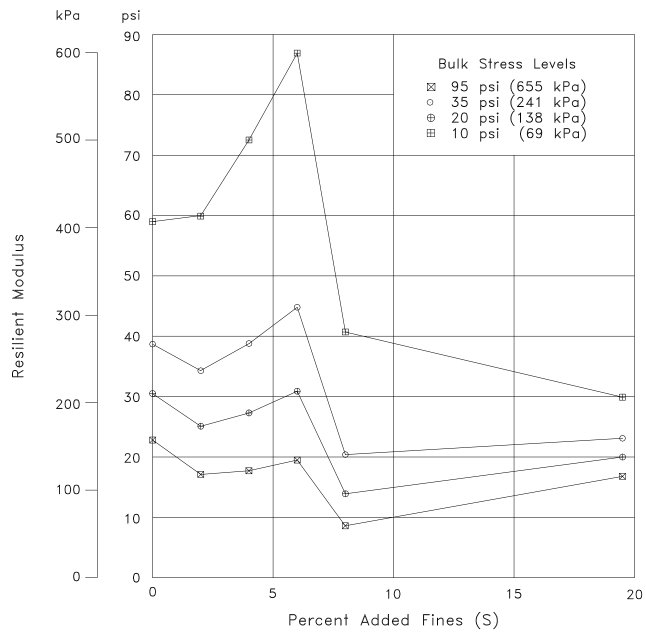


Figure 2.5 Resilient modulus versus percent added fines. (Jorenby, B. N. and Hicks, R. G., 1986. "Base Course Contamination Limits," *Transportation Research Record 1095*, Washington, DC. Used under Fair Use, 1997).

However, use of these stiffness criteria may not permit adequate drainage through the aggregate. To provide adequate drainage, Jorenby and Hicks suggest that the total fine content of the base course be limited to 8 percent, which corresponds to a value of S equal to 2.5 percent for the aggregate mix used in their study.

Jorenby and Hicks evaluated the influence added fines would have on the service life of a pavement section by employing three analytical models: the US Forest Service method with the AASHTO equation, Boussinesq method of equivalent thickness, and elastic layer theory (ELSYM5). To facilitate their evaluation, the researchers defined pavement life ratio (PLR) as the allowable number of 18,000 lb (80 kN) equivalent axle loads for a given percentage of added fines divided by the allowable axle loads when no fines are added. The PLR corresponding to specific levels of added fines is shown in Table 2.2. The three models used for PLR analysis yielded different estimates of pavement life, but showed a general trend of decreased service life with increased amounts of added fines.

Table 2.2 Pavement life ratios for different levels of base course contamination with soil fines. (Jorenby, B. N. and Hicks, R. G., 1986. “Base Course Contamination Limits,” *Transportation Research Record 1095*, Washington, DC. Used under Fair Use, 1997).

S[1] (%)	E_2[2] lb/in^2 (kPa)	AASHTO PLR	Boussinesq PLR	ELSYM5 PLR	Recommended Design PLR
0	37,500 (258,560)	1.00	1.00	1.00	1.00
2	33,225 (229,090)	1.00	0.768	0.868	1.00
4	37,500 (258,560)	0.885	1.00	1.00	1.00
6	37,500 (258,560)	0.778	1.00	1.00	1.00
8	19,750 (136,180)	0.689	0.266	0.531	0.53
10	18,500 (127,560)	0.605	0.235	0.505	0.50
12	17,250 (118,940)	0.532	0.206	0.480	0.48
19.5	12,500 (86,190)	0.407	0.115	0.388	0.39

Note 1: Values of E_2 and PLR at levels of S equal to 10 and 12 percent were interpolated from test data.
Note 2: Resilient modulus values based on θ=35 lb/in^2 (241 kPa) and a data normalization process employed by the researchers.

The work of Jorenby and Hicks showed that a dramatic decrease in the resilient modulus of an aggregate is experienced when additional fines are added. However, it should be noted that in their experiment the fines were blended directly into the aggregate mix. It is possible that in the base course of a road structure, the same degree of blending may not occur. Rather, the fines may simply migrate into existing voids, but not intercede between aggregate particles. If this occurs, the loss of aggregate shear strength may not be as great as their experiments suggest. The amount by which soil fines reduce the point-to-point contact of aggregate particles may depend upon the amount of aggregate movement which occurs under traffic loading.

2.2.2 The RMC Program

In late 1980, a research program was initiated to evaluate existing metallic and nonmetallic road reinforcing materials, including geogrids (Abdel Halim et al. 1983). It included the design and implementation of an experimental program as a cooperative effort between the Royal Military College (RMC) at Kingston, the Ontario Ministry of Transportation and Communications, Gulf Canada, Ltd., and the University of Waterloo. After considering candidate materials, a geogrid manufactured by the Tensar Corporation was selected for further study. The main objective of this research was to investigate the mechanical behavior and load carrying capabilities of flexible pavements when a geogrid is included within the HMA wearing course. This program is relevant because the same laboratory modeling procedures were used in subsequent research programs conducted by some of the same investigators to evaluate geogrid stabilization of the base course of a road section.

The study was performed using the RMC testing program in which Tensar biaxial geogrid AR-1 was placed within HMA flexible pavement sections of various thicknesses (Abdel Halim et al. 1983). During this program, five pavement sections were constructed directly on a sand subgrade and designated as test loops. Within each test loop, between four and nine tests were conducted.

The test loops were constructed in a concrete pit measuring 13 ft x 7.9 ft x 6.6 ft deep (4 m x 2.4 m x 2 m deep), and equipped with a sump and water distribution system. The subgrades for each loop were constructed to a thickness of 4.0 ft (1.2 m) with medium to coarse sand. The sand was placed in lifts of 6 in (150mm) at an optimum water content of 11.5 percent, and then compacted using a plate tamper. No measurements of subgrade soil strength at any water content were reported. Instead, test loops were evaluated for saturated and dry subgrade conditions. The saturated and dry states were achieved by use of the test pit's sump and water distribution system.

Completion of the sand subgrade was followed by the construction of an HMA flexible pavement. An aggregate base course was not included in the pavement cross section. For each test loop, half of the pavement was reinforced with a geogrid, and the other half was left unreinforced. The unreinforced portion of the pavement was intended to function as a test control. To construct the pavement, a layer of HMA was placed at a thickness of 1 in (25mm). Next, the geogrid was installed over half of the HMA surface. This was followed by the placement of an additional 2 in (50mm) of HMA and compacted using a plate tamper. Additional HMA lifts of 1 to 3 in (25 to 75mm) were placed and compacted to bring the pavement layer to its desired thickness. The total pavement thicknesses ranged from 6 to 10 in (150 to 250mm).

Each test was performed by loading the pavement surface through a rigid circular plate with a diameter of 12 in (300mm). Loading was controlled by a hydraulic actuator and a computer-linked function generator. To model traffic loading, a sinusoidal pulse was applied to the pavement surface at a frequency of 10 Hertz (Hz) with a peak load of 9,000 lb (40 kN) for a total pressure of 80 lb/in^2 (556 kPa). At predetermined cycle counts, dynamic loading was discontinued, and a static loading sequence was applied. The static loading sequence was necessary to make it possible to read surface displacement gauges, strain gauges, and pressure cells.

To monitor test section loading responses, six types of instrumentation were employed. A load cell and linear variable displacement transformer (LVDT) were part of the loading actuator and were used for all five test loops. This facilitated monitoring of the applied loading force and resulting loading plate displacement. Three dial gauges were positioned on the loading plate and two were positioned on the pavement surface. These instruments permitted the recording of surface deflections at their respective locations during static loading periods.

Each test loop also included foil-type strain gauges attached to the bottom and top of the geogrid at various locations to permit an evaluation of the magnitude and distribution of elastic and plastic strains induced by pavement loading. Test loops two through five included the embedment of mastic strain carriers in the HMA directly beneath the loading plate locations, where it was anticipated that maximum tensile strains would occur.

Test loop five included the placement of a circular aluminum plate pressure cell beneath the loading plate location at a depth of about 2 in (50mm) below the sand-HMA interface.

The pressure plate was 6.1 in (155mm) in diameter and 0.51 in (13mm) thick. The authors noted that its presence affected the value of the permanent deformation because it acted as additional reinforcement. Its purpose was to allow a comparison of stresses at the plate for reinforced and control sections.

After the loading of a test loop was completed, the pavement layer and top 6 in (150mm) of subgrade sand were removed. Next, the second 6-in- (150-mm-) thick layer of sand was remixed and recompacted. This was followed by the reconstruction of the top 6-in- (150-mm-) thick subgrade lift and construction of the pavement layer as required by test loop objectives. After construction of the subgrade for the first test loop, the initial 3 ft (0.9 m) of subgrade sand was never remixed and recompacted.

Each test location was loaded until at least one of five failure criteria were met in order to compare the performance of reinforced and control sections. The criteria were:

1. a permanent vertical surface deformation of 1.2 in (30mm),
2. extensive cracks developed,
3. a steady increase occurred in the measured value of stresses on the subgrade,
4. surface deflection increased as much as 20 percent, or
5. horizontal strain at the interface increased by 30 percent.

The investigators sought to establish several relationships between the number of loading cycles applied and response of the pavement sections by adjusting some of the controllable variables for each loop. These variables included the strength of the subgrade and the thickness of the HMA layer.

By varying HMA layer thickness for both reinforced and control locations, the investigators sought to determine how much additional HMA was required to obtain performance improvement equivalent to that provided by a geogrid. Based on the results of their study, the authors concluded that placement of the geogrid within the HMA pavement could provide substantial savings in HMA thickness. They also stated that the geogrid made it possible to double the number of load repetitions and to prevent or minimize fatigue cracks in the HMA layer. Although the thicker unreinforced section yielded lower elastic rebound, the reinforced section produced lower permanent tensile strain and less fatigue cracking.

This testing program accomplished more than an evaluation of the performance of pavement sections when a geogrid is placed within the HMA pavement layer. It identified difficulties and established some procedures for subsequent laboratory programs which sought to further investigate the effect of geosynthetic stabilization. It served as the basic model for continued geogrid reinforcement research at the University of Waterloo, and for the research conducted at Virginia Tech.

The research also revealed opportunities to improve the laboratory model of the pavement section. For example, testing of sections constructed with subgrades which were either dry or saturated failed to represent quantifiable subgrade strength conditions.

A more complete evaluation requires the construction of subgrades with a range of shear strengths, as well as quantification and verification of these values. Also, realistic cross sections are required to effectively assess potential field performance. In the RMC program, the pavement was constructed directly over the subgrade. The margin of improvement implied by the geogrid cannot be directly translated to field conditions, where an aggregate base course is usually used. Further, pure sand subgrades are likely to represent only a fraction of the conditions typically encountered in the field, and can be expected to behave differently than subgrades consisting of fine-grained soil. To properly evaluate the effect of geogrid reinforcement in the HMA layer, cross sections which more effectively model actual roads would be preferable.

2.2.3 The Waterloo Program

The results of the RMC program encouraged researchers to evaluate the effect of a geogrid placed in a granular base course layer. Based on the results of preliminary computer modeling, researchers at the University of Waterloo hypothesized that a geogrid could reduce deformation at the pavement surface by decreasing vertical strains and plastic deformations of the subgrade (Kennepohl et al. 1985). Further, it was suggested that construction of roads with geogrid-reinforced base courses could be accomplished relatively simply and inexpensively. For these reasons, a laboratory test program was initiated at the University of Waterloo to quantify the potential benefits of geogrid base reinforcement and to produce the data necessary to develop a design procedure.

Three reports of the Waterloo research program have been reviewed: Kennepohl et al. (1985), Carroll et al. (1987), and Hass et al. (1988). A description of the Waterloo research testing procedures, results, and analyses is presented in this section. In general, the test setup and procedure were planned to simulate the RMC program as closely as possible. Hass et al. (1988) and Carroll et al. (1988) reported that a total of six test series were conducted. However, Kennepohl et al.(1985) reported only three, possibly because all six test series were not completed at the time of their 1985 publication.

The six plate loading test series were designated as loops one through six by Haas et al. (1988) and Carroll et al. (1987), but Kennepohl et al. (1985) designated the three loops discussed in their report as A, B, and C. Based on a comparison of the descriptions of the loops in these reports, loops A, B, and C appear to correspond to loops 1, 2, and 4, respectively. Within each loop, four plate loading tests were performed, each at a different location on the pavement surface, to evaluate the effect of different test variables.

The test pit at the University of Waterloo consisted of a large rectangular plywood box reinforced by a steel frame. It measured 15 ft x 6 ft x 3 ft deep (4.5 m x 1.8 m x 0.9 m deep). The walls of the box were lined with galvanized steel sheeting and sealed at the joints with a silicon caulking compound for moisture retention.

The subgrade of each test loop was constructed using a very fine-grained beach sand classified as a poorly-graded sand (SP) according to the USCS. It was reported that 99 percent of the material passed the U.S. Standard Sieve No. 40, 32 percent passed the No. 100 sieve, and 4 percent passed the No. 200 sieve. Kennepohl et al. (1985) reported that CBR tests were performed on the subgrade sand at different moisture contents. However, no information has been provided on the number of CBR tests conducted or on the method of achieving a specified CBR value.

The base course was constructed using a well-graded crushed stone aggregate classified as GW according to the USCS, with 100 percent passing the 1 in sieve, 49 percent passing the No. 4 sieve, 4 percent passing the No. 100 sieve, and 2.3 percent passing the No. 200 sieve. The HMA was a dense-graded aggregate mix with a maximum particle size of 0.6 in (15mm) and an 85/100 penetration grade asphalt cement. The reinforcement was a biaxial polypropylene geogrid manufactured by Tensar and designated as BX1100. It is also referred to as SS1.

The loading system consisted of an MTS function generator and servo-hydraulic controller which drove an actuator assembly mounted to a bolt-down rolling plate on a reaction frame. The hydraulic actuator was rated for 22,000 lb (100 kN) and was equipped with a load cell and an internally-mounted LVDT.

The loading sequence for each test section consisted of a series of dynamic loads followed by a single static load at fixed cycle counts. A dynamic loading force of 9,000 lb (40 kN) was applied at a rate of 8 Hz through a rigid plate with a diameter of 12 in (300mm), resulting in a pressure of 80 lb/in^2 (550 kPa). The static load was applied to permit surface displacement gauges, strain gauges, and pressure cells to be read and the readings recorded.

To help establish the pavement surface displacement profile, a total of five dial gauges were placed across the 6-ft- (1.8 m) wide axis of the test pit. Two gages were positioned directly on the pavement surface on either side of the loading plate. The other three dial gages were placed directly on the loading plate: one near the center of the plate and the remaining two near opposite edges of the plate. The LVDT mounted inside the hydraulic actuator was also used to monitor pavement displacement beneath the loading plate.

According to Haas et al. (1988), pressure cells were installed in the subgrade in test loops one through five to help compare differences in stress distribution between reinforced and unreinforced sections. At each of the four loading locations in the test loop, one pressure cell was positioned directly beneath the loading plate and second placed at a distance of 12 in (300mm) from the load center. The vertical position of the pressure cells was 1.5 in (38mm) below the subgrade-base course interface. Pressure cells were also used in loop six, but only at three of the four loading locations.

Strains in the reinforcing geogrid were measured using foil type strain gauges. These instruments were attached to the geogrid at various locations of increasing radial distance from the load center.

The pavement section component thicknesses, subgrade CBR values, and geogrid locations for test loops A, B, and C (loops 1, 2, and 4) are described by Kennepohl et al. (1985) as shown in Table 2.3. Also shown in Table 2.3 are the approximate number of loading cycles required to obtain 0.8 in (20mm) of permanent vertical deflection beneath the loading plate (the exact number of cycles was not reported). This amount of deflection was defined as pavement failure.

Table 2.3 Waterloo program variables and results for three test loops. (Kennepohl, G., Kamel, N., Walls, J., and Hass, R., 1985. "Geogrid Reinforcement of Flexible Pavements: Design Basis and Field Trials," *Proceedings, Annual Meeting of the Association of Asphalt Paving Technologists*, Vol. 54, San Antonio, TX. Used under Fair Use, 1997).

Loop No.[1]	Test No.	HMA Thickness in (mm)	Base Course Thickness in (mm)	Reinforcement Location within Base	Subgrade CBR (%)	Cycles to Failure (x 1000)
A (1)	1	4 (100)	8 (200)	None	8	200
	2	4 (100)	8 (200)	Bottom	8	600
	3	4 (100)	8 (200)	Middle	8	570
	4	4 (100)	8 (200)	Top	8	160
B(2)	1	3 (75)	8 (200)	None	4[2]	10
	2	3 (75)	8 (200)	Bottom	4[2]	30
	3	3 (75)	6 (150)	Bottom	4[2]	25
	4	3 (75)	4 (100)	Bottom	4[2]	11
C(4)	1	3 (75)	6 (150)	Bottom	1	NR
	2	3 (75)	8 (200)	Bottom	1	NR
	3	3 (75)	8 (200)	Unreinforced	1	NR
	4	3 (75)	12 (300)	Middle	1	NR

NR - Not reported.

Note 1: Letter refers to designation by Kennepohl et al. (1985) and number to designation by Carroll et al. (1987) and Haas et al. (1988).

Note 2: These CBR values were reported as 3.5 percent by Haas et al. (1988).

It can be seen that target CBR values of 8, 4, and 1 percent were selected for test loops A, B, and C, respectively. It can also be seen that tests were performed with the geogrid positioned at three different levels within the base course. These subgrade strengths and geogrid locations were evaluated with combinations of different HMA layer and base course thicknesses.

The purpose of loop A (also designated as loop one) was to compare the performance of reinforced and unreinforced (control) pavement sections with the same base course thicknesses over relatively firm subgrades, and to examine the effects of reinforcement location within the base course (Carroll et al. 1987). The investigators concluded that the results of loop A clearly indicate that reinforcement of the base course improves the deformation resistance of the HMA layer and extends the service life of the pavement. They also observed that the most effective location for reinforcement was in the lower half of the base course.

Loop B (also designated as loop two) was designed to determine if the action of reinforcement warranted a reduction in base course thickness over a subgrade with a CBR value of 4 percent. To achieve the relatively low bearing strength, Kennepohl et al. (1985) reported that the subgrade sand was saturated. The test results indicate that the reinforced section was able to withstand three times as many load cycles as the control section before failure was reached when the two sections had equivalent HMA and base course layers. The results also indicate that the reinforced base course was able to withstand 2.5 times as many load cycles as the control section when the reinforced base course was 75 percent the thickness of the control section. Hass et al. (1988) reported that, based on measurements, reinforcement resulted in a reduction of the stress applied to the subgrade of about 23 percent until 10,000 loading cycles were applied. After 150,000 cycles were applied, the stress reduction was about 12 percent.

Carroll et al. (1987) and Haas et al. (1988) reported that loop 3, which was not reported by Kennepohl et al. (1985), was constructed to examine the effect of geogrid location within various thicknesses of base course. However, between the start and end of the test loop the subgrade soil gained significant strength as moisture was lost. The addition of this variable made meaningful comparisons of reinforced and control section behavior impossible.

Carroll et al. (1987) reported that test loops four (also designated as loop C) and six were constructed with a mixture of peat moss in the top 8 in (200mm) to model a weak subgrade. The resulting CBR values ranged from 0.5 to 1 percent. Failure was redefined as 1.5 in (75mm) of vertical displacement under the loading plate. At the end of 10,000 cycles in loop four, deflections of 1.9 in (48mm) and 2.4 in (61mm) were reached for the reinforced and control sections, respectively. At the end of 10,000 cycles in loop six, deflections of 1.8 in (46mm) and 2.3 in (58mm) were measured for the reinforced and control sections, respectively. Haas et al. (1988) observed that in loops four and six, greater initial stresses (3 to 25 percent) were measured beneath reinforced sections, and the stresses became approximately equal with those of control sections by the end of testing. They concluded that the geogrid was significantly stressed beyond its range of totally recoverable elastic response.

Test loop five was constructed to evaluate the effect that geogrid pre-tensioning would have. Based on test results, Carroll et al. (1987) reported that pre-tensioning provided no significant benefits.

Based on overall section performance, Carroll et al. (1987) suggested that a 50 percent reduction in base course thickness was possible if a geogrid was included in the design. Its optimum location would be at the bottom of the base course, for base course layer thicknesses of less than 10 in (250mm). For thicker base courses, the geogrid should be placed near the middle.
The investigators in the Waterloo study conceived of and implemented an innovative research program. Their findings were significant and hold important implications for geogrid-enhanced road design. Given the technological limitations of instrumentation and data acquisition, their methods for collecting pavement section responses under

loading were thorough. The tests provided an indication of geogrid performance under specific conditions, but because a fined-grained subgrade soil was not used, the applicability of the researchers' findings is limited.

2.2.3 The University of Nottingham Program

Barksdale et al. (1989) conducted both an analytical and a large-scale laboratory study. The analytical study involved finite element modeling of pavement sections reinforced with either geotextiles or geogrids. The laboratory study was performed using the University of Nottingham Pavement Test Facility (UNPTF).

The analytical study was performed using a finite element program called GAPPS7 and was designed to predict the response of geosynthetic-reinforced pavement sections. Using a linear cross-anisotropic model (i.e. different elastic material properties in the vertical and horizontal directions), the researchers evaluated reinforced pavement sections with variations in geosynthetic stiffness, pavement geometry, and subgrade strength. Geosynthetic stiffness was defined as the geosynthetic's tensile modulus at 5 percent strain. When designing with geosynthetics, this value is typically referred to as the secant modulus at 5 percent strain. It is calculated by measuring the tensile strength mobilized at 5 percent strain during a wide width strip tensile test (ASTM D 4595), and dividing this value by 0.05. Because most geosynthetics do not have exactly the same tensile properties in the machine and cross-machine directions, the stiffness of the geosynthetic is dependent on its orientation.

The analytical model used by the authors indicated that the effect of the geosynthetic reinforcement was relatively small in terms of the change it caused in tensile strain at the bottom of the HMA layer, the vertical subgrade stress and strain, and vertical deflections throughout the pavement section. However, the model indicated that the presence of the geosynthetic could have a small but significant effect on the radial and tangential stresses and strains developed in the base course and the top of the subgrade during loading.

The laboratory study included four series of experiments using large-scale pavement models, and each series comprised three test sections. In this study, the researchers sought to evaluate the effect of the following variables:

1. geosynthetic type (e.g. geogrid or geotextile),
2. location of geosynthetic within the base course,
3. pre-rutting of reinforced and non-reinforced subgrades,
4. prestressing the aggregate base with the geosynthetic, and
5. pavement material quality.

The pavement models were constructed in a concrete test pit with a surface area measuring 16 ft x 8 ft (4.9 m x 2.4 m). The HMA wearing surface used in the construction of the pavements ranged in thickness from 1.2 to 1.6 in (30 to 40mm) and was constructed using a gap-graded HMA prepared in accordance with British Standard

594 (Barksdale and Brown 1989). The wearing surface for the remaining three series was constructed with HMA prepared using the Marshall design method.

The base course thicknesses ranged from 5.8 to 8.6 in (150 to 220mm). The sections in the first test series were designed to be relatively weak, using a sand and gravel mixture with a maximum particle size of 0.75 in (19mm) and classified as a British Type 2 subbase. A review of the grain size distribution curve for this material showed that between 40 and 50 percent of the material passed the No. 4 sieve, and between 25 and 35 percent of the material passed the No. 40 sieve. The weak aggregate was used to more effectively demonstrate the significance of geosynthetics in the pavement cross-sections. Because the weak aggregate helped precipitate relatively early failure in the first test series, an aggregate with a higher shear strength, meeting British Standard Type 1 requirements, was used in subsequent sections. The Type 1 aggregate had a maximum particle size of 1.5 in (38mm) and consisted of crushed dolomitic limestone. This material is typical of those used in British highway construction.

The subgrade was constructed using a silty clay. It was found to have a plastic limit (PL) of 18 percent, a liquid limit (LL) of 37 percent, and an optimum water content of 15.5 percent. The clay was transported to the test facility in the form of unfired bricks. For each test series, an 18-in- (450-mm-) thick layer of this material was placed over a 3.5-ft- (1.1-m-) thick layer of drier and stiffer silty clay. After each section was tested, the top 18 in (450mm) of clay subgrade was excavated and recompacted. The top 18-in (460-mm) layer was placed at a CBR value of 2.6 percent and a water content of 18 percent. The material below this layer had a CBR of 8 to 10 percent.

The geotextile used in the study was a very heavy and strong woven polypropylene material. It was reported to have a wide-width tensile strength of 886 lb/in (155 kN/m) and a weight of 28.5 oz/yd^2 (970 gm/m^2). Typical woven and nonwoven polypropylene geotextiles used in road stabilization applications in the United States range in weight from about 4 to 16 oz/yd^2 (130 to 540 gm/m^2) and have a wide-width tensile strength which does not usually exceed 400 lb/in (70 kN/m) [IFAI, 1994].

The geogrid used in the study was a Tensar BX1100 (SS1) biaxial polypropylene geogrid. It was reported to have a wide-width tensile strength of 119 lb/in (21 kN/m) and a weight of 5.99 oz/yd^2 (204 gm/m^2). The stiffness of the geotextile and geogrid at 5 percent strain was measured to be 4,300 lb/in (750 kN/m) and 1,600 lb/in (280 kN/m), respectively.

The load was applied to the pavement surface by a 22-in- (560-mm-) diameter wheel with a width of 6.0 in (150mm) at velocities between 2 and 3 mph (3 and 5 km/hr). The wheel was attached to a support carriage, which enabled control of the wheel's movement and load. Wheel wander was modeled by shifting the wheel path in increments of 3 in (75mm) over a total of nine positions during a phase designated as multi-track testing. Following application of these loads, single-path loads were applied in locations where the pavement was not yet rutted to further evaluate the test sections. This phase was designated as single-track testing.

The load applied through the wheel during test series one varied from 700 to 2,500 lb (3 to 11 kN). Variance in the load was caused by different amounts of surface deflection which occurred at the three test locations. Test series two, three, and four used a stronger pavement design and the load-controlling system was refined, allowing for a uniform load application of 1,500 lb (6.6 kN). Tire pressure was maintained at 80 lb/in^2 (550 kPa). Based on an evaluation of the tire wall strength, tire pressures, and wheel loads, the contact pressure acting on the pavement from the 1,500 lb (6.6 kN) loads was 67 lb/in^2 (460 kPa).

The principal measurement of pavement section performance was the amount of vertical deflection induced at the pavement surface by the wheel loads. However, instrumentation and data acquisition were used to continuously record transient stresses near the top and bottom of the base course and near the top of the subgrade. Permanent strain in the base course and subgrade was recorded at intervals of 100 to 200 wheel passes.

The results of test series one were reported at 150 and 1,262 passes of the wheel load. The series was designed to evaluate the effect of a geotextile placed at the bottom of the base course, with and without pre-rutting the section. The results are summarized in Table 2.4.

Table 2.4 Results of multi-track test series 1 of UNPTF program. (Barksdale, R.D., Brown, S.F., and Chan, F., 1989. "Potential Benefits of Geosynthetics in Flexible Pavement Systems," NCHRP Report No. 315, Washington DC. Used under Fair Use, 1997).

Section[1]	Geometry		Deformation at 150 Passes			Deformation at 1,262 Passes		
	HMA in (mm)	Base in (mm)	Base in (mm)	Subgrade in (mm)	Total in (mm)	Base in (mm)	Subgrade in (mm)	Total in (mm)
PR-GX-B[1]	1.2 (30)	6.3 (160)	0.28 (7.1)	0.02 (0.51)	0.30 (0.6)	0.59 (15)	0.04 (1.0)	0.63 (16)
Control	1.4 (36)	5.8 (147)	0.31 (7.9)	0.12 (3.0)	0.43 (11)	0.69 (17)	0.25 (6.3)	0.94 (24)
GX-B[2]	1.3 (33)	6.1 (155)	0.15 (3.8)	0.09 (2.3)	0.24 (6.1)	0.35 (8.9)	0.20 (5.1)	0.55 (14)

Note 1: PR-GX-B, pre-rutted with geotextile at bottom of base course.
Note 2: GX-B, geotextile at bottom of base course (no pre-rutting).

Table 2.4 shows that at 1,262 passes, the use of the geotextile in the pre-rutted section reduced the total deformation by approximately 33 percent and subgrade deformation by 84 percent compared to the control section. In the geotextile section constructed without pre-rutting, the total vertical deformation was reduced by almost 50 percent and subgrade deformation by 20 percent. It can be seen that in the pre-rutted section, almost all of the deformation occurred in the base course. In the control section and the non pre-rutted geotextile section, approximately two-thirds of the rutting occurred in the base course.

In constructing pre-rutted test sections, the researchers first placed the subgrade, geosynthetic, and base course materials, and then traversed the base course surface with a wheel load until a specified rut depth was obtained (Barksdale and Brown 1989). However, the researchers did not state what rut depth was specified. They did comment that in uninstrumented test sections, the base course was pre-rutted to a depth of about 2 in (50mm). Upon completion of pre-rutting, the rut was backfilled with base course material and compacted. It appears from the researchers' report that the base course thickness measurements presented in Table 2.4 were taken before pre-rutting. Thus, backfilling the ruts with aggregate would have effectively increased the thickness of the base course at the rut location by an amount approximately equal to the rut depth. The pre-rutting process may have caused local densification of aggregate and subgrade soil, and may also have produced a tensioned-membrane effect in the geotextile. It is logical to expect that the pre-rutting process would have increased the load-carrying capacity of the test section. However, the data in Table 2.4 indicates that the total deformation at 1,262 passes in the pre-rutted geotextile section was almost 13 percent greater than the total deformation in the geotextile section constructed without pre-rutting.

The results of test series two, three, and four were reported at 10,000 passes and 70,000 passes. Compared to test series one, these subsequent test sections were constructed with higher quality wearing surface and base course materials, and more passes were required to produce the desired surface deflections. Test series two evaluated the performance of a control section compared to a section which included geogrid reinforcement between the base course and subgrade. The results of this test series are summarized in Table 2.5.

Table 2.5 Results of multi-track test series 2 of UNPTF program. (Barksdale, R.D., Brown, S.F., and Chan, F., 1989. "Potential Benefits of Geosynthetics in Flexible Pavement Systems," NCHRP Report No. 315, Washington DC. Used under Fair Use, 1997).

Section	Geometry		Deformation at 10,000 Passes			Deformation at 70,000 Passes		
	HRA in (mm)	Base in (mm)	Base in (mm)	Subgrade in (mm)	Total in (mm)	Base in (mm)	Subgrade in (mm)	Total in (mm)
PR-GD-B[1]	1.2 (30)	8.5 (220)	0.21 (5.3)	0.03 (0.76)	0.28 (7.1)	0.45 (11)	0.03 (.76)	0.56 (14)
Control	1.2 (30)	8.3 (210)	0.57 (14)	0.21 (5.3)	0.83 (21)	1.07 (27.1)	0.37 (9.4)	1.55 (39.4)
GD-B[2]	1.2 (30)	8.1 (210)	0.60 (15)	0.10 (2.5)	0.76 (19)	1.10 (27.9)	0.15 (3.8)	1.36 (34.5)

Note 1: PR-GD-B, pre-rutted with geogrid at bottom of base course.
Note 2: GD-B, geogrid at bottom of base course (no pre-rutting).

The results of test series two indicate that at 70,000 passes, the pre-rutted geogrid-reinforced section performed significantly better than the control section, reducing total deformation by about 64 percent, and subgrade deformation by 92 percent. The geogrid-reinforced section constructed without pre-rutting reduced total deformation by about 12 percent, and subgrade deformation by 59 percent.

Test series three evaluated the effect of a geotextile used at the bottom of the base course and at the middle of the base course. The results of this test are shown at 10,000 and 70,000 passes in Table 2.6.

Table 2.6 Results of multi-track test series 3 of UNPTF program. (Barksdale, R.D., Brown, S.F., and Chan, F., 1989. "Potential Benefits of Geosynthetics in Flexible Pavement Systems," NCHRP Report No. 315, Washington DC. Used under Fair Use, 1997).

Section	Geometry		Deformation at 10,000 Passes			Deformation at 70,000 Passes		
	HRA in (mm)	Base in (mm)	Base in (mm)	Subgrade in (mm)	Total in (mm)	Base in (mm)	Subgrade in (mm)	Total in (mm)
GX-B[1]	1.2 (30)	8.1 (210)	0.28 (7.1)	0.03 (0.8)	0.34 (8.6)	0.77 (20)	0.13 (3.3)	0.98 (25)
Control	1.2 (30)	8.3 (210)	0.29 (7.4)	0.07 (1.8)	0.39 (7.4)	0.62 (16)	0.13 (3.3)	0.90 (23)
GX-M[2]	1.3 (33)	7.7 (200)	0.20 (5.1)	0.06 (1.5)	0.28 (5.1)	0.51 (13)	0.15 (3.8)	0.70 (18)

Note 1: GX-B, geotextile at bottom of base course.
Note 2: GX-M, geotextile in middle of base course.

The results of test series three indicate that at 70,000 passes, the section with the geotextile located at the bottom of the base course exhibited about 9 percent more deformation than the control section. Interestingly, the section with the geotextile placed in the middle of the base course experienced 22 percent less total deformation than the control section. The results appear to be in conflict with the performance trend observed in test series one. However, the authors noted that the geotextile provided significant improvement at 100,070 wheel passes, which coincided with a total surface deformation of the control section of about 1 in (25mm). At 100,070 passes, the authors reported that the geotextile placed at the bottom of the base course resulted in a 57 percent reduction in deformation of the subgrade and a 3 percent reduction in deformation of the base course, compared to the control section (Barksdale et al. 1989). The placement of the geotextile in the middle of the base course resulted in 31 percent reduction in deformation of the base course and 14 percent reduction in deformation of the subgrade. This significant margin of improvement appears to have occurred during the period between about 0.90 and 1.0 in (22 and 25mm) of vertical deformation of the control section. This is a relatively short interval for such significant change in deformation trend, and it suggests that the previous passes may have served primarily to compact the test section components.

Test series four evaluated the reinforcement capability of a pre-tensioned geogrid placed in the middle of the base course and a geogrid and geotextile each placed in the middle of the base course without pre-tensioning. The results of this test series are shown in Table 2.7.

Table 2.7 Results of multi-track test series 4 of UNPTF program. (Barksdale, R.D., Brown, S.F., and Chan, F., 1989. "Potential Benefits of Geosynthetics in Flexible Pavement Systems," NCHRP Report No. 315, Washington DC. Used under Fair Use, 1997).

Section	Geometry		Deformation at 10,000 Passes			Deformation at 70,000 Passes		
	HRA in (mm)	Base in (mm)	Base in (mm)	Subgrade in (mm)	Total in (mm)	Base in (mm)	Subgrade in (mm)	Total in (mm)
GX-M[1]	1.5 (38)	8.3 (210)	0.17 (4.3)	0.03 (.76)	0.26 (6.6)	0.46 (12)	0.07 (1.8)	0.68 (17)
GD-M[2]	1.4 (36)	8.5 (220)	0.09 (2.3)	0.04 (1.0)	0.18 (4.6)	0.25 (6.4)	0.07 (1.8)	0.42 (11)
PS-GD-M[3]	1.6 (41)	8.6 (220)	0.06 (1.5)	0.01 (.25)	0.10 (2.5)	0.17 (4.3)	0.03 (.76)	0.26 (6.6)

Note 1: GX-B, geotextile in middle of base course.
Note 2: GD-M, geogrid in middle of base course.
Note 3: PS-GD-M, pre-stressed geogrid in middle f base course.

The results indicate that the deformation of the subgrade in each of the three test sections was relatively insignificant. The results also indicate that the pre-stressed geogrid placed in the middle of the base course resulted in less total deformation than the geogrid placed in the same location without pre-tensioning. Both sections reinforced with geogrids at the base course midpoint experienced less deformation than the section reinforced with a geotextile at the base course midpoint.

The laboratory facilities used in the UNPTF program allowed a more complete analysis of pavement section performance than those used in the Waterloo study. The data acquisition and instrumentation systems were more sophisticated and permitted less intrusive data collection. With these facilities, the researchers collected very interesting data.

In planning their research program, the authors chose to focus on the effect of reinforcement, one of the two principal modes by which geosynthetics are reported to improve pavement performance. Careful consideration was given to the stiffness of the geotextile and geogrid in both the computer and laboratory models of the pavement sections. However, it appears that it was not possible to evaluate reinforcement effects independently of the separation effects provided by the geotextile. The authors observed that no contamination of the base course occurred in sections where the geotextile was installed between the base course and subgrade. But, in the control and geogrid-reinforced test sections, the base course was contaminated to heights of 1.0 to 1.5 in (25 to 38mm) above the subgrade. It may be possible to better quantify the roles of stiffness and separation by evaluating test sections which use a geotextile with a low tensile modulus.

The authors concluded that placement of a geosynthetic in the middle of a thin aggregate base can reduce total permanent deformations, and that this is the optimum location for geosynthetic reinforcement in light pavement sections constructed with low-quality aggregate. In contrast, researchers in the Waterloo study determined that the base course-subgrade interface was the optimum location for a geogrid if the base course has a thickness less than 10 in (250mm) (Carroll et al. 1987).

The authors concluded that for improvement of fatigue performance of the HMA wearing surface, the optimum position for geogrid reinforcement appears to be at the interface of the HMA layer and the aggregate. This conclusion appears reasonable if the geogrid tensile modulus is considered the most significant property. However, it is interesting to note that the researchers in the Waterloo program found no performance improvement with a geogrid placed at the HMA-base course interface (Carroll et al. 1987).

The authors also found that geogrid reinforcement performed better than a much stiffer woven geotextile. The test results as a whole do not seem to support this conclusion. The investigation did not compare the performance of these two materials except in test series four, where the geotextile was located in the middle of the base course. In this position, the beneficial influence of geotextile separation is considerably reduced. Further, the geotextile significantly improved the performance of the pavement section significantly in both test series one and three.

2.2.5 Austin and Coleman Study

Austin and Coleman (1993) conducted a full-scale field study near Greeneville, Mississippi to evaluate the performance of geogrid and geotextile stabilization of an unpaved road constructed over very soft soil. When the initial investigation of the test site was performed, it was learned that the subgrade soil consisted of a fat clay meeting USCS classification as CH. It had a natural water content between 27 and 40 percent, a LL of 73 to 85 percent, and a PL of 23 to 33 percent. It was also determined that the CBR value of this soil ranged from 3 to 6 percent, values which were considered too high to satisfy the objectives of this study.

The investigators sought to obtain a subgrade with CBR values less than about 1 percent. Thus, the test site was flooded for a period of eight months and then drained. This process had the desired effect, reducing the CBR values to between 0.6 and 0.9 percent in most locations. The in-situ CBR values were measured using two procedures. The first of these was described as a field bearing ratio test, although details of the test were not provided and no specific test procedure was referenced. The second procedure utilized a dynamic cone penetrometer device (Webster 1991b) to measure soil strength within the top 12 in (300mm) of the subgrade.

The geosynthetics used to stabilize the road section included four types of polypropylenegeogrids and geotextiles. The nonwoven polypropylene was used in conjunction with oneof the geogrids. The properties reported for these materials are shown in Table 2.8.

Table 2.8 Geosynthetic properties in Austin and Coleman study. (Austin, D.N. and Coleman, D. M., 1993. "A Field Evaluation of Geosynthetic-Reinforced Haul Roads Over Soft Foundation Soils," *Proceedings, Geosynthetics '93 Conference*, IFAI, St. Paul, MN. Used after Fair Use, 1997).

Geosynthetic	Wide Width Tensile Strength[1]		Structure
	machine direction lb/in (kN/m)	cross-machine direction lb/in (kN/m)	
Geogrid 1	88.5 (15.5)	119 (20.8)	Extruded
Geogrid 2	101 (17.7)	188 (32.9)	Sheet-punched
Geogrid 3	81.1 (14.2)	90.8 (15.9)	Extruded tri-planar
Geogrid 4	151 (26.4)	150 (26.3)	Extruded tri-planar
Geotextile 1	224 (39.2)	254 (44.5)	Woven
Geotextile 2	Not Tested	Not Tested	Nonwoven

Note 1: tested in accordance with ASTM D 4595

The geosynthetics were installed on the test road, overlapping adjacent sections in the direction of fill placement. Each test section was approximately 20 ft (6 m) wide and 20 ft (6 m) long. In addition to the geosynthetic-stabilized test sections, three non-stabilized control sections were established. Following installation of the geosynthetics, 14 to 20 in (350 to 500mm) of aggregate stone was spread over the test section using a low ground pressure bulldozer. The bulldozer was then used to back-blade the material, cutting its thickness to about 8 in (200mm). The aggregate was classified as a well-graded material (GW) according to the USCS. It had a maximum particle size of 1.5 in (38mm) and approximately 20 percent passed the No. 4 sieve.

The test sections were loaded by a two-axle dump truck with the rear dual-tire axle loaded to approximately 18,000 lb (80 kN). The tire pressures were maintained at 80 lb/in^2 (550 kPa). The performance of each test section was based on the number of vehicle passes which induced surface deflections of 2.0 in (50mm) and 30 in (75mm). The number of passes was converted to equivalent single axle loads (ESAL) using a factor of 1.13 per each actual vehicle pass.

To minimize the influence adjacent sections had on each other, data collection stations were established at the midpoints of each test section. In addition to deflection measurements, data collection included measurements of in-situ CBR values of the subgrade and base, as well as dry density, moisture, and thickness measurements of the base. After loading of the test road was completed, each test section was carefully excavated and the percent contamination of the base aggregate by subgrade soil was evaluated. The station location of each test section is shown in Table 2.9.

Table 2.9 Test configuration and results in Austin and Coleman study. (Austin, D.N. and Coleman, D. M., 1993. "A Field Evaluation of Geosynthetic-Reinforced Haul Roads Over Soft Foundation Soils," *Proceedings, Geosynthetics '93 Conference*, IFAI, St. Paul, MN. Used after Fair Use, 1997).

Station ft (m)	Test Section Designation[1]	Subgrade CBR (%)	No. ESAL Passes at Surface Deflection Noted		Contamination of Base (%)
			2.0 in (50mm)	3.0 in (75mm)	
10 (3.05)	GG1	0.8	60	71	12.8
30 (9.15)	GG2	0.9	35	49	21.2
50 (15.25)	C1	0.6	18	23	21.8
70 (21.35)	GT1	0.5	59	67	0.0
90 (27.45)	C2	1.0	5	14	49.1
110 (33.55)	GG4	0.6	-[2]	-[2]	36.8
130 (39.65)	C3	0.9	2	7	57.7
150 (45.75)	GG1 & GT2	0.9	34	51	0.0
170 (51.85)	GG3	1.0	24	51	24.2

Note 1: GG - Geogrid, GT - geotextile, C - control.
Note 2: Testing of this section discontinued after 33 ESAL passes. Corresponding rut depth measured at 1.6 in (40mm).

Table 2.9 also shows the in-situ CBR value measured after road construction, the number of ESAL required to obtain surface deflections of 2.0 in (50mm) and 3.0 in (75mm), as well as the percent contamination by subgrade soil which was found to have occurred in the base course.

From a review of the comparative performance shown in Table 2.9, it is apparent that the use of geosynthetic significantly improved the unpaved road performance at each stabilized location. However, there does not seem to be a logical correlation between the subgrade CBR value and the number of passes at the control sections. It may be noted that the strongest control section, C2, sustained only about one-third as many passes as the weakest control section, C1, before a deflection of 2.0 in (50mm) was reached. Further, C3, which had about the same subgrade CBR value as C2, sustained only half as many passes as C2 at both 2.0 in (50mm) and 3.0 in (75mm) of deflection.

The field study considered many factors, but the surface deflection at each section was the most significant performance indicator. In their analyses, the investigators evaluated performance factors to further quantify test section behavior and geosynthetic effectiveness. The factors were determined by comparing the performance of a geosynthetic-stabilized section to a control section with similar subgrade strengths, as shown by the following:

$$\text{Performance Factor} = \frac{\text{Passes Over Geosynthetic-Stabilized Section}}{\text{Passes Over Control Section}} \qquad (2.5)$$

Table 2.10 shows the performance factors for each section at surface deflections of 2.0 in (50mm) and 3.0 in (75mm). It also shows the control section which was used for comparison.

Table 2.10 Performance factors for geosynthetic stabilization. (Austin, D.N. and Coleman, D. M., 1993. "A Field Evaluation of Geosynthetic-Reinforced Haul Roads Over Soft Foundation Soils," *Proceedings, Geosynthetics '93 Conference*, IFAI, St. Paul, MN. Used after Fair Use, 1997).

Geosynthetic Section	Control Section	Performance Factor	
		at 2.0 in (50mm) Deflection	at 3.0 in (75mm) Deflection
GG1	C1	3.3	3.1
GG2	C1	1.9	2.1
GT1	C1	3.3	2.9
GG4	C3	1.3	-
GG1 & GT2	C2	6.8	3.6
GG3	C1	1.3	2.2

The performance factors shown in Table 2.10 were recalculated and, in some instances, were found to differ slightly from those presented in the researchers' report. However, it is clear that the use of a geosynthetic significantly improved the performance of each test section compared to the control sections.

The research also demonstrated the effectiveness of the geotextile as a separator. The investigators observed that no contamination of the base aggregate occurred at the geotextile-stabilized sections, but that significant contamination occurred at the control sections and the geogrid sections.

The test results suggest that the tensile strength of geogrids may not have a significant influence on their ability to stabilize an unpaved road over weak soil. The strongest geogrid, GG2, resulted in less performance improvement than GG1, even though it was placed over a slightly stronger subgrade.

2.2.6 Webster Study

Webster (1991b) conducted a research program which involved full-scale testing of geogrid-reinforced pavement sections used by light aircraft. The pavement was constructed over weak subgrade soil. The testing was performed at the U.S. Army Corps of Engineers Waterways Experiment Station (USACOE-WES) facility in Vicksburg, Mississippi, inside a large hangar. The test section was divided into four traffic lanes, each containing four test configurations which the researchers referred to as "items" 1 through 4. Lane 1 and lane 2 used a traffic pattern with wheel loads distributed over five wheel widths for a total width of 7.3 ft (2.2 m). Lane 3 and lane 4 used a traffic pattern which consisted of a single wheel path which had a width of 2.0 ft (1.5 m).

Lane 1 was designed to evaluate the reinforcement potential of Tensar BX1200 (SS2) when placed over a subgrade with a CBR value of 8 percent, and with base course thicknesses of 6 in (150mm) and 10 in (250mm).

Lane 2 was designed to evaluate the reinforcement potential of Tensar BX1200 (SS2) when placed over a subgrade with a CBR value of 3 percent, and with base thicknesses of 18 in (460mm) and 12 in (300mm).

Lane 3 was designed to evaluate two aspects of geogrid reinforcement: the optimum location in a relatively thick base course and the importance of geogrid modulus. Lanes 3 and 4 also evaluated the relative performance of six different geogrids.

In addition to the two Tensar geogrids, Huesker Fortac 35/20-20, Conwed GB-3022, and Nicolon-Mirafi Miragrid 5T were tested. A sixth candidate geogrid was referred to as "Geogrid X." These materials represent the use of two types of polymers and five methods of geogrid construction. Webster considered the geogrid's secant modulus at 5 percent to be a good indication of stiffness, and used this property to attempt a correlation with reinforcement potential. These stiffness values are shown in Table 2.11 along with some of the other properties and characteristics of the evaluated geogrids.

Table 2.11 Properties of geogrids in Webster study. (Webster, S. L., 1991b, *Full-Scale Tests on Geogrid and Geotextile Reinforced Aggregate Layers Over a Sand (SP) Subgrade*, US Army Corps of Engineers Waterways Experiment Station, Vicksburg, MS. Used under Fair Use, 1997).

Geogrid	Construction	Weight oz/yd^2 (g/m^2)	Aperture in (mm)	5% Secant Modulus	
				MD lb/in (kN/m)	CMD lb/in (kN/m)
BX1100	PP, punched sheet drawn	6.4 (220)	1.0x1.3 (25x33)	950 (170)	1470 (257)
BX1200	PP, punched sheet drawn	9.0 (310)	1.0x1.3 (25x33)	1170 (205)	2000 (350)
Geogrid X	PP, bi-oriented	5.9 (200)	1.8x1.7 (45x23)	920 (160)	1250 (219)
Fortrac	PET, PVC coated woven	9.0 (310)	0.9x0.9 (23x23)	1840 (322)	840 (147)
GB-3022	PET, PVC coated woven	5.7 (190)	0.69x0.75 (18x19)	1250 (219)	920 (161)
Miragrid 5T	PET, woven	8.0 (270)	1.2x1.3 (30 x 33)	1300 (228)	710 (124)

PP - polypropylene PVC - polyvinyl chloride CMD - cross-machine direction
PET - polyester MD - machine direction

Each test lane was surfaced with an HMA layer with a nominal thickness of 2.0 in (50mm). It contained a maximum aggregate particle size of 0.5 in (12mm) and had a minimum Marshall stability of 1,500 lb (6,700 N). The HMA wearing surface was not considered a test variable during this study.

The base course was constructed using a low quality, crushed limestone aggregate which was classified as silty sand to silty clay (SM-SC) according to the USCS. The maximum particle size was 1 in (25mm) and 15 percent passed the No. 200 sieve. Webster (1991b) observed that based on his literature review, low quality base material offered the highest potential for due to for geogrid reinforcement.

The subgrade was constructed using a local clayey soil. It was classified as a fat clay (CH) according to the USCS. It had an LL of 67 percent and a PL of 23 percent.

To construct the test section, an area measuring 144 ft x 50 ft (44 m x 15 m) was excavated to a depth of about 40 in (1000mm). The lean clay material at the bottom of the excavation was compacted until its CBR value was greater than 10 percent. The subgrade was then compacted in lifts of 6 in (150mm). The total pavement section thickness was 40 in (1 m). The minimum subgrade thickness of 20 in (500mm) occurred in lane 2 under a base course of 18 in (460mm).

The traffic loads were applied over a five month period using a single-wheel-assembly test cart attached to the front half of a four-wheel-drive truck. The test wheel and tire were from the landing gear of a C-130 aircraft. Pressure in the tire was maintained at 68 lb/in^2 (469 kPa). The load it was designed to place on the test surface was 30,000 lb (133 kN).

Failure of the test section was defined as 1 in (25mm) of surface rutting. Traffic was usually continued until 3 in (75mm) of rutting occurred, or until each item in a test lane sustained 1 in (25mm) of rutting. Rut depth measurements were recorded at intervals throughout the traffic test period and included both the permanent deformation in the middle and upheaval on both sides.

The configuration and strength properties for each lane are shown in Table 2.12. The CBR values shown for the base course and subgrade are based on post-traffic measurements. The number of passes shown refers to the amount which produced a permanent surface deformation of 1.0 in (25mm), including upheaval at the sides of the rut. Also shown is the traffic improvement factor (IF) which was determined as follows:

$$\text{Improvement Factor} = \frac{\text{Passes Over Geogrid Reinforced Item}}{\text{Passes Over Control Item}} \tag{2.6}$$

A review of the test results shown in Table 2.12 indicates that significant performance improvement was provided by some of the geogrids. Lanes 3 and 4 results indicate that the type of geogrid affects the potential performance improvement. Two of the woven polyester geogrids (5T and Fortrac) and one polypropylene geogrid (Grid X) demonstrated insignificant reinforcement benefit. Webster reported that lane 1, item 4 rutted 1.0 in (25mm) with only 670 passes, and that the remaining items had ruts less than in (25mm) deep after 10,000 passes. Webster extrapolated the deflection rates for items 1 through 3 in lane 1 to estimate the number of passes required to produce ruts with a depth of 1.0 in (25mm).

Table 2.12 Test section configurations and results of Webster study. (Webster, S. L., 1991b, *Full-Scale Tests on Geogrid and Geotextile Reinforced Aggregate Layers Over a Sand (SP) Subgrade*, US Army Corps of Engineers Waterways Experiment Station, Vicksburg, MS. Used under Fair Use, 1997).

Lane	Item	Thickness in (mm)		Geogrid		CBR (%)		No. Passes	IF[2]
		Base	Subgrade	Type	Location[1]	Base	Subgrade		
1	1	10 (25)	28 (700)	None		142.3	7.4	15,000	
	2	10 (25)	28 (700)	BX1200	Bottom	114.0	7.1	100,000	6.7
	3	6 (150)	42 (1,050)	BX1200	Bottom	104.0	7.3	15,000	22.4
	4	6 (150)	42 (1,050)	None		NR[3]	7.9	670	
2	1	18 (450)	20 (500)	None		86.9	3.1	1,131	
	2	18 (450)	20 (500)	BX1200	Bottom	79.6	3.0	1,432	1.3
	3	12 (300)	26 (650)	BX1200	Bottom	59.8	3.0	262	3.1
	4	12 (300)	26 (650)	None		39.4	2.9	90	
3	1	14 (350)	24 (600)	GB-3022	Bottom	85.7	2.9	170	1.6
	2	14 (350)	24 (600)	BX1200	Middle	103.7	2.9	230	2.2
	3	14 (350)	24 (600)	BX1200	Bottom	92.7	2.3	500	4.7
	4	14 (350)	24 (600)	BX1100	Bottom	NR[3]	3.1	285	2.7
4	1	14 (350)	24 (600)	Grid X	Bottom	87.5	3.4	100	0.9
	2	14 (350)	24 (600)	5T	Bottom	104.0	3.3	97	0.9
	3	14 (350)	24 (600)	Fortrac	Bottom	99.3	2.3	117	1.1
	4	14 (350)	24 (600)	None		NR[3]	2.9	106	

Note 1: location refers to position within base course
Note 2: IF - improvement factor
Note 3: NR - not reported

A comparison of items 2 and 3 in lane 3 indicates that placement of the geogrid in the middle of the base course for relatively thick layers is not as effective as placement at the bottom of the base course. This contradicts the findings in both the Waterloo program and the UNPTF program.

Based on the results of the testing program, Webster developed a relationship between unreinforced pavement section thickness and equivalent reinforced section thickness, shown in Figure 2.6. Webster concluded that the total pavement design thickness can be reduced by the amounts indicated in this relationship when a geogrid reinforcement product equivalent to Tensar BX1200 (SS2) is used.

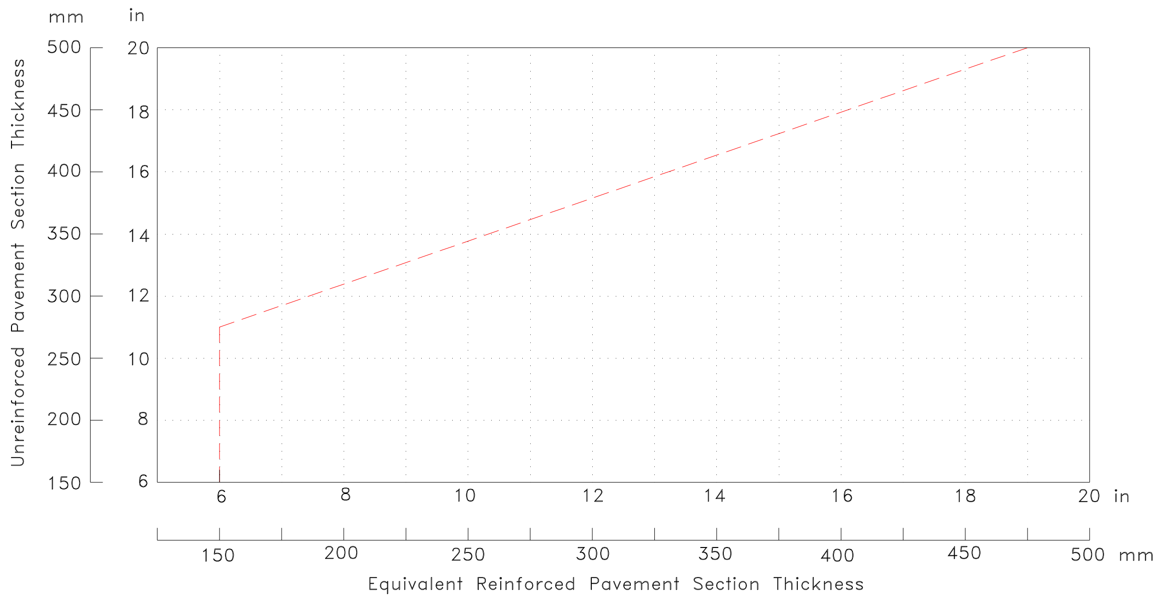


Figure 2.6 Design criteria for unreinforced pavement section thickness versus equivalent reinforced thickness. (Webster, S. L., 1991b, *Full-Scale Tests on Geogrid and Geotextile Reinforced Aggregate Layers Over a Sand (SP) Subgrade*, US Army Corps of Engineers Waterways Experiment Station, Vicksburg, MS. Used under Fair Use, 1997).

This relationship assumes that the HMA layer is 2-in- (50-mm-) thick. It also shows that a total equivalent section thickness of 6 in (150mm) is the minimum for which geogrid reinforcement may be used. For designs which require section thicknesses to be greater than 6 in (150mm), it can be seen that aggregate thickness can be reduced from 1 in (25mm) to 5 in (250mm) if a reinforcement equivalent to BX1200 (SS2) is used. It can also be observed that as the required unreinforced design thickness increases, the aggregate savings diminishes.

The decision by a designer to incorporate a geogrid into a pavement section based on the relationship shown in Figure 2.6 should be based partly on the potential economic advantages. A logical design sequence may involve calculating the required unreinforced design thickness and reinforced design thickness, and evaluating the potential cost savings based on the reduction in aggregate thickness. If the savings provided by the reduction in aggregate is greater than the cost of the reinforcement, then reinforcement of the section may represent a cost-effective design option. Based on the cost of BX1200 (SS2) in 1990 as reported by Webster, the savings due to aggregate reduction must exceed at least $2.95 per square yard of pavement section.

It is possible to further simplify evaluation of the cost-effectiveness of this reinforcement material by making an assumption regarding the in-place density of the base course aggregate. For the purposes of this brief analysis, it is assumed that the in-place density of the aggregate is 135 lb/ft^3 (2,160 kg/m^3). It is also assumed that the cost of the reinforcement material is \$2.95/yd^2. Based on these assumptions, the range of bulk aggregate costs and base course thicknesses in which geogrid reinforcement is cost effective is shown in Figure 2.7.

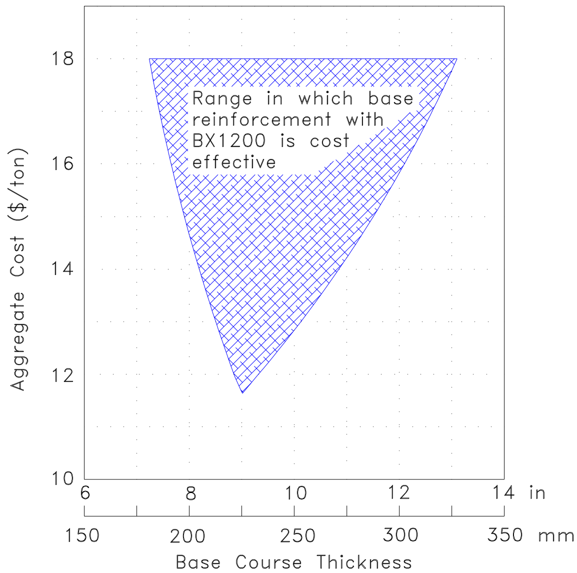


Figure 2.7 Range of bulk aggregate cost and base course thicknesses in which use of BX1200 is cost effective. (Webster, S. L., 1991b, *Full-Scale Tests on Geogrid and Geotextile Reinforced Aggregate Layers Over a Sand (SP) Subgrade*, US Army Corps of Engineers Waterways Experiment Station, Vicksburg, MS. Used under Fair Use, 1997).

Using Figure 2.7, it can be seen that the opportunity for cost savings using a reinforced design increases as aggregate cost increases. However, almost no cost savings is possible when the price of aggregate is below $12/ton. Aggregate cost may exceed $12/ton in regions where there are few natural deposits of suitable stone, but typical installed prices seem to fall between $8 and $12/ton. Even with the price of aggregate greater than $12/ton, the opportunity for savings is restricted within a range of base course thicknesses. It can be seen that at an aggregate cost of $14/ton, geogrid reinforcement is cost-effective only when the required base course thickness is between 8 and 11 in (200 and 275mm).

The results of Webster's study may have important implications for the design of flexible pavements for light aircraft landing fields using geogrid stabilization. Before this can be fully ascertained, the impact of uncontrolled environmental factors must be evaluated. The subgrade soil used by Webster was a fat clay. Based on published reports (Bell et al. 1982; Jorenby and Hicks 1986), the resilient modulus of the base course resilient modulus decreases as subgrade fines migrate upward. Given the relatively plastic nature of the subgrade soil in Webster's study, migration may be expected to occur as a result of soil softening. For soil softening to take place, excess moisture (e.g., rain or near-surface groundwater flow) is required. By conducting his full-scale research in the protected confines of an aircraft hangar, Webster may have excluded an important environmental factor from his research.

Chapter 3 - Laboratory Testing Program

To satisfy the objectives of this study, 18 pavement sections were constructed and tested. These included control sections constructed without a geosynthetic, and test sections constructed with either a geotextile or a geogrid. Following the construction of each test section, the pavement was dynamically loaded and the resulting surface displacement was monitored and recorded.

This chapter presents the following aspects of the laboratory testing program:

- testing facilities
- test materials
- test section design and construction
- pavement loading and instrumentation
- test pit excavation

3.1 Testing Facilities

The laboratory testing program was conducted at the Virginia Tech Price's Fork Geotechnical Research Center. Located at the research center is the Instrumented Test Facility which includes a test pit constructed for use in previous experimental programs (Sehn and Duncan 1990; Filz 1992). The plan area of the test pit measures 10 ft (3.0 m) long and 6.0 ft (1.8 m) wide. The rear and side walls are each 7.0 ft (2.1 m) high. The floor of the pit is located approximately 3 ft (0.9 m) below the elevation of the floor of the laboratory. Access to the pit is provided by a ramp which slopes downward from the laboratory floor. The test pit floor and walls are constructed of reinforced concrete. One of the side walls contains sensitive instruments for measurement of horizontal earth pressures. In order to protect the embedded instruments, the rear and side walls were covered with plywood and polyethylene sheets.

A steel I-beam secured to the top of the side walls provides the reaction for the application of a vertical load up to 14,000 lb (62 kN). However, only 9,000 lb (40 kN) were used in this study to load the pavement sections. The test pit and reaction frame are depicted in Figure 3.1.

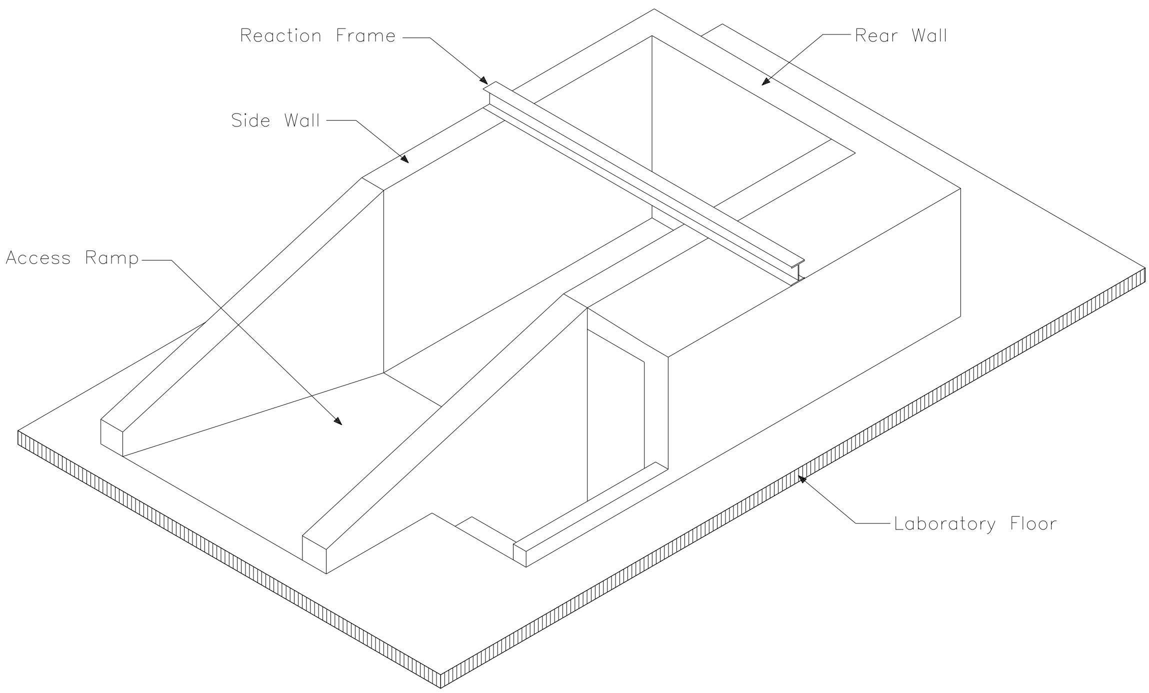


Figure 3.1 Laboratory pavement test pit at Virginia Tech Price's Fork Geotechnical Research Center.

3.2 Test Materials

The test sections were constructed with a silty sand subgrade, a well-graded aggregate base course, and an HMA wearing surface. During construction of the geosynthetic-stabilized sections, a geotextile or geogrid was placed at the base course-subgrade interface. This section describes the properties of the materials used in each of the test pavements.

3.2.1 Subgrade Soil

The subgrade was constructed using Yatesville silty sand (YSS) which was obtained from alluvial deposits excavated during the construction of the Yatesville Lake Dam in Lawrence County, Kentucky. According to USCS criteria, it is classified as an SM. According to American Association of State Highway Transportation Officials (AASHTO) classification criteria, it is A-4. Approximately 40 to 47 percent of the silty sand passes No. 200 (0.075mm) US Standard sieve. The average gradation of this material is presented in Figure 3.2. The soil passing No. 200 (0.075mm) sieve was determined to be non-plastic. The specific gravity (G_s) of YSS was found to be about 2.67 (Filz 1992).

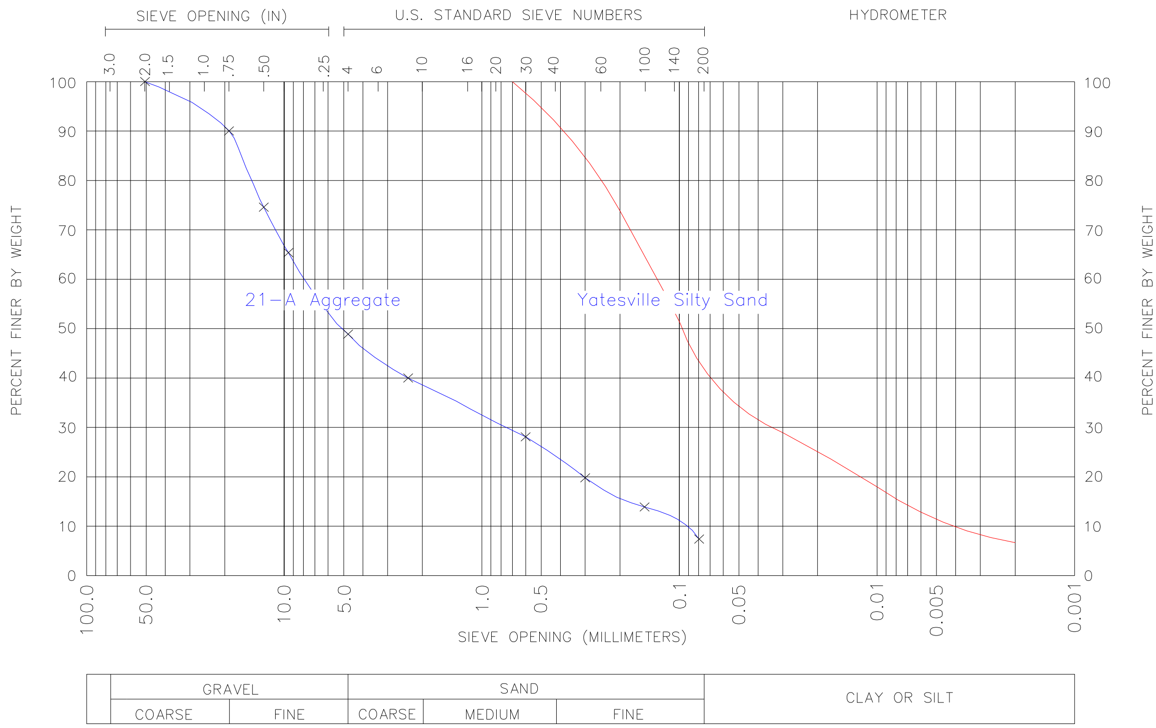


Figure 3.2 Gradation curve for YSS and 21-A aggregate base course.

Moisture-density relationships were established for YSS using four types of compaction tests: a modified Proctor test (ASTM D 1557), a standard Proctor test (ASTM D 698), a low energy test, and a very low energy test (Filz 1992). The maximum dry densities and corresponding optimum moisture contents for each compactive effort are shown in Table 3.1. The compaction curves developed using each compactive effort are shown in Figure 3.3.

Table 3.1 Moisture-density relations for YSS. (Filz, G.M., 1992. "An Experimental Analytic Study of Earth Loads on Rigid Retaining Walls," Geotechnical Engineering Division, Dept. of Civil Engineering, Virginia Polytechnic Institute and State University, Blacksburg, VA. Used under Fair Use, 1997).

Test Type	Compactive Effort		Maximum Dry Density		Optimum Water Content
	(ft-lb/ ft^3)	(kN-m/m^3)	(lb/ ft^3)	(kg/m^3)	(%)
Modified Proctor	56,250	2,712	132	2,114	8.8
Standard Proctor	12,375	597	125	2,002	10.9
Low Energy	6,187	298	121	1,938	11.6
Very Low Energy	2,475	119	114.5	1,834	14.0

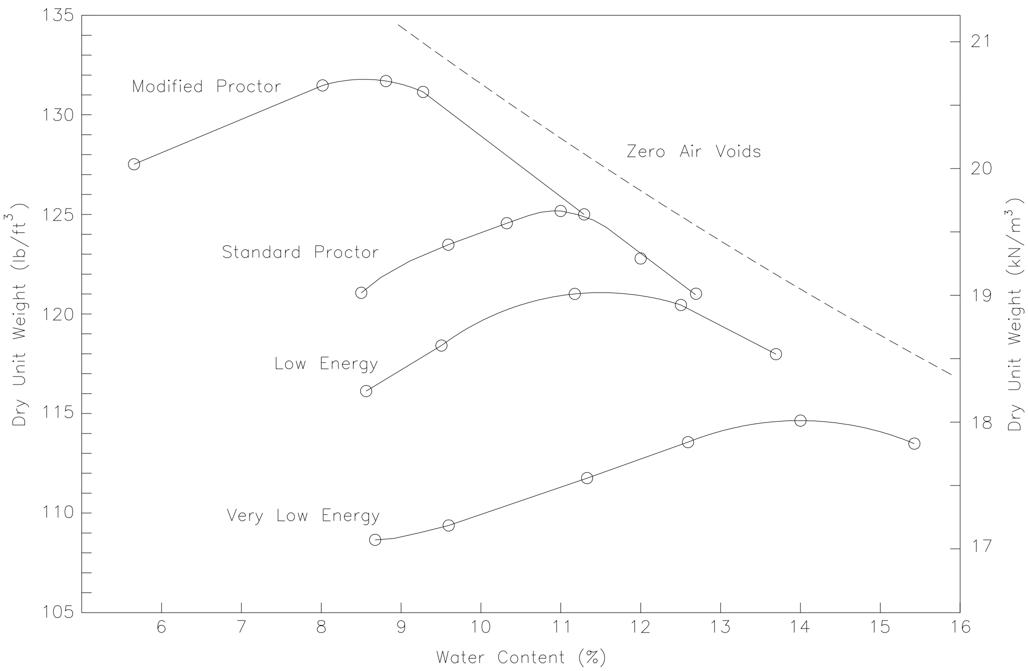


Figure 3.3 Moisture-density relationships for YSS using four compactive efforts. (Filz, G.M., 1992. "An Experimental Analytic Study of Earth Loads on Rigid Retaining Walls," Geotechnical Engineering Division, Dept. of Civil Engineering, Virginia Polytechnic Institute and State University, Blacksburg, VA. Used under Fair Use, 1997).

3.2.2 California Bearing Ratio Testing

One of the most common methods of characterizing subgrade strength for the purpose of paved road design is the CBR test (ASTM D 1883-87). Previous investigations of geosynthetic stabilization have used this method (Kennepohl et al. 1985; Barksdale et al. 1989; Austin and Coleman 1993; Webster 1991b). In view of this precedence, and in the interest of comparative analysis, it was deemed appropriate to use the CBR test to quantify the strength of each test section in this research program.

Generally, CBR tests are performed on remolded soil samples compacted to their maximum densities at their optimum moisture contents for either a standard or modified proctor effort. To simulate soft soil conditions, the CBR test must be performed on soaked specimens. The CBR test may also be performed for a range of densities and moisture contents that are expected during construction. To perform a CBR test, a piston with a diameter of 1.954 in (49.63mm) is driven into the surface of the soil sample at a rate of 0.05 in (1.3mm) per minute, and the stress required to penetrate a distance of 0.10 in (2.5mm) is recorded. To obtain the CBR value, the recorded stress is divided by 1000 lb/in^2 (6.895 kPa) and multiplied by 100 percent.

Because it was desired to place the lifts of subgrade soil at a specific CBR rather than a standard dry density, it was necessary to evaluate the CBR as a function of both compactive effort and water content. To achieve this, 43 CBR tests were conducted.

After passing the YSS soil through a No. 4 (4.750mm) U.S. Standard sieve, the specimens were compacted into molds with a diameter of 6.0 in (150mm) and prepared in accordance with procedures outlined in ASTM D 1557 or ASTM D 698. The dry density and moisture content of each specimen were recorded and the CBR value was determined. From the data obtained, it was possible to construct the curves shown in Figure 3.4.

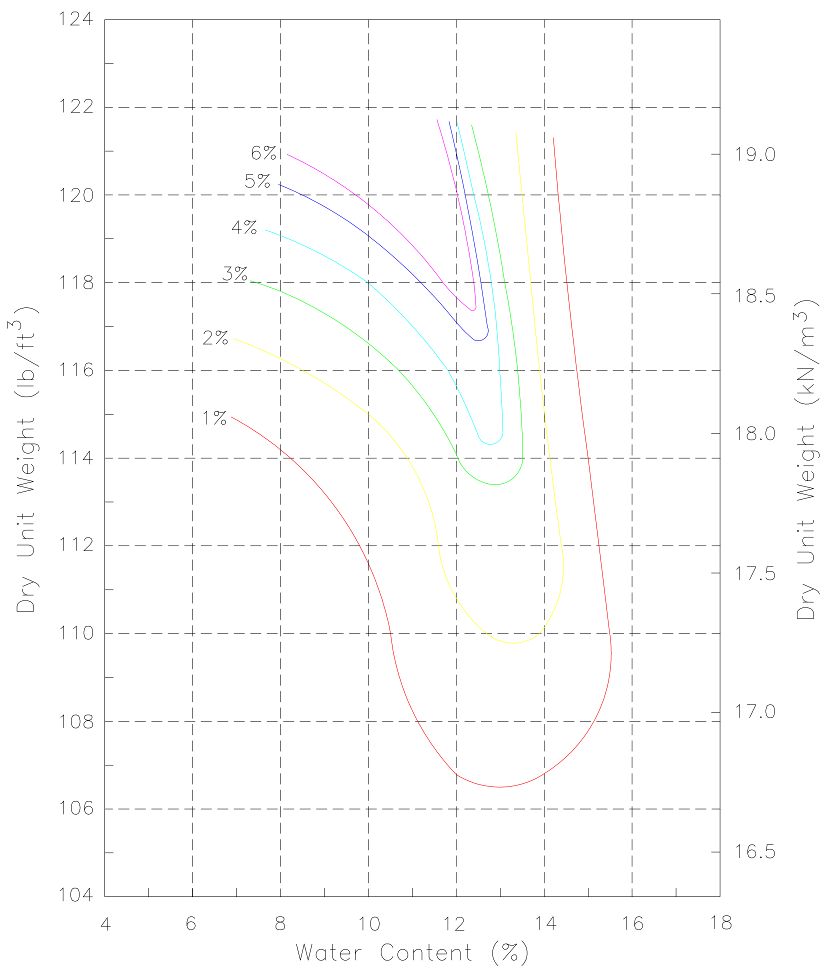


Figure 3.4 CBR values of YSS as a function of dry density and water content. (Smith, T. E., 1994. *Laboratory Behavior of Geogrid and Geotextile Reinforced Flexible Pavement*, Thesis submitted in partial fulfillment for the degree of M.S.: Virginia Tech, Blacksburg, VA. Used under Fair Use, 1997).

3.2.3 Base Course Aggregate

Two types of aggregate were evaluated for their use as base course material. Both were classified as well-graded gravel (GW) according to USCS criteria and met the Virginia Department of Transportation (VDOT) gradation specifications for VDOT 21-A. The first aggregate evaluated was composed predominantly of limestone. The results obtained from Test Section 1 indicated that cementation of the aggregate may have occurred, producing a base course layer which was stiffer than desired and resulting in damage to the loading system. A granite-based aggregate was used in subsequent test sections to preclude cementation. The average gradation of four samples of the granite material is shown in Figure 3.2.

The moisture-density relationship of the granite aggregate was established by performing modified Proctor tests (ASTM D 1557-91). Its maximum dry density was determined to be 146 lb/ft^3 (22.9 kN/m^3) at an optimum moisture content of 5.8 percent. The moisture-density relationship of this material is shown in Figure 3.5. It was also determined that the granite aggregate has a specific gravity of 2.81 and an absorption value of 0.4 percent (ASTM C97-90).

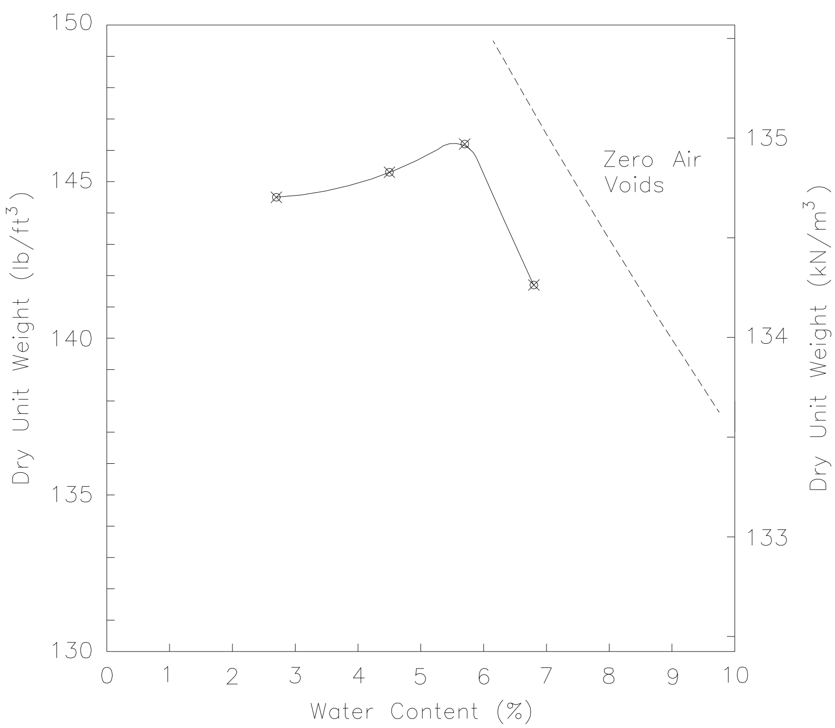


Figure 3.5 Moisture-density relationship of granite-based 21-A aggregate using modified Proctor effort.

3.2.4 Hot-Mix Asphalt Wearing Surface

The HMA wearing surface used in the construction of Test Section 1 (TS 1) met the specifications of VDOT SM-2BL. Design modifications incorporated in subsequent test sections included the use of a VDOT SM-2AL mix. This HMA is often used on secondary roads constructed in the state of Virginia. The aggregate in the SM-2AL mix consisted of an unpolished crusher-run dolomitic limestone. The average properties of the SM-2AL HMA mix are shown in Table 3.2.

Table 3.2 Average properties of the SM-2AL HMA mix. (Smith, T. E., 1994. *Laboratory Behavior of Geogrid and Geotextile Reinforced Flexible Pavement*, Thesis submitted in partial fulfillment for the degree of M.S.: Virginia Tech, Blacksburg, VA. Used under Fair Use, 1997).

Property	Unit	Value
Asphalt Cement Content	%	5.93
Maximum Theoretical Specific Gravity	dimensionless	2.54
Bulk Specific Gravity	dimensionless	2.405
Stability	lb (N)	2350 (10,450)
Flow	x .01 in (mm)	10.4 (2.64)
Voids in Total Mix	dimensionless	4.75
Voids in Mineral Aggregate	dimensionless	18.2
Voids Filled with Asphalt Cement	dimensionless	73.7
Unit Weight	lb/ft^3 (kg/m^3)	150.1 (2,404)
Resilient Modulus	lb/in^2 (kPa)	250,000 (36,250)

3.2.5 Geosynthetic Materials

Two types of woven polypropylene geotextiles were evaluated. Geotextile A is woven with a slit-tape in the machine direction and a fibrillated slit-tape in the cross-machine direction. Geotextile B is woven with an oval monofilament in the machine direction and a fibrillated slit-tape in the cross-machine direction.

The manufacture of a polypropylene slit-tape requires the extrusion of a thin, wide polypropylene sheet. It is then slit to the desired tape width. A fibrillated slit tape is fabricated in the same manner except following the slitting process, short razor cuts are made in the tape in a process called fibrillation. Oval monofilaments are extruded as single yarns, as opposed to extrusion in sheets.

When a woven geotextile contains a fibrillated slit-tape, a greater open area is provided in the fabric matrix compared to a geotextile woven exclusively with slit tape. This results from the tendency of fibrillated tape to “bunch” during weaving, increasing the size of its effective cross-sectional area. A relatively large open area also is obtained with the use of a monofilament, which typically has a larger cross-sectional area than a slit tape. Use of fibrillated slit-tapes and monofilaments result in increased hydraulic flow rates normal to the fabric plane as a result of the increased open area. The mechanical properties of Geotextiles A and B are shown in Table 3.3.

The geogrid used in the testing program is described as biaxial with regard to its tensile strength properties, according to manufacturer literature. It is manufactured by extruding a sheet of polypropylene and then punching holes at the desired aperture locations. The material is then drawn (elongated), thereby increasing its tensile strength. Details of the manufacturer specifications are presented in Table 3.4.

Table 3.3 Manufacturer's specifications for Geotextile A and B. (Amoco Fabrics and Fibers Company, 1992. Specifications for Geotextiles, Atlanta, GA. Used under Fair Use, 1997).

Property	ASTM Test	Unit	Geotextile A	Geotextile B
Grab Tensile Strength	D 4632	lb (N)	200 (890)	300 (1330)
Grab Elongation	D 4632	%	15	20
Mullen Burst Strength	D 3786	lb/in^2 (kPa)	400 (2760)	800 (5520)
Puncture	D 4833	lb (N)	90 (400)	120 (534)
Trapezoidal Tear	D 4533	lb (N)	75 (334)	120 (534)
Wide Width Tensile[1]	D 4595	lb/in (kN/m)	@ 2% Strain - 22.0 (3.85)	@ 2% Strain - 25.2 (4.48)
			@ 5% Strain - 50.9 (8.91)	@ 5% Strain - 58.6 (10.3)
			@ Ultimate - 146 (25.6)	@ Ultimate - 196 (34.3)

Note 1: Wide width tensile values apply to the machine direction.

Table 3.4 Manufacturer's specifications for geogrid. (Industrial Fabrics Association International, 1992. *1993 Specifier's Guide, Geotechnical Fabrics Report*, St. Paul, MN. Used under Fair Use, 1997).

Property	ASTM Test	Unit	Value
Aperture (MD)	NA	in (mm)	1.0 (25)
Aperture (CMD)	NA	in (mm)	1.3 (33)
Thickness at Rib	D 1777	mils (mm)	40 (1.0)
Thickness at Junction	D 1777	mils (mm)	150 (3.8)
Wide Width Tensile	D 4595	lb/in (kN/m)	@ 2% strain- 30.8 (5.39)
			@ 5% strain - 58.3 (10.2)
			@ Ultimate - 97.5 (17.1)

3.3 Pavement Section Design and Construction

The design specifications of the pavement sections were established to reflect conditions representative of a secondary road constructed over weak granular subgrade material. To obtain these conditions, TS 1 was designed to have a subgrade CBR value of 5 percent and a thickness of 48 in (1200mm). Subsequent sections were designed with subgrade CBR values of either 2 or 4 percent. Test sections also included base courses designed with a nominal thicknesses of 6 or 8 in (150 or 200mm). The nominal thickness of the HMA wearing course was initially set at 3 in (80mm), but was changed to 2.8 in (71mm) following evaluation of TS 1 performance. A schematic drawing of the pavement cross-section design is shown in Figure 3.6.

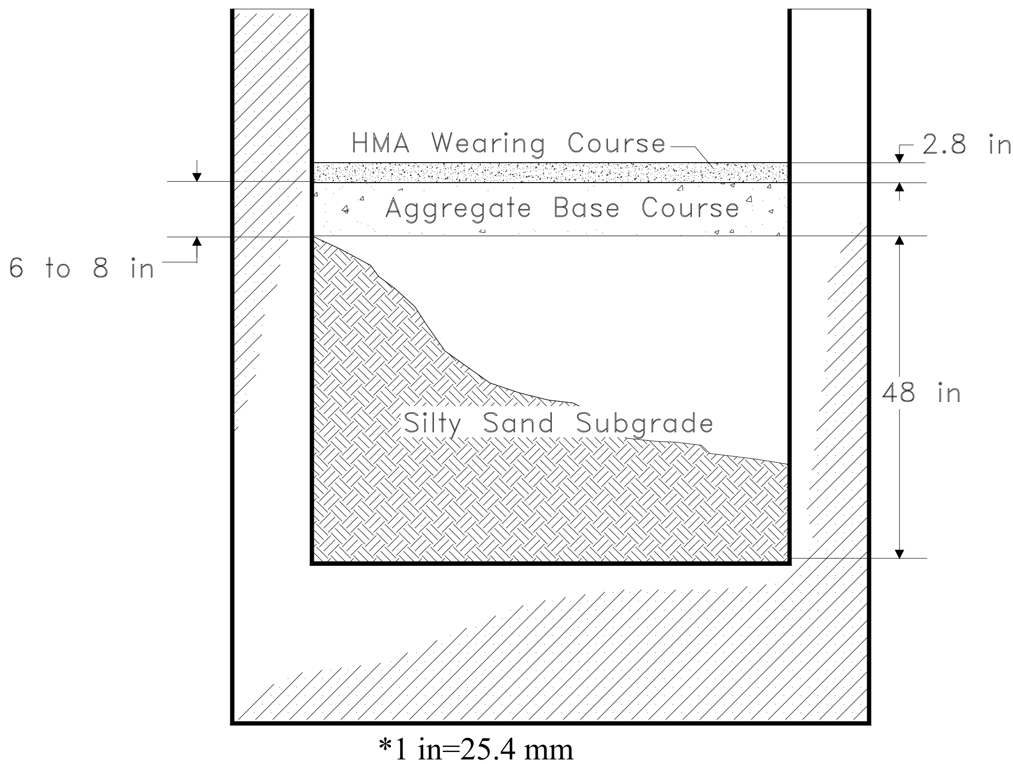


Figure 3.6 Test pavement cross-section design.

3.3.1 Subgrade Construction

The subgrade was placed in 8-in- (200-mm-) thick loose lifts. The water content of the soil in each lift was controlled according to the specified CBR value. To obtain the correct water content, a stockpile of YSS was moistened and blended using a small front-end loader (Bobcat Model 643). Soil samples were collected and their water contents measured using expedient microwave oven procedures. If the water content was outside the acceptable range, the stockpile was either moistened or aerated as necessary.

Once the water content was brought to the desired value, the soil was placed in the test pit. During soil placement, care was exercised to not allow the wheels of the loader to rest on the test section, as this could result in additional compaction of previous lifts. Following lift placement, a hand-operated tiller was used to break down soil clumps. The lift was then raked to obtain a level surface. Next, the soil water content was again measured and, if it was within acceptable limits, it was compacted. If it was outside the acceptable range, the water content was increased or decreased as necessary.

Rulers were attached to the test pit walls to help control individual lift and total subgrade section thicknesses. Following compaction, each lift was surveyed to determine the total subgrade section thickness and uniformity.

The loose soil lifts were compacted using a hand-operated vibratory sled (Wacker model BPU 2440A). With some experience, it was possible to estimate the number of compactor passes required to obtain the desired dry density. To verify the water content and dry density of the compacted soil, at least one sand cone test (ASTM D 1556-90) was performed for each lift. In the event that either the resulting moisture content or dry density was not within the acceptable range, the soil was aerated, moistened, or compacted as necessary to meet design requirements. To expedite this procedure, the water contents were determined with the use of a microwave oven, and then the values yielded by this procedure were verified with the use of conventional oven procedures (ASTM D 4959-89).

Measurements of subgrade soil dry density and water content were attempted using two different nuclear density gages. However, dry density and water content values could not be reconciled with those collected using conventional methods. It is suspected that the reinforced concrete test pit effectively represented "trench" conditions under which accurate readings could not be obtained. Efforts to compensate using offset features of each gage were unsuccessful. Therefore, verification of subgrade density and moisture properties was performed through the use of sand cone tests.

The construction of a test section's subgrade lifts frequently required two or more days of labor. Upon completion of a day's work, the subgrade was covered with polyethylene sheeting to prevent desiccation.

3.3.2 Geosynthetic Installation

For each stabilized section, the geosynthetic was placed over the subgrade and then trimmed to fit the dimensions of the test pit. No effort was made to place the geosynthetics into tension, but attempts were made to smooth all wrinkles.

Geotextiles A and B were installed with the machine direction parallel to the long axis of the test pit, and the geogrid was installed with the cross-machine direction parallel to the long axis of the test pit. These orientations correspond to the typical use of these products, assuming that the long axis of the test pit represented the axis of travel on a road.

3.3.3 Base Course Construction

After the subgrade was completed, the base course aggregate stockpile was brought to a water content within 1 percent of its optimum value. Using procedures similar to those used for the subgrade material, the aggregate was placed and compacted to a minimum of 95 percent of its maximum dry density as determined by the modified Proctor test (ASTM D 1557-90). The water content and dry density of the aggregate were verified using a sand cone test. For test sections constructed with a 6-in- (150-mm-) thick base course, the aggregate was placed in a single lift. To ensure uniform density, two aggregate lifts were used to construct 8-in- (200-mm-) thick base courses. Following aggregate compaction, the test section was surveyed to verify total section thickness and uniformity.

3.3.4 Hot-Mix Asphalt Wearing Surface Construction

Approximately 1.5 tons (1400 kg) of HMA were used to construct the wearing surface of each test section. The HMA was delivered in quantities of 3 tons (2700 kg) to help ensure that the asphalt temperature remained above a minimum threshold of 220° F (104° C).

The HMA was supplied from a local batch plant by Adams Construction Company of Blacksburg, Virginia. Upon delivery, the material was placed with the combined use of the front-end loader and hand tools. Loose lift thicknesses were measured using a calibrated steel rod. It was found that a loose lift thickness of 3.0 in (76mm) compacted to approximately 2.8 in (71mm) using the vibratory sled. The bottom of the vibratory sled was lubricated with diesel fuel to prevent adhesion with asphalt.

Nine overlapping passes of the compactor were required to obtain the target density of 135 lb/ft^3 (2,170 kg/m^3) for the SM-2AL HMA mixture. The HMA was allowed to cool for 15 minutes and then three additional passes were made to smooth the wearing course surface. This was followed by a final survey to verify test section dimensions and uniformity. At least 24 hours were allowed to pass before loading of the pavement section commenced.

3.3.5 Test Section Specifications

During the construction of each test section, an attempt was made to conform as closely as possible to design specifications. However, there was inevitable variation between the design and as-built specifications. These values are presented in Table 3.5. The as-built values for subgrade CBR reflect the average of the eight lifts placed for each test section. Similarly, the as-built base course and HMA layer thickness values reflect the averages after compaction.

On Figure 3.4, which shows CBR values of YSS as a function of dry density and water content, it can be seen that at dry densities above 115 lb/ft^3 (18.1 kN/m^3), a shift in water content of only 0.5 percent results in a change in CBR value of as much as 2 percent. The sensitivity of the silty sand CBR values to water content are thought to have contributed to the discrepancy between the design and as-built specifications for subgrade strength.

Table 3.5 Design and as-built specifications for TS 1 through TS 18.

Test Section	Geosynthetic	Subgrade CBR (%)		Base Course Thickness (in)		HMA Thickness (in)	
		design	as-built	design	as-built	design	as-built
1	None	5.0	3.8	6.0	≈6	3.0	≈3
2	None	4.0	≈4	6.0	≈6	2.8	≈3
3	GTX A	4.0	4.5	6.0	5.3	2.8	2.8
4	GG	4.0	5.7	6.0	5.3	2.8	3.1
5	None	4.0	5.4	6.0	4.5	2.8	3.1
6	None	4.0	4.4	6.0	5.8	2.8	2.9
7	GTX B	4.0	4.2	6.0	5.8	2.8	2.8
8	None	4.0	4.8	8.0	7.3	2.8	2.9
9	None	4.0	5.4	8.0	8.3	2.8	3.3
10	None	4.0	4.3	6.0	5.5	2.8	2.8
11	GTX A	4.0	4.4	6.0	5.9	2.8	2.9
12	GG	4.0	4.6	6.0	5.6	2.8	3.1
13	None	4.0	4.2	8.0	7.7	2.8	2.4
14	GTX A	4.0	4.5	8.0	8.8	2.8	3.1
15	None	2.0	2.0	6.0	5.2	2.8	2.9
16	GTX A	2.0	2.2	6.0	4.8	2.8	3.7
17	GTX A	2.0	2.0	6.0	5.2	2.8	2.9
18	GG	2.0	2.0	6.0	5.2	2.8	2.9

Note: GTX - geotextile, GG - geogrid

3.4 Pavement Loading and Data Collection

The pavement loading and data collection systems were developed through the use of pneumatics, computer control, and sensitive instrumentation. The systems were designed to simulate the dual tire load of an 18,000 lb (80 kN) axle with a tire pressure of 80 lb/in^2 (550 kPa) and record pavement response.

3.4.1 Loading System

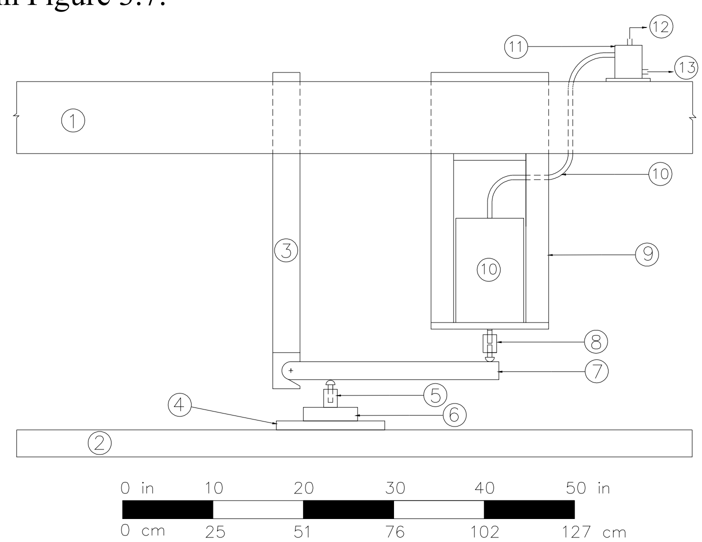
The loading system erected for TS 1 utilized a Bellofram air cylinder to load an 8.0-in- (200-mm-) diameter steel plate located at the center of the test section surface. The air cylinder was secured in a frame attached to the bottom of a steel I-Beam. The I-beam was bolted to the top of the reinforced concrete test pit walls, thus providing the reaction for the force applied to the pavement.

Bellofram air cylinder action was controlled by air flow through a Shrader Bellows PAR-15 digital pressure regulator. The pressure regulator was operated by a personal computer parallel printer interface. A software program was written to permit loading of the test section by computer using different load patterns. Air flow to the pressure regulator was controlled by a hand-operated valve on one of three air compressors used to drive the loading system. Adjustments of the valve at the air compressor were made as necessary to maintain the desired load.

The first test section served to validate operation of the loading system and to indicate necessary modifications. Over 120,000 cycles of continuous loading were required to produce a displacement of less than 0.3 in (8mm) in TS 1, damaging two air cylinders in the process. In view of the time and resources required to evaluate test sections constructed to the initial specifications, the following modifications were made to the loading system and test section design:

1. The SM-2BL HMA was replaced by a more appropriate secondary road wearing surface mix, SM-2AL HMA.
2. A lever arm was introduced between the air cylinder piston and the loading plate to increase mechanical leverage by a factor of about 2.5, and thus reduce the stress on the Bellofram air cylinder.
3. The limestone base course aggregate was replaced by a granite aggregate to preclude the possibility of cementation of limestone particles.
4. The 8.0-in- (200-mm-) diameter loading plate was replaced by a 12.0-in- (300-mm) diameter loading plate to more accurately model tire imprint area and pressure.
5. The subgrade CBR design value was changed from 5 to 4 percent.

A schematic diagram of the modified pavement loading system used for TS 2 through TS 18 is shown in Figure 3.7.



1. Steel I-Beam Reaction Frame
2. HMA Wearing Surface
3. Lever Arm Support
4. Loading Plate
5. Fulcrum Load Point Spacer
6. Load Cell
7. Lever Arm
8. Bellofram Load Point Spacer
9. Bellofram Support Frame
10. Bellofram Air Supply hose
11. PAR-15 Digital Pressure Regulator
12. Pressure Regulator Air Supply Hose
13. Cable for Digital Control of Pressure Regulator

Figure 3.7   Diagram of modified pavement loading system used for TS 2 through TS 18.

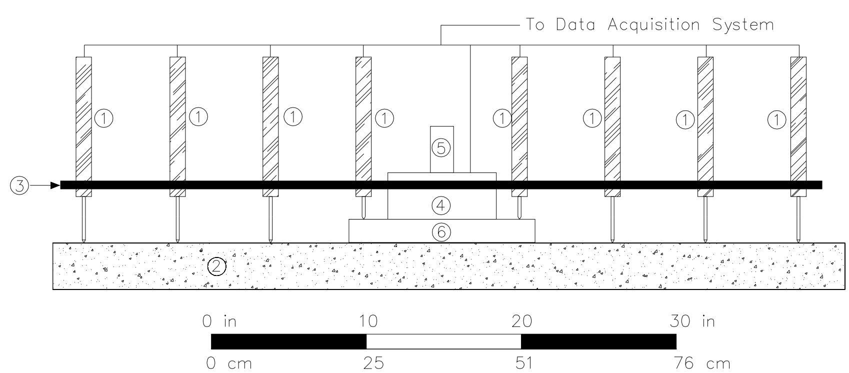
3.4.2 Instrumentation and Data Acquisition System

The instrumentation system consisted of eight linear variable displacement transducers (LVDTs) and one load cell. The LVDTs were used to measure pavement surface displacement and the load cell was used to measure loads applied through the air piston. Kulite earth pressure cells were installed in the subgrades of TS 10 through TS 13.

The data acquisition system consisted of analog-to-digital converters and multiplexing cards which measured the resulting LVDT and load cell voltages, converted them to binary format, and stored them in a data file. Measurements could be collected at a rate of 200 Hz, but because the load was applied at a rate of 0.5 Hz, a data collection rate of 5 Hz was found to be sufficient. The data acquisition system also included two digital multimeters (DMM) which facilitated calibration of instruments and monitoring of the load system.

The LVDTs were secured by a frame which was isolated from the motions of the reaction frame and loading system. They were mounted at 6-in- (150-mm-) intervals on the long axis of the test pit, parallel to the side walls. The exception to the interval spacing was the two center LVDTs. These were located at a distance of 5.0 in (130mm) from the center of the loading plate in order to accommodate the space required by the load cell. The plungers of the two center LVDTs rested directly on the load plate. The plungers of the remaining six LVDTs rested directly on the HMA wearing surface, as shown in Figure 3.7.

The Kulite earth pressure cells were used to record total earth pressures within the subgrade resulting from dynamic surface loads. A complete discussion of the installation of these instruments and the data they produced is provided by Lacina (1995).



1. LVDT
2. HMA Wearing Surface
3. LVDT Array Frame
4. Load Cell
5. Fulcrum-Loading Point Adjustment
6. Rigid Loading Plate

Figure 3.8 Schematic diagram of instrumentation system.

3.4.3 Test Section Loading and Recording Procedures

Loading of the pavement test section began following installation of the loading, instrumentation, and data acquisition systems. As previously mentioned, one of the load system modifications after TS 1 was the introduction of a lever arm between the Bellofram air piston and the loading plate, resulting in reduced stress on the air piston. Experience with TS 2 showed that as displacement of the pavement surface occurred, it was necessary to adjust the length of the Fulcrum Load Point and Bellofram Load Point spacers (items 5 and 8 in Figure 3.7) to maintain the desired force applied to the loading plate (item 4 in Figure 3.7). To make this adjustment, loading of the pavement surface had to be briefly suspended.

In subsequent test sections, the pavement load was applied in 200-cycle increments. At the end of each 200-cycle period, adjustments of the Load Point Spacers were made as necessary. The pause in loading also provided an opportunity to adjust LVDT elevations to ensure that the LVDT plungers maintained continuous contact with the surfaces of the pavement and loading plate.

It was observed that the pavement surface rebounded once the load was suspended. By monitoring DMM readout of one of the center LVDTs, it was possible to determine when pavement rebound was complete. The time required for completion of rebound was about 5 minutes. At the end of this period, the LVDTs located on the load plate were read to determine the amount of permanent pavement surface displacement. Failure of a test section was defined as 1.0 in (25mm) of permanent vertical displacement beneath the load plate. If failure was not yet reached, an additional sequence of loads was applied.

The second DMM was connected to the load cell and was monitored by the operator of the air compressor valve. Based on DMM readout, the operator was advised when an increase or decrease in the force applied to the loading plate was necessary.

3.5 Test Pit Excavation

Careful excavation of the test pit followed the completed loading process. The objective of this exercise was to perform physical measurement of vertical displacement of pavement section layers and to inspect each layer for indications of failure mechanisms. To perform this excavation, the HMA wearing surface was cut along the short axis of the test pit under the center of the loading. The HMA wearing surface was then removed from the front half of the test section using the front-end loader and hand tools. This was followed by the careful hand-excavation of the base course and subgrade materials from the front half of the test pit to a depth of at least 24 in (600mm). The excavation was performed in vertical increments measuring approximately 6 in (150mm). The final wearing surface, base course aggregate, and subgrade layers were then inspected, and the exposed cross-sectional surface of the HMA was marked at regular intervals to facilitate survey of surface displacements.
During subgrade excavation, the water contents were measured and compared to pre-loading values. This was done to help determine if moisture changes had occurred,

indicating possible seepage within the subgrade. No significant changes in moisture content were observed.

Inspection of the base course-subgrade interfaces indicated that intermixing of the YSS and aggregate occurred in sections in which a geotextile was not used. The thickness of the contaminated aggregate layer was difficult to accurately measure since the "density" of contamination decreased as the vertical distance from the subgrade surface increased, effectively establishing a contamination gradient. However, visual inspection indicated that the contaminated layer in control and geogrid-stabilized sections had a thickness of at least 1.0 in (25mm).

Chapter 4 - Analysis of Laboratory Test Results

Of the 18 pavement sections tested, the results of 15 were used to assess the influence of geosynthetic stabilization. The first two tests served to indicate required modifications in section and loading system design. Difficulties were encountered with the loading and data collection system while testing TS 8, and that section yielded no usable data. The results from the remaining 15 test sections were analyzed and are presented in this chapter.

4.1 Pavement Surface Deflections

Failure of each test section was defined as 1.0 in (25mm) of permanent vertical displacement beneath the loading plate. During the analysis of pavement surface deflection data, it was observed that most test sections experienced a significant portion of their total deflection during the first 25 loading cycles. This response was attributed to a reduction of air voids in the HMA. For this reason, deflection induced by the first 25 cycles was discounted in analyses. A similar response may be observed in the field during the first few months of pavement service.

Table 4.1 shows the surface deflection induced during the first 25 load cycles for each test section. The number of cycles resulting in additional deflections of 0.5, 0.8, and 1.0 in (1.3, 2.0, and 25mm) are also shown.

Table 4.1 Number of applied load cycles and surface deflections for laboratory test sections.

Test Section	Deflection at 25 Load Cycles in (mm)	Load Cycles Applied to Obtain Following Additional Deflections		
		0.50 in (13 mm)	0.8 in (20 mm)	1.0 in (25 mm)
3	0.10 (2.5)	350	975	1590
4	0.10 (2.5)	190	480	875
5	0.08 (2.0)	675	1725	2925
6	0.55 (14.0)	175	435	800
7	0.14 (3.6)	440	1125	1790
9	0.15 (3.8)	1375	5225	8275
10	0.08 (2.0)	330	690	860
11	0.15 (3.8)	600	1920	3500
12	0.19 (4.8)	300	900	1525
13	0.19 (4.8)	510	1140	1700
14	0.19 (4.8)	1275	7200	12250
15	0.48 (12.2)	70	190	320
16	0.36 (9.1)	180	400	610
17	0.33 (8.4)	160	380	555
18	0.41 (10.4)	100	175	290

4.2 Analytical Procedure

A direct comparison of test section performance was of limited value because it would not account for differences in test section properties and loading pressures. In order to perform a meaningful comparison, a procedure was used by which these differences could be normalized. The procedure selected was based on the flexible pavement design method outlined by AASHTO (1993).

Use of the AASHTO model involved extensive analyses of pavement section properties and performance. The initial analyses were performed by Smith (1994) using the following analytical procedure:

1. Calculate a structural number for each pavement test section.
2. Based on the structural number, calculate the allowable ESAL required to induce pavement failure.
3. Convert laboratory plate loads to dual tire loads.
4. Convert dual tire loads to applied ESAL.
5. Compare the applied ESAL to the allowable ESAL.

The work performed by Smith (1994) has been reviewed, and independent calculations and analyses are presented herein. Although results in this report occasionally differ from those obtained by Smith, the differences are not significant and the trends identified by Smith have been verified. The differences which have been observed are noted and evaluated in this chapter.

Analyses were also performed to assess the influence of one of the pavement section material properties. The resilient modulus of the HMA used in the laboratory tests was measured by personnel at the Virginia Transportation Research Council (VTRC), VDOT, and was found to be lower than that of HMA frequently used in flexible pavement design. To assess the significance of the relatively low resilient modulus of the laboratory HMA, analyses were performed using a theoretical pavement model to determine the impact of increased resilient modulus on pavement service life and life-cycle costs.

4.3 Calculation of Test Section Structural Number

Determination of the structural numbers permitted characterization of each test section using a uniform set of criteria upon which pavement performance is predicted using the AASHTO design procedure. To calculate the structural number of each pavement test section, the following AASHTO equation (1993) was used:

$$SN = a_1 D_1 + a_2 m_2 D_2 \qquad (4.1)$$

where,

SN = structural number,
a_1 = HMA layer coefficient,
D_1 = HMA thickness,
a_2 = aggregate layer coefficient,
m_2 = aggregate layer drainage coefficient, and
D_2 = aggregate layer thickness.

During construction of the test sections, specimens of HMA were collected and cast into Marshall molds using 50 blows on each side. Resilient modulus and creep compliance tests were then performed on two specimens by VTRC. The results of these tests are shown in Appendix A. The average resilient modulus for the HMA layer was found to be approximately 250,000 lb/in^2 (1.7 GPa). This value was then used to determine the layer coefficient for the HMA layer. According to the AASHTO procedure, the HMA layer coefficient corresponding to this resilient modulus value is 0.33 (i.e., $a_1 = 0.33$).

The resilient modulus of the YSS subgrade (M_R) was determined using the relationship described by Heukelom and Klomp (1962) in which:

$$M_R = 1500 \bullet CBR \quad (4.2)$$

Using this relationship, the resilient modulus was calculated for each test section and is shown in Table 4.2.

Table 4.2 Test section subgrade resilient modulus values.

Test Section	CBR %	M_R lb/in^2 (kPa)
3	4.5	6,750 (46,500)
4	5.7	8,550 (59,000
5	5.4	8,100 (55,800)
6	4.4	6,600 (45,500)
7	4.2	6,300 (43,400)
9	5.4	8,100 (55,800)
10	4.3	6,450 (44,400)
11	4.4	6,600 (45,500)
12	4.6	6,900 (47,500)
13	4.2	6,300 (43,400)
14	4.5	6,750 (46,500)
15	2.0	3,000 (20,700)
16	2.2	3,300 (22,700)
17	2.0	3,000 (20,700)
18	2.0	3,000 (20,700)

The resilient modulus of the base course layer was estimated using the AASHTO correlation which relates the resilient modulus to the moisture condition of the aggregate, the strength of the subgrade, and the thickness of the HMA layer. This relationship is described by the following equation:

$$E_2 = K_1 \bullet \theta^{K_2} \tag{4.3}$$

where,

E_2 = resilient modulus of aggregate,
K_1 = a non-linear coefficient,
K_2 = an exponent coefficient, and
θ = stress state.

Table 4.3 shows the range of K_1 and K_2 values for different moisture conditions. The K_1 and K_2 values chosen for the base course aggregate were 6,000 and 0.6, respectively. Typical values for stress state, θ, are shown in Table 4.4 given a range of HMA layer thicknesses and subgrade resilient modulus values.

Table 4.3 Resilient modulus coefficients for subgrade soil.

Moisture Condition	K_1	K_2
Dry	6,000 to 10,000	0.5 to 0.7
Moist	4,000 to 6,000	0.5 to 0.7
Wet	2,000 to 4,000	0.5 to 0.7

Table 4.4 Typical values for stress state.

HMA Thickness in (mm)	M_R = 3,000 lb/in^2 (21,000 kPa)	M_R = 7,500 lb/in^2 (52,000 kPa)	M_R = 15,000 lb/in^2 (21,000 kPa)
less than 2 (50)	20	25	30
2 to 4 (50 to 100)	10	15	20
4 to 6 (100 to 150)	5	10	15
greater than 6 (150)	5	5	5

Based on the subgrade resilient moduli (Table 4.2), the measured HMA thicknesses, and interpolation of the typical values shown in Table 4.4, the stress state values shown in Table 4.5 were determined. Also shown is the aggregate resilient modulus (E_2), calculated using Equation 4.3, for each test section based on the stress state.

Table 4.5 Values of stress state (θ) and resilient modulus of aggregate (E_2).

Test Section	Subgrade M_R[1] lb/in^2 (kPa)	Avg HMA Thickness in (mm)	Stress State, θ	Aggregate E_2 lb/in^2 (MPa)
3	6,750 (46,500)	2.80 (71.2)	10.83	25,062 (173)
4	8,550 (59,000)	3.14 (79.8)	15.14	30,636 (211)
5	8,100 (55,800)	3.13 (79.5)	15.08	30,563 (210)
6	6,600 (45,500)	2.94 (74.7)	10.80	25,015 (172)
7	6,300 (43,400)	2.78 (70.6)	10.73	24,923 (172)
9	8,100 (55,800)	3.28 (83.3)	15.08	30,563 (211)
10	6,450 (44,400)	2.80 (71.1)	10.77	24,969 (172)
11	6,600 (45,500)	2.86 (72.6)	10.80	25,015 (172)
12	6,900 (47,500)	3.08 (78.2)	10.87	25,108 (173)
13	6,300 (43,400)	2.40 (61.0)	10.73	24,923 (172)
14	6,750 (46,500)	3.09 (78.5)	10.83	25,062 (173)
15	3,000 (20,700)	2.92 (74.2)	10.00	23,886 (165)
16	3,300 (22,700)	3.66 (93.0)	10.00	23,892 (165)
17	3,000 (20,700)	2.89 (73.4)	9.99	23,866 (165)
18	3,000 (20,700)	2.98 (75.7)	9.90	23,743 (164)

Note 1: Subgrade M_R values from Table 4.2

Given the resilient modulus of the base course aggregate, it was possible to calculate its layer coefficient, a_2, using the following AASHTO equation:

$$a_2 = 0.249 (\log E_2) - 0.977 \quad (4.4)$$

To estimate a drainage coefficient for the base course layer, it was assumed that the section would be exposed to moisture conditions approaching saturation for a period between 1 and 5 percent of its life. Based on AASHTO guidelines, it was also assumed that the quality of drainage was "good," indicating that water in the base course would be removed within 1 day. Given these drainage conditions, a drainage coefficient (m_2) of 1.2 was selected for all test sections.

Using Equation 4.1, the structural number (SN) of each pavement test section was calculated. The results are summarized Table 4.6, along with the layer and drainage coefficients used in the calculations.

To evaluate the effect of uncertainty in the selection of variables used to calculate the structural numbers, Smith (1994) performed a sensitivity analysis. His analysis showed that the use of 1 percent variation in the structural number of each test section did not significantly influence the allowable number of ESAL.

Table 4.6 Layer coefficients and structural numbers for each test section.

Test Section	a_1	D_1 in (mm)	a_2	m_2	D_2 in (mm)	SN
3	0.33	2.80 (71.1)	0.12	1.2	5.29 (134)	1.69
4	0.33	3.14 (79.8)	0.14	1.2	5.29 (134)	1.92
5	0.33	3.13 (79.5)	0.14	1.2	4.51 (115)	1.79
6	0.33	2.94 (74.7)	0.12	1.2	5.84 (148)	1.81
7	0.33	2.78 (70.6)	0.12	1.2	5.78 (147)	1.75
9	0.33	3.28 (3.28)	0.14	1.2	8.28 (210)	2.47
10	0.33	2.80 (71.1)	0.12	1.2	5.54 (141)	1.72
11	0.33	2.86 (72.6)	0.12	1.2	5.94 (151)	1.80
12	0.33	3.08 (78.2)	0.12	1.2	5.58 (142)	1.82
13	0.33	2.40 (61.0)	0.12	1.2	7.68 (195)	1.90
14	0.33	3.09 (78.5)	0.12	1.2	8.74 (222)	2.28
15	0.33	2.92 (74.2)	0.11	1.2	5.16 (131)	1.64
16	0.33	3.66 (93.0)	0.11	1.2	4.79 (122)	1.84
17	0.33	2.89 (73.4)	0.11	1.2	4.26 (108)	1.52
18	0.33	2.98 (75.7)	0.11	1.2	6.11 (155)	1.79

4.4 Theoretical Pavement Model

As previously noted, tests performed on HMA specimens collected during construction of the test sections indicated a resilient modulus of 250,000 lb/in^2 (1.7 GPa) which correlates to a layer coefficient of 0.33 (a_1 = 0.33). For AASHTO pavement designs, engineers typically assume structural coefficient values between 0.40 and 0.44. These coefficients correspond to HMA resilient moduli between 370,000 and 440,000 lb/in^2 (2.5 and 2.7 GPa).

To evaluate the influence of higher than tested HMA resilient modulus values on service life and life-cycle costs, 15 theoretical pavement sections were developed. The HMA characteristics for these sections are based on the properties of HMA specimens collected during construction of the Bedford Road Test Project near Bedford, Virginia, which is currently under evaluation by Virginia Tech researchers (Brandon et al. 1995; Al-Qadi et al. 1996). Resilient modulus and creep compliance tests were performed on the HMA specimens at Virginia Tech, and the test results are shown in Appendix A. The average resilient modulus of the specimens is 370,000 lb/in^2 (2.5 GPa), corresponding to a structural coefficient of 0.40 (a_1 = 0.40).

The dimensions of the HMA layers in the theoretical pavement sections correspond exactly to the thickness of the HMA layers in the 15 laboratory test sections. Similarly, the subgrade and base course dimensions and properties of the models correspond exactly to the laboratory test sections. Given these parameters, Table 4.7 presents the layer coefficients and structural numbers for the theoretical sections. In Table 4.7 and throughout the remainder of this report, a system of notation is adopted to distinguish actual laboratory test sections from theoretical test sections. Using this notation, theoretical test section number TS 13 is written as TS 13'.

Table 4.7 Layer coefficients and structural numbers for theoretical pavement sections.

Theoretical Section	a_1'	D_1 in (mm)	a_2	m_2	D_2 in (mm)	SN'
3'	0.40	2.80 (71.1)	0.12	1.2	5.29 (134)	1.88
4'	0. 40	3.14 (79.8)	0.14	1.2	5.29 (134)	2.14
5'	0. 40	3.13 (79.5)	0.14	1.2	4.51 (115)	2.01
6'	0. 40	2.94 (74.7)	0.12	1.2	5.84 (148)	2.02
7'	0. 40	2.78 (70.6)	0.12	1.2	5.78 (147)	1.94
9'	0. 40	3.28 (3.28)	0.14	1.2	8.28 (210)	2.70
10'	0. 40	2.80 (71.1)	0.12	1.2	5.54 (141)	1.92
11'	0. 40	2.86 (72.6)	0.12	1.2	5.94 (151)	2.00
12'	0. 40	3.08 (78.2)	0.12	1.2	5.58 (142)	2.04
13'	0. 40	2.40 (61.0)	0.12	1.2	7.68 (195)	2.07
14'	0. 40	3.09 (78.5)	0.12	1.2	8.74 (222)	2.49
15'	0. 40	2.92 (74.2)	0.11	1.2	5.16 (131)	1.85
16'	0. 40	3.66 (93.0)	0.11	1.2	4.79 (122)	2.10
17'	0. 40	2.89 (73.4)	0.11	1.2	4.26 (108)	1.72
18'	0. 40	2.98 (75.7)	0.11	1.2	6.11 (155)	2.00

For the purposes of analyzing the response of the theoretical pavements, it is assumed that each section experienced the same loading and response as its laboratory counterpart.

4.5 Calculation of Allowable ESAL

The number of ESAL repetitions theoretically required to induce failure (allowable ESAL) can be determined based on the structural number of a pavement section using the following AASHTO (1993) equation:

$$\log W_{18} = Z_R \bullet S_O + 9.36 \bullet \log_{10}(SN+1) - 0.20 + \left[\frac{\log\left[\frac{\Delta PSI}{4.2-1.5}\right]}{0.40 + \frac{1094}{(SN+1)^{5.19}}} \right] + 2.32 \bullet \log_{10} M_R - 8.07 \quad (4.5)$$

where,

W_{18} = allowable ESAL,
Z_R = normal standard deviate,
S_O = standard deviation
ΔPSI = the change in the pavement serviceability index.

Equation 4.5 is derived based on empirical analyses using English units of measurements. Therefore, calculations using this equation must also use English units.

To determine the allowable ESAL for each test section, the variables in Equation 4.5 were selected based on values typically associated with low-volume secondary roads, and are shown in Table 4.8.

Table 4.8 Variables used to calculate allowable ESAL.

Variable	Value
Reliability	50 percent
Normal Standard Deviate, Z_O	0
Standard Deviation, S_O	0.45
Change in Serviceability Index, ΔPSI	2.2

It was assumed that the pavement section would be completed with one-stage construction in that the design service life would be obtained without use of a HMA overlay. To quantify the change in serviceability of the test sections, it was assumed that the initial pavement serviceability index (PSI_i) was 4.2 and the terminal pavement serviceability index (PSI_t) was 2.0, providing a change in serviceability index (ΔPSI) of 2.2. Use of these variables in Equation 4.5 yields the allowable ESAL shown in Table 4.9 for each test section.

Table 4.9 Allowable ESAL for test sections based on AASHTO.

Test Section	Allowable ESAL	Theoretical Section	Allowable ESAL
3	41,410	3'	79,110
4	156,700	4'	303,600
5	89,920	5'	179,600
6	59,810	6'	114,200
7	42,830	7'	82,050
9	656,200	9'	1,1161,000
10	42,130	10'	79,760
11	57,510	11'	108,200
12	68,230	12'	133,900
13	70,950	13'	118,700
14	255,600	14'	453,800
15	5,475	15'	10,860
16	13,160	16'	28,960
17	4,308	17'	8,797
18	8,956	18'	17,330

4.6 Conversion of Laboratory Plate Loads to Dual Tire Loads

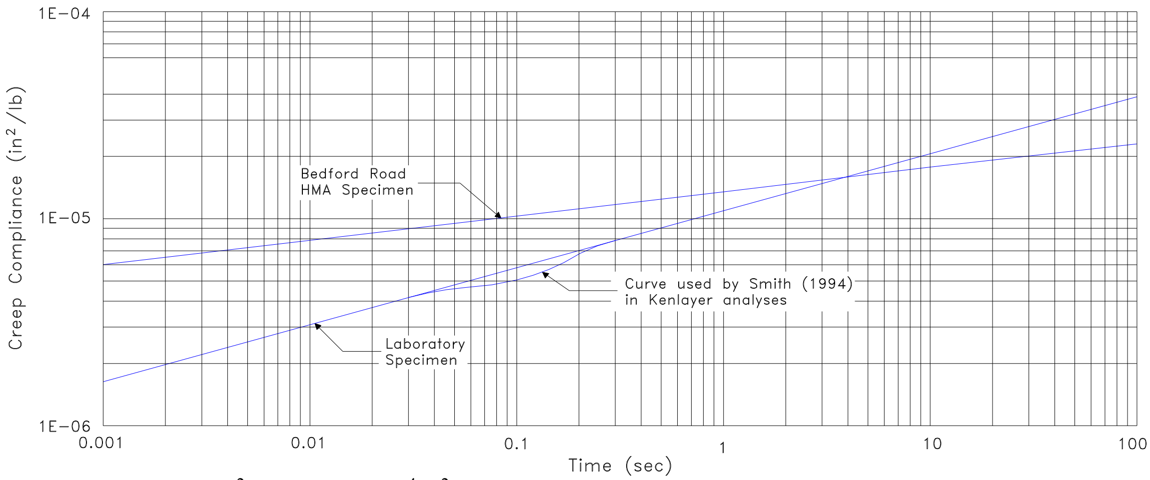
The loading system was designed to simulate the effects of half an ESAL and a tire pressure of 80 lb/in^2 (550 kPa). However, there remained important differences between the laboratory model and typical field conditions. These differences included the magnitude, configuration, and duration of the surface load. In order to calculate the ESAL applied to each test section, it was necessary to convert the single plate loads to ESAL. Also, the magnitude of the load applied to the surface of each test section occasionally deviated from the desired pressure as a result of frictional losses in the loading system. To account for variations, the average plate load was used to calculate the ESAL applied to each test section.

To correct for the differences between laboratory and typical field load configuration and duration, conversion factors unique to each test section were established with the use of the computer program Kenlayer (Huang 1993). The *Kenlayer* computer program for flexible pavements can be applied to a multi-layered system under stationary or moving multiple wheel loads. The HMA layer can be modeled as linear elastic, nonlinear elastic, or viscoelastic while other layers are modeled as elastic. Given the properties of the materials in a test section, as well as load data including duration and configuration, *Kenlayer* can calculate values of stress, strain, and coefficients of damage at selected locations. If pavement failure is defined in terms of pavement damage, *Kenlayer* can calculate the allowable number of load repetitions.

Kenlayer evaluates the viscoelastic behavior of HMA based on the material's creep compliance. Creep compliance is the inverse of creep modulus, which is the strain of the HMA specimen at some interval divided by the time duration. To provide *Kenlayer* with this data, creep tests were performed by VTRC on two specimens of the HMA used to construct the laboratory test sections (Smith 1994). Although the curve is correctly plotted in the report published by Smith, it was observed that the creep compliance value Smith used at 0.1 seconds in the *Kenlayer* analyses was incorrect. According to VTRC laboratory data, the creep compliance at 0.1 seconds is 5.80 x 10^{-5} in^2/lb (8.41 x 10^{-9} m^2/N), as shown in Appendix A. Smith used a value of 5.08 x 10^{-5} in^2/lb (7.37 x 10^{-9} m^2/N), inadvertently transposing two numbers. The difference in the erroneous creep compliance value was found to affect subsequent analyses by a small amount, but did not significantly change the trends observed by Smith. Both the curve based on laboratory results and the curve used by Smith in his *Kenlayer* analyses are shown in Figure 4.1. Also shown is the average creep compliance curve for HMA specimens collect by Virginia Tech researches at the Bedford Road Test Project. Properties of these HMA specimens were used to develop the theoretical pavement sections in this report.

To perform an analysis, *Kenlayer* requires input of the thickness, resilient modulus, and Poisson's ratio of each pavement section layer. The values of layer thickness and resilient modulus have been previously discussed. The Poisson's ratio for the HMA used in the laboratory test sections and Bedford Road Test Project were both estimated to be 0.35. The Poisson's ratios of the aggregate in the laboratory test sections was estimated to be 0.30. The Poisson's ratio for the YSS subgrade was estimated to be 0.30 based on consolidation test results (Lacina 1995).

To model typical field loads, laboratory plate loads were converted to equivalent dual tire loads. It was assumed the dual tire spacing was 13.5 in (343mm) and that the contact radius was 4.2 in (110mm).



Note: 1.00 $in^2/lb = 1.45 \times 10^{-4}\ m^2/N$

Figure 4.1 Creep compliance curves for Laboratory and Bedford Road HMA specimens.

Kenlayer permits calculation of the allowable number of load repetitions to failure based on either fatigue cracking or rutting. Fatigue cracking results from tensile stresses at the bottom of the HMA layer. Rutting results from compressive stresses at the top of the HMA layer. Because rutting was the principal failure mode developed in the laboratory test sections, *Kenlayer* was used to calculate the allowable number of loading repetitions to failure with the following equation:

$$N_d = f_4 \bullet \varepsilon_c^{-f_5} \qquad (4.6)$$

where,

N_d = allowable number of load repetitions,
f_4, f_5 = constants determined from road tests or field performance, and
ε_c = vertical compressive strain on top of subgrade.

Several values for f and f have been proposed by different researchers, including Claussen et al. (1977) and the Asphalt Institute (1982). In accordance with recommendations by the Asphalt Institute (1982), values of 1.365×10^{-9} and 4.477 were used for f_4 and f_5, respectively. The maximum vertical compressive strain at the top of the subgrade was used as the failure criteria for both the single plate loading and dual tire loading conditions.

The duration of single plate loads in the laboratory was approximately 1 second. According to Sebaaly et al. (1991), the load duration of a typical truck is about 0.1 seconds at a speed of 40 mph (64 km/hr). Because of its greater contact period and single contact area, the plate can be expected to induce greater pavement damage than a vehicle at either of the above speeds.

Kenlayer was used to predict the allowable load repetitions (N_d) to failure in accordance with Equation 4.6 for each laboratory and theoretical pavement section using single plate loads with a duration of 1.0 second, and dual tire loads of 0.1 and 0.035 seconds. Given these values, it was then possible to establish the conversion factor for each test section using Equation 4.7.

$$\text{conversion factor} = N_d\ (\text{dual}) / N_d\ (\text{single}) \tag{4.7}$$

The conversion factor for each section is shown in Table 4.10. These factors account for test section differences in thickness and resilient modulus of the HMA, aggregate, and subgrade layer.

Table 4.10 Conversion factors for single plate to dual tire loading.

Test Section	Conversion Factor Plate to Dual Tire Load		Theoretical Section	Conversion Factor Plate to Dual Tire Load	
	Dual 40 mph (64 km/hr)	Dual 60 mph (97 km/hr)		Dual 40 mph (64 km/hr)	Dual 60 mph (97 km/hr)
3	14.2	19.1	3’	8.8	9.8
4	14.4	20.6	4’	8.9	9.9
5	16.8	23.3	5’	9.2	10.4
6	12.4	16.8	6’	8.5	9.4
7	12.4	16.5	7’	8.4	9.2
9	7.6	9.7	9’	5.6	6.0
10	13.2	17.7	10’	8.6	9.5
11	12.2	16.3	11’	8.4	9.2
12	13.3	18.2	12’	8.7	9.8
13	8.2	9.8	13’	6.7	6.9
14	6.9	8.8	14’	5.3	5.6
15	11.8	16.8	15’	7.4	8.2
16	13.0	20.1	16’	7.4	8.5
17	14.6	21.2	17’	8.5	9.7
18	9.6	13.5	18’	6.2	6.7

4.7 Conversion of Dual Tire Loads to Equivalent Single Axle Loads

The factors presented in Table 4.10 permitted the calculation of dual tire loads for both laboratory and theoretical pavement sections. Next, it was necessary to determine the ESAL applied to each test section. Thus, a procedure to convert from dual tire loads to ESAL was necessary.

To accomplish this, the AASHTO equations for computing equivalent axle load factor (EALF) were used. An EALF defines the damage to a pavement per pass of the axle in question relative to the damage per pass of a standard axle load (18 kip [80 kN]), and is calculated by Equation 4.8.

$$\text{EALF} = \frac{W_{t\,x}}{W_{t\,18}} \quad (4.8)\text{a}$$

$$\log\left[\frac{W_{t\,x}}{W_{t\,18}}\right] = 4.79 \bullet \log[18+1] - 4.79 \bullet \log[L_X + L_2] + 4.33 \bullet \log[L_2] + \frac{G_t}{\beta_0} - \frac{G_t}{\beta_{18}} \quad (4.8\text{b})$$

$$G_t = \log_{10}[4.2\text{-PSI}_t / (4.2-1.5)] \quad (4.8\text{c})$$

$$\beta_X = 0.40+[0.081 \bullet (L_X + L_2)^{3.23}) / (SN+1)^{5.19} \bullet L_2^{3.23}] \quad (4.8\text{d})$$

where,

- W_{tx} = number of x-axle load applications at the end of time *t*,
- W_{t18} = the number of ESAL applications at time *t*,
- L_X = load on one single axle, one set of tandem axles, or one set of tridem axles (kips),
- L_2 = axle code (1 for single axle, 2 for tandem axle, 3 for tridem axles),
- G_t = a function of the pavement's terminal serviceability index, and
- β_{18} = value of β_X when L_X is equal to 18 and L_2 is equal to 1.

Given a method to determine the EALF, the process of converting single plate loads to ESAL could be completed. This process is illustrated with the following example. Table 4.1 shows that for TS 3, 1,590 plate loadings were required to induce 1.0 in (25mm) of vertical displacement (rutting) in the pavement surface. According to Table 4.10, the factor to convert this number of loadings dual tire loadings applied by a vehicle traveling 40 mph (64 km/hr) on a similar pavement section is 14.2. Therefore, the 1,590 plate loadings are equivalent to 22,578 dual tire loadings or axle load applications (W_{tx}) at this velocity. Next, Equation 4.8b, through 4.8d can be used to calculate the EALF. Having determined the axle load applications and EALF, the number of ESAL can be found.

This process was used to determine the ESAL applied to each laboratory and theoretical pavement section to induce failure, and these values are presented in Tables 4.11 and 4.12. In this analysis, failure was defined as a rut depth of 1.0 in (25mm). As previously noted, the vertical deflection induced by the first 25 plate loads was discounted. Also shown are the allowable ESAL as determined using *Kenlayer* at vehicle speeds of 40 and 60 mph (64 and 97 km/hr). It should be noted that the allowable number of ESAL is independent of speed for the AASHTO model. This is because the AASHTO formula for calculating ESAL repetitions to failure (Equation 4.5) does not explicitly account for load duration.

Table 4.11 Number of applied and allowable ESAL to obtain failure for laboratory pavement test sections.

Test Section	ESAL Applied at Failure 40 mph (64 km/hr)	ESAL Applied at Failure 60 mph (97 km/hr)	Allowable ESAL *Kenlayer* 40 mph (64 km/hr)	Allowable ESAL *Kenlayer* 60 mph (97 km/hr)	Allowable ESAL AASHTO
3	19,070	25,650	21,030	28,220	41,410
4	10,140	14,510	68,610	93,290	156,700
5	22,740	31,530	48,060	66,670	89,920
6	10,690	14,500	27,790	37,430	59,810
7	22,650	30,140	19,270	25,580	42,830
9	59,400	75,810	170,400	217,900	656,200
10	8,320	11,160	19,760	26,420	42,130
11	41,930	56,020	25,720	34,240	57,510
12	17,820	24,390	35,530	48,770	68,230
13	12,870	15,380	24,090	29,070	70,950
14	81,780	104,300	87,510	111,100	255,600
15	1,386	1,973	2,672	3,820	5,457
16	3,493	5,400	10,140	15,600	13,160
17	2,928	4,252	2,611	3,800	4,308
18	710	999	3,845	5,372	8,956

Table 4.12 Number of applied and allowable ESAL to obtain failure for theoretical pavement sections.

Test Section	ESAL Applied at Failure 40 mph (64 km/hr)	ESAL Applied at Failure 60 mph (97 km/hr)	Allowable ESAL *Kenlayer* 40 mph (64 km/hr)	Allowable ESAL *Kenlayer* 60 mph (97 km/hr)	Allowable ESAL AASHTO
3’	11,830	13,170	5,477	6,082	79,110
4’	6,281	6,987	17,110	19,080	303,600
5’	12,550	14,190	9,603	10,870	179,600
6’	7,320	8,106	8,040	8,893	114,200
7’	15,340	16,800	5,785	6,368	82,050
9’	43,790	46,920	66,470	70,510	1,161,000
10’	5,434	6,003	5,522	6,107	79,760
11’	28,870	31,620	7,838	8,630	108,200
12’	11,670	13,140	9,203	10,270	133,900
13’	10,520	10,830	12,250	12,740	118,700
14’	62,840	66,390	35,610	37,690	453,800
15’	877	972	614	679	10,860
16’	2,009	2,308	1,549	1,779	28,960
17’	1,719	1,961	486	556	8,797
18’	466	503	1,004	1,098	17,330

4.8 Comparison of Allowable ESAL

It can be seen in Table 4.12 that the increased modulus of the theoretical HMA layer results in an increased number of allowable AASHTO ESAL compared to the allowable AASHTO ESAL of the laboratory test sections in Table 4.11. For example, the allowable AASHTO ESAL for TS 3' is 79,110 and for TS 3, it is 41,410. This is a logical trend since the use of the higher HMA resilient modulus in TS 3' yields a higher pavement section structural number. However, the same trend is not observed for allowable *Kenlayer* ESAL.

A thorough review of the *Kenlayer* data confirmed that there were no computational mistakes. This led to a closer examination of the input data; specifically, the values used to establish the creep compliance of the HMA. Analyses performed using *Kenlayer* can incorporate either resilient modulus or creep compliance values to characterize the behavior of HMA. If a viscoelastic model is selected to described a specific material, *Kenlayer* uses the material's creep compliance properties. If creep compliance data is inaccurate, a logical relationship may exist between the laboratory and theoretical pavements for AASHTO allowable ESAL, but not for *Kenlayer* allowable ESAL.

In view of the apparent absence of other possible sources of error, it was concluded that the data used to construct creep compliance curves for the laboratory and theoretical HMA is the cause of inconsistency of *Kenlayer*-generated results. It is important to note that creep compliance and resilient modulus are laboratory dependent. These procedures can provide repeatable results within a single laboratory environment. However, the results are not always repeatable between different laboratories because of the sensitivity of the test procedures to specific test apparatus characteristics and operator technique. As previously mentioned, the creep compliance values for the laboratory HMA specimens were determined by VTRC, VDOT. The creep compliance values for the theoretical HMA were based on Bedford Road Test Project specimens evaluated at a Virginia Tech laboratory. Because the specimens were tested using different facilities, the two sets of creep compliance data are not likely to be the same. As previously mentioned, the creep compliance values obtained from laboratory HMA specimens by the VTRC, VDOT were used in for *Kenlayer* models of laboratory pavement sections. Creep compliance values obtained by Virginia Tech researchers on specimens collected from the Bedford Road Test Project were used for *Kenlayer* models of theoretical pavement sections.

4.9 Comparison of Applied and Allowable ESAL

It can be seen from Table 4.11 that the number of ESAL applied to each test section to induce failure did not agree with the allowable ESAL calculated using either *Kenlayer* or the AASHTO method. In large part, this is attributable to the fact that three definitions of failure are used.

In the *Kenlayer* model, the definition of failure (Equation 4.6) is related to compressive strain at the top of the subgrade. The compressive strain at this location does not necessarily correlate with the definition of failure used during laboratory tests, which was vertical deflection of 1.0 in (25mm) at the pavement surface. However, since the definitions for failure used by *Kenlayer* and in the laboratory do not change between test sections, a consistent ratio between the loads required to induce failure should exist.

A similar relationship may be found between the laboratory and AASHTO models. Failure according to the AASHTO model is based upon a terminal serviceability (PSI_t) of 2.0. Use of the terminal serviceability value to calculate the allowable ESAL to failure presumes that a change in the serviceability index of 2.2 (ΔPSI) corresponds to a rutting depth of 1.0 (25mm). Given the empirical nature of the AASHTO model, this specific correlation is not necessarily accurate. However, since the definitions for failure used by AASHTO and in the laboratory do not change between test sections, the ratio of the loads required to induce failure should also exist.

In this report, the ratio of applied ESAL to failure and allowable ESAL to failure is defined as the *Load Ratio*. Based on the preceding discussion, there should be little variation between the load ratios of comparable control sections. The load ratio for laboratory test sections is denoted as LR. The load ratio for theoretical pavement sections is denoted as LR'. The values of LR and LR' have been determined for each section using the AASHTO model and the *Kenlayer* model. The load ratios for control sections are provided in Tables 4.13 and 4.14.

Control sections 5, 6, 10, and 15 were designed to have a base course thickness of 6 in (150mm), and the average of the load ratios for these sections were determined for the two velocities. Similarly, control sections 9 and 13 were designed to have a base course thickness of 8 in (200mm), and the average of the load ratios for these sections were determined for the two velocities. There should be little variation between load ratios of comparable sections since the analytical procedure has accounted for physical differences between test sections and variations in applied loading pressures. The process of converting plate loads to dual tire loads normalized differences in subgrade strength, base course thickness, and HMA thickness. The process of converting dual tire loads to ESAL then normalized differences in loading pressures.

The fact that small variations are present in the load ratio correctly indicates that the data normalization procedure can not entirely account for some differences between test sections. The procedure is limited by the accuracy of physical measurements and correlation of test section dimensions and strength properties. The values used in the *Kenlayer* and AASHTO analyses were based on the averages of the collected data.

Tables 4.15 and 4.16 show the load ratios of laboratory and theoretical pavement sections stabilized with either a geotextile or a geogrid. These test sections are comparable to the control sections in every respect with the exception of the geosynthetic. Therefore, the load ratios of these sections should also be comparable to the average of the control sections unless influenced by the presence of the geosynthetic. If the stabilized test section's load ratio is significantly different, the difference is necessarily the result of geosynthetic action.

Table 4.13 Load ratios for laboratory control sections.

Test Section	LR Kenlayer 40 mph (64 km/hr)	LR Kenlayer 60 mph (97 km/hr)	LR AASHTO 40 mph (64 km/hr)	LR AASHTO 60 mph (97 km/hr)	Base Course Design Thickness (in)
5	0.473	0.473	0.253	0.351	6
6	0.385	0.387	0.179	0.242	6
10	0.421	0.422	0.198	0.265	6
15	0.519	0.516	0.253	0.360	6
Average	0.450	0.450	0.221	0.305	
9	0.349	0.348	0.091	0.116	8
13	0.534	0.529	0.181	0.217	8
Average	0.442	0.439	0.136	0.167	

Table 4.14 Load ratios for theoretical control sections.

Test Section	LR' Kenlayer 40 mph (64 km/hr)	LR' Kenlayer 60 mph (97 km/hr)	LR' AASHTO 40 mph (64 km/hr)	LR' AASHTO 60 mph (97 km/hr)	Base Course Design Thickness (in)
5	1.307	1.305	0.070	0.079	6
6	0.910	0.912	0.064	0.071	6
10	0.984	0.983	0.068	0.075	6
15	1.428	1.432	0.080	0.089	6
Average	1.157	1.159	0.071	0.079	
9	0.659	0.665	0.038	0.040	8
13	0.859	0.850	0.088	0.091	8
Average	0.759	0.758	0.063	0.066	

It can be seen from the tables that the geosynthetic significantly influenced the behavior of some test sections. To quantify the effect of the geosynthetic, the load ratio of stabilized test sections was divided by the average load ratio of corresponding control sections. This value defines the factor of improvement attributable to the geosynthetic used in a given test section. Thus, a FI equal to 1.0 indicates that the geosynthetic did not improve the performance of a pavement section. A FI equal to 2.0 indicates the geosynthetic doubled the loads required for pavement failure. Factors of improvement are denoted as FI for laboratory test sections and FI' for theoretical pavement sections, and are shown in Tables 4.17 and 4.18, respectively.

Table 4.15 Load ratios for stabilized laboratory sections.

Test Section	LR Kenlayer 40 mph (64 km/hr)	LR Kenlayer 60 mph (97 km/hr)	LR AASHTO 40 mph (64 km/hr)	LR AASHTO 60 mph (97 km/hr)	Base Course Design Thickness in (mm)
Control Avg[1]	0.450	0.450	0.221	0.305	6 (150)
3	0.907	0.909	0.465	0.626	6 (150)
4	0.148	0.156	0.065	0.092	6 (150)
7	1.175	1.178	0.517	0.688	6 (150)
11	1.630	1.636	0.729	0.974	6 (150)
12	0.502	0.500	0.261	0.358	6 (150)
16	0.344	0.346	0.265	0.409	6 (150)
17	1.121	1.119	0.679	0.987	6 (150)
18	0.185	0.186	0.079	0.111	6 (150)
Control Avg[1]	0.442	0.439	0.136	0.167	8 (200)
14	0.935	0.939	0.319	0.407	8 (200)

Note 1: Values from Table 4.13

Table 4.16 Load ratios for stabilized theoretical sections.

Test Section	LR' Kenlayer 40 mph (64 km/hr)	LR' Kenlayer 60 mph (97 km/hr)	LR' AASHTO 40 mph (64 km/hr)	LR' AASHTO 60 mph (97 km/hr)	Base Course Design Thickness in (mm)
Control Avg[1]	1.157	1.159	0.071	0.079	6 (150)
3	2.160	2.165	0.150	0.166	6 (150)
4	0.367	0.366	0.021	0.023	6 (150)
7	2.652	2.638	0.187	0.205	6 (150)
11	3.683	3.664	0.267	0.293	6 (150)
12	1.268	1.279	0.087	0.098	6 (150)
16	1.297	1.297	0.069	0.080	6 (150)
17	3.537	3.527	0.195	0.223	6 (150)
18	0.464	0.458	0.027	0.029	6 (150)
Control Avg[1]	0.759	0.758	0.063	0.066	8 (200)
14	1.765	1.761	0.138	0.146	8 (200)

Note 1: Values from Table 4.14

It is apparent from the data in Tables 4.17 and 4.18 that the presence of a geosynthetic at the subgrade-base course interface can significantly influence the performance of a flexible pavement section. For test sections constructed with a subgrade CBR of about 4.5 percent, the use of Geotextile A increased pavement service life by a factor between 2.0 and 3.6.

For test sections constructed with a subgrade CBR of about 2.0 percent, the use of Geotextile A increased pavement service life by as much as a factor of 3.2. Interestingly, Geotextile A seemed to have little effect on the performance of TS 16. This test section's as-built HMA thickness was 3.7 in (94mm); significantly thicker than stipulated in the design specifications. With this thickness, the HMA may have reduced the stress reaching the base course to a greater extent compared to other test sections, effectively diminishing the significance of the base course's role in the support of surface loads. Since the geotextile's principle contribution is to preserve the structural integrity of the base course, it follows that its presence resulted in little or no increase in test section service life.

Table 4.17 Factor of improvement for stabilized laboratory test sections.

Test Section	Design Parameters		FI Kenlayer 40 mph (64 km/hr)	FI Kenlayer 60 mph (97 km/hr)	FI AASHTO 40 mph (64 km/hr)	FI AASHTO 60 mph (97 km/hr)
3	HMA Base Subgrade CBR Geosynthetic	2.8 in (71 mm) 5.3 in (135 mm) 4.5 % GTX A	2.02	2.02	2.10	2.05
4	HMA Base Subgrade CBR Geosynthetic	3.1 in (79 mm) 5.3 in (135 mm) 5.7 % GG	0.33	0.35	0.29	0.30
7	HMA Base Subgrade CBR Geosynthetic	2.8 in (71 mm) 5.8 in (147 mm) 4.2 % GTX B	2.61	2.62	2.34	2.26
11	HMA Base Subgrade CBR Geosynthetic	2.9 in (74 mm) 5.9 in (150 mm) 4.4 % GTX A	3.62	3.64	3.30	3.19
12	HMA Base Subgrade CBR Geosynthetic	3.1 in (79 mm) 5.6 in (142 mm) 4.6 % GG	1.11	1.11	1.18	1.17
14	HMA Base Subgrade CBR Geosynthetic	3.1 in (79 mm) 8.7 in (221 mm) 4.5 % GTX A	2.11	2.14	2.35	2.44
16	HMA Base Subgrade CBR Geosynthetic	3.7 in (94 mm) 4.8 in (122 mm) 2.2 % GTX A	0.77	0.77	1.20	1.34
17	HMA Base Subgrade CBR Geosynthetic	2.9 in (74 mm) 4.3 in (109 mm) 2.0 % GTX A	2.49	2.49	3.07	3.23
18	HMA Base Subgrade CBR Geosynthetic	3.0 in (76 mm) 6.1 in (155 mm) 2.0 % GG	0.41	0.41	0.36	0.37

Table 4.18 Factor of improvement for stabilized theoretical pavement sections.

Test Section	Design Parameters	FI' Kenlayer 40 mph (64 km/hr)	FI' Kenlayer 60 mph (97 km/hr)	FI' AASHTO 40 mph (64 km/hr)	FI' AASHTO 60 mph (97 km/hr)
3	HMA 2.8 in (71 mm) Base 5.3 in (135 mm) Subgrade CBR 4.5 % Geosynthetic GTX A	1.87	1.87	2.11	2.11
4	HMA 3.1 in (79 mm) Base 5.3 in (135 mm) Subgrade CBR 5.7 % Geosynthetic GG	0.32	0.32	0.29	0.29
7	HMA 2.8 in (71 mm) Base 5.8 in (147 mm) Subgrade CBR 4.2 % Geosynthetic GTX B	2.28	2.28	2.63	2.59
11	HMA 2.9 in (74 mm) Base 5.9 in (150 mm) Subgrade CBR 4.4 % Geosynthetic GTX A	3.18	3.16	3.76	3.71
12	HMA 3.1 in (79 mm) Base 5.6 in (142 mm) Subgrade CBR 4.6 % Geosynthetic GG	1.10	1.10	1.23	1.24
14	HMA 3.1 in (79 mm) Base 8.7 in (221 mm) Subgrade CBR 4.5 % Geosynthetic GTX A	2.32	2.32	2.20	2.22
16	HMA 3.7 in (94 mm) Base 4.8 in (122 mm) Subgrade CBR 2.2 % Geosynthetic GTX A	1.12	1.12	0.98	1.01
17	HMA 2.9 in (74 mm) Base 4.3 in (109 mm) Subgrade CBR 2.0 % Geosynthetic GTX A	3.06	3.05	2.75	2.82
18	HMA 3.0 in (76 mm) Base 6.1 in (155 mm) Subgrade CBR 2.0 % Geosynthetic GG	0.40	0.40	0.38	0.37

The use of Geotextile B increased the service life of TS 7 by an amount that is within the range of improvement provided by Geotextile A. This may suggest that the significantly higher tensile modulus properties of Geotextile B were not a factor, and that the principal geotextile mechanism for increased service life was separation of the base course from the subgrade.

The use of the biaxial geogrid had virtually no effect on the performance of the three test sections in which it was used. This result appears to contradict the findings of some research programs discussed in Chapter 2 (Kennepohl et al. 1985; Carroll et al.1987;

Hass et al. 1988; Webster 1991b) One of the reasons the geogrid-stabilized sections performed differently in this study is thought to be the type of subgrade soil used. Previous investigations used relatively clean sand or fat clay. The use of sand subgrades virtually precludes the possibility of aggregate contamination with fine particles, thereby preventing a corresponding gradual reduction in base course resilient modulus. The use of a fat clay could precipitate considerable aggregate contamination, but only if exposed to natural environmental conditions leading to moistening or inundation of the subgrade. In Webster's study (1991b), excess moisture was not available to the pavement system and contamination of the aggregate was not observed.

The laboratory sections constructed in this study were not exposed to natural environmental factors, including excess moisture in the subgrade. However, excess moisture may not be a requirement for contamination when the subgrade is composed of non-plastic fine soil particles, such as YSS. Under laboratory and field conditions, it is possible for non-plastic soil particles to migrate into the base course as a result of dissipating excess pore water pressures produced by surface loads.

If it is assumed that the geogrid actually increases the resilient modulus of the base course as a result of lateral confinement, the results of the laboratory tests in this study indicate that this modulus increase is insignificant compared to the reduction in modulus resulting from contamination of the aggregate.

4.10 Comparison of Theoretical and Laboratory Improvement Factors

Table 4.18 shows that factors of improvement for the stabilized theoretical pavement sections were similar to those for the stabilized laboratory test sections for both AASHTO models and *Kenlayer* models. This is to be expected since the analyses of the theoretical section are based on the same laboratory performance data set. The only difference was the strength of the HMA layer. It is interesting to compare FI and FI', as shown in Table 4.19, and to evaluate how closely the ratio FI:FI' approximates unity.

It can be seen that the ratio FI:FI' is reasonably close to 1.0 for most test sections. The notable exception is section 16. As previously discussed, this section was built with a relatively thick HMA wearing course and was not influenced by the presence of Geotextile A.

Table 4.19 Ratio of FI to FI' for stabilized sections.

Test Section	FI/FI' Kenlayer 40 mph (64 km/hr)	FI/FI' Kenlayer 60 mph (97 km/hr)	FI/FI' AASHTO 40 mph (64 km/hr)	FI/FI' AASHTO 60 mph (97 km/hr)
3	1.08	1.08	1.00	0.97
4	1.03	1.09	1.00	1.03
7	1.14	1.15	0.89	0.87
11	1.14	1.15	0.88	0.86
12	1.01	1.01	0.96	0.94
14	0.91	0.92	1.07	1.10
16	0.69	0.69	1.22	1.22
17	0.81	0.82	1.11	1.15
18	1.03	1.03	0.95	1.00

4.11 Structural Numbers of Stabilized Pavement Sections

If the allowable ESAL values shown in Tables 4.11 and 4.12 are multiplied by the corresponding factors of improvement shown in Tables 4.17 and 4.18, an approximation of the ESAL permitted by geosynthetic-stabilized pavement sections is possible. Using the predicted ESAL and Equation 4.1, it is possible to calculate the effective SN value of the stabilized pavement section. The predicted ESAL of laboratory and theoretical pavement sections are shown in Tables 4.20 and 4.21, respectively.

Table 4.20 Predicted ESAL for stabilized laboratory test sections.

Test Section	Predicted ESAL Kenlayer 40 mph (64 km/hr)	Predicted ESAL Kenlayer 60 mph (97 km/hr)	Predicted ESAL AASHTO 40 mph (64 km/hr)	Predicted ESAL AASHTO 60 mph (97 km/hr)
3	42,480	57,000	86,100	84,050
4	22,640	32,650	45,530	47,100
7	50,300	67,020	102,490	98,990
11	93,110	124,630	189,800	183,400
12	39,444	54,130	80,480	79,790
14	184,600	237,800	601,600	624,600
16	7,808	12,010	15,840	17,690
17	6,501	9,462	13,230	13,920
18	1,576	2,202	3,225	3,315

Table 4.21 Predicted ESAL for stabilized theoretical pavement sections.

Test Section	Predicted ESAL Kenlayer 40 mph (64 km/hr)	Predicted ESAL Kenlayer 60 mph (97 km/hr)	Predicted ESAL AASHTO 40 mph (64 km/hr)	Predicted ESAL AASHTO 60 mph (97 km/hr)
3’	10,230	11,370	166,600	166,700
4’	5,429	6,034	88,460	88,400
7’	13,260	14,510	216,100	212,700
11’	24,950	27,310	406,600	400,300
12’	10,090	11,347	164,400	166,300
14’	82,790	87,590	997,500	1,006,000
16’	1,736	1,993	28,300	29,220
17’	1,486	1,693	24,211	24,820
18’	403	434	6,563	6,367

In the work performed by Smith (1994), the author determined the SN value required of each stabilized test section to provide the predicted ESAL to failure assuming that a geosynthetic was not used. By equating the effect of a geosynthetic with a change in SN, a quantification of the contribution of the geosynthetic using the AASHTO design procedure is provided. Calculations to determine the equivalent SN values have been performed for this study, using the predicted ESAL values in Tables 4.20 and 4.21, and are shown in Tables 4.22 and 4.23.

A review of the equivalent SN values in Table 4.22 and those reported by Smith (1994) indicate some minor differences. These result primarily from the use of the incorrect creep compliance value for the laboratory HMA at a time of 0.1 seconds. A review of the SN values also indicates that the use of a geotextile effectively increased the SN value by approximately 12 to 25 percent.

Table 4.22 Equivalent structural numbers for stabilized laboratory test sections.

Test Section	Geosynthetic Type	SN without Geosynthetic	SN with Geosynthetic 40 mph (64 km/hr)	SN with Geosynthetic 60 mph (97 km/hr)
3	Geotextile A	1.69	1.90	1.90
4	Geogrid	1.92	1.57[1]	1.56[1]
7	Geotextile B	1.75	2.01	2.02
11	Geotextile A	1.80	2.18	2.19
12	Geogrid	1.82	1.87	1.87
14	Geotextile A	2.28	2.62	2.61
16	Geotextile A	1.84	1.93	1.90
17	Geotextile A	1.52	1.93	1.91
18	Geogrid	1.79	1.61[1]	1.60[1]

Note 1: Geosynthetic did not increase effective structural number of test section

Table 4.23 Equivalent structural numbers for stabilized theoretical pavement sections.

Test Section	Geosynthetic Type	SN without Geosynthetic	SN with Geosynthetic 40 mph (64 km/hr)	SN with Geosynthetic 60 mph (97 km/hr)
3'	Geotextile A	1.88	2.13	2.13
4'	Geogrid	2.14	1.75[1]	1.75[1]
7'	Geotextile B	1.94	2.27	2.28
11'	Geotextile A	2.00	2.47	2.47
12'	Geogrid	2.04	2.11	2.10
14'	Geotextile A	2.49	2.82	2.82
16'	Geotextile A	2.10	2.10	2.09[1]
17'	Geotextile A	1.72	2.12	2.11
18'	Geogrid	2.00	1.80[1]	1.81[1]

Note 1: Geosynthetic did not increase effective structural number of test section

4.12 Influence of Geosynthetic on Pavement Costs

To quantify the economic benefits of geosynthetics, cost analyses have been performed using AASHTO procedures and test results obtained in this study. A similar analysis was performed by Smith (1994), but since results of laboratory test sections presented in this report differ slightly from those Smith used, the analysis is repeated. In addition, a cost-benefit analysis using results of theoretical pavement sections has been performed.

Two cases were evaluated in these analyses. In Case 1, the cost of an unstabilized road section was compared to that of a geotextile-stabilized road and a geogrid-stabilized road. In Case 2, the cost of a geogrid-stabilized road was compared to that of a road stabilized with a geotextile.

4.12.1 Case 1 Cost Analysis

To perform the cost-benefit analysis in Case 1, two types of hypothetical pavement sections were designed. The distinction between the two types was the resilient modulus of the HMA used to construct the wearing course. Three versions of each design were evaluated: non-stabilized, geotextile-stabilized, and geogrid-stabilized.

Each road section was designed with a width of 24 ft (7.3 m) and a length of 1.0 mile (1.6 km). The designation of each section with respect to HMA resilient modulus and geosynthetic stabilization is shown in Table 4.24.

Table 4.24 Designation and design of hypothetical roads used in Case 1 cost-benefit analysis.

Road Section	HMA Resilient Modulus, E_1 lb/in^2 (GPa)	Design Description
R1	250,000 (1.7)	no geosynthetic stabilization
R1GTX	250,000 (1.7)	geotextile stabilization[1]
R1GG	250,000 (1.7)	geogrid stabilization[1]
R2	370,000 (2.6)	no geosynthetic stabilization
R2GTX	370,000 (2.6)	geotextile stabilization[1]
R2GG	370,000 (2.6)	geogrid stabilization[1]

Note 1: Geosynthetic placed at base course-subgrade interface

The subgrade and base course properties of each road section were based on averages from TS 3, 7, 11, and 12; these sections were constructed with either a geotextile or geogrid. These properties are shown in Table 4.25.

Table 4.25 Properties and dimensions of road sections in Case 1 cost-benefit analysis.

Road No.	E_1 lb/in^2 (GPa)	HMA Thickness in (mm)	E_2 lb/in^2 (MPa)	Base Course Thickness in (mm)	Subgrade M_R lb/in^2 (kPa)	CBR (%)
1	250,000 (1.7)	2.88 (732)	25,000 (170)	5.65 (144)	6,640 (45.8)	4.43
2	370,000 (2.6)	2.88 (732)	25,000 (170)	5.65 (144)	6,640 (45.8)	4.43

The structural coefficients of R1 and R2 were determined in accordance with AASHTO guidelines using the moduli in Table 4.25. The corresponding structural numbers were then calculated using Equation 4.1. The structural number of R1GTX was based on the average of the equivalent SN values of TS 3, 7, and 11 at velocities of 40 mph (64 km/hr) and 60 mph (97 km/hr), shown in Table 4.22. Similarly, the structural number of R2GTX was based on the average equivalent SN values of TS 3’, 7’, and 11’, shown in Table 4.23. The equivalent structural numbers of R1GG and R2GG were based on TS 12 and TS 12’, respectively. Of the six laboratory and theoretical sections evaluated using a geogrid, only TS 12 indicated that the geogrid may result in improved performance. Therefore, the use of an equivalent structural number based on TS 12 and TS 12’ represent best-case scenarios. A summary of the SN values used in the Case 1 cost-benefit analysis is shown in Table 4.26.

Table 4.26 Structural numbers used in Case 1 cost-benefit analysis.

Road Section	SN	Equivalent SN
R1	1.76	-
R1GTX	-	2.03
R1GG	-	1.87
R2	1.97	-
R2GTX	-	2.29
R2GG	-	2.11

In Case 1, R1 was compared to R1GTX and R1GG, and R2 was compared to R2GTX and R2GG. To assess the cost-benefit of geosynthetic stabilization, R1 and R2 were designed using two-stage construction, and the stabilized versions using one-stage construction. Stage two consisted of an HMA overlay which allowed a sufficient number of additional ESAL such that the combined ESAL during stages one and two equaled to the total ESAL of the corresponding stabilized pavement sections.

It was assumed that each road section would be constructed with an initial pavement serviceability of 4.2 ($PSI_i = 4.2$) and a terminal serviceability of 2.0 ($PSI_t = 2.0$). The HMA overlay in stage two of R1 and R2 was applied when the pavement serviceability index declined to 2.5.

Calculation of allowable ESAL was performed using the statistical variables shown in Table 4.27. It should be noted that the overall reliability of stages one and two for sections R1 and R2 is 50 percent. Therefore, the reliability of the individual stages is equal to the square root of 50 percent which is 71 percent.

Table 4.27 Variables used to calculate allowable ESAL.

Variable	Stage 1 of R1 & R2	Stage 2 of R1 & R2	Stabilized Sections
Reliability	71 percent	71 percent	50 percent
Normal Standard Deviate, Z_O	-0.524	-0.524	-0.0
Standard Deviation, S_O	0.45	0.45	0.45
PSI_i	4.2	4.2	4.2
PSI_t	2.5	2.0	2.0

With the design parameters presented thus far, it was possible to complete the analysis of Case 1 using the following eight steps:

1. Determine the allowable ESAL of stabilized road sections based on their equivalent structural numbers.
2. Calculate the allowable ESAL of non-stabilized road sections at the end of stage one.
3. Determine the ESAL required of the non-stabilized road sections at the end of stage two such that the total ESAL repetitions is equal to the allowable ESAL of stabilized road sections (calculated in step one).
4. Calculate the remaining structural capacity of the non-stabilized sections at the end of stage one.
5. Based on the ESAL required of the stage two overlays, calculate the total structural number required at the beginning of stage two.
6. Based on the total structural number required at the beginning of stage two, calculate structural number required of the overlays.
7. Based on the required structural number of the overlays, calculate each of the overlay thickness.

8. Compare the cost associated with the overlay thickness to that of the geosynthetics.

To calculate the allowable ESAL for each stabilized road section, the equivalent structural numbers in Table 4.26 and the corresponding statistical variables in Table 4.27 were used in Equation 4.5. These calculations result in the values shown in Table 4.28.

Table 4.28 Allowable ESAL of stabilized sections.

Road Section	Equivalent SN	Allowable ESAL
R1GTX	2.03	120,434
R1GG	1.87	73,352
R2GTX	2.29	254,092
R2GG	2.11	152,667

To evaluate the cost-benefit potential of the geosynthetics, it was necessary to perform an overlay design for R1 and R2 which would yield a total ESAL from stage one and two that matched the ESAL of corresponding sections shown in Table 4.28. The calculation of ESAL allowable during stage one is a straightforward process using Equation 4.5. However, to perform the overlay design, it was necessary to determine the remaining life of the pavement structure. This required an assessment of the actual amount of traffic the pavement carried during stage one and the total amount of traffic the pavement could be expected to carry to failure. The percentage of remaining life was determined using the following AASHTO equation:

$$RL = 100 \bullet \left[1 - \left(\frac{N_P}{N_{1.5}} \right) \right] \tag{4.9}$$

where:

RL = remaining life (percent),
N_P = total ESAL repetitions to date, and
$N_{1.5}$ = total traffic to pavement "failure."

In calculating the value of $N_{1.5}$, the value of PSI_t was set equal to 1.5 and reliability was set equal to 50 percent; values which correspond to those in the original AASHTO equation. In calculating the value of N_P, the design reflected two-stage construction, which required the use of a reliability value equal to the square root of 70 percent. The value of RL was then used to obtain a condition factor using an empirical AASHTO relationship (see page III-91 AASHTO 1993). The condition factor relates the effective structural number at the end of stage one with the original structural number. Using this relationship, the values in Table 4.29 were determined.

Table 4.29 Values used in calculation of effective SN at end of stage one for R1 and R2.

Road Section	Original SN	N_P (ESAL)	$N_{1.5}$ (ESAL)	RL (percent)	Condition Factor	Effective SN at end of Stage 1
R1	1.76	28,526	53,008	46.2	0.880	1.54
R2	1.97	54,872	105,300	47.9	0..886	1.75

Based on the data presented in Table 4.29, it can be seen that at the end of stage one, 28,526 ESAL were applied to R1; this could be expected to result in a decline of its structural number from 1.76 to 1.54. Similarly, 54,872 ESAL were applied to R2, resulting in a decline in its structural number from 1.97 to 1.75.

To calculate the overlay requirements, the ESAL applied during stage one were compared to the total ESAL permitted by a corresponding stabilized section. The difference in ESAL defines the service requirements for the stage two overlay. For example, it can be seen in Table 4.28 that R1GTX permitted a total of 120,434 ESAL repetitions. At the end of stage one, R1 allowed 28,526 ESAL. The difference between these amounts is 91,908 ESAL. For the total ESAL permitted by R1 to equal that of R1GTX, the stage two overlay of R1 was designed to permit 91,908 additional ESAL. Using this procedure, the ESAL required of an overlay was calculated for both R1 and R2 with respect to the corresponding stabilized sections. The results are shown in Table 4.30.

Table 4.30 ESAL required during stage two to equal that of stabilized sections.

Road Section	Stabilized section under comparison			
	R1GTX	R1GG	R2GTX	R2GG
R1	91,908	44,826		
R2			199,220	97,797

With the stage two ESAL quantified, it was possible to calculate the total structural number required of each pavement section. The structural numbers in Table 4.31 represent the combined structural capacity of the old pavement section and the new overlay.

Table 4.31 Total SN required at beginning of stage two to equal performance of stabilized section.

Road Section	Stabilized section under comparison			
	R1GTX	R1GG	R2GTX	R2GG
R1	2.12	1.89	-	-
R2	-	-	2.40	2.14

To determine the portion of the total structural capacity that was required of the overlay, the effective SN value at the end of stage one in Table 4.29 was subtracted from the corresponding total SN value in Table 4.31.

Table 4.32 HMA SN required at beginning of stage two to equal performance of stabilized section.

Road Section	Stabilized section under comparison			
	R1GTX	R1GG	R2GTX	R2GG
R1	0.58	0.35	-	-
R2	-	-	0.65	0.39

In constructing the overlay, an HMA mix was used which had the same resilient modulus as the HMA mix in stage one. Based on the AASHTO structural coefficient associated with the resilient moduli, the HMA thicknesses required to provide the structural numbers in Table 4.32 were calculated. The required thicknesses of the HMA overlays are shown in Table 4.33.

Table 4.33 Total HMA thickness required at beginning of stage two to equal performance of stabilized section.

Road Section	Stabilized section under comparison			
	R1GTX in (mm)	R1GG in (mm)	R2GTX in (mm)	R2GG in (mm)
R1	1.75 (44.5)	1.06 (26.9)	-	-
R2	-	-	1.63 (41.4)	0.98 (24.9)

Having identified the HMA required for construction of the overlay, it was possible to evaluate construction and material expenses. The costs for subgrade and base course preparation for each road section were assumed to be identical, since each road was constructed to the same subgrade and base course specifications. Further, each road section was initially constructed with identical HMA layers. Therefore, cost differential is a function of the expense of the HMA overlays in R1 and R2, and the geosynthetics used in the stabilized sections.

The geosynthetic material and installation costs used in this study are based on those that a contractor typically pays. Table 4.34 reflects the contractor's unit costs for the geosynthetics, and the total cost to cover a road with a width of 24 ft (7.3 m) and a length of 1.0 mile (1.6 km).

Table 4.34 Material and installation costs of geosynthetics.

Geosynthetic	Unit Cost $\$/yd^2$ ($\$/m^2$)	Installation Cost $\$/yd^2$ ($\$/m^2$)	Geosynthetic Cost for Road Section[1] ($)
Geotextile A	0.55 (0.46)	0.10 (0.08)	9,117
Geotextile B	0.85 (0.71)	0.10 (0.08)	13,325
Geogrid	1.70 (1.42)	0.10 (0.08)	25,246

Note 1: Road assumed to be 24 ft (7.3 m) wide and 1.0 mile (1.6 km) long.

To determine the costs associated with HMA, it was assumed that HMA would be placed at a density of 150 lb/ft^3 (240 kg/m^3). It was also assumed that the installed cost of the

HMA was $30 per ton ($33 metric ton). Based on these amounts, the HMA costs for geosynthetic-stabilized sections and stage one of the non-stabilized sections is $68,429. The cost of the HMA overlays of R1 and R2 are shown in Table 4.35.

Table 4.35 Cost of HMA overlays required to equal performance of stabilized section.

Road Section	Stabilized section under comparison			
	R1GTX	R1GG	R2GTX	R2GG
R1	$41,579	$25,185	-	-
R2	-	-	$38,728	$23,284

It is important to note that the costs shown in Table 4.35 do not reflect upward rounding of overlay thickness or surface preparation costs such as milling and surface leveling. To complete the analysis in Case 1, the cost of the geosynthetic in Table 4.34 was subtracted from the cost of the overlays in Table 4.35, and the resulting sum is shown in Table 4.36. It should be noted that "A" or "B" has been added to the designation of the geotextile-stabilized sections to distinguish the costs associated with the use of Geotextiles A and B.

Table 4.36 Cost of providing non-stabilized section with same service life as geosynthetic-stabilized section.

Road Section	Stabilized section under comparison					
	R1GTXA	R1GTXB	R1GG	R2GTXA	R2GTXB	R2GG
R1	$32,462	$28,254	($61)	-	-	-
R2	-	-	-	$29,611	$25,403	($1,962)

It can be seen from Table 4.36 that in order for R1 to provide a service life equal to that of R1GTXA, it costs an additional $32,462 per mile of road. This cost reflects the difference between that of Geotextile A and the HMA overlay in stage two of road section R1. Similar cost differentials can be observed for the other geotextile sections. The higher cost of Geotextile B results in a smaller cost differential. However, it should be noted that a geotextile with physical properties comparable to Geotextile B may be required under some project conditions. Federal Highway Administration guidelines require physical properties that exceed those of Geotextile A if warranted by potential installation stresses (Holtz et al. 1995).

It can also be seen in Table 4.36 that use of the geogrid results in higher total costs compared to R1 and R2. To obtain the service life provided by the geogrid-stabilized road section, it was less expensive to use the two-stage construction of R1 and R2. It should be noted that, as previously discussed, the equivalent structural number used with the geogrid represented a best-case scenario.

4.12.2 Case 2 Cost Analysis

The analysis performed in Case 2 compared the cost benefits of geotextile- and geogrid-stabilized road sections using the eight-step procedure outlined in Case 1. To obtain the same service life from a geogrid stabilized road as provided by a geotextile-stabilized road, the geogrid-stabilized road requires a HMA overlay. Thus, road sections R1GG and R2GG were designed using two-stage construction. Stage two was designed such that the total number of ESAL applied to the geogrid-stabilized roads was equal to the allowable ESAL of the geotextile-stabilized roads.

Equation 4.9 was used to determine the effective structural number of R1GG and R2GG at the end of stage one. The values used in this computation are shown in Table 4.37.

Table 4.37 Values used in calculation of effective SN at end of stage one for R1GG and R2GG.

Road Section	Original Equivalent SN	N_P (ESAL)	$N_{1.5}$ (ESAL)	RL (percent)	CF	Effective SN at end of Stage 1
R1GG	1.87	40,477	76,420	47.0	0.885	1.65
R2GG	2.11	82,283	162,057	49.2	0.890	1.88

Table 4.28 shows that the allowable ESAL for R1GTX and R2GTX are 120,434 and 254,092, respectively. Table 4.37 shows that the total ESAL repetitions to date (N_P) on R1GG and R2GG are 40,477 and 82,283, respectively. Thus, the ESAL required during stage two of R1GG and R2GG are 79,957 and 171,809, respectively.

With this data, it was possible to complete steps four though seven of the cost-benefit analysis. Step seven indicated that the thicknesses of the stage two overlays for R1GG and R2GG were 1.27 and 1.18 in (32.3 and 30.0mm), respectively. Based on the typical cost of HMA previously presented, the overlays for R1GG and R2GG will cost $30,175 and $28,036, respectively. Added to this cost is the amount by which a geogrid will cost more than a geotextile at the beginning of stage one. A comparison of the combined overlay and geogrid costs to geotextile expenses results in the differences shown in Table 4.38. As with the Case 1, the costs shown in Table 4.35 do not reflect upward rounding of overlay thickness or surface preparation costs such as milling and surface leveling

Table 4.38 Cost of providing geogrid-stabilized section with same service life as geotextile-stabilized section.

Geogrid-Stabilized Section	Geotextile-Stabilized Section			
	R1GTXA	R1GTXB	R2GTXA	R2GTXB
R1GG	$46,304	$42,096	-	-
R2GG	-	-	$44,165	$39,957

Based on the data presented in Table 4.38, the cost to construct a geogrid-stabilized pavement section that will provide performance equivalent to that of a geotextile-stabilized road is significant. Based on the results obtained in the analysis of Cases 1 and

2, the use of a geogrid under field conditions modeled in this study is not cost-effective. The results also indicate that the use of a geotextile may result in substantial cost savings.

4.13 Summary

The analysis of laboratory and theoretical pavement section data indicates that the use of a geotextile can extend the service life of a flexible pavement constructed over a silty subgrade with a CBR of approximately 2 percent by a factor as high as 3.0. The amount of improvement appears to be dependent on the ratio of HMA thickness to base course thickness, as demonstrated in TS 16 and TS 16'. As the HMA becomes thicker, the significance of the geotextile in preserving the structural capacity of the base course is reduced and its potential may not be evident in short term evaluations. The analysis also indicates that without the use of a separator, a geogrid has no significant predictable impact on pavement section behavior.

The analyses of test sections constructed over subgrades with a CBR between 4 and 5 percent indicate that the use of a geotextile consistently increased the service life by a factor between approximately 2 and 3. The use of a geogrid under comparable conditions extended test section service life in one instance by 10 percent, and in another instance it had no effect.

The analyses of test sections constructed over subgrades with a CBR of 2 percent indicates that the use of a geotextile can increase the service life by a factor of as much as 3.2. The use of a geogrid appeared to have no beneficial effect.

Inspection of excavated test sections indicated that an interlayer with a thickness of at least 1.0 in- (25 mm-) formed at the base course-subgrade interface of both control and geogrid-stabilized sections. The density of fine soil particles in the interlayer was greater than that of the virgin aggregate and less than that of the subgrade soil, indicating the migration of silt particles from the subgrade into the aggregate. No interlayer was evident in geotextile-stabilized sections. This distinction between geotextile-stabilized sections and the control and geogrid-stabilized sections indicates that prevention of aggregate contamination with fine soil particles is the key to performance improvement. It also indicates that while the geogrid may reinforce the contaminated aggregate through a mechanism of lateral confinement, the magnitude of reinforcement is insignificant compared to the detrimental effect of contamination.

At first glance, the results of this study appear to contradict the findings of previous studies. However, upon closer examination, it is evident that no contradiction exists, and that these studies are complementary efforts toward understanding mechanisms of geosynthetic stabilization. Previous studies have concluded that the ability of a stiff biaxially-oriented geogrid to laterally confine aggregate at the base course-subgrade interface results in significant stabilization of road sections (Kennepohl et al. 1985; Carroll et al. 1987; Hass et al. 1988; Webster 1991b). These conclusions were based on tests in which subgrade and environmental conditions significantly limited the potential for contamination of base course aggregate with fine soil particles.

In research performed at the University of Waterloo (Kennepohl et al. 1985; Carroll et al. 1987; Hass et al. 1988), the subgrade soil was a uniform sand. Sand particles are not prone to migrate into the base course under the influence of dissipating pore water pressures as are cohesionless silt particles. It is also unlikely that contamination with sand particles would be as detrimental to the structural capacity of aggregate as contamination with silt. Thus, by eliminating the potential for contamination, the researchers isolated test variables to that of the reinforcement effect of a geogrid.

In research performed at the USACOE Waterways Experiment Station, Webster (1991b) included cohesive soil in his evaluation of geogrid performance. Bell et al. (1982) suggest that contamination of aggregate with cohesive clay particles results from the upward extrusion of a clay-water slurry developed at the base course-subgrade interface. The slurry is formed in the indentations made by compacted aggregate particles. Water in the indentations softens the clay soil and mixes under traffic loads. For this process to occur, excess water must flow to the subgrade surface as a result of natural precipitation or groundwater flow. The test conditions in Webster’s research did not provide for the presence of the excess water necessary for formation of a clay slurry. At most, the conditions permitted assessment of the effect of aggregate penetration into the subgrade surface. However, by eliminating the natural environmental factor of excess water, Webster isolated test variables to that of the reinforcement effect of a geogrid.

While an assessment of the reinforcement effect of a geogrid is important, field conditions are rarely so benign as to preclude the possibility of base course contamination. Thus, it is also important to assess the effect of geogrid reinforcement concurrently with the effect of contamination. Like Webster’s and the Waterloo studies, the tests performed at the Virginia Tech Price's Fork Geotechnical Research Center artificially limited the influence of environmental factors because the effect of natural precipitation or groundwater flow were not modeled. But because the subgrade consisted of cohesionless silt, excess water at the base course-subgrade interface was not necessary to induce migration of fines, and an evaluation of geogrid-stabilization of a contaminated base course was possible. This evaluation indicates that geogrid stabilization cannot significantly compensate for the loss of base course strength caused by contamination with subgrade fines.

Economic analyses of geotextile-stabilized flexible pavements indicate that these geosynthetics can be used to make transportation construction dollars go significantly further. They also indicate that the use of a geogrid is not cost-effective under conditions that do not prevent base course contamination. The use of geotextiles may require an additional $10,000 per mile of constructed road and therefore results in higher costs at the beginning of the project’s life-cycle. However, the geotextiles result in a significantly increased service life. In order to equal this service life, a non-stabilized version of the road will require at least $30,000 per mile in HMA overlays.

Chapter 5 - Conclusions

Based on the testing and analysis of geosynthetic-stabilized pavements constructed in this study, the following findings have been made.

1. The performance of flexible pavements constructed on silty subgrades with CBR values in excess of 4 percent were significantly enhanced using geotextiles. An increase of 200 to 300 percent in the service lives of these structures was demonstrated.

2. The service lives of flexible pavement sections constructed over weak to medium strength silty subgrades (i.e., CBR value of approximately 2 to 4.5 percent) were increased as much as 300 percent using geotextiles.

3. For pavement sections using an HMA with a layer coefficient of 0.33, and for which the structural number was between 1.5 and 2.3, the use of a geotextile effectively increased the structural number by approximately 0.2 to 0.4.

4. Geotextiles provided levels of improvement in the performance of theoretical pavement models comparable to the improvement they provided in laboratory models, when the models were identical in every respect except HMA resilient modulus. The theoretical HMA had a structural coefficient of 0.40, whereas the laboratory HMA had a structural coefficient of 0.33.

5. The loading of control and geogrid-stabilized pavement sections constructed over silty sand subgrades resulted in the development of an interlayer at the subgrade-base course interface. The silt-aggregate interlayer had a thickness of approximately 1.0 in (25mm) and was characterized by an increase in fine content compared to virgin aggregate.

6. The development of this type of silt-aggregate interlayer was prevented by the use of a geotextile separator.

7. Geogrids extended the life of one test section by approximately 10 percent, and had no effect upon the service lives of the two other sections which incorporated geogrids.

Based on this study, the following conclusions can be made.

1. The principal method by which geotextiles extend the service life of flexible pavements constructed over subgrades consisting of fine soil is by maintaining the thickness and structural capacity of the base course.

2. Geotextiles can significantly extend the service lives of flexible pavement sections constructed over subgrades composed of cohesionless fine soil with CBR

values less than 4.5 percent.

3. Geogrids do not significantly improve the performance of pavement sections constructed over subgrades composed of cohesionless fine soil with CBR values less than 5.7 percent.

4. If geogrids provide reinforcement of aggregate at the base course-subgrade, the benefit of such reinforcement is insignificant compared to the detrimental effect that contamination with fine soil particles has on the aggregate's resilient modulus.

5. Over the service life of a road, geotextile stabilization represents approximately a 60 percent reduction in life-cycle costs compared to pavement rehabilitation using HMA overlays.

6. Over the service life of a road, geogrid stabilization may represent a life-cycle cost increase compared to pavement rehabilitation using HMA overlays.

Chapter 6 - Recommendations

Thus far, laboratory studies at Virginia Tech's Price's Fork Research Facility have evaluated flexible pavement sections constructed with the following:

- a wearing course using HMA with a resilient modulus of 250,000 lb/in^2 (1.7 GPa) at a thickness of approximately 2.8 in (7.1 cm),
- a base course with a thickness of approximately 6 and 8 in (150 and 200mm), and
- a subgrade composed of silty sand with CBR values ranging from approximately 2 to 5 percent.

Theoretical pavement sections were also evaluated using an HMA mix with a resilient modulus of 370,000 lb/in^2 (2.6 GPa). Laboratory and theoretical sections were designed with and without geosynthetic stabilization. Geogrids evaluated in this study included stiff biaxial polypropylene products, and geotextiles included woven polypropylene products. The data collected in this study has provided considerable insight into the mechanics of stabilization under conditions representative of many low-volume secondary roads constructed in the state of Virginia.

Currently underway is the Bedford Road Test Project, a Virginia Tech research program in which the biaxial geogrid and Geotextile A are being evaluated under actual field conditions (Brandon et al. 1995; Al-Qadi et al. 1996). One of the differences between the conditions used in the laboratory study and those at the field site is the subgrade soil. Soil at the project site consists predominantly of fat and lean clays.

It should be possible to correlate results of the field study with those obtained from the laboratory study. However, the actual mechanism of contamination of base course aggregate with subgrade fine soil particles can be expected to differ. The presence of cohesive subgrade fines at the field site suggests that contamination will not occur as a result of dissipating pore water pressures. Rather, a mechanism of contamination similar to that described by Bell et al. (1982) is expected to dictate the condition of aggregate at the base course-subgrade interface. A slurry formed by softened clay and water is expected to form at the surface of the subgrade following periods of precipitation, and this slurry will be extruded upward into the base course under traffic loads. Upon completion of this field study and excavation of the project site, it is recommended that careful measurements of aggregate contamination be taken.

The geotextiles evaluated in laboratory at Virginia Tech and under current evaluation in the field consist of woven polypropylene. However, nonwoven geotextiles are used more frequently in road stabilization applications than woven geotextiles. For example, non-woven polypropylene fabrics constitute approximately 65 percent of geotextile stabilization market in the United States and more than 80 percent of the market in other countries. In view of the prevalent use of this material, non-woven geotextiles should be evaluated in future research efforts.

Finally, identification of specific mechanisms of contamination is an important topic for future studies. These mechanisms are thought to be a function of subgrade soil gradation and plasticity, excess water content, pore water pressures, and the original fine content of the aggregate base course. These factors appear to determine whether a biaxial geogrid will provide significant reinforcement. They may also determine the type of geotextile necessary to provide optimum separation. To better assess these factors, a laboratory test program is recommended. The program should be able to construct soil-aggregate models in unit cells or in triaxial specimens suitable for dynamic loading. The test equipment should enable researchers to measure pore water pressures and contamination levels in aggregate. The soils evaluated should include both plastic and non-plastic fine-grained material. The migration of fine soil particles under dissipating pore water pressure and extrusion of cohesive soil-water mixtures should be studied. Geotextiles used in the laboratory research should be evaluated for their ability to restrain soil movement without clogging.

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Appendix A - Resilient Modulus and Creep Compliance Data

Table A.1 Resilient modulus test results of laboratory SM-2AL HMA at 77° F (25° C). (Smith, T. E., 1994. *Laboratory Behavior of Geogrid and Geotextile Reinforced Flexible Pavement*, Thesis submitted in partial fulfillment for the degree of M.S.: Virginia Tech, Blacksburg, VA. Used under Fair Use, 1997).

Specimen	Resilient Modulus
	lb/in^2 (N/m^2)
A	239,902 (1.65x10^9)
B	252,563 (1.74 x10^9)
Average	246,232 (1.70 x10^9)

Table A.2 Resilient modulus test results of theoretical HMA. (Al-Qadi, I.L., Brandon, T.L., Bhutta, S. A., Appea, A. and Lacina, B. L., 1996. *Field Testing of Geosynthetically Stabilized Pavement Sections*, Draft, Second Progress Report Submitted to Amoco Fabrics and Fibers Company and The Virginia Center for Innovative Technology, Virginia Tech, Blacksburg, VA. Used under Fair Use, 1997).

Specimen	Resilient Modulus lb/in^2 (N/m^2)		
	104° F (40° C)	77° F (25° C)	41° F (5° C)
1-1	324,799 (2,24 x10^9)	376,160 (2.59x10^9)	424,663 (2.92 x10^9)
1-3	311,521 (2,15 x10^9)	382,808 (2.63 x10^9)	412,769 (2.85 x10^9)
2-3	317,127 (2,19 x10^9)	366,062 (2.52 x10^9)	403,817 (2.78 x10^9)
2-5	324,215 (2,24 x10^9)	365,118 (2.51 x10^9)	412,368 (2.84 x10^9)
3-2	324,210 ((2,24 x10^9)	374,276 (2.58 x10^9)	413,468 (2.85 x10^9)
3-8	322,981 (2,23 x10^9)	355,633 (2.45 x10^9)	424,705 (2.93 x10^9)
Average	320,809 (2,21 x10^9)	370,010 (2.55 x10^9)	415,298 (2.86 x10^9)

Table A.3 Creep compliance values used for analysis of HMA (Smith, T. E., 1994. *Laboratory Behavior of Geogrid and Geotextile Reinforced Flexible Pavement*, Thesis submitted in partial fulfillment for the degree of M.S.: Virginia Tech, Blacksburg, VA. Used under Fair Use, 1997).

Time (sec)	Creep Compliance in^2/lb (m^2/N)	
	Theoretical HMA	Laboratory HMA
0.001	$5.89\ x10^{-6}$ ($8.54x10^{-10}$)	$1.632\ x10^{-6}$ ($2.36x10^{-10}$)
0.003	$6.76\ x10^{-6}$ ($9.80x10^{-10}$)	$2.209x10^{-6}$ ($3.20x10^{-10}$)
0.01	$7.76\ x10^{-6}$ ($1.125x10^{-9}$)	$3.078x10^{-6}$ ($4.46x10^{-10}$)
0.03	$8.91\ x10^{-6}$ ($1.29x10^{-9}$)	$4.166x10^{-6}$ ($6.04x10^{-10}$)
0.1	$1.02\ x10^{-5}$ ($1.47x10^{-9}$)	$5.803x10^{-6}$ ($7.37x10^{-10}$)
0.3	$1.17\ x10^{-5}$ ($1.69x10^{-9}$)	$7.854x10^{-6}$ ($1.14x10^{-9}$)
1	$1.34\ x10^{-5}$ ($1.94x10^{-9}$)	$1.094x10^{-5}$ ($1.58x10^{-9}$)
3	$1.53\ x10^{-5}$ ($2.21x10^{-9}$)	$1.481x10^{-5}$ ($2.15x10^{-9}$)
10	$1.77\ x10^{-5}$ ($2.56x10^{-9}$)	$2.063x10^{-5}$ ($2.99x10^{-9}$)
30	$2.00\ x10^{-5}$ ($2.90x10^{-9}$)	$2.792x10^{-5}$ ($4.04x10^{-9}$)
100	$2.32\ x10^{-5}$ ($3.36x10^{-9}$)	$3.89x10^{-5}$ ($5.64x10^{-9}$)

Appendix B - Test Section Properties and Load-Displacement Data

Data Summary: Section 1
Subgrade CBR (%): 4
Type of Construction: Control

Avg. HMA Thickness (in): NM
Avg Base Course Thickness (in): NM

Test Section Construction Data

Lift No.	Soil Lift Properties				Elevation at Top of Compacted Lifts (in)					
	Before Compaction		After Compaction		Center	Right front	Right rear	Left front	Left rear	Avg.
	WC (%)	Thick (in)	WC (%)	γ_{Dry} (pcf)						
1	NM	8.00	NM	NM	NM	NM	NM	NM	NM	NM
2	NM	8.00	NM	NM	NM	NM	NM	NM	NM	NM
3	NM	8.00	NM	NM	NM	NM	NM	NM	NM	NM
4	NM	8.00	NM	NM	NM	NM	NM	NM	NM	NM
5	NM	8.00	NM	NM	NM	NM	NM	NM	NM	NM
6	NM	8.00	NM	NM	NM	NM	NM	NM	NM	NM
7	NM	8.00	NM	NM	NM	NM	NM	NM	NM	NM
8	NM	8.00	NM	NM	NM	NM	NM	NM	NM	NM
Agg	NM	7.00	NM	NM	NM	NM	NM	NM	NM	NM
HMA1	NM	2.50			NM	NM	NM	NM	NM	NM
HMA1	NM	0.40			NM	NM	NM	NM	NM	NM

Data as Tested	Data after Seating Displacement
No. Cycles to Failure:	No. Cycles to Failure:
Cumulative Displacement (in):	Cumulative Displacement (in):

Test Section Excavation Data

Distance from Pavement Edge (in)	Depth to HMA (in)	HMA Thick. (in)	Depth to Agg. (in)	Agg. Thick. (in)	Depth to Subgrade (in)
0.0	NM	NM	NM	NM	NM
6.0	NM	NM	NM	NM	NM
12.0	NM	NM	NM	NM	NM
18.0	NM	NM	NM	NM	NM
24.0	NM	NM	NM	NM	NM
30.0	NM	NM	NM	NM	NM
36.0	NM	NM	NM	NM	NM
42.0	NM	NM	NM	NM	NM
48.0	NM	NM	NM	NM	NM
54.0	NM	NM	NM	NM	NM
60.0	NM	NM	NM	NM	NM
66.0	NM	NM	NM	NM	NM
72.0	NM	NM	NM	NM	NM

NM- Not Measured

Data Summary: Section 2

Subgrade CBR (%): 4

Type of Construction: Control

Avg. HMA Thickness (in): NM

Avg Base Course Thickness (in): NM

Test Section Construction Data

Lift No.	Soil Lift Properties				Elevation at Top of Compacted Lifts (in)					
	Before Compaction		After Compaction		Center	Right front	Right rear	Left front	Left rear	Avg.
	WC (%)	Thick (in)	WC (%)	γ_{Dry} (pcf)						
1	NM	8.00	NM	NM	NM	NM	NM	NM	NM	NM
2	NM	8.00	NM	NM	NM	NM	NM	NM	NM	NM
3	NM	8.00	NM	NM	NM	NM	NM	NM	NM	NM
4	NM	8.00	NM	NM	NM	NM	NM	NM	NM	NM
5	NM	8.00	NM	NM	NM	NM	NM	NM	NM	NM
6	NM	8.00	NM	NM	NM	NM	NM	NM	NM	NM
7	NM	8.00	NM	NM	NM	NM	NM	NM	NM	NM
8	NM	8.00	NM	NM	NM	NM	NM	NM	NM	NM
Agg	NM	7.00	NM	NM	NM	NM	NM	NM	NM	NM
HMA1	NM	2.50			NM	NM	NM	NM	NM	NM
HMA1	NM	0.40			NM	NM	NM	NM	NM	NM

Data as Tested	Data after Seating Displacement
No. Cycles to Failure: 637	No. Cycles to Failure: NM
Cumulative Displacement (in): NM	Cumulative Displacement (in): 0.93

Test Section Excavation Data

Distance from Pavement Edge (in)	Depth to HMA (in)	HMA Thick. (in)	Depth to Agg. (in)	Agg. Thick. (in)	Depth to Subgrade (in)
0.0	NM	NM	NM	NM	NM
6.0	NM	NM	NM	NM	NM
12.0	NM	NM	NM	NM	NM
18.0	NM	NM	NM	NM	NM
24.0	NM	NM	NM	NM	NM
30.0	NM	NM	NM	NM	NM
36.0	NM	NM	NM	NM	NM
42.0	NM	NM	NM	NM	NM
48.0	NM	NM	NM	NM	NM
54.0	NM	NM	NM	NM	NM
60.0	NM	NM	NM	NM	NM
66.0	NM	NM	NM	NM	NM
72.0	NM	NM	NM	NM	NM

NM- Not Measured

Data Summary: Section 3

Subgrade CBR (%): 4.5	Avg. HMA Thick.: 2.80 in	Avg. Cyclic Press.: 76.9 psi
Type of Section: Geotextile	Avg. Agg. Thick.: 5.29 in	

Test Section Construction Data

Lift No.	Soil Lift Properties				Elevation at Top of Compacted Lifts (in)					
	Before Compaction		After Compaction		Center	Right Front	Right Rear	Left Front	Left Rear	Avg.
	WC (%)	Thick (in)	WC (%)	γ_{Dry} (pcf)						
1	12.90	8.00	12.80	117.40	6.48	6.80	5.50	6.70	5.40	6.18
2	12.00	8.00	11.90	118.30	13.00	11.80	12.10	12.00	11.90	12.16
3	12.55	8.00	12.68	118.42	19.00	18.16	17.74	18.12	18.12	18.23
4	12.31	8.00	12.28	118.46	25.36	24.88	25.06	25.08	24.98	25.07
5	12.53	8.00	12.46	117.62	30.76	29.68	30.70	29.76	30.02	30.18
6	13.12	8.00	13.24	119.33	36.04	36.16	36.10	36.24	36.24	36.16
7	12.73	8.00	12.65	118.50	41.20	41.44	41.38	41.28	41.54	41.37
8	12.30	8.00	12.20	121.20	46.60	46.24	46.06	46.08	46.10	46.22
Agg	6.35	7.00	141.10	6.40	52.24	51.76	51.82	52.20	51.86	51.98
HMA1										
HMA1		3.00	12.53	118.65	24.88	54.70	54.10	55.08	54.02	54.56

Data as Tested	Data after Seating Displacement
No. Cycles to Failure: 1600	No. Cycles to Failure: 1575
Cumulative Displacement (in): 1.07	Cumulative Displacement (in): 0.92

Test Section Excavation Data

Distance from Pavement Edge (in)	Depth to HMA (in)	HMA Thick. (in)	Depth to Agg. (in)	Agg. Thick. (in)	Depth to Subgrade (in)
0.0	0.00	2.88	2.88	5.50	8.38
6.0	0.00	2.88	2.88	5.50	8.38
12.0	0.00	2.88	2.88	5.38	8.25
18.0	0.00	2.88	2.88	5.38	8.25
24.0	0.13	2.63	2.75	5.50	8.25
30.0	1.06	2.63	3.69	5.13	8.81
33.0	1.00	2.75	3.75	5.13	8.88
36.0	1.00	2.75	3.75	5.13	8.88
39.0	1.00	2.75	3.75	5.13	8.88
42.0	0.94	2.63	3.56	5.13	8.69
48.0	0.19	2.63	2.81	5.00	7.81
54.0	0.00	2.63	2.63	5.00	7.63
60.0	0.00	2.88	2.88	5.13	8.00
66.0	0.00	2.88	2.88	5.25	8.13
72.0	0.00	2.88	2.88	5.25	8.13

Data Summary: Section 4

Subgrade CBR (%): 5.7	Avg. HMA Thick.: 3.14 in	Avg. Cyclic Press.: 76.20 psi
Type of Section: Geogrid	Avg. Agg. Thick.: 5.29 in	

Test Section Construction Data

Lift No.	Soil Lift Properties				Elevation at Top of Compacted Lifts (in)					
	Before Compaction		After Compaction		Center	Right Front	Right Rear	Left Front	Left Rear	Avg.
	WC (%)	Thick (in)	WC (%)	γ_{Dry} (pcf)						
1		8.00	12.45	117.76	6.96	6.84	6.84	6.24	6.60	6.70
2		8.00	12.37	119.82	12.00	12.48	11.64	12.24	12.00	12.07
3		8.00	12.38	119.03	17.88	17.52	17.04	18.24	18.48	17.83
4		8.00	12.26	117.64	23.88	22.92	23.04	24.60	24.36	23.76
5		8.00	12.41	119.45	30.72	29.52	30.12	30.48	30.00	30.17
6		8.00	12.47	115.27	35.52	33.84	33.60	35.28	35.50	34.75
7		8.00	12.50	116.90	42.06	41.16	40.98	42.00	42.41	41.72
8		8.00	12.11	119.77	48.60	48.48	48.36	48.72	49.32	48.70
Agg		7.00	5.40	148.57	54.48	53.76	54.00	54.24	54.72	54.24
HMA1										
HMA1		3.00	12.37	118.21	57.00	56.88	56.88	56.64	56.40	56.76

Data as Tested	Data after Seating Displacement
No. Cycles to Failure: 1500	No. Cycles to Failure: 1475
Cumulative Displacement (in): 1.27	Cumulative Displacement (in): 1.23

Test Section Excavation Data

Distance from Pavement Edge (in)	Depth to HMA (in)	HMA Thick. (in)	Depth to Agg. (in)	Agg. Thick. (in)	Depth to Subgrade (in)
0.0	0.00	3.00	3.00	5.31	8.31
6.0	0.00	3.03	3.03	5.31	8.34
12.0	0.00	3.06	3.06	5.31	8.38
18.0	0.00	2.97	2.97	5.34	8.31
24.0	0.13	2.88	3.00	5.38	8.38
30.0	1.06	2.88	3.94	5.06	9.00
33.0	1.00	2.81	3.81	5.19	9.00
36.0	0.94	2.75	3.69	5.31	9.00
39.0	0.88	2.88	3.75	5.34	9.09
42.0	0.81	3.00	3.81	5.38	9.19
48.0	0.19	3.13	3.31	5.25	8.56
54.0	0.00	3.25	3.25	5.25	8.50
60.0	0.00	3.38	3.38	5.25	8.63
66.0	0.00	3.38	3.38	5.25	8.63
72.0	0.00	3.38	3.38	5.25	8.63

Data Summary: Section 5

Subgrade CBR (%): 5.4	Avg. HMA Thick.: 3.13 in	Avg. Cyclic Press.: 59.72 psi
Type of Section: Control	Avg. Agg. Thick.: 4.51 in	

Test Section Construction Data

Lift No.	Soil Lift Properties				Elevation at Top of Compacted Lifts (in)					
	Before Compaction		After Compaction		Center	Right Front	Right Rear	Left Front	Left Rear	Avg.
	WC (%)	Thick (in)	WC (%)	γ_{Dry} (pcf)						
1	12.50	8.00	12.46	117.25	5.88	6.00	6.12	6.36	6.24	6.12
2	12.50	8.00	12.50	115.32	12.24	12.24	12.55	12.36	12.36	12.35
3	12.50	8.00	12.27	119.29	18.60	18.48	18.98	18.36	18.48	18.58
4	12.50	8.00	12.35	119.42	23.67	23.40	22.92	24.00	24.24	23.66
5	12.50	8.00	12.50	120.63	29.48	29.52	29.28	29.52	29.28	29.42
6	12.50	8.00	12.15	118.23	35.40	35.16	35.16	35.28	34.68	35.14
7	12.50	8.00	12.27	116.27	41.16	41.04	40.32	40.68	41.04	40.85
8	12.50	8.00	12.50	120.86	48.84	48.00	48.00	49.32	48.96	48.62
Agg	7.00	7.00	6.25	139.25	53.28	53.28	52.92	54.00	54.12	53.52
HMA1										
HMA1		3.25			56.04	56.04	55.92	56.04	56.04	56.02

Data as Tested	Data after Seating Displacement
No. Cycles to Failure: 1634	No. Cycles to Failure: 1609
Cumulative Displacement (in): 0.82	Cumulative Displacement (in): 0.73

Test Section Excavation Data

Distance from Pavement Edge (in)	Depth to HMA (in)	HMA Thick. (in)	Depth to Agg. (in)	Agg. Thick. (in)	Depth to Subgrade (in)
0.0	0.00	3.25	3.25	4.75	8.00
6.0	0.00	3.25	3.25	4.75	8.00
12.0	0.00	3.25	3.25	4.75	8.00
18.0	0.00	3.13	3.13	4.75	7.88
24.0	0.13	3.00	3.13	4.75	7.88
30.0	1.25	2.75	4.00	4.63	8.63
33.0	1.13	2.75	4.00	4.63	8.63
36.0	1.13	2.75	3.88	4.63	8.50
39.0	1.00	2.75	3.88	4.63	8.50
42.0	0.19	2.75	3.75	4.63	8.38
48.0	0.00	2.75	2.94	4.38	7.31
54.0	0.00	2.88	2.88	4.25	7.13
60.0	0.00	3.25	3.25	4.25	7.50
66.0	0.00	3.25	3.25	4.25	7.50
72.0	0.00	3.25	3.25	4.25	7.50

Data Summary: Section 6

Subgrade CBR (%): 4.4	Avg. HMA Thick.: 2.94 in	Avg. Cyclic Press.: 78.82 psi
Type of Section: Control	Avg. Agg. Thick.: 5.84 in	

Test Section Construction Data

Lift No.	Soil Lift Properties				Elevation at Top of Compacted Lifts (in)					
	Before Compaction		After Compaction		Center	Right Front	Right Rear	Left Front	Left Rear	Avg.
	WC (%)	Thick (in)	WC (%)	γ_{Dry} (pcf)						
1	12.40	8.00	12.90	116.30	NM	NM	NM	NM	NM	NM
2	12.40	8.00	12.80	115.20	NM	NM	NM	NM	NM	NM
3	12.40	8.00	12.60	117.60	NM	NM	NM	NM	NM	NM
4	12.40	8.00	12.80	114.80	NM	NM	NM	NM	NM	NM
5	12.30	8.00	12.15	118.43	NM	NM	NM	NM	NM	NM
6	12.50	8.00	13.00	114.43	NM	NM	NM	NM	NM	NM
7	12.70	8.00	12.59	117.85	NM	NM	NM	NM	NM	NM
8	12.50	8.00	13.06	116.29	NM	NM	NM	NM	NM	NM
Agg	6.70	7.00	6.50	137.56	NM	NM	NM	NM	NM	NM
HMA1					NM	NM	NM	NM	NM	NM
HMA1		3.00			NM	NM	NM	NM	NM	NM

Data as Tested	Data after Seating Displacement
No. Cycles to Failure: 822	No. Cycles to Failure: 800
Cumulative Displacement (in): 1.42	Cumulative Displacement (in): 1.09

Test Section Excavation Data

Distance from Pavement Edge (in)	Depth to HMA (in)	HMA Thick. (in)	Depth to Agg. (in)	Agg. Thick. (in)	Depth to Subgrade (in)
0.0	0.00	2.75	2.75	6.25	9.00
6.0	0.00	2.75	2.75	5.75	8.50
12.0	0.00	3.25	3.25	6.00	9.25
18.0	0.00	3.00	3.00	6.00	9.00
24.0	0.13	3.00	3.13	5.38	8.50
30.0	1.10	3.00	4.10	5.25	9.35
33.0	1.13	2.88	4.00	5.38	9.38
36.0	1.15	2.50	3.65	5.25	8.90
39.0	1.18	2.50	3.68	5.38	9.05
42.0	1.20	2.88	4.08	5.63	9.70
48.0	0.19	3.00	3.19	5.50	8.69
54.0	0.00	3,13	3.13	5.50	8.63
60.0	0.00	3.13	3.13	5.75	8.88
66.0	0.00	2.75	2.75	6.00	8.75
72.0	0.00	2.63	2.63	6.25	8.88

Data Summary: Section 7

Subgrade CBR (%): 4.2	Avg. HMA Thick.: 2.78 in	Avg. Cyclic Press.: 79.8 psi
Type of Section: Geotextile B	Avg. Agg. Thick.: 5.78 in	

Test Section Construction Data

Lift No.	Soil Lift Properties				Elevation at Top of Compacted Lifts (in)					
	Before Compaction		After Compaction		Center	Right Front	Right Rear	Left Front	Left Rear	Avg.
	WC (%)	Thick (in)	WC (%)	γ_{Dry} (pcf)						
1	12.7	8.00	12.8	118.66	5.88	5.76	5.82	5.70	5.64	5.76
2	12.3	8.00	13.0	117.50	11.76	11.52	11.64	11.40	11.28	11.52
3	12.4	8.00	12.58	118.78	18.00	18.24	18.24	17.88	17.64	18.00
4	12.6	8.00	12.88	118.77	23.76	23.88	24.12	24.84	24.60	24.24
5	12.5	8.00	12.69	114.82	29.28	29.04	29.04	29.76	29.76	29.38
6	12.5	8.00	12.79	116.80	35.52	35.16	35.40	35.40	35.40	35.38
7	12.7	8.00	12.69	116.84	41.88	40.92	40.68	42.72	41.38	41.62
8	12.7	8.00	12.62	118.16	47.88	47.40	47.28	47.88	47.40	47.57
Agg	6.6	7.00	8.13	141.66	NM	NM	NM	NM	NM	NM
HMA1										
HMA1		3.00			NM	NM	NM	NM	NM	NM

NM – Not Measured

Data as Tested	Data after Seating Displacement
No. Cycles to Failure: 1600	No. Cycles to Failure: 1575
Cumulative Displacement (in): 1.06	Cumulative Displacement (in): 0.83

Test Section Excavation Data

Distance from Pavement Edge (in)	Depth to HMA (in)	HMA Thick. (in)	Depth to Agg. (in)	Agg. Thick. (in)	Depth to Subgrade (in)
0.0	0.00	2.50	2.50	6.13	8.63
6.0	0.00	2.75	2.75	5.88	8.63
12.0	0.00	2.88	2.88	5.63	8.50
18.0	0.00	3.00	3.00	5.63	8.63
24.0	0.13	2.88	3.00	5.50	8.50
30.0	1.06	2.50	3.56	5.50	9.06
33.0	1.00	2.50	3.50	5.63	9.13
36.0	1.00	2.63	3.63	5.63	9.25
39.0	1.00	2.50	3.50	5.75	9.25
42.0	0.94	2.50	3.44	5.63	9.06
48.0	0.19	2.75	2.94	5.75	8.69
54.0	0.00	2.75	2.75	5.75	8.50
60.0	0.00	2.75	2.75	5.75	8.50
66.0	0.00	2.75	2.75	5.88	8.63
72.0	0.00	2.75	2.75	5.88	8.63

Data Summary: Section 8

Subgrade CBR (%): 4.8	Avg. HMA Thick.: 2.85 in	Avg. Cyclic Press.: psi
Type of Section: Control 8"	Avg. Agg. Thick.: 7.34 in	

Test Section Construction Data

Lift No.	Soil Lift Properties				Elevation at Top of Compacted Lifts (in)					
	Before Compaction		After Compaction		Center	Right Front	Right Rear	Left Front	Left Rear	Avg.
	WC (%)	Thick (in)	WC (%)	γ_{Dry} (pcf)						
1	12.6	8.00	12.9	115.3	6.24	5.76	6.12	5.76	6.12	6.00
2	12.5	8.00	12.5	117.4	12.24	11.88	11.76	11.88	11.76	11.90
3	12.5	8.00	12.8	114.9	17.04	16.68	18.84	17.64	18.48	17.70
4	12.6	8.00	12.5	116.9	23.72	22.68	24.48	23.40	24.30	23.72
5	12.5	8.00	12.2	117.2	29.52	28.68	30.12	29.16	30.12	29.52
6	12.4	8.00	12.7	116.0	36.36	35.76	35.16	36.36	36.60	36.05
7	12.5	8.00	12.9	117.3	42.84	42.12	42.84	42.60	42.60	42.60
8	12.4	8.00	12.3	117.4	48.24	47.64	48.36	47.76	48.24	48.05
Agg 1										
Agg 2	6.50	9.30	6.20	113.6	55.68	56.04	56.04	55.80	55.24	55.80
HMA1					58.08	58.20	58.08	58.32	58.08	58.15

Data as Tested	Data after Seating Displacement
No. Cycles to Failure: 30328	No. Cycles to Failure: 30213
Cumulative Displacement (in): 0.99	Cumulative Displacement (in): 0.84

Test Section Excavation Data

Distance from Pavement Edge (in)	Depth to HMA (in)	HMA Thick. (in)	Depth to Agg. (in)	Agg. Thick. (in)	Depth to Subgrade (in)
0.0	0.00	3.13	3.13	7.38	10.25
6.0	0.00	3.00	3.00	7.25	10.25
12.0	0.00	2.88	2.88	7.25	10.13
18.0	0.00	2.75	2.75	7.13	9.88
24.0	0.00	2.88	2.88	7.38	10.25
30.0	0.75	2.50	3.25	7.13	10.38
33.0	0.75	2.63	3.38	7.00	10.38
36.0	0.75	2.50	3.25	7.00	10.25
39.0	0.75	2.38	3.13	7.00	10.13
42.0	0.75	2.38	3.13	7/00	10.13
48.0	0.00	2.63	2.63	7.38	10.00
54.0	0.00	2.50	2.50	7.63	10.13
60.0	0.00	2.75	2.75	7.50	10.25
66.0	0.00	3.00	3.00	7.25	10.25
72.0	0.00	3.00	3.00	7.25	10.25

Data Summary: Section 9

Subgrade CBR (%): 5.4	Avg. HMA Thick.: 3.28 in	Avg. Cyclic Press.: psi
Type of Section: Control 8"	Avg. Agg. Thick.: 8.28 in	

Test Section Construction Data

Lift No.	Soil Lift Properties				Elevation at Top of Compacted Lifts (in)					
	Before Compaction		After Compaction		Center	Right Front	Right Rear	Left Front	Left Rear	Avg.
	WC (%)	Thick (in)	WC (%)	γ_{Dry} (pcf)						
1	12.4	8.00	13.2	117.30	6.12	5.16	6.12	5.16	5.88	5.70
2	12.6	8.00	12.4	117.80	11.52	10.32	12.24	110.80	12.12	11.40
3	12.8	8.00	12.8	115.90	18.24	17.76	18.72	17.64	18.72	18.20
4	12.3	8.00	12.1	116.60	24.00	23.64	24.00	23.76	23.52	23.80
5	12.2	8.00	12.5	116.70	30.24	30.60	31.08	30.00	30.12	30.40
6	12.4	8.00	12.4	115.80	36.00	35.04	36.84	34.68	36.84	35.88
7	12.6	8.00	12.3	118.00	41.67	40.56	42.00	41.16	41.88	41.50
8	12.3	8.00	12.5	118.40	48.60	48.60	48.36	48.12	48.24	48.40
Agg	6.2	4.67	7.30	137.20	52.44	52.08	53,28	52.32	53.16	52.66
HMA1	6.4	4.67	5.60	114.90	57.00	56.88	56.88	56.52	56.76	56.80
HMA1					59.88	59.88	59.40	59.76	58.92	59.60

Data as Tested	Data after Seating Displacement
No. Cycles to Failure: 6519	No. Cycles to Failure: 6494
Cumulative Displacement (in): 1.07	Cumulative Displacement (in): 0.87

Test Section Excavation Data

Distance from Pavement Edge (in)	Depth to HMA (in)	HMA Thick. (in)	Depth to Agg. (in)	Agg. Thick. (in)	Depth to Subgrade (in)
0.0	0.00	3.00	3.00	7.75	10.75
6.0	0.00	3.00	3.00	7.75	10.75
12.0	0.00	3.00	3.00	8.00	11.00
18.0	0.00	2.88	2.88	8.25	11.13
24.0	0.25	3.00	3.25	8.25	11..50
30.0	1.00	3.00	4.00	8.00	12.00
33.0	1.00	3.00	4.00	8.13	12.13
36.0	1.00	3.00	4.00	8.13	12.13
39.0	1.00	3.13	4.13	8.00	12.13
42.0	1.00	3.00	4.00	8.13	12.13
48.0	0.13	3.00	3.13	8.75	11.88
54.0	0.00	3.63	3.63	8.38	12.00
60.0	0.00	3.75	3.75	8.25	12.00
66.0	0.00	4.00	4.00	8.38	12.38
72.0	0.00	3.50	3.50	9.00	12.50

Data Summary: Section 10

Subgrade CBR (%): 4.3	Avg. HMA Thick.: 2.80 in	Avg. Cyclic Press.: 79.8 psi
Type of Section: Control 6"	Avg. Agg. Thick.: 5.54 in	

Test Section Construction Data

Lift No.	Soil Lift Properties				Elevation at Top of Compacted Lifts (in)					
	Before Compaction		After Compaction		Center	Right Front	Right Rear	Left Front	Left Rear	Avg.
	WC (%)	Thick (in)	WC (%)	γ_{Dry} (pcf)						
1	12.7	8.00	12.2	116.00	6.72	5.88	5.88	5.88	5.88	6.00
2	12.9	8.00	12.8	116.70	11.40	10.56	11.88	10.80	12.48	11.40
3	12.2	8.00	12.3	116.60	17.40	17.64	18.48	17.28	18.48	17.90
4	12.7	8.00	13.3	115.80	23.28	23.88	22.68	23.40	23.40	23.30
5	12.8	8.00	13.0	116.60	30.24	30.60	28.44	30.36	27.96	29.50
6	12.6	8.00	12.3	115.70	36.00	36.24	36.36	36.24	35.64	36.10
7	12.7	8.00	13.0	115.20	42.84	42.24	41.88	42.96	42.12	42.40
8	12.7	8.00	12.8	115,20	48.00	47.88	48.96	48.60	48.72	48.40
Agg	6.3	7.00	6.00	131.60	53.76	53.04	54.72	53.76	54.36	53.90
HMA1										
HMA1		3.00			56.04	56.28	56.76	56.52	56.04	56.30

Data as Tested	Data after Seating Displacement
No. Cycles to Failure: 959	No. Cycles to Failure: 934
Cumulative Displacement (in): 1.06	Cumulative Displacement (in): 0.95

Test Section Excavation Data

Distance from Pavement Edge (in)	Depth to HMA (in)	HMA Thick. (in)	Depth to Agg. (in)	Agg. Thick. (in)	Depth to Subgrade (in)
0.0	0.00	2.75	2.75	5.25	8.00
6.0	0.00	2.75	2.75	5.25	8.00
12.0	0.00	2.75	2.75	5.25	8.00
18.0	0.00	2.75	2.75	5.25	8.00
24.0	0.13	2.63	2.75	5.38	8.13
30.0	1.63	2.38	4.00	5.38	9.38
33.0	1.50	2.33	3.83	5.43	9.25
36.0	1.50	2.25	3.75	5.50	9.25
39.0	1.38	2.50	3.88	5.38	9.25
42.0	1.38	2.38	3.75	5.38	9.13
48.0	0.25	2.63	2.88	5.75	8.63
54.0	0.00	2.75	2.75	5.88	8.63
60.0	0.00	3.00	3.00	5.75	8.75
66.0	0.00	3.00	3.00	5.88	8.88
72.0	0.00	3.00	3.00	5.75	8.75

Data Summary: Section 11

Subgrade CBR (%): 4.4	Avg. HMA Thick.: 2.86 in	Avg. Cyclic Press.: psi
Type of Section: Geotextile A	Avg. Agg. Thick.: 5.94 in	

Test Section Construction Data

Lift No.	Soil Lift Properties				Elevation at Top of Compacted Lifts (in)					
	Before Compaction		After Compaction		Center	Right Front	Right Rear	Left Front	Left Rear	Avg.
	WC (%)	Thick (in)	WC (%)	γ_{Dry} (pcf)						
1	12.9	8.00	12.4	115.80	5.40	5.28	6.00	5.40	6.00	5.62
2	12.5	8.00	12.3	116.50	11.76	11.28	12.48	10.80	12.60	11.78
3	12.9	8.00	12.1	115.50	17.04	17.64	18.00	17.04	18.24	17.59
4	12.7	8.00	12.1	115.40	24.72	23.88	23.64	24.48	24.12	24.17
5	12.9	8.00	12.0	116.40	30.96	30.00	30.12	30.48	30.12	30.34
6	12.4	8.00	12.4	115.70	37.44	36.96	36.12	36.60	35.88	36.60
7	12.3	8.00	12.5	116.40	41.64	42.36	42.24	42.24	42.24	42.14
8	12.6	8.00	12.0	116.40	48.60	48.24	48.00	48.24	48.36	48.29
Agg	6.6	7.00	6.80	143.30	54.48	54.12	53.28	53.76	53.52	53.83
HMA1										
HMA1		3.00			57.00	56.28	55.80	56.28	55.92	56.26

Data as Tested	Data after Seating Displacement
No. Cycles to Failure: 2451	No. Cycles to Failure: 2426
Cumulative Displacement (in): 1.02	Cumulative Displacement (in): 0.76

Test Section Excavation Data

Distance from Pavement Edge (in)	Depth to HMA (in)	HMA Thick. (in)	Depth to Agg. (in)	Agg. Thick. (in)	Depth to Subgrade (in)
0.0	0.00	3.00	3.00	5.75	8.75
6.0	0.00	3.00	3.00	5.75	8.75
12.0	0.00	3.00	3.00	5.75	8.75
18.0	0.00	2.75	2.75	6.13	8.88
24.0	0.13	2.75	2.88	6.25	9.13
30.0	0.88	2.50	3.38	6.00	9.38
33.0	0.75	2.50	3.25	6.25	9.50
36.0	0.75	2.50	3.25	6.25	9.50
39.0	0.75	2.50	3.25	6.25	9.50
42.0	0.63	2.50	3.13	6.25	9.38
48.0	0.13	2.63	2.75	6.25	9.00
54.0	0.00	2.75	2.75	6.13	8.88
60.0	0.00	3.00	3.00	5.75	8.75
66.0	0.00	2.75	2.75	5.88	8.63
72.0	0.00	3.00	3.00	5.75	8.75

Data Summary: Section 12

Subgrade CBR (%): 4.6	Avg. HMA Thick.: 3.08 in	Avg. Cyclic Press.: psi
Type of Section: Geogrid 6"	Avg. Agg. Thick.: 5.58 in	

Test Section Construction Data

Lift No.	Soil Lift Properties				Elevation at Top of Compacted Lifts (in)					
	Before Compaction		After Compaction		Center	Right Front	Right Rear	Left Front	Left Rear	Avg.
	WC (%)	Thick (in)	WC (%)	γ_{Dry} (pcf)						
1	13.00	8.00	12.2	115.20	4.44	3.72	4.92	4.32	3.48	4.18
2	12.40	8.00	12.4	116.50	11.64	11.52	11.64	11.16	11.52	11.50
3	12.80	8.00	12.2	116.50	17.40	17.40	17.40	17.88	17.40	17.50
4	12.80	8.00	12.1	115.20	23.52	23.28	23.88	23.16	23.52	23.47
5	12.50	8.00	12.4	116.70	30.00	29.64	29.64	29.64	30.00	29.78
6	13.10	8.00	12.4	116.50	36.24	36.12	36.24	36.72	36.12	36.29
7	12.30	8.00	12.1	116.60	42.96	42.72	42.60	43.08	41.88	42.65
8	12.60	8.00	12.4	116.20	NM	NM	NM	NM	NM	NM
Agg	6.40	7.00	6.4	135.00	55.32	55.08	54.12	55.32	53.88	54.74
HMA1										
HMA1					57.72	57.60	57.36	57,72	57.12	57.50

Data as Tested	Data after Seating Displacement
No. Cycles to Failure: 1475	No. Cycles to Failure: 1450
Cumulative Displacement (in): 1.16	Cumulative Displacement (in): 0.98

Test Section Excavation Data

Distance from Pavement Edge (in)	Depth to HMA (in)	HMA Thick. (in)	Depth to Agg. (in)	Agg. Thick. (in)	Depth to Subgrade (in)
0.0	0.00	4.00	4.00	5.25	9.25
6.0	0.00	4.00	4.00	5.00	9.00
12.0	0.00	3.50	3.50	5.38	8.88
18.0	0.00	3.13	3.13	5.63	8.75
24.0	0.25	3.25	3.50	5.38	8.88
30.0	1.25	2.63	3.88	5.38	9.25
33.0	1.25	2.63	3.88	5.63	9.50
36.0	1.13	2.50	3.63	5.88	9.50
39.0	1.00	2.50	3.50	5.88	9.38
42.0	0.88	2.50	3.38	5.88	9.25
48.0	0.25	2.88	3.13	5.88	9.00
54.0	0.00	2.75	2.75	6.13	8.88
60.0	0.00	2.88	2.88	5.88	8.75
66.0	0.00	3.13	3.13	5.63	8.75
72.0	0.00	3.13	3.13	5.63	8.75

Data Summary: Section 13

Subgrade CBR (%): 4.2	Avg. HMA Thick.: 2.40 in	Avg. Cyclic Press.: psi
Type of Section: Control 8"	Avg. Agg. Thick.: 7.68 in	

Test Section Construction Data

Lift No.	Soil Lift Properties				Elevation at Top of Compacted Lifts (in)					
	Before Compaction		After Compaction		Center	Right Front	Right Rear	Left Front	Left Rear	Avg.
	WC (%)	Thick (in)	WC (%)	γ_{Dry} (pcf)						
1	12.4	8.00	12.5	116.8	7.44	7.56	7.80	7.32	7.92	7.61
2	13.0	8.00	12.5	116.6	13.08	12.36	12.60	13.20	13.08	12.86
3	12.9	8.00	12.8	116.0	18.84	20.64	17.52	19.20	17.76	18.79
4	12.6	8.00	12.8	115.3	24.00	24.72	23.16	23.88	23.76	23.90
5	12.9	8.00	13.0	115.5	30.60	30.60	30.12	29.88	30.72	30.38
6	12.6	8.00	13.0	115.4	35.40	35.40	35.52	34.92	35.88	35.42
7	12.8	8.00	13.0	115.8	41.76	41.88	41.76	42.00	41.52	41.78
8	12.8	8.00	12.6	116.4	48.24	48.36	47.64	47.64	47.40	47.86
Agg	7.0	4.60	6.6	132.9	51.72	51.72	51.60	51.60	51.36	51.60
HMA1	6.8	4.60	6.4	131.4	56.04	56.88	55.92	56.52	56.16	56.30
HMA1					58.44	57.96	55.08	58.44	58.20	58.22

Data as Tested	Data after Seating Displacement
No. Cycles to Failure: 1050	No. Cycles to Failure: 1025
Cumulative Displacement (in): 1.09	Cumulative Displacement (in): 0.76

Test Section Excavation Data

Distance from Pavement Edge (in)	Depth to HMA (in)	HMA Thick. (in)	Depth to Agg. (in)	Agg. Thick. (in)	Depth to Subgrade (in)
0.0	0.00	2.50	2.50	8.13	10.63
6.0	0.00	2.50	2.50	8.00	10.50
12.0	0.00	2.50	2.50	8.25	10.75
18.0	0.13	2.25	2.38	7.75	10.13
24.0	0.25	2.25	2.50	7.88	10.38
30.0	1.13	2.50	2.63	7.13	10.75
33.0	1.06	2.69	3.75	7.00	10.75
36.0	1.00	2.50	3.50	7.25	10.75
39.0	0.88	2.63	3.50	7.00	10.50
42.0	0.81	2.69	3.50	6.81	10.31
48.0	0.19	2.56	2.75	7.19	9.94
54.0	0.13	2.25	2.38	7.25	9.63
60.0	0.00	2.50	2.50	7.13	9.63
66.0	0.00	2.31	2.31	7.63	9.94
72.0	0.00	2.38	2.38	7.63	10.00

Data Summary: Section 14

Subgrade CBR (%): 4.5	Avg. HMA Thick.: 3.09 in	Avg. Cyclic Press.: psi
Type of Section: Geotextile A	Avg. Agg. Thick.: 8.74 in	

Test Section Construction Data

Lift No.	Soil Lift Properties				Elevation at Top of Compacted Lifts (in)					
	Before Compaction		After Compaction		Center	Right Front	Right Rear	Left Front	Left Rear	Avg.
	WC (%)	Thick (in)	WC (%)	γ_{Dry} (pcf)						
1	12.4	8.00	12.2	115.90	6.48	6.12	6.00	5.88	5.88	6.07
2	12.6	8.00	12.6	116.50	14.16	13.08	13.08	13.80	13.32	13.49
3	12.6	8.00	12.6	116.10	19.80	18.84	19.32	18.96	19.56	19.30
4	12.9	8.00	12.6	115.70	24.48	24.48	24.12	24.12	24.24	24.29
5	12.7	8.00	12.3	116.70	31.56	30.96	31.92	31.32	31.56	31.46
6	12.7	8.00	12.4	116.50	36.24	36.24	35.76	36.24	35.76	36.05
7	12.8	8.00	12.7	116.50	42.12	41.64	41.64	42.12	42.84	42.07
8	13.0	8.00	13.1	114.10	47.04	47.52	48.00	47.04	47.76	47.47
Agg 1	6.9	4.6			52.08	51.48	51.12	51.60	51.12	51.48
Agg 2	6.9	4.6			56.64	55.68	55.80	56.16	55.56	55.97
HMA1					59.64	55.68	58.68	58.56	58.80	58.87

Data as Tested	Data after Seating Displacement
No. Cycles to Failure: 6625	No. Cycles to Failure: 6600
Cumulative Displacement (in): 1.00	Cumulative Displacement (in): 0.78

Test Section Excavation Data

Distance from Pavement Edge (in)	Depth to HMA (in)	HMA Thick. (in)	Depth to Agg. (in)	Agg. Thick. (in)	Depth to Subgrade (in)
0.0	0.00	3.50	3.50	8.25	11.75
6.0	0.00	3.13	3.13	8.63	11.75
12.0	0.00	2.75	2.75	9.13	11.88
18.0	0.00	2.75	2.75	9.13	11.88
24.0	0.25	2.75	3.00	8.88	11.88
30.0	0.90	2.85	3.75	8.75	12.50
33.0	0.88	2.75	3.63	8.88	12.50
36.0	0.75	2.88	3.63	8.78	12.40
39.0	0.70	2.70	3.40	8.85	12.25
42.0	0.60	2.90	3.50	8.63	12.13
48.0	0.13	3.00	3.13	8.88	12.00
54.0	0.13	3.00	3.13	8.88	12.00
60.0	0.00	3.00	3.00	9.00	12.00
66.0	0.00	3.38	3.38	8.43	11.80
72.0	0.00	3.63	3.63	8.25	11.88

Data Summary: Section 15

Subgrade CBR (%): 2	Avg. HMA Thick.: 2.92 in	Avg. Cyclic Press.: psi
Type of Section: Control	Avg. Agg. Thick.: 5.16 in	

Test Section Construction Data

Lift No.	Soil Lift Properties				Elevation at Top of Compacted Lifts (in)					
	Before Compaction		After Compaction		Center	Right Front	Right Rear	Left Front	Left Rear	Avg.
	WC (%)	Thick (in)	WC (%)	γ_{Dry} (pcf)						
1	14.03	8.00	13.77	112.49	5.40	4.92	4.92	5.16	5.76	5.23
2	14.62	8.00	14.83	112.20	11.16	11.04	11.76	11.40	11.88	11.45
3	14.81	8.00	14.94	109.61	17.04	16.44	16.08	16.20	16.68	16.49
4	14.36	8.00	14.61	114.47	23.04	21.60	23.64	21.00	24.12	22.68
5	14.55	8.00	14..83	109.99	30.36	30.60	30.48	29.76	30.60	30.36
6	13.91	8.00	14.40	113.60	36.84	35.88	35.88	35.52	36.36	36.10
7	13.99	8.00	13.78	113.14	41.88	40.20	41.76	40.56	41.76	41.23
8	13.55	8.00	13.78	111.45	47.40	47.16	47.52	47.16	47.76	47.40
Agg	7.03	7.00	6.37	142.05	52.44	52.32	52.74	54.12	53.04	52.93
HMA1										
HMA1					55.44	54.60	54.84	55.75	54.36	55.00

Data as Tested	Data after Seating Displacement
No. Cycles to Failure: 375	No. Cycles to Failure: 350
Cumulative Displacement (in): 1.54	Cumulative Displacement (in): 1.06

Test Section Excavation Data

Distance from Pavement Edge (in)	Depth to HMA (in)	HMA Thick. (in)	Depth to Agg. (in)	Agg. Thick. (in)	Depth to Subgrade (in)
0.0	0.00	2.75	2.75	5.13	7.88
6.0	0.00	2.75	2.75	5.13	7.88
12.0	0.00	2.63	2.63	5.25	7.88
18.0	0.00	2.75	2.75	5.00	7.75
24.0	0.31	3.06	3.38	5.13	8.50
30.0	1.25	3.25	4.50	4.50	9.00
33.0	1.25	2.88	4.13	5.00	9.13
36.0	1.06	3.19	4.25	4.88	9.13
39.0	1.00	2.88	3.88	5.38	9.25
42.0	0.88	3.00	3.88	5.25	9.13
48.0	0.13	3.00	3.13	5.13	8.25
54.0	0.00	3.00	3.00	5.38	8.38
60.0	0.00	3.13	3.13	5.00	8.13
66.0	0.00	3.13	3.13	5.13	8.25
72.0	0.00	3.00	3.00	5.38	8.38

Data Summary: Section 16

Subgrade CBR (%): 2.2	Avg. HMA Thick.: 3.66 in	Avg. Cyclic Press.: psi
Type of Section: Geotextile A	Avg. Agg. Thick.: 4.79 in	

Test Section Construction Data

Lift No.	Soil Lift Properties				Elevation at Top of Compacted Lifts (in)					
	Before Compaction		After Compaction		Center	Right Front	Right Rear	Left Front	Left Rear	Avg.
	WC (%)	Thick (in)	WC (%)	γ_{Dry} (pcf)						
1	13.81	8.00	13.77	107.14	5.76	4.56	6.00	5.40	5.88	5.52
2	13.50	8.00	13.78	112.31	12.00	12.36	12.60	10.80	11.40	11.83
3	13.93	8.00	13.85	111.50	17.28	16.44	17.76	17.16	16.68	17.06
4	13.89	8.00	14.05	110.05	24.24	23.28	25.20	23.28	24.96	24.19
5	14.45	8.00	14.68	107.40	29.16	28.08	29.64	28.68	29.64	29.04
6	14.52	8.00	14.53	106.77	34.68	33.96	34.44	34.32	34.08	34.30
7	13.25	8.00	13.75	116.33	39.84	39.84	40.80	39.84	40.92	40.25
8	13.98	8.00	13.64	115.55	47.28	46.32	47.64	46.44	47.64	47.06
Agg	6.92	7.00	6.92	129.72	51.36	51.60	51.48	51.84	51.36	51.53
HMA1										
HMA1					55.08	54.96	54.24	55.56	53.88	54.74

Data as Tested	Data after Seating Displacement
No. Cycles to Failure: 775	No. Cycles to Failure: 750
Cumulative Displacement (in): 1.48	Cumulative Displacement (in): 1.13

Test Section Excavation Data

Distance from Pavement Edge (in)	Depth to HMA (in)	HMA Thick. (in)	Depth to Agg. (in)	Agg. Thick. (in)	Depth to Subgrade (in)
0.0	0.00	3.38	3.38	5.38	8.75
6.0	0.00	3.50	3.50	5.00	8.50
12.0	0.00	3.50	3.50	4.75	8.25
18.0	0.00	3.63	3.63	4.63	8.25
24.0	0.50	3.75	4.25	4.75	9.00
30.0	1.50	3.25	4.75	4.38	9.13
33.0	1.50	3.50	5.00	4.25	9.25
36.0	1.38	3.25	4.63	4.63	9.25
39.0	1.25	3.50	4.75	4.25	9.00
42.0	1.25	3.50	4.75	4.25	9.00
48.0	0.38	3.50	3.88	4.38	8.25
54.0	0.00	3.75	3.75	4.75	8.50
60.0	0.00	3.38	3.38	4.63	8.00
66.0	0.00	3.50	3.50	4.75	8.25
72.0	0.00	3.88	3.88	4.88	8.75

Data Summary: Section 17

Subgrade CBR (%): 2.2	Avg. HMA Thick.: 2.89 in	Avg. Cyclic Press.: psi
Type of Section: Geotextile A	Avg. Agg. Thick.: 4.26 in	

Test Section Construction Data

Lift No.	Soil Lift Properties				Elevation at Top of Compacted Lifts (in)					
	Before Compaction		After Compaction		Center	Right Front	Right Rear	Left Front	Left Rear	Avg.
	WC (%)	Thick (in)	WC (%)	γ_{Dry} (pcf)						
1	13.79	8.00	13.56	107.72	6.36	5.76	6.24	6.24	6.36	6.19
2	14.19	8.00	13.61	110.89	12.24	11.40	12.24	11.52	12.24	11.93
3	13.94	8.00	14.06	112.77	17.28	17.28	18.36	17.40	18.24	17.71
4	14.93	8.00	15.03	118.38	23.04	23.52	23.16	23.64	23.40	23.35
5	14.07	8.00	14.13	113.53	29.40	28.68	28.92	28.68	29.76	29.09
6	14.21	8.00	14.38	112.91	35.28	34.20	34.68	35.40	34.80	34.87
7	14.27	8.00	14.26	110.81	41.28	41.04	41.40	41.16	41.16	41.21
8	13.91	8.00	13.81	113.28	47.52	47.80	47.88	47.40	47.40	47.60
Agg	6.95	7.00	5.92	135.76	52.32	52.32	52.68	52.08	53.04	52.49
HMA1										
HMA1					55.08	55.68	55.08	56.04	55.44	55.46

Data as Tested	Data after Seating Displacement
No. Cycles to Failure: 625	No. Cycles to Failure: 600
Cumulative Displacement (in): 1.37	Cumulative Displacement (in): 1.05

Test Section Excavation Data

Distance from Pavement Edge (in)	Depth to HMA (in)	HMA Thick. (in)	Depth to Agg. (in)	Agg. Thick. (in)	Depth to Subgrade (in)
0.0	0.00	3.00	3.00	4.00	7.00
6.0	0.00	2.75	2.75	4.00	6.75
12.0	0.00	2.50	2.50	4.00	6.50
18.0	0.00	2.75	2.75	4.00	6.75
24.0	0.25	3.00	3.25	4.00	7.25
30.0	1.25	3.00	4.25	4.00	8.25
33.0	1.25	3.00	4.25	4.00	8.25
36.0	1.25	2.75	4.00	4.25	8.25
39.0	1.13	2.75	3.88	4.25	8.13
42.0	1.00	2.88	3.88	3.75	7.63
48.0	0.25	3.00	3.25	4.00	7.25
54.0	0.00	3.00	3.00	4.25	7.25
60.0	0.00	2.75	2.75	4.38	7.13
66.0	0.00	2.75	2.75	5.00	7.75
72.0	0.00	2.88	2.88	5.00	7.88

Data Summary: Section 18

Subgrade CBR (%): 2.0	Avg. HMA Thick.: 2.98 in	Avg. Cyclic Press.: psi
Type of Section: Geogrid	Avg. Agg. Thick.: 6.11 in	

Test Section Construction Data

Lift No.	Soil Lift Properties				Elevation at Top of Compacted Lifts (in)					
	Before Compaction		After Compaction		Center	Right Front	Right Rear	Left Front	Left Rear	Avg.
	WC (%)	Thick (in)	WC (%)	γ_{Dry} (pcf)						
1	14.18	8.00	14.10	115.07	6.84	6.48	6.60	5.76	6.84	6.50
2	14.52	8.00	14.84	115..49	12.48	10.44	12.36	11.40	12.72	11.88
3	14.17	8.00	14.05	116.46	17.76	15.96	17.40	16.44	17.28	16.97
4	13.90	8.00	14.12	113.73	23.52	24.00	23.64	23.76	24.12	23.81
5	13.90	8.00	14.43	109.54	28.56	29.04	28.80	27.52	28.44	28.51
6	14.48	8.00	14.12	109.46	34.80	34.32	34.80	34.42	35.52	34.77
7	14.23	8.00	14.27	111.58	42.00	40.80	41.76	40.68	41.52	41.35
8	13.51	8.00	14.23	119.18	47.16	46.80	47.52	46.88	47.76	47.18
Agg	6.09	7.00	5.47	138.95	53.76	54.84	53.26	54.00	52.44	53.64
HMA1										
HMA1		3.13			56.40	56.64	55.44	56.52	54.84	56.40

Data as Tested	Data after Seating Displacement
No. Cycles to Failure: 361	No. Cycles to Failure: 336
Cumulative Displacement (in): 1.48	Cumulative Displacement (in): 1.07

Test Section Excavation Data

Distance from Pavement Edge (in)	Depth to HMA (in)	HMA Thick. (in)	Depth to Agg. (in)	Agg. Thick. (in)	Depth to Subgrade (in)
0.0	0.00	3.38	3.38	5.63	9.00
6.0	0.00	3.13	3.13	6.38	9.50
12.0	0.00	3.13	3.13	6.63	9.75
18.0	0.00	2.88	2.88	6.25	9.13
24.0	0.38	3.13	3.50	6.00	9.50
30.0	1.50	2.75	4.25	6.00	10.25
33.0	1.38	3.13	4.50	5.88	10.38
36.0	1.25	2.75	4.00	6.25	10.25
39.0	1.13	3.00	4.13	5.88	10.00
42.0	1.13	2.63	3.75	5.88	9.63
48.0	0.25	2.63	2.88	6.00	8.88
54.0	0.00	2.63	2.63	6.00	8.63
60.0	0.00	2.63	2.63	5.88	8.50
66.0	0.00	2.75	2.75	6.25	9.00
72.0	0.00	2.88	2.88	6.13	9.00

Appendix C - *Kenlayer* Computer Analysis Output

NUMBER OF PROBLEMS TO BE SOLVED = 6

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* SECTION 3 PLATE LOAD HMA MR=250 KSI *

MATL = 3 FOR VISCOELASTIC LAYERED SYSTEM

NDAMA=1, SO DAMAGE ANALYSIS WILL BE PERFORMED

NUMBER OF PERIODS PER YEAR (NPY) = 1

NUMBER OF LOAD GROUPS (NLG) = 1

TOLERANCE FOR INTEGRATION (DEL) = .00100

NUMBER OF LAYERS (NL) = 3

NUMBER OF Z COORDINATES (NZ) = 0

LIMIT OF INTEGRATION CYCLES (ICL) = 80

COMPUTING CODE (NSTD) = 9

THICKNESS OF LAYERS (TH) ARE: 2.80000 5.29000

POISSON'S RATIOS OF LAYERS (PR) ARE: .35000 .30000 .30000

CONDITIONS OF INTERFACES (INT) ARE: 0 0

FOR PERIOD NO. 1 ELASTIC MODULI OF LAYERS ARE: .250000E+06 .250600E+05 .675000E+04

LOAD GROUP NO. 1 HAS 1 CONTACT AREAS
CONTACT RADIUS (CR) = 6.00000
CONTACT PRESSURE (CP)= 80.00000
RADIAL COORDINATES OF THE 1 POINTS (RC) ARE: .00000

DURATION OF MOVING LOAD (DUR) = 1.00000

NUMBER OF VISCOELASTIC LAYER (NVL) = 1

LAYER NUMBERS WHICH ARE VISCOELASTIC (LNV) = 1

CREEP TIMES (TYME) ARE:
.100E-02 .300E-02 .100E-01 .300E01 .100E+00 .300E+00 .100E+01 .300E+01 . 100E+02 .300E+02 .100E+03

FOR LAYER 1 TIME TEMPERATURE SHIFT FACTOR (BETA)= .11300 REFERENCE TEMPERATURE (TEMREF)= 77.00000

CREEP COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.163E-05 .221E-05 .308E-05 .417E-05 .580E-05 .785E-05 .109E-04 .148E-04 .206E-04 .279E-04 .389E-04

LAYER NO. 1 DIRICHLET SERIES FOR CREEP (GG) AT REFERENCE TEMPERATURE (TEMREF) OF 77.00000 ARE:
-.1543E-05 - .1086E-05 - .1254E-05 -.8227E-05 .3934E-05 -.2991E-04 .3962E-04

COMPUTED COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.174E-05 .210E-05 .302E-05 .427E-05 .576E-05 .767E-05 .112E-04 .151E-04 .196E-04 .288E-04 .386E-04

FOR PERIOD NO. 1 LAYER NO. AND TEMPERATURE ARE:

1 . 7000E+02

CREEP COMPLIANCES (CREEP) OF LAYER 1 AT TEMPERATURE (TEMP) OF 70.00000 ARE:
.157E-05 .163E-05 .186E-05 .239E-05 .355E-05 .484E-05 .649E-05 .886E-05 .130E-04 .165E-04 .230E-04

NUMBER OF LAYERS FOR BOTTOM TENSION (NLBT) = 0

NUMBER OF LAYERS FOR TOP COMPRESSION (NLTC) = 1

LAYER NO. FOR TOP COMPRESSION (LNTC) ARE: 3

LOAD REPETITIONS (TNLR) IN PERIOD 1 FOR EACH LOAD GROUP ARE: 3750.00

DAMAGE COEFFICENTS (FT) FOR TOP COMPRESSION OF LAYER 3 ARE: .1365E-08 .4477E+01

DAMAGE ANALYSIS OF PERIOD NO. 1 LOAD GROUP NO. 1

RADIAL VERTICAL VERTICAL VERTICAL RADIAL TANGENTIAL SHEAR VERTICAL RADIAL TANGENTIAL SHEAR
COORDINATE COORDINATE DISP STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
.00000 8.09010 .6592E-01 .2660E+02 .2128E+02 .2128E+02 .0000E+00 .2050E-02 .1025E-02 .1025E-02 0000E+00

AT TOP OF LAYER 3 COMPRESSIVE STRAIN = .2050E-02 ALLOWABLE LOAD REPETITIONS = .14821E+04 DAMAGE RATIO= .25302E+01

SUMMARY OF DAMAGE ANALYSIS

AT TOP OF LAYER 3 SUM OF DAMAGE RATIO= .25302E+01

MAXIMUM DAMAGE RATO= .25302E+01 DESIGN LIFE IN YEARS= .40

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* SECTION 3 DUAL TIRE LOAD 40 MPH HMA MR=250 KSI *

MATL = 3 FOR VISCOELASTIC LAYERED SYSTEM

NDAMA=1, SO DAMAGE ANALYSIS WILL BE PERFORMED

NUMBER OF PERIODS PER YEAR (NPY) = 1

NUMBER OF LOAD GROUPS (NLG) = 1

TOLERANCE FOR INTEGRATION (DEL) = .00100

NUMBER OF LAYERS (NL) = 3

NUMBER OF Z COORDINATES (NZ) = 1

LIMIT OF INTEGRATION CYCLES (ICL) = 80

COMPUTING CODE (NSTD) = 9

THICKNESS OF LAYERS (TH) ARE: 2.80000 5.29000

POISSON'S RATIOS OF LAYERS (PR) ARE: .35000 .30000 .30000

CONDITIONS OF INTERFACES (INT) ARE: 0 0

FOR PERIOD NO. 1 ELASTIC MODULI OF LAYERS ARE: .250000E+06 .250600E+05 .675000E+04

LOAD GROUP NO. 1 HAS 2 CONTACT AREAS
CONTACT RADIUS (CR) = 4.23000
CONTACT PRESSURE (CP)= 80.00000
NO. OF POINTS AT WHICH RESULTS ARE DESIRED (NPT) = 3
WHEEL SPACING ALONG X-AXIS (XW) = .00000
WHEEL SPACING ALONG Y-AXIS (YW) = 13.50000
POINT NO. AND X AND Y COORDIANTES ARE:
1 .00000 .00000 2 .00000 4.23 3 .00000 6.75000

DURATION OF MOVING LOAD(DUR) = .10000

NUMBER OF VISCOELASTIC LAYER (NVL) = 1

LAYER NUMBERS WHICH ARE VISCOELASTIC (LNV) = 1

CREEP TIMES (TYME) ARE:
.100E-02 .300E-02 .100E-01 .300E01 .100E+00 .300E+00 .100E+01 .300E+01 . 100E+02 .300E+02 .100E+03

FOR LAYER 1 TIME TEMPERATURE SHIFT FACTOR (BETA)= .11300 REFERENCE TEMPERATURE (TEMREF)= 77.00000

CREEP COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.163E-05 .221E-05 .308E-05 .417E-05 .580E-05 .785E-45 .109E-04 .148E-04 .206E-04 .279E-04 .389E-04

LAYER NO. 1 DIRICHLET SERIES FOR CREEP (GG) AT REFERENCE TEMPERATURE (TEMREF) OF 77.00000 ARE:
-.1561E-05 - .1042E-05 - .1290E-05 -.8239E-05 .3897E-05 -.2985E-04 .3962E-04

COMPUTED COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.174E-05 .210E-05 .303E-05 .427E-05 .576E-05 .768E-05 .112E-04 .151E-04 .197E-04 .288E-04 .386E-04

FOR PERIOD NO. 1 LAYER NO. AND TEMPERATURE ARE:
1 . 7000E+02

CREEP COMPLIANCES (CREEP) OF LAYER 1 AT TEMPERATURE (TEMP) OF 70.00000 ARE:
.157E-05 .163E-05 .185E-05 .239E-05 .355E-05 .483E-05 .649E-05 .888E-05 .130E-04 .166E-04 .230E-04

NUMBER OF LAYERS FOR BOTTOM TENSION (NLBT) = 0

NUMBER OF LAYERS FOR TOP COMPRESSION (NLTC) = 1

LAYER NO. FOR TOP COMPRESSION (LNTC) ARE: 3

LOAD REPETITIONS (TNLR) IN PERIOD 1 FOR EACH LOAD GROUP ARE: 3750.00

DAMAGE COEFFICENTS (FT) FOR TOP COMPRESSION OF LAYER 3 ARE: .1365E-08 .4477E+01

DAMAGE ANALYSIS OF PERIOD NO. 1 LOAD GROUP NO. 1

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
1 8.09010 .4711E-01 .1442E+02 .1442E+02 .1212E+02 .1094E+02 .1111E-02 .1111E-02 .4419E-03 .4419E-03

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
2 8.09010 .4963E-01 .1471E+02 .1471E+02 .1250E+02 .1104E+02 .1133E-02 .1133E-02 .4265E-03 .4265E-03

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
3 8.09010 .4989E-01 .1449E+02 .1449E+02 .1238E+02 .1080E+02 .1116E-02 .1116E-02 .4060E-03 .4060E-03

AT TOP OF LAYER 3 COMPRESSIVE STRAIN = .1133E-02 ALLOWABLE LOAD REPETITIONS = .21026E+05 DAMAGE RATIO= .17835E+00

SUMMARY OF DAMAGE ANALYSIS

AT TOP OF LAYER 3 SUM OF DAMAGE RATIO= .178352E+00

MAXIMUM DAMAGE RATO= .178352E+00 DESIGN LIFE IN YEARS= 5.61

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* SECTION 3 DUAL TIRE LOAD 60 MPH HMA MR=250 KSI *

MATL = 3 FOR VISCOELASTIC LAYERED SYSTEM

NDAMA=1, SO DAMAGE ANALYSIS WILL BE PERFORMED

NUMBER OF PERIODS PER YEAR (NPY) = 1

NUMBER OF LOAD GROUPS (NLG) = 1

TOLERANCE FOR INTEGRATION (DEL) = .00100

NUMBER OF LAYERS (NL) = 3

NUMBER OF Z COORDINATES (NZ) = 1

LIMIT OF INTEGRATION CYCLES (ICL) = 80

COMPUTING CODE (NSTD) = 9

THICKNESS OF LAYERS (TH) ARE: 2.80000 5.29000

POISSON'S RATIOS OF LAYERS (PR) ARE: .35000 .30000 .30000

CONDITIONS OF INTERFACES (INT) ARE: 0 0
FOR PERIOD NO. 1 ELASTIC MODULI OF LAYERS ARE: .250000E+06 .250600E+05 .675000E+04

LOAD GROUP NO. 1 HAS 2 CONTACT AREAS
CONTACT RADIUS (CR) = 4.23000
CONTACT PRESSURE (CP)= 80.00000
NO. OF POINTS AT WHICH RESULTS ARE DESIRED (NPT) = 3
WHEEL SPACING ALONG X-AXIS (XW) = .00000
WHEEL SPACING ALONG Y-AXIS (YW) = 13.50000
POINT NO. AND X AND Y COORDIANTES ARE:
1 .00000 .00000 2 .00000 4.23 3 .00000 6.75000

DURATION OF MOVING LOAD(DUR) = .03500

NUMBER OF VISCOELASTIC LAYER (NVL) = 1

LAYER NUMBERS WHICH ARE VISCOELASTIC (LNV) = 1

CREEP TIMES (TYME) ARE:
.100E-02 .300E-02 .100E-01 .300E01 .100E+00 .300E+00 .100E+01 .300E+01 .100E+02 .300E+02 .100E+03

FOR LAYER 1 TIME TEMPERATURE SHIFT FACTOR (BETA)= .11300 REFERENCE TEMPERATURE (TEMREF)= 77.00000

CREEP COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.163E-05 .221E-05 .308E-05 .417E-05 .580E-05 .785E-45 .109E-04 .148E-04 .206E-04 .279E-04 .389E-04

LAYER NO. 1 DIRICHLET SERIES FOR CREEP (GG) AT REFERENCE TEMPERATURE (TEMREF) OF 77.00000 ARE:
-.1561E-05 - .1042E-05 - .1290E-05 -.8239E-05 .3897E-05 -.2985E-04 .3962E-04

COMPUTED COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.174E-05 .210E-05 .303E-05 .427E-05 .576E-05 .768E-05 .112E-04 .151E-04 .197E-04 .288E-04 .386E-04

FOR PERIOD NO. 1 LAYER NO. AND TEMPERATURE ARE:
1 . 7000E+02

CREEP COMPLIANCES (CREEP) OF LAYER 1 AT TEMPERATURE (TEMP) OF 70.00000 ARE:
.157E-05 .163E-05 .185E-05 .239E-05 .355E-05 .483E-05 .649E-05 .888E-05 .130E-04 .166E-04 .230E-04

NUMBER OF LAYERS FOR BOTTOM TENSION (NLBT) = 0

NUMBER OF LAYERS FOR TOP COMPRESSION (NLTC) = 1

LAYER NO. FOR TOP COMPRESSION (LNTC) ARE: 3

LOAD REPETITIONS (TNLR) IN PERIOD 1 FOR EACH LOAD GROUP ARE: 3750.00

DAMAGE COEFFICENTS (FT) FOR TOP COMPRESSION OF LAYER 3 ARE: .1365E-08 .4477E+01

DAMAGE ANALYSIS OF PERIOD NO. 1 LOAD GROUP NO. 1

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
1 8.09010 .4551E-01 .1339E+02 .1339E+02 .1124E+02 .1018E+02 .1031E-02 .1031E-02 .4136E-03 .4136E-03

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
2 8.09010 .4793E-01 .1378E+02 .1378E+02 .1166E+02 .1038E+02 .1061E-02 .1061E-02 .4082E-03 .4082E-03

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
3 8.09010 .4821E-01 .1361E+02 .1361E+02 .1158E+02 .1021E+02 .1049E-02 .1049E-02 .3926E-03 .3926E-03

AT TOP OF LAYER 3 COMPRESSIVE STRAIN = .1061E-02 ALLOWABLE LOAD REPETITIONS = .28223E+05 DAMAGE RATIO= .13287E+00

SUMMARY OF DAMAGE ANALYSIS

AT TOP OF LAYER 3 SUM OF DAMAGE RATIO= .13287E+00

MAXIMUM DAMAGE RATO= .13287E+00 DESIGN LIFE IN YEARS= 7.53

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* SECTION 3 PLATE LOAD HMA MR=370 KSI *

MATL = 3 FOR VISCOELASTIC LAYERED SYSTEM

NDAMA=1, SO DAMAGE ANALYSIS WILL BE PERFORMED

NUMBER OF PERIODS PER YEAR (NPY) = 1

NUMBER OF LOAD GROUPS (NLG) = 1

TOLERANCE FOR INTEGRATION (DEL) = .00100

NUMBER OF LAYERS (NL) = 3

NUMBER OF Z COORDINATES (NZ) = 0

LIMIT OF INTEGRATION CYCLES (ICL) = 80

COMPUTING CODE (NSTD) = 9

THICKNESS OF LAYERS (TH) ARE: 2.80000 5.29000

POISSON'S RATIOS OF LAYERS (PR) ARE: .35000 .30000 .30000

CONDITIONS OF INTERFACES (INT) ARE: 0 0

FOR PERIOD NO. 1 ELASTIC MODULI OF LAYERS ARE: .370000E+06 .250600E+05
.675000E+04

LOAD GROUP NO. 1 HAS 1 CONTACT AREAS
CONTACT RADIUS (CR) = 6.00000
CONTACT PRESSURE (CP)= 80.00000
RADIAL COORDINATES OF THE 1 POINTS (RC) ARE: .00000

DURATION OF MOVING LOAD (DUR) = 1.00000

NUMBER OF VISCOELASTIC LAYER (NVL) = 1

LAYER NUMBERS WHICH ARE VISCOELASTIC (LNV) = 1

CREEP TIMES (TYME) ARE:
.100E-02 .300E-02 .100E-01 .300E01 .100E+00 .300E+00 .100E+01 .300E+01 . 100E+02 .300E+02
.100E+03

FOR LAYER 1 TIME TEMPERATURE SHIFT FACTOR (BETA)= .11300 REFERENCE TEMPERATURE (TEMREF)= 77.00000

CREEP COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.589E-05 .676E-05 .776E-05 .891E-05 .102E-04 .117E-04 .134E-04 .153E-04 .177E-04 .200E-04 .232E-04

LAYER NO. 1 DIRICHLET SERIES FOR CREEP (GG) AT REFERENCE TEMPERATURE (TEMREF) OF 77.00000 ARE:
-.3015E-05 - .6485E-06 - .2508E-05 -.4060E-05 .5460E-06 -.8125E-05 .2336E-04

COMPUTED COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.605E-05 .656E-05 .776E-05 .899E-05 .101E-05 .117E-05 .135E-04 .154E-04 .173E-04 .203E-04 .231E-04

FOR PERIOD NO. 1 LAYER NO. AND TEMPERATURE ARE:
1 . 7000E+02

CREEP COMPLIANCES (CREEP) OF LAYER 1 AT TEMPERATURE (TEMP) OF 70.00000 ARE:
.580E-05 .590E-05 .622E-05 .696E-05 .835E-05 .940E-05 .108E-04 .123E-04 .144E-44 .161E-04 .185E-04

NUMBER OF LAYERS FOR BOTTOM TENSION (NLBT) = 0

NUMBER OF LAYERS FOR TOP COMPRESSION (NLTC) = 1

LAYER NO. FOR TOP COMPRESSION (LNTC) ARE: 3

LOAD REPETITIONS (TNLR) IN PERIOD 1 FOR EACH LOAD GROUP ARE: 3750.00

DAMAGE COEFFICENTS (FT) FOR TOP COMPRESSION OF LAYER 3 ARE: .1365E-08 .4477E+01

DAMAGE ANALYSIS OF PERIOD NO. 1 LOAD GROUP NO. 1

RADIAL VERTICAL VERTICAL VERTICAL RADIAL TANGENTIAL SHEAR VERTICAL RADIAL TANGENTIAL SHEAR
COORDINATE COORDINATE DISP STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
.00000 8.09010 .7298E-01 .3228E+02 .2582E+02 .2582E+02 .0000E+00 .2478E-02 .1243E-02 .1243E-02 0000E+00

AT TOP OF LAYER 3 COMPRESSIVE STRAIN = .2487E-02 ALLOWABLE LOAD REPETITIONS = .62376E+03 DAMAGE RATIO= .60120E+01

SUMMARY OF DAMAGE ANALYSIS

AT TOP OF LAYER 3 SUM OF DAMAGE RATIO= .60120E+01

MAXIMUM DAMAGE RATO= .60120E+01 DESIGN LIFE IN YEARS= .17

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* SECTION 3 DUAL TIRE LOAD 40 MPH HMA MR=370 KSI *

MATL = 3 FOR VISCOELASTIC LAYERED SYSTEM

NDAMA=1, SO DAMAGE ANALYSIS WILL BE PERFORMED

NUMBER OF PERIODS PER YEAR (NPY) = 1

NUMBER OF LOAD GROUPS (NLG) = 1

TOLERANCE FOR INTEGRATION (DEL) = .00100

NUMBER OF LAYERS (NL) = 3

NUMBER OF Z COORDINATES (NZ) = 1

LIMIT OF INTEGRATION CYCLES (ICL) = 80

COMPUTING CODE (NSTD) = 9

THICKNESS OF LAYERS (TH) ARE: 2.80000 5.29000

POISSON'S RATIOS OF LAYERS (PR) ARE: .35000 .30000 .30000

CONDITIONS OF INTERFACES (INT) ARE: 0 0

FOR PERIOD NO. 1 ELASTIC MODULI OF LAYERS ARE: .370000E+06 .250600E+05 .675000E+04

LOAD GROUP NO. 1 HAS 2 CONTACT AREAS
CONTACT RADIUS (CR) = 4.23000
CONTACT PRESSURE (CP)= 80.00000
NO. OF POINTS AT WHICH RESULTS ARE DESIRED (NPT) = 3
WHEEL SPACING ALONG X-AXIS (XW) = .00000
WHEEL SPACING ALONG Y-AXIS (YW) = 13.50000
POINT NO. AND X AND Y COORDIANTES ARE:
1 .00000 .00000 2 .00000 4.23 3 .00000 6.75000

DURATION OF MOVING LOAD(DUR) = .10000

NUMBER OF VISCOELASTIC LAYER (NVL) = 1

LAYER NUMBERS WHICH ARE VISCOELASTIC (LNV) = 1

CREEP TIMES (TYME) ARE:
.100E-02 .300E-02 .100E-01 .300E01 .100E+00 .300E+00 .100E+01 .300E+01 . 100E+02 .300E+02 .100E+03

FOR LAYER 1 TIME TEMPERATURE SHIFT FACTOR (BETA)= .11300 REFERENCE TEMPERATURE (TEMREF)= 77.00000

CREEP COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.589E-05 .676E-05 .776E-05 .891E-05 .102E-04 .117E-04 .134E-04 .153E-04 .177E-04 .200E-04 .232E-04

LAYER NO. 1 DIRICHLET SERIES FOR CREEP (GG) AT REFERENCE TEMPERATURE (TEMREF) OF 77.00000 ARE:
-.3015E-05 - .6485E-06 - .2508E-05 -.4060E-05 .5460E-06 -.8125E-05 .2336E-04

COMPUTED COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.605E-05 .656E-05 .776E-05 .899E-05 .101E-04 .117E-04 .135E-04 .154E-04 .173E-04 .203E-04 .231E-04

FOR PERIOD NO. 1 LAYER NO. AND TEMPERATURE ARE:
1 . 7000E+02

CREEP COMPLIANCES (CREEP) OF LAYER 1 AT TEMPERATURE (TEMP) OF 70.00000 ARE:
.580E-05 .590E-05 .622E-05 .696E-05 .835E-05 .940E-05 .108E-04 .123E-04 .144E-04 .161E-04 .185E-04

NUMBER OF LAYERS FOR BOTTOM TENSION (NLBT) = 0

NUMBER OF LAYERS FOR TOP COMPRESSION (NLTC) = 1

LAYER NO. FOR TOP COMPRESSION (LNTC) ARE: 3

LOAD REPETITIONS (TNLR) IN PERIOD 1 FOR EACH LOAD GROUP ARE: 3750.00

DAMAGE COEFFICENTS (FT) FOR TOP COMPRESSION OF LAYER 3 ARE: .1365E-08 .4477E+01

DAMAGE ANALYSIS OF PERIOD NO. 1 LOAD GROUP NO. 1

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL

NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
1 8.09010 .5444E-01 .1987E+02 .1987E+02 .1678E+02 .1501E+02 .1531E-02 .1531E-02 .5947E-03 .5947E-03

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR
MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
2 8.09010 .5697E-01 .1909E+02 .1909E+02 .1656E+02 .1399E+02 .1471E-02 .1471E-02 .4886E-03 .4886E-03

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR
MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
3 8.09010 .5704E-01 .1832E+02 .1832E+02 .1609E+02 .1322E+02 .1411E-02 .1411E-02 .4289E-03 .4289E-03

AT TOP OF LAYER 3 COMPRESSIVE STRAIN = .1531E-02 ALLOWABLE LOAD REPETITIONS = .54768E+04 DAMAGE RATIO= .68471E+00

SUMMARY OF DAMAGE ANALYSIS

AT TOP OF LAYER 3 SUM OF DAMAGE RATIO= .68471E+00

MAXIMUM DAMAGE RATO= .68471E+00 DESIGN LIFE IN YEARS= 1.46

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* SECTION 3 DUAL TIRE LOAD 60 MPH HMA MR=370 KSI *

MATL = 3 FOR VISCOELASTIC LAYERED SYSTEM

NDAMA=1, SO DAMAGE ANALYSIS WILL BE PERFORMED

NUMBER OF PERIODS PER YEAR (NPY) = 1

NUMBER OF LOAD GROUPS (NLG) = 1

TOLERANCE FOR INTEGRATION (DEL) = .00100

NUMBER OF LAYERS (NL) = 3

NUMBER OF Z COORDINATES (NZ) = 1

LIMIT OF INTEGRATION CYCLES (ICL) = 80

COMPUTING CODE (NSTD) = 9

THICKNESS OF LAYERS (TH) ARE: 2.80000 5.29000

POISSON'S RATIOS OF LAYERS (PR) ARE: .35000 .30000 .30000

CONDITIONS OF INTERFACES (INT) ARE: 0 0
FOR PERIOD NO. 1 ELASTIC MODULI OF LAYERS ARE: .370000E+06 .250600E+05 .675000E+04

LOAD GROUP NO. 1 HAS 2 CONTACT AREAS
CONTACT RADIUS (CR) = 4.23000
CONTACT PRESSURE (CP)= 80.00000
NO. OF POINTS AT WHICH RESULTS ARE DESIRED (NPT) = 3
WHEEL SPACING ALONG X-AXIS (XW) = .00000
WHEEL SPACING ALONG Y-AXIS (YW) = 13.50000

POINT NO. AND X AND Y COORDIANTES ARE:
1 .00000 .00000 2 .00000 4.23 3 .00000 6.75000

DURATION OF MOVING LOAD(DUR) = .03500

NUMBER OF VISCOELASTIC LAYER (NVL) = 1

LAYER NUMBERS WHICH ARE VISCOELASTIC (LNV) = 1

CREEP TIMES (TYME) ARE:
.100E-02 .300E-02 .100E-01 .300E01 .100E+00 .300E+00 .100E+01 .300E+01 .100E+02 .300E+02 .100E+03

FOR LAYER 1 TIME TEMPERATURE SHIFT FACTOR (BETA)= .11300 REFERENCE TEMPERATURE (TEMREF)= 77.00000

CREEP COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.589E-05 .676E-05 .776E-05 .891E-05 .102E-04 .117E-45 .134E-04 .153E-04 .177E-04 .200E-04 .232E-04

LAYER NO. 1 DIRICHLET SERIES FOR CREEP (GG) AT REFERENCE TEMPERATURE (TEMREF) OF 77.00000 ARE:
-.3015E-05 - .6485E-06 - .2508E-05 -.4060E-05 .5460E-06 -.8125E-05 .2336E-04

COMPUTED COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.605E-05 .656E-05 .776E-05 .899E-05 .101E-04 .117E-04 .135E-04 .154E-04 .173E-04 .203E-04 .231E-04

FOR PERIOD NO. 1 LAYER NO. AND TEMPERATURE ARE:
1 . 7000E+02

CREEP COMPLIANCES (CREEP) OF LAYER 1 AT TEMPERATURE (TEMP) OF 70.00000 ARE:
.580E-05 .590E-05 .622E-05 .696E-05 .835E-05 .940E-05 .108E-04 .123E-04 .144E-04 .161E-04 .185E-04

NUMBER OF LAYERS FOR BOTTOM TENSION (NLBT) = 0

NUMBER OF LAYERS FOR TOP COMPRESSION (NLTC) = 1

LAYER NO. FOR TOP COMPRESSION (LNTC) ARE: 3

LOAD REPETITIONS (TNLR) IN PERIOD 1 FOR EACH LOAD GROUP ARE: 3750.00

DAMAGE COEFFICENTS (FT) FOR TOP COMPRESSION OF LAYER 3 ARE: .1365E-08 .4477E+01

DAMAGE ANALYSIS OF PERIOD NO. 1 LOAD GROUP NO. 1

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
1 8.09010 .5390E-01 .1941E+02 .1941E+02 .1639E+02 .1466E+02 .1495E-02 .1495E-02 .5813E-03 .5813E-03

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
2 8.09010 .5647E-01 .1877E+02 .1877E+02 .1625E+02 .1379E+02 .1446E-02 .1446E-02 .4861E-03 .4861E-03

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
3 8.09010 .5657E-01 .1806E+02 .1806E+02 .1583E+02 .1308E+02 .1392E-02 .1392E-02 .4309E-03 .4309E-03

AT TOP OF LAYER 3 COMPRESSIVE STRAIN = .1495E-02 ALLOWABLE LOAD REPETITIONS = .60824E+04   DAMAGE RATIO= .61653E+00

SUMMARY OF DAMAGE ANALYSIS

AT TOP OF LAYER 3   SUM OF DAMAGE RATIO= .61653E+00

MAXIMUM DAMAGE RATO= .61653E+00   DESIGN LIFE IN YEARS= 1.62

NUMBER OF PROBLEMS TO BE SOLVED = 6

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* SECTION 4 PLATE LOAD HMA MR=250 KSI *

MATL = 3 FOR VISCOELASTIC LAYERED SYSTEM

NDAMA=1, SO DAMAGE ANALYSIS WILL BE PERFORMED

NUMBER OF PERIODS PER YEAR (NPY) = 1

NUMBER OF LOAD GROUPS (NLG) = 1

TOLERANCE FOR INTEGRATION (DEL) = .00100

NUMBER OF LAYERS (NL) = 3

NUMBER OF Z COORDINATES (NZ) = 0

LIMIT OF INTEGRATION CYCLES (ICL) = 80

COMPUTING CODE (NSTD) = 9

THICKNESS OF LAYERS (TH) ARE: 3.14000 5.29000

POISSON'S RATIOS OF LAYERS (PR) ARE: .35000 .30000 .30000

CONDITIONS OF INTERFACES (INT) ARE: 0 0

FOR PERIOD NO. 1 ELASTIC MODULI OF LAYERS ARE: .250000E+06 .306400E+05
.855000E+04

LOAD GROUP NO. 1 HAS 1 CONTACT AREAS
CONTACT RADIUS (CR) = 6.00000
CONTACT PRESSURE (CP)= 80.00000
RADIAL COORDINATES OF THE 1 POINTS (RC) ARE: .00000

DURATION OF MOVING LOAD (DUR) = 1.00000

NUMBER OF VISCOELASTIC LAYER (NVL) = 1

LAYER NUMBERS WHICH ARE VISCOELASTIC (LNV) = 1

CREEP TIMES (TYME) ARE:
.100E-02 .300E-02 .100E-01 .300E01 .100E+00 .300E+00 .100E+01 .300E+01 . 100E+02 .300E+02
.100E+03

FOR LAYER 1 TIME TEMPERATURE SHIFT FACTOR (BETA)= .11300 REFERENCE TEMPERATURE
(TEMREF)= 77.00000

CREEP COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.163E-05 .221E-05 .308E-05 .417E-05 .580E-05 .785E-05 .109E-04 .148E-04 .206E-04 .279E-04 .389E-04

LAYER NO. 1 DIRICHLET SERIES FOR CREEP (GG) AT REFERENCE TEMPERATURE (TEMREF) OF
77.00000 ARE:
-.1543E-05 - .1086E-05 - .1254E-05 -.8227E-05 .3934E-05 -.2991E-04 .3962E-04

COMPUTED COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.174E-05 .210E-05 .302E-05 .427E-05 .576E-05 .767E-05 .112E-04 .151E-04 .196E-04 .288E-04 .386E-04

FOR PERIOD NO. 1 LAYER NO. AND TEMPERATURE ARE:

1 . 7000E+02

CREEP COMPLIANCES (CREEP) OF LAYER 1 AT TEMPERATURE (TEMP) OF 70.00000 ARE:
.157E-05 .163E-05 .186E-05 .239E-05 .355E-05 .484E-05 .649E-05 .886E-05 .130E-04 .165E-04 .230E-04

NUMBER OF LAYERS FOR BOTTOM TENSION (NLBT) = 0

NUMBER OF LAYERS FOR TOP COMPRESSION (NLTC) = 1

LAYER NO. FOR TOP COMPRESSION (LNTC) ARE: 3

LOAD REPETITIONS (TNLR) IN PERIOD 1 FOR EACH LOAD GROUP ARE: 3750.00

DAMAGE COEFFICENTS (FT) FOR TOP COMPRESSION OF LAYER 3 ARE: .1365E-08 .4477E+01

DAMAGE ANALYSIS OF PERIOD NO. 1 LOAD GROUP NO. 1

RADIAL VERTICAL VERTICAL VERTICAL RADIAL TANGENTIAL SHEAR VERTICAL RADIAL TANGENTIAL SHEAR
COORDINATE COORDINATE DISP STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
.00000 8.43010 .5133E-01 .2594E+02 .2075E+02 .2075E+02 .0000E+00 .1578E-02 .7887E-03 .7887E-03 0000E+00

AT TOP OF LAYER 3 COMPRESSIVE STRAIN = .1578E-02 ALLOWABLE LOAD REPETITIONS = .47835E+04 DAMAGE RATIO= .78395E+00

SUMMARY OF DAMAGE ANALYSIS

AT TOP OF LAYER 3 SUM OF DAMAGE RATIO= .78395E+00

MAXIMUM DAMAGE RATO= .78395E+00 DESIGN LIFE IN YEARS= 1.28

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* SECTION 4 DUAL TIRE LOAD 40 MPH HMA MR=250 KSI *

MATL = 3 FOR VISCOELASTIC LAYERED SYSTEM

NDAMA=1, SO DAMAGE ANALYSIS WILL BE PERFORMED

NUMBER OF PERIODS PER YEAR (NPY) = 1

NUMBER OF LOAD GROUPS (NLG) = 1

TOLERANCE FOR INTEGRATION (DEL) = .00100

NUMBER OF LAYERS (NL) = 3

NUMBER OF Z COORDINATES (NZ) = 1

LIMIT OF INTEGRATION CYCLES (ICL) = 80

COMPUTING CODE (NSTD) = 9

THICKNESS OF LAYERS (TH) ARE: 3.14000 5.29000

POISSON'S RATIOS OF LAYERS (PR) ARE: .35000 .30000 .30000

CONDITIONS OF INTERFACES (INT) ARE: 0 0

FOR PERIOD NO. 1 ELASTIC MODULI OF LAYERS ARE: .250000E+06 .306400E+05
.855000E+04

LOAD GROUP NO. 1 HAS 2 CONTACT AREAS
CONTACT RADIUS (CR) = 4.23000
CONTACT PRESSURE (CP)= 80.00000
NO. OF POINTS AT WHICH RESULTS ARE DESIRED (NPT) = 3
WHEEL SPACING ALONG X-AXIS (XW) = .00000
WHEEL SPACING ALONG Y-AXIS (YW) = 13.50000
POINT NO. AND X AND Y COORDIANTES ARE:
1 .00000 .00000 2 .00000 4.23 3 .00000 6.75000

DURATION OF MOVING LOAD(DUR) = .10000

NUMBER OF VISCOELASTIC LAYER (NVL) = 1

LAYER NUMBERS WHICH ARE VISCOELASTIC (LNV) = 1

CREEP TIMES (TYME) ARE:
.100E-02 .300E-02 .100E-01 .300E01 .100E+00 .300E+00 .100E+01 .300E+01 . 100E+02 .300E+02
.100E+03

FOR LAYER 1 TIME TEMPERATURE SHIFT FACTOR (BETA)= .11300 REFERENCE TEMPERATURE (TEMREF)= 77.00000

CREEP COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.163E-05 .221E-05 .308E-05 .417E-05 .580E-05 .785E-45 .109E-04 .148E-04 .206E-04 .279E-04 .389E-04

LAYER NO. 1 DIRICHLET SERIES FOR CREEP (GG) AT REFERENCE TEMPERATURE (TEMREF) OF 77.00000 ARE:
-.1561E-05 - .1042E-05 - .1290E-05 -.8239E-05 .3897E-05 -.2985E-04 .3962E-04

COMPUTED COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.174E-05 .210E-05 .303E-05 .427E-05 .576E-05 .768E-05 .112E-04 .151E-04 .197E-04 .288E-04 .386E-04

FOR PERIOD NO. 1 LAYER NO. AND TEMPERATURE ARE:
1 . 7000E+02

CREEP COMPLIANCES (CREEP) OF LAYER 1 AT TEMPERATURE (TEMP) OF 70.00000 ARE:
.157E-05 .163E-05 .185E-05 .239E-05 .355E-05 .483E-05 .649E-05 .888E-05 .130E-04 .166E-04 .230E-04

NUMBER OF LAYERS FOR BOTTOM TENSION (NLBT) = 0

NUMBER OF LAYERS FOR TOP COMPRESSION (NLTC) = 1

LAYER NO. FOR TOP COMPRESSION (LNTC) ARE: 3

LOAD REPETITIONS (TNLR) IN PERIOD 1 FOR EACH LOAD GROUP ARE: 3750.00

DAMAGE COEFFICENTS (FT) FOR TOP COMPRESSION OF LAYER 3 ARE: .1365E-08 .4477E+01

DAMAGE ANALYSIS OF PERIOD NO. 1 LOAD GROUP NO. 1

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR
MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
1 8.43010 .3665E-01 .1400E+02 .1400E+02 .1176E+02 .1064E+02 .8515E-03 .8515E-03 .3400E-03 .3400E-03

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR
MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL

NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
2 8.43010 .3859E-01 .1431E+02 .1431E+02 .1214E+02 .1075E+02 .8702E-03 .8703E-03 .3299E-03 .3299E-03

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
3 8.43010 .43880E-01 .1410E+02 .1410E+02 .1203E+02 .1053E+02 .8576E-03 .8576E-03 .3148E-03 .3148E-03

AT TOP OF LAYER 3 COMPRESSIVE STRAIN = .8702E-03 ALLOWABLE LOAD REPETITIONS = .68611E+05 DAMAGE RATIO= .54656E-01

SUMMARY OF DAMAGE ANALYSIS

AT TOP OF LAYER 3 SUM OF DAMAGE RATIO= .54656E-01

MAXIMUM DAMAGE RATO= .54656E-01 DESIGN LIFE IN YEARS= 18.30

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* SECTION 4 DUAL TIRE LOAD 60 MPH HMA MR=250 KSI *

MATL = 3 FOR VISCOELASTIC LAYERED SYSTEM

NDAMA=1, SO DAMAGE ANALYSIS WILL BE PERFORMED

NUMBER OF PERIODS PER YEAR (NPY) = 1

NUMBER OF LOAD GROUPS (NLG) = 1

TOLERANCE FOR INTEGRATION (DEL) = .00100

NUMBER OF LAYERS (NL) = 3

NUMBER OF Z COORDINATES (NZ) = 1

LIMIT OF INTEGRATION CYCLES (ICL) = 80

COMPUTING CODE (NSTD) = 9

THICKNESS OF LAYERS (TH) ARE: 3.14000 5.29000

POISSON'S RATIOS OF LAYERS (PR) ARE: .35000 .30000 .30000

CONDITIONS OF INTERFACES (INT) ARE: 0 0
FOR PERIOD NO. 1 ELASTIC MODULI OF LAYERS ARE: .250000E+06 .306400E+05 .855000E+04

LOAD GROUP NO. 1 HAS 2 CONTACT AREAS
CONTACT RADIUS (CR) = 4.23000
CONTACT PRESSURE (CP)= 80.00000
NO. OF POINTS AT WHICH RESULTS ARE DESIRED (NPT) = 3
WHEEL SPACING ALONG X-AXIS (XW) = .00000
WHEEL SPACING ALONG Y-AXIS (YW) = 13.50000
POINT NO. AND X AND Y COORDIANTES ARE:
1 .00000 .00000 2 .00000 4.23 3 .00000 6.75000

DURATION OF MOVING LOAD(DUR) = .03500

NUMBER OF VISCOELASTIC LAYER (NVL) = 1

LAYER NUMBERS WHICH ARE VISCOELASTIC (LNV) = 1

CREEP TIMES (TYME) ARE:
.100E-02 .300E-02 .100E-01 .300E01 .100E+00 .300E+00 .100E+01 .300E+01 .100E+02 .300E+02 .100E+03

FOR LAYER 1 TIME TEMPERATURE SHIFT FACTOR (BETA)= .11300 REFERENCE TEMPERATURE (TEMREF)= 77.00000

CREEP COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.163E-05 .221E-05 .308E-05 .417E-05 .580E-05 .785E-45 .109E-04 .148E-04 .206E-04 .279E-04 .389E-04

LAYER NO. 1 DIRICHLET SERIES FOR CREEP (GG) AT REFERENCE TEMPERATURE (TEMREF) OF 77.00000 ARE:
-.1561E-05 - .1042E-05 - .1290E-05 -.8239E-05 .3897E-05 -.2985E-04 .3962E-04

COMPUTED COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.174E-05 .210E-05 .303E-05 .427E-05 .576E-05 .768E-05 .112E-04 .151E-04 .197E-04 .288E-04 .386E-04

FOR PERIOD NO. 1 LAYER NO. AND TEMPERATURE ARE:
1 . 7000E+02

CREEP COMPLIANCES (CREEP) OF LAYER 1 AT TEMPERATURE (TEMP) OF 70.00000 ARE:
.157E-05 .163E-05 .185E-05 .239E-05 .355E-05 .483E-05 .649E-05 .888E-05 .130E-04 .166E-04 .230E-04

NUMBER OF LAYERS FOR BOTTOM TENSION (NLBT) = 0

NUMBER OF LAYERS FOR TOP COMPRESSION (NLTC) = 1

LAYER NO. FOR TOP COMPRESSION (LNTC) ARE: 3

LOAD REPETITIONS (TNLR) IN PERIOD 1 FOR EACH LOAD GROUP ARE: 3750.00

DAMAGE COEFFICENTS (FT) FOR TOP COMPRESSION OF LAYER 3 ARE: .1365E-08 .4477E+01

DAMAGE ANALYSIS OF PERIOD NO. 1 LOAD GROUP NO. 1

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
1 8.43010 .3536E-01 .1297E+02 .1297E+02 .1088E+02 .9871E+01 .7889E-03 .7889E-03 .3176E-03 .3176E-03

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
2 8.43010 .3722E-01 .1336E+02 .1336E+02 .1129E+02 .1009E+02 .8125E-03 .8125E-03 .3147E-03 .3147E-03

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
3 8.43010 .3744E-01 .1321E+02 .1321E+02 .1122E+02 .9921E+01 .8035E-03 .8035E-03 .3032E-03 .3032E-03

AT TOP OF LAYER 3 COMPRESSIVE STRAIN = .8125E-03 ALLOWABLE LOAD REPETITIONS = .93294E+05 DAMAGE RATIO= .40196E-01

SUMMARY OF DAMAGE ANALYSIS

AT TOP OF LAYER 3 SUM OF DAMAGE RATIO= .40196E-01

MAXIMUM DAMAGE RATO= .40196E-01 DESIGN LIFE IN YEARS= 24.88

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* SECTION 4 PLATE LOAD HMA MR=370 KSI *

MATL = 3 FOR VISCOELASTIC LAYERED SYSTEM

NDAMA=1, SO DAMAGE ANALYSIS WILL BE PERFORMED

NUMBER OF PERIODS PER YEAR (NPY) = 1

NUMBER OF LOAD GROUPS (NLG) = 1

TOLERANCE FOR INTEGRATION (DEL) = .00100

NUMBER OF LAYERS (NL) = 3

NUMBER OF Z COORDINATES (NZ) = 0

LIMIT OF INTEGRATION CYCLES (ICL) = 80

COMPUTING CODE (NSTD) = 9

THICKNESS OF LAYERS (TH) ARE: 3.14000 5.29000

POISSON’S RATIOS OF LAYERS (PR) ARE: .35000 .30000 .30000

CONDITIONS OF INTERFACES (INT) ARE: 0 0

FOR PERIOD NO. 1 ELASTIC MODULI OF LAYERS ARE: .370000E+06 .306400E+05
.855000E+04

LOAD GROUP NO. 1 HAS 1 CONTACT AREAS
CONTACT RADIUS (CR) = 6.00000
CONTACT PRESSURE (CP)= 80.00000
RADIAL COORDINATES OF THE 1 POINTS (RC) ARE: .00000

DURATION OF MOVING LOAD (DUR) = 1.00000

NUMBER OF VISCOELASTIC LAYER (NVL) = 1

LAYER NUMBERS WHICH ARE VISCOELASTIC (LNV) = 1

CREEP TIMES (TYME) ARE:
.100E-02 .300E-02 .100E-01 .300E01 .100E+00 .300E+00 .100E+01 .300E+01 . 100E+02 .300E+02
.100E+03

FOR LAYER 1 TIME TEMPERATURE SHIFT FACTOR (BETA)= .11300 REFERENCE TEMPERATURE
(TEMREF)= 77.00000

CREEP COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.589E-05 .676E-05 .776E-05 .891E-05 .102E-04 .117E-04 .134E-04 .153E-04 .177E-04 .200E-04 .232E-04

LAYER NO. 1 DIRICHLET SERIES FOR CREEP (GG) AT REFERENCE TEMPERATURE (TEMREF) OF
77.00000 ARE:
-.3015E-05 - .6485E-06 - .2508E-05 -.4060E-05 .5460E-06 -.8125E-05 .2336E-04

COMPUTED COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.605E-05 .656E-05 .776E-05 .899E-05 .101E-05 .117E-05 .135E-04 .154E-04 .173E-04 .203E-04 .231E-04

FOR PERIOD NO. 1 LAYER NO. AND TEMPERATURE ARE:
1 . 7000E+02

CREEP COMPLIANCES (CREEP) OF LAYER 1 AT TEMPERATURE (TEMP) OF 70.00000 ARE:
.580E-05 .590E-05 .622E-05 .696E-05 .835E-05 .940E-05 .108E-04 .123E-04 .144E-44 .161E-04 .185E-04

NUMBER OF LAYERS FOR BOTTOM TENSION (NLBT) = 0

NUMBER OF LAYERS FOR TOP COMPRESSION (NLTC) = 1

LAYER NO. FOR TOP COMPRESSION (LNTC) ARE: 3

LOAD REPETITIONS (TNLR) IN PERIOD 1 FOR EACH LOAD GROUP ARE: 3750.00

DAMAGE COEFFICENTS (FT) FOR TOP COMPRESSION OF LAYER 3 ARE: .1365E-08 .4477E+01

DAMAGE ANALYSIS OF PERIOD NO. 1 LOAD GROUP NO. 1

RADIAL VERTICAL VERTICAL VERTICAL RADIAL TANGENTIAL SHEAR VERTICAL RADIAL TANGENTIAL SHEAR
COORDINATE COORDINATE DISP STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
.00000 8.43010 .5715E-01 .3177E+02 .2542E+02 .2542E+02 .0000E+00 .1993E-02 .9662E-03 .9662E-03 0000E+00

AT TOP OF LAYER 3 COMPRESSIVE STRAIN = .1933E-02 ALLOWABLE LOAD REPETITIONS = .19280E+04 DAMAGE RATIO= .19450E+01

SUMMARY OF DAMAGE ANALYSIS

AT TOP OF LAYER 3 SUM OF DAMAGE RATIO= .19450E+01

MAXIMUM DAMAGE RATO= .19450E+01 DESIGN LIFE IN YEARS= .51

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* SECTION 4 DUAL TIRE LOAD 40 MPH HMA MR=370 KSI *

MATL = 3 FOR VISCOELASTIC LAYERED SYSTEM

NDAMA=1, SO DAMAGE ANALYSIS WILL BE PERFORMED

NUMBER OF PERIODS PER YEAR (NPY) = 1

NUMBER OF LOAD GROUPS (NLG) = 1

TOLERANCE FOR INTEGRATION (DEL) = .00100

NUMBER OF LAYERS (NL) = 3

NUMBER OF Z COORDINATES (NZ) = 1

LIMIT OF INTEGRATION CYCLES (ICL) = 80

COMPUTING CODE (NSTD) = 9

THICKNESS OF LAYERS (TH) ARE: 3.1400 5.29000

POISSON'S RATIOS OF LAYERS (PR) ARE: .35000 .30000 .30000

CONDITIONS OF INTERFACES (INT) ARE: 0 0

FOR PERIOD NO. 1 ELASTIC MODULI OF LAYERS ARE: .370000E+06 .306400E+05 .855000E+04

LOAD GROUP NO. 1 HAS 2 CONTACT AREAS
CONTACT RADIUS (CR) = 4.23000
CONTACT PRESSURE (CP)= 80.00000
NO. OF POINTS AT WHICH RESULTS ARE DESIRED (NPT) = 3
WHEEL SPACING ALONG X-AXIS (XW) = .00000
WHEEL SPACING ALONG Y-AXIS (YW) = 13.50000
POINT NO. AND X AND Y COORDIANTES ARE:
1 .00000 .00000 2 .00000 4.23 3 .00000 6.75000

DURATION OF MOVING LOAD(DUR) = .10000

NUMBER OF VISCOELASTIC LAYER (NVL) = 1

LAYER NUMBERS WHICH ARE VISCOELASTIC (LNV) = 1

CREEP TIMES (TYME) ARE:
.100E-02 .300E-02 .100E-01 .300E01 .100E+00 .300E+00 .100E+01 .300E+01 . 100E+02 .300E+02 .100E+03

FOR LAYER 1 TIME TEMPERATURE SHIFT FACTOR (BETA)= .11300 REFERENCE TEMPERATURE (TEMREF)= 77.00000

CREEP COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.589E-05 .676E-05 .776E-05 .891E-05 .102E-04 .117E-04 .134E-04 .153E-04 .177E-04 .200E-04 .232E-04

LAYER NO. 1 DIRICHLET SERIES FOR CREEP (GG) AT REFERENCE TEMPERATURE (TEMREF) OF 77.00000 ARE:
-.3015E-05 - .6485E-06 - .2508E-05 -.4060E-05 .5460E-06 -.8125E-05 .2336E-04

COMPUTED COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.605E-05 .656E-05 .776E-05 .899E-05 .101E-04 .117E-04 .135E-04 .154E-04 .173E-04 .203E-04 .231E-04

FOR PERIOD NO. 1 LAYER NO. AND TEMPERATURE ARE:
1 . 7000E+02

CREEP COMPLIANCES (CREEP) OF LAYER 1 AT TEMPERATURE (TEMP) OF 70.00000 ARE:
.580E-05 .590E-05 .622E-05 .696E-05 .835E-05 .940E-05 .108E-04 .123E-04 .144E-04 .161E-04 .185E-04

NUMBER OF LAYERS FOR BOTTOM TENSION (NLBT) = 0

NUMBER OF LAYERS FOR TOP COMPRESSION (NLTC) = 1

LAYER NO. FOR TOP COMPRESSION (LNTC) ARE: 3

LOAD REPETITIONS (TNLR) IN PERIOD 1 FOR EACH LOAD GROUP ARE: 3750.00

DAMAGE COEFFICENTS (FT) FOR TOP COMPRESSION OF LAYER 3 ARE: .1365E-08 .4477E+01

DAMAGE ANALYSIS OF PERIOD NO. 1 LOAD GROUP NO. 1

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN

1 8.43010 .4264E-01 .1951E+02 .1951E+02 .1648E+02 .1474E+02 .1187E-02 .1187E-02 .4614E-03 .4614E-03

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
2 8.43010 .4466E-01 .1884E+02 .1884E+02 .1631E+02 .1383E+02 .1146E-02 .1146E-02 .3839E-03 .3839E-03

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
3 8.43010 .4473E-01 .1811E+02 .1811E+02 .1588E+02 .1310E+02 .1102E-02 .1102E-02 .3394E-03 .3394E-03

AT TOP OF LAYER 3 COMPRESSIVE STRAIN = .1187E-02 ALLOWABLE LOAD REPETITIONS = .17109E+05 DAMAGE RATIO= .21919E+00

SUMMARY OF DAMAGE ANALYSIS

AT TOP OF LAYER 3 SUM OF DAMAGE RATIO= .21919E+00

MAXIMUM DAMAGE RATO= .21919E+00 DESIGN LIFE IN YEARS= 4.56

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* SECTION 4 DUAL TIRE LOAD 60 MPH HMA MR=370 KSI *

MATL = 3 FOR VISCOELASTIC LAYERED SYSTEM

NDAMA=1, SO DAMAGE ANALYSIS WILL BE PERFORMED

NUMBER OF PERIODS PER YEAR (NPY) = 1

NUMBER OF LOAD GROUPS (NLG) = 1

TOLERANCE FOR INTEGRATION (DEL) = .00100

NUMBER OF LAYERS (NL) = 3

NUMBER OF Z COORDINATES (NZ) = 1

LIMIT OF INTEGRATION CYCLES (ICL) = 80

COMPUTING CODE (NSTD) = 9

THICKNESS OF LAYERS (TH) ARE: 3.14000 5.29000

POISSON'S RATIOS OF LAYERS (PR) ARE: .35000 .30000 .30000

CONDITIONS OF INTERFACES (INT) ARE: 0 0
FOR PERIOD NO. 1 ELASTIC MODULI OF LAYERS ARE: .370000E+06 .306400E+05 .855000E+04

LOAD GROUP NO. 1 HAS 2 CONTACT AREAS
CONTACT RADIUS (CR) = 4.23000
CONTACT PRESSURE (CP)= 80.00000
NO. OF POINTS AT WHICH RESULTS ARE DESIRED (NPT) = 3
WHEEL SPACING ALONG X-AXIS (XW) = .00000
WHEEL SPACING ALONG Y-AXIS (YW) = 13.50000
POINT NO. AND X AND Y COORDIANTES ARE:

1 .00000 .00000 2 .00000 4.23 3 .00000 6.75000

DURATION OF MOVING LOAD(DUR) = .03500

NUMBER OF VISCOELASTIC LAYER (NVL) = 1

LAYER NUMBERS WHICH ARE VISCOELASTIC (LNV) = 1

CREEP TIMES (TYME) ARE:
.100E-02 .300E-02 .100E-01 .300E01 .100E+00 .300E+00 .100E+01 .300E+01 .100E+02 .300E+02 .100E+03

FOR LAYER 1 TIME TEMPERATURE SHIFT FACTOR (BETA)= .11300 REFERENCE TEMPERATURE (TEMREF)= 77.00000

CREEP COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.589E-05 .676E-05 .776E-05 .891E-05 .102E-04 .117E-45 .134E-04 .153E-04 .177E-04 .200E-04 .232E-04

LAYER NO. 1 DIRICHLET SERIES FOR CREEP (GG) AT REFERENCE TEMPERATURE (TEMREF) OF 77.00000 ARE:
-.3015E-05 - .6485E-06 - .2508E-05 -.4060E-05 .5460E-06 -.8125E-05 .2336E-04

COMPUTED COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.605E-05 .656E-05 .776E-05 .899E-05 .101E-04 .117E-04 .135E-04 .154E-04 .173E-04 .203E-04 .231E-04

FOR PERIOD NO. 1 LAYER NO. AND TEMPERATURE ARE:
1 . 7000E+02

CREEP COMPLIANCES (CREEP) OF LAYER 1 AT TEMPERATURE (TEMP) OF 70.00000 ARE:
.580E-05 .590E-05 .622E-05 .696E-05 .835E-05 .940E-05 .108E-04 .123E-04 .144E-04 .161E-04 .185E-04

NUMBER OF LAYERS FOR BOTTOM TENSION (NLBT) = 0

NUMBER OF LAYERS FOR TOP COMPRESSION (NLTC) = 1

LAYER NO. FOR TOP COMPRESSION (LNTC) ARE: 3

LOAD REPETITIONS (TNLR) IN PERIOD 1 FOR EACH LOAD GROUP ARE: 3750.00

DAMAGE COEFFICENTS (FT) FOR TOP COMPRESSION OF LAYER 3 ARE: .1365E-08 .4477E+01

DAMAGE ANALYSIS OF PERIOD NO. 1 LOAD GROUP NO. 1

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
1 8.43010 .4220E-01 .1904E+02 .1904E+02 .1608E+02 .1439E+02 .1158E-02 .1158E-02 .4508E-03 .4508E-03

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
2 8.43010 .4424E-01 .1850E+02 .1850E+02 .1599E+02 .1361E+02 .1125E-02 .1125E-02 .3814E-03 .3814E-03

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
3 8.43010 .4433E-01 .1784E+02 .1784E+02 .1560E+02 .1294E+02 .1085E-02 .1085E-02 .3404E-03 .3404E-03

AT TOP OF LAYER 3 COMPRESSIVE STRAIN = .1158E-02 ALLOWABLE LOAD REPETITIONS = .19081E+05   DAMAGE RATIO= .19653E+00

SUMMARY OF DAMAGE ANALYSIS

AT TOP OF LAYER 3   SUM OF DAMAGE RATIO= .19653E+00

MAXIMUM DAMAGE RATO= .19653E+00   DESIGN LIFE IN YEARS= 5.09

NUMBER OF PROBLEMS TO BE SOLVED = 6

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* SECTION 5 PLATE LOAD HMA MR=250 KSI *

MATL = 3 FOR VISCOELASTIC LAYERED SYSTEM

NDAMA=1, SO DAMAGE ANALYSIS WILL BE PERFORMED

NUMBER OF PERIODS PER YEAR (NPY) = 1

NUMBER OF LOAD GROUPS (NLG) = 1

TOLERANCE FOR INTEGRATION (DEL) = .00100

NUMBER OF LAYERS (NL) = 3

NUMBER OF Z COORDINATES (NZ) = 0

LIMIT OF INTEGRATION CYCLES (ICL) = 80

COMPUTING CODE (NSTD) = 9

THICKNESS OF LAYERS (TH) ARE: 3.13000 4.51000

POISSON'S RATIOS OF LAYERS (PR) ARE: .35000 .30000 .30000

CONDITIONS OF INTERFACES (INT) ARE: 0 0

FOR PERIOD NO. 1 ELASTIC MODULI OF LAYERS ARE: .250000E+06 .305600E+05
.810000E+04

LOAD GROUP NO. 1 HAS 1 CONTACT AREAS
CONTACT RADIUS (CR) = 6.00000
CONTACT PRESSURE (CP)= 80.00000
RADIAL COORDINATES OF THE 1 POINTS (RC) ARE: .00000

DURATION OF MOVING LOAD (DUR) = 1.00000

NUMBER OF VISCOELASTIC LAYER (NVL) = 1

LAYER NUMBERS WHICH ARE VISCOELASTIC (LNV) = 1

CREEP TIMES (TYME) ARE:
.100E-02 .300E-02 .100E-01 .300E01 .100E+00 .300E+00 .100E+01 .300E+01 . 100E+02 .300E+02
.100E+03

FOR LAYER 1 TIME TEMPERATURE SHIFT FACTOR (BETA)= .11300 REFERENCE TEMPERATURE
(TEMREF)= 77.00000

CREEP COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.163E-05 .221E-05 .308E-05 .417E-05 .580E-05 .785E-05 .109E-04 .148E-04 .206E-04 .279E-04 .389E-04

LAYER NO. 1 DIRICHLET SERIES FOR CREEP (GG) AT REFERENCE TEMPERATURE (TEMREF) OF
77.00000 ARE:
-.1543E-05 - .1086E-05 - .1254E-05 -.8227E-05 .3934E-05 -.2991E-04 .3962E-04

COMPUTED COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.174E-05 .210E-05 .302E-05 .427E-05 .576E-05 .767E-05 .112E-04 .151E-04 .196E-04 .288E-04 .386E-04

FOR PERIOD NO. 1 LAYER NO. AND TEMPERATURE ARE:

1 . 7000E+02

CREEP COMPLIANCES (CREEP) OF LAYER 1 AT TEMPERATURE (TEMP) OF 70.00000 ARE:
.157E-05 .163E-05 .186E-05 .239E-05 .355E-05 .484E-05 .649E-05 .886E-05 .130E-04 .165E-04 .230E-04

NUMBER OF LAYERS FOR BOTTOM TENSION (NLBT) = 0

NUMBER OF LAYERS FOR TOP COMPRESSION (NLTC) = 1

LAYER NO. FOR TOP COMPRESSION (LNTC) ARE: 3

LOAD REPETITIONS (TNLR) IN PERIOD 1 FOR EACH LOAD GROUP ARE: 3750.00

DAMAGE COEFFICENTS (FT) FOR TOP COMPRESSION OF LAYER 3 ARE: .1365E-08 .4477E+01

DAMAGE ANALYSIS OF PERIOD NO. 1 LOAD GROUP NO. 1

RADIAL VERTICAL VERTICAL VERTICAL RADIAL TANGENTIAL SHEAR VERTICAL RADIAL TANGENTIAL SHEAR
COORDINATE COORDINATE DISP STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
.00000 7.64010 .5590E-01 .2755E+02 .2204E+02 .2204E+02 .0000E+00 .1769E-02 .8842E-03 .8842E-03 0000E+00

AT TOP OF LAYER 3 COMPRESSIVE STRAIN = .1769E-02 ALLOWABLE LOAD REPETITIONS = .28675E+04 DAMAGE RATIO= .13078E+01

SUMMARY OF DAMAGE ANALYSIS

AT TOP OF LAYER 3 SUM OF DAMAGE RATIO= .13078E+01

MAXIMUM DAMAGE RATO= .13078E+01 DESIGN LIFE IN YEARS= .76

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* SECTION 5 DUAL TIRE LOAD 40 MPH HMA MR=250 KSI *

MATL = 3 FOR VISCOELASTIC LAYERED SYSTEM

NDAMA=1, SO DAMAGE ANALYSIS WILL BE PERFORMED

NUMBER OF PERIODS PER YEAR (NPY) = 1

NUMBER OF LOAD GROUPS (NLG) = 1

TOLERANCE FOR INTEGRATION (DEL) = .00100

NUMBER OF LAYERS (NL) = 3

NUMBER OF Z COORDINATES (NZ) = 1

LIMIT OF INTEGRATION CYCLES (ICL) = 80

COMPUTING CODE (NSTD) = 9

THICKNESS OF LAYERS (TH) ARE: 3.13000 4.51000

POISSON'S RATIOS OF LAYERS (PR) ARE: .35000 .30000 .30000

CONDITIONS OF INTERFACES (INT) ARE: 0 0

FOR PERIOD NO. 1 ELASTIC MODULI OF LAYERS ARE: .250000E+06 .305600E+05
.810000E+04

LOAD GROUP NO. 1 HAS 2 CONTACT AREAS
CONTACT RADIUS (CR) = 4.23000
CONTACT PRESSURE (CP)= 80.00000
NO. OF POINTS AT WHICH RESULTS ARE DESIRED (NPT) = 3
WHEEL SPACING ALONG X-AXIS (XW) = .00000
WHEEL SPACING ALONG Y-AXIS (YW) = 13.50000
POINT NO. AND X AND Y COORDIANTES ARE:
1 .00000 .00000 2 .00000 4.23 3 .00000 6.75000

DURATION OF MOVING LOAD(DUR) = .10000

NUMBER OF VISCOELASTIC LAYER (NVL) = 1

LAYER NUMBERS WHICH ARE VISCOELASTIC (LNV) = 1

CREEP TIMES (TYME) ARE:
.100E-02 .300E-02 .100E-01 .300E01 .100E+00 .300E+00 .100E+01 .300E+01 . 100E+02 .300E+02
.100E+03

FOR LAYER 1 TIME TEMPERATURE SHIFT FACTOR (BETA)= .11300 REFERENCE TEMPERATURE (TEMREF)= 77.00000

CREEP COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.163E-05 .221E-05 .308E-05 .417E-05 .580E-05 .785E-45 .109E-04 .148E-04 .206E-04 .279E-04 .389E-04

LAYER NO. 1 DIRICHLET SERIES FOR CREEP (GG) AT REFERENCE TEMPERATURE (TEMREF) OF 77.00000 ARE:
-.1561E-05 - .1042E-05 - .1290E-05 -.8239E-05 .3897E-05 -.2985E-04 .3962E-04

COMPUTED COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.174E-05 .210E-05 .303E-05 .427E-05 .576E-05 .768E-05 .112E-04 .151E-04 .197E-04 .288E-04 .386E-04

FOR PERIOD NO. 1 LAYER NO. AND TEMPERATURE ARE:
1 . 7000E+02

CREEP COMPLIANCES (CREEP) OF LAYER 1 AT TEMPERATURE (TEMP) OF 70.00000 ARE:
.157E-05 .163E-05 .185E-05 .239E-05 .355E-05 .483E-05 .649E-05 .888E-05 .130E-04 .166E-04 .230E-04

NUMBER OF LAYERS FOR BOTTOM TENSION (NLBT) = 0

NUMBER OF LAYERS FOR TOP COMPRESSION (NLTC) = 1

LAYER NO. FOR TOP COMPRESSION (LNTC) ARE: 3

LOAD REPETITIONS (TNLR) IN PERIOD 1 FOR EACH LOAD GROUP ARE: 3750.00

DAMAGE COEFFICENTS (FT) FOR TOP COMPRESSION OF LAYER 3 ARE: .1365E-08 .4477E+01

DAMAGE ANALYSIS OF PERIOD NO. 1 LOAD GROUP NO. 1

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
1 7.64010 .3928E-01 .1458E+02 .1458E+02 .1225E+02 .1108E+02 .9361E-03 .9361E-03 .3740E-03 .3740E-03

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL

NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
2 7.64010 .41270E-01 .1468E+02 .1468E+02 .1249E+02 .1099E+02 .9423E-03 .89423E-03 .3507E-03 .3508E-03

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
3 7.64010 .41450E-01 .1437E+02 .1437E+02 .1231E+02 .1067E+02 .9223E-03 .9223E-03 .3292E-03 .3292E-03

AT TOP OF LAYER 3 COMPRESSIVE STRAIN = .9423E-03 ALLOWABLE LOAD REPETITIONS = .48059E+05 DAMAGE RATIO= .78029E-01

SUMMARY OF DAMAGE ANALYSIS

AT TOP OF LAYER 3 SUM OF DAMAGE RATIO= .78029E-01

MAXIMUM DAMAGE RATO= .78029E-01 DESIGN LIFE IN YEARS= 12.82

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* SECTION 5 DUAL TIRE LOAD 60 MPH HMA MR=250 KSI *

MATL = 3 FOR VISCOELASTIC LAYERED SYSTEM

NDAMA=1, SO DAMAGE ANALYSIS WILL BE PERFORMED

NUMBER OF PERIODS PER YEAR (NPY) = 1

NUMBER OF LOAD GROUPS (NLG) = 1

TOLERANCE FOR INTEGRATION (DEL) = .00100

NUMBER OF LAYERS (NL) = 3

NUMBER OF Z COORDINATES (NZ) = 1

LIMIT OF INTEGRATION CYCLES (ICL) = 80

COMPUTING CODE (NSTD) = 9

THICKNESS OF LAYERS (TH) ARE: 3.13000 4.51000

POISSON'S RATIOS OF LAYERS (PR) ARE: .35000 .30000 .30000

CONDITIONS OF INTERFACES (INT) ARE: 0 0
FOR PERIOD NO. 1 ELASTIC MODULI OF LAYERS ARE: .250000E+06 .3056400E+05 .810000E+04

LOAD GROUP NO. 1 HAS 2 CONTACT AREAS
CONTACT RADIUS (CR) = 4.23000
CONTACT PRESSURE (CP)= 80.00000
NO. OF POINTS AT WHICH RESULTS ARE DESIRED (NPT) = 3
WHEEL SPACING ALONG X-AXIS (XW) = .00000
WHEEL SPACING ALONG Y-AXIS (YW) = 13.50000
POINT NO. AND X AND Y COORDIANTES ARE:
1 .00000 .00000 2 .00000 4.23 3 .00000 6.75000

DURATION OF MOVING LOAD(DUR) = .03500

NUMBER OF VISCOELASTIC LAYER (NVL) = 1

LAYER NUMBERS WHICH ARE VISCOELASTIC (LNV) = 1

CREEP TIMES (TYME) ARE:
.100E-02 .300E-02 .100E-01 .300E01 .100E+00 .300E+00 .100E+01 .300E+01 .100E+02 .300E+02 .100E+03

FOR LAYER 1 TIME TEMPERATURE SHIFT FACTOR (BETA)= .11300 REFERENCE TEMPERATURE (TEMREF)= 77.00000

CREEP COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.163E-05 .221E-05 .308E-05 .417E-05 .580E-05 .785E-45 .109E-04 .148E-04 .206E-04 .279E-04 .389E-04

LAYER NO. 1 DIRICHLET SERIES FOR CREEP (GG) AT REFERENCE TEMPERATURE (TEMREF) OF 77.00000 ARE:
-.1561E-05 - .1042E-05 - .1290E-05 -.8239E-05 .3897E-05 -.2985E-04 .3962E-04

COMPUTED COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.174E-05 .210E-05 .303E-05 .427E-05 .576E-05 .768E-05 .112E-04 .151E-04 .197E-04 .288E-04 .386E-04

FOR PERIOD NO. 1 LAYER NO. AND TEMPERATURE ARE:
1 . 7000E+02

CREEP COMPLIANCES (CREEP) OF LAYER 1 AT TEMPERATURE (TEMP) OF 70.00000 ARE:
.157E-05 .163E-05 .185E-05 .239E-05 .355E-05 .483E-05 .649E-05 .888E-05 .130E-04 .166E-04 .230E-04

NUMBER OF LAYERS FOR BOTTOM TENSION (NLBT) = 0

NUMBER OF LAYERS FOR TOP COMPRESSION (NLTC) = 1

LAYER NO. FOR TOP COMPRESSION (LNTC) ARE: 3

LOAD REPETITIONS (TNLR) IN PERIOD 1 FOR EACH LOAD GROUP ARE: 3750.00

DAMAGE COEFFICENTS (FT) FOR TOP COMPRESSION OF LAYER 3 ARE: .1365E-08 .4477E+01

DAMAGE ANALYSIS OF PERIOD NO. 1 LOAD GROUP NO. 1

POINT NO.	VERTICAL COORDINATE	VERTICAL DISP.	VERTICAL STRESS	MAJOR PRINCIPAL STRESS	INTERMEDIATE PRINCIPAL STRESS	MINOR PRINCIPAL STRESS	VERTICAL STRAIN	MAJOR PRINCIPAL STRAIN	MINOR PRINCIPAL STRAIN	HORIZONTAL PRINCIPAL STRAIN
1	7.64010	.3779E-01	.1343E+02	.1343E+02	.1126E+02	.1022E+02	.8619E-03	.8619E-03	.3472E-03	.3472E-03

POINT NO.	VERTICAL COORDINATE	VERTICAL DISP.	VERTICAL STRESS	MAJOR PRINCIPAL STRESS	INTERMEDIATE PRINCIPAL STRESS	MINOR PRINCIPAL STRESS	VERTICAL STRAIN	MAJOR PRINCIPAL STRAIN	MINOR PRINCIPAL STRAIN	HORIZONTAL PRINCIPAL STRAIN
2	7.64010	.3970E-01	.1364E+02	.1364E+02	.1156E+02	.1027E+02	.8758E-03	.8758E-03	.3340E-03	.3340E-03

POINT NO.	VERTICAL COORDINATE	VERTICAL DISP.	VERTICAL STRESS	MAJOR PRINCIPAL STRESS	INTERMEDIATE PRINCIPAL STRESS	MINOR PRINCIPAL STRESS	VERTICAL STRAIN	MAJOR PRINCIPAL STRAIN	MINOR PRINCIPAL STRAIN	HORIZONTAL PRINCIPAL STRAIN
3	7.64010	.3990E-01	.1341E+02	.1341E+02	.1143E+02	.1002E+02	.8610E-03	.8610E-03	.3174E-03	.3174E-03

AT TOP OF LAYER 3 COMPRESSIVE STRAIN = .8758E-03 ALLOWABLE LOAD REPETITIONS = .66673E+05 DAMAGE RATIO= .56245E-01

SUMMARY OF DAMAGE ANALYSIS

AT TOP OF LAYER 3 SUM OF DAMAGE RATIO= .56245E-01

MAXIMUM DAMAGE RATO= .56245E-01 DESIGN LIFE IN YEARS= 17.78

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* SECTION 5 PLATE LOAD HMA MR=370 KSI *

MATL = 3 FOR VISCOELASTIC LAYERED SYSTEM

NDAMA=1, SO DAMAGE ANALYSIS WILL BE PERFORMED

NUMBER OF PERIODS PER YEAR (NPY) = 1

NUMBER OF LOAD GROUPS (NLG) = 1

TOLERANCE FOR INTEGRATION (DEL) = .00100

NUMBER OF LAYERS (NL) = 3

NUMBER OF Z COORDINATES (NZ) = 0

LIMIT OF INTEGRATION CYCLES (ICL) = 80

COMPUTING CODE (NSTD) = 9

THICKNESS OF LAYERS (TH) ARE: 3.13000 4.51000

POISSON'S RATIOS OF LAYERS (PR) ARE: .35000 .30000 .30000

CONDITIONS OF INTERFACES (INT) ARE: 0 0

FOR PERIOD NO. 1 ELASTIC MODULI OF LAYERS ARE: .370000E+06 .305600E+05
.810000E+04

LOAD GROUP NO. 1 HAS 1 CONTACT AREAS
CONTACT RADIUS (CR) = 6.00000
CONTACT PRESSURE (CP)= 80.00000
RADIAL COORDINATES OF THE 1 POINTS (RC) ARE: .00000

DURATION OF MOVING LOAD (DUR) = 1.00000

NUMBER OF VISCOELASTIC LAYER (NVL) = 1

LAYER NUMBERS WHICH ARE VISCOELASTIC (LNV) = 1

CREEP TIMES (TYME) ARE:
.100E-02 .300E-02 .100E-01 .300E01 .100E+00 .300E+00 .100E+01 .300E+01 . 100E+02 .300E+02
.100E+03

FOR LAYER 1 TIME TEMPERATURE SHIFT FACTOR (BETA)= .11300 REFERENCE TEMPERATURE (TEMREF)= 77.00000

CREEP COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.589E-05 .676E-05 .776E-05 .891E-05 .102E-04 .117E-04 .134E-04 .153E-04 .177E-04 .200E-04 .232E-04

LAYER NO. 1 DIRICHLET SERIES FOR CREEP (GG) AT REFERENCE TEMPERATURE (TEMREF) OF 77.00000 ARE:
-.3015E-05 - .6485E-06 - .2508E-05 -.4060E-05 .5460E-06 -.8125E-05 .2336E-04

COMPUTED COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.605E-05 .656E-05 .776E-05 .899E-05 .101E-05 .117E-05 .135E-04 .154E-04 .173E-04 .203E-04 .231E-04

FOR PERIOD NO. 1 LAYER NO. AND TEMPERATURE ARE:
1 . 7000E+02

CREEP COMPLIANCES (CREEP) OF LAYER 1 AT TEMPERATURE (TEMP) OF 70.00000 ARE:
.580E-05 .590E-05 .622E-05 .696E-05 .835E-05 .940E-05 .108E-04 .123E-04 .144E-44 .161E-04 .185E-04

NUMBER OF LAYERS FOR BOTTOM TENSION (NLBT) = 0

NUMBER OF LAYERS FOR TOP COMPRESSION (NLTC) = 1

LAYER NO. FOR TOP COMPRESSION (LNTC) ARE: 3

LOAD REPETITIONS (TNLR) IN PERIOD 1 FOR EACH LOAD GROUP ARE: 3750.00

DAMAGE COEFFICENTS (FT) FOR TOP COMPRESSION OF LAYER 3 ARE: .1365E-08 .4477E+01

DAMAGE ANALYSIS OF PERIOD NO. 1 LOAD GROUP NO. 1

RADIAL VERTICAL VERTICAL VERTICAL RADIAL TANGENTIAL SHEAR VERTICAL RADIAL TANGENTIAL SHEAR
COORDINATE COORDINATE DISP STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
.00000 7.64010 .6310E-01 .3454E+02 .2763E+02 .2763E+02 .0000E+00 .2217E-02 .1108E-02 .1108E-02 0000E+00

AT TOP OF LAYER 3 COMPRESSIVE STRAIN = .2217E-02 ALLOWABLE LOAD REPETITIONS = .10422E+04 DAMAGE RATIO= .35980E+01

SUMMARY OF DAMAGE ANALYSIS

AT TOP OF LAYER 3 SUM OF DAMAGE RATIO= .35980E+01

MAXIMUM DAMAGE RATO= .35980E+01 DESIGN LIFE IN YEARS= .28

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* SECTION 5 DUAL TIRE LOAD 40 MPH HMA MR=370 KSI *

MATL = 3 FOR VISCOELASTIC LAYERED SYSTEM

NDAMA=1, SO DAMAGE ANALYSIS WILL BE PERFORMED

NUMBER OF PERIODS PER YEAR (NPY) = 1

NUMBER OF LOAD GROUPS (NLG) = 1

TOLERANCE FOR INTEGRATION (DEL) = .00100

NUMBER OF LAYERS (NL) = 3

NUMBER OF Z COORDINATES (NZ) = 1

LIMIT OF INTEGRATION CYCLES (ICL) = 80

COMPUTING CODE (NSTD) = 9

THICKNESS OF LAYERS (TH) ARE: 3.1300 4.51000

POISSON'S RATIOS OF LAYERS (PR) ARE: .35000 .30000 .30000

CONDITIONS OF INTERFACES (INT) ARE: 0 0

FOR PERIOD NO. 1 ELASTIC MODULI OF LAYERS ARE: .370000E+06 .305600E+05 .810000E+04

LOAD GROUP NO. 1 HAS 2 CONTACT AREAS
CONTACT RADIUS (CR) = 4.23000
CONTACT PRESSURE (CP)= 80.00000
NO. OF POINTS AT WHICH RESULTS ARE DESIRED (NPT) = 3
WHEEL SPACING ALONG X-AXIS (XW) = .00000
WHEEL SPACING ALONG Y-AXIS (YW) = 13.50000
POINT NO. AND X AND Y COORDIANTES ARE:
1 .00000 .00000 2 .00000 4.23 3 .00000 6.75000

DURATION OF MOVING LOAD(DUR) = .10000

NUMBER OF VISCOELASTIC LAYER (NVL) = 1

LAYER NUMBERS WHICH ARE VISCOELASTIC (LNV) = 1

CREEP TIMES (TYME) ARE:
.100E-02 .300E-02 .100E-01 .300E01 .100E+00 .300E+00 .100E+01 .300E+01 . 100E+02 .300E+02 .100E+03

FOR LAYER 1 TIME TEMPERATURE SHIFT FACTOR (BETA)= .11300 REFERENCE TEMPERATURE (TEMREF)= 77.00000

CREEP COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.589E-05 .676E-05 .776E-05 .891E-05 .102E-04 .117E-04 .134E-04 .153E-04 .177E-04 .200E-04 .232E-04

LAYER NO. 1 DIRICHLET SERIES FOR CREEP (GG) AT REFERENCE TEMPERATURE (TEMREF) OF 77.00000 ARE:
-.3015E-05 - .6485E-06 - .2508E-05 -.4060E-05 .5460E-06 -.8125E-05 .2336E-04

COMPUTED COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.605E-05 .656E-05 .776E-05 .899E-05 .101E-04 .117E-04 .135E-04 .154E-04 .173E-04 .203E-04 .231E-04

FOR PERIOD NO. 1 LAYER NO. AND TEMPERATURE ARE:
1 . 7000E+02

CREEP COMPLIANCES (CREEP) OF LAYER 1 AT TEMPERATURE (TEMP) OF 70.00000 ARE:
.580E-05 .590E-05 .622E-05 .696E-05 .835E-05 .940E-05 .108E-04 .123E-04 .144E-04 .161E-04 .185E-04

NUMBER OF LAYERS FOR BOTTOM TENSION (NLBT) = 0

NUMBER OF LAYERS FOR TOP COMPRESSION (NLTC) = 1

LAYER NO. FOR TOP COMPRESSION (LNTC) ARE: 3

LOAD REPETITIONS (TNLR) IN PERIOD 1 FOR EACH LOAD GROUP ARE: 3750.00

DAMAGE COEFFICENTS (FT) FOR TOP COMPRESSION OF LAYER 3 ARE: .1365E-08 .4477E+01

DAMAGE ANALYSIS OF PERIOD NO. 1 LOAD GROUP NO. 1

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL

NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
1 7.64010 .4644E-01 .2103E+02 .2103E+02 .1776E+02 .1589E+02 .1350E-02 .1350E-02 .5254E-03 .5254E-03

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR
MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
2 7.64010 .4841E-01 .1979E+02 .1979E+02 .1724E+02 .1443E+02 .1271E-02 .1271E-02 .4097E-03 .4097E-03

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR
MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
3 7.64010 .4838E-01 .1879E+02 .1879E+02 .1662E+02 .1344E+02 .1206E-02 .1206E-02 .3475E-03 .3475E-03

AT TOP OF LAYER 3 COMPRESSIVE STRAIN = .1350E-02 ALLOWABLE LOAD REPETITIONS = .96034E+04 DAMAGE RATIO= .39049E+00

SUMMARY OF DAMAGE ANALYSIS

AT TOP OF LAYER 3 SUM OF DAMAGE RATIO= .39049E+00

MAXIMUM DAMAGE RATO= .39049E+00 DESIGN LIFE IN YEARS= 2.56

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* SECTION 5 DUAL TIRE LOAD 60 MPH HMA MR=370 KSI *

MATL = 3 FOR VISCOELASTIC LAYERED SYSTEM

NDAMA=1, SO DAMAGE ANALYSIS WILL BE PERFORMED

NUMBER OF PERIODS PER YEAR (NPY) = 1

NUMBER OF LOAD GROUPS (NLG) = 1

TOLERANCE FOR INTEGRATION (DEL) = .00100

NUMBER OF LAYERS (NL) = 3

NUMBER OF Z COORDINATES (NZ) = 1

LIMIT OF INTEGRATION CYCLES (ICL) = 80

COMPUTING CODE (NSTD) = 9

THICKNESS OF LAYERS (TH) ARE: 3.13000 4.51000

POISSON'S RATIOS OF LAYERS (PR) ARE: .35000 .30000 .30000

CONDITIONS OF INTERFACES (INT) ARE: 0 0
FOR PERIOD NO. 1 ELASTIC MODULI OF LAYERS ARE: .370000E+06 .305600E+05 .810000E+04

LOAD GROUP NO. 1 HAS 2 CONTACT AREAS
CONTACT RADIUS (CR) = 4.23000
CONTACT PRESSURE (CP)= 80.00000
NO. OF POINTS AT WHICH RESULTS ARE DESIRED (NPT) = 3
WHEEL SPACING ALONG X-AXIS (XW) = .00000
WHEEL SPACING ALONG Y-AXIS (YW) = 13.50000

POINT NO. AND X AND Y COORDIANTES ARE:
1 .00000 .00000 2 .00000 4.23 3 .00000 6.75000

DURATION OF MOVING LOAD(DUR) = .03500

NUMBER OF VISCOELASTIC LAYER (NVL) = 1

LAYER NUMBERS WHICH ARE VISCOELASTIC (LNV) = 1

CREEP TIMES (TYME) ARE:
.100E-02 .300E-02 .100E-01 .300E01 .100E+00 .300E+00 .100E+01 .300E+01 .100E+02 .300E+02 .100E+03

FOR LAYER 1 TIME TEMPERATURE SHIFT FACTOR (BETA)= .11300 REFERENCE TEMPERATURE (TEMREF)= 77.00000

CREEP COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.589E-05 .676E-05 .776E-05 .891E-05 .102E-04 .117E-45 .134E-04 .153E-04 .177E-04 .200E-04 .232E-04

LAYER NO. 1 DIRICHLET SERIES FOR CREEP (GG) AT REFERENCE TEMPERATURE (TEMREF) OF 77.00000 ARE:
-.3015E-05 - .6485E-06 - .2508E-05 -.4060E-05 .5460E-06 -.8125E-05 .2336E-04

COMPUTED COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.605E-05 .656E-05 .776E-05 .899E-05 .101E-04 .117E-04 .135E-04 .154E-04 .173E-04 .203E-04 .231E-04

FOR PERIOD NO. 1 LAYER NO. AND TEMPERATURE ARE:
1 . 7000E+02

CREEP COMPLIANCES (CREEP) OF LAYER 1 AT TEMPERATURE (TEMP) OF 70.00000 ARE:
.580E-05 .590E-05 .622E-05 .696E-05 .835E-05 .940E-05 .108E-04 .123E-04 .144E-04 .161E-04 .185E-04

NUMBER OF LAYERS FOR BOTTOM TENSION (NLBT) = 0

NUMBER OF LAYERS FOR TOP COMPRESSION (NLTC) = 1

LAYER NO. FOR TOP COMPRESSION (LNTC) ARE: 3

LOAD REPETITIONS (TNLR) IN PERIOD 1 FOR EACH LOAD GROUP ARE: 3750.00

DAMAGE COEFFICENTS (FT) FOR TOP COMPRESSION OF LAYER 3 ARE: .1365E-08 .4477E+01

DAMAGE ANALYSIS OF PERIOD NO. 1 LOAD GROUP NO. 1

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
1 7.64010 .4588E-01 .2046E+02 .2046E+02 .1727E+02 .1546E+02 .1313E-02 .1313E-02 .5116E-03 .5116E-03

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
2 7.64010 .4790E-01 .1940E+02 .1940E+02 .1686E+02 .1418E+02 .1245E-02 .1245E-02 .4073E-03 .4073E-03

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
3 7.64010 .4790E-01 .1848E+02 .1848E+02 .1630E+02 .1327E+02 .1186E-02 .1186E-02 .3498E-03 .3498E-03

AT TOP OF LAYER 3 COMPRESSIVE STRAIN = .1313E-02 ALLOWABLE LOAD REPETITIONS = .10869E+05   DAMAGE RATIO= .34503E+00

SUMMARY OF DAMAGE ANALYSIS

AT TOP OF LAYER 3   SUM OF DAMAGE RATIO= .34503E+00

MAXIMUM DAMAGE RATO= .34503E+00   DESIGN LIFE IN YEARS= 2.90

NUMBER OF PROBLEMS TO BE SOLVED = 6

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* SECTION 6 PLATE LOAD HMA MR=250 KSI *

MATL = 3 FOR VISCOELASTIC LAYERED SYSTEM

NDAMA=1, SO DAMAGE ANALYSIS WILL BE PERFORMED

NUMBER OF PERIODS PER YEAR (NPY) = 1

NUMBER OF LOAD GROUPS (NLG) = 1

TOLERANCE FOR INTEGRATION (DEL) = .00100

NUMBER OF LAYERS (NL) = 3

NUMBER OF Z COORDINATES (NZ) = 0

LIMIT OF INTEGRATION CYCLES (ICL) = 80

COMPUTING CODE (NSTD) = 9

THICKNESS OF LAYERS (TH) ARE: 2.94000 5.84000

POISSON’S RATIOS OF LAYERS (PR) ARE: .35000 .30000 .30000

CONDITIONS OF INTERFACES (INT) ARE: 0 0

FOR PERIOD NO. 1 ELASTIC MODULI OF LAYERS ARE: .250000E+06 .250200E+05 .660000E+04

LOAD GROUP NO. 1 HAS 1 CONTACT AREAS
CONTACT RADIUS (CR) = 6.00000
CONTACT PRESSURE (CP)= 80.00000
RADIAL COORDINATES OF THE 1 POINTS (RC) ARE: .00000

DURATION OF MOVING LOAD (DUR) = 1.00000

NUMBER OF VISCOELASTIC LAYER (NVL) = 1

LAYER NUMBERS WHICH ARE VISCOELASTIC (LNV) = 1

CREEP TIMES (TYME) ARE:
.100E-02 .300E-02 .100E-01 .300E01 .100E+00 .300E+00 .100E+01 .300E+01 . 100E+02 .300E+02 .100E+03

FOR LAYER 1 TIME TEMPERATURE SHIFT FACTOR (BETA)= .11300 REFERENCE TEMPERATURE (TEMREF)= 77.00000

CREEP COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.163E-05 .221E-05 .308E-05 .417E-05 .580E-05 .785E-05 .109E-04 .148E-04 .206E-04 .279E-04 .389E-04

LAYER NO. 1 DIRICHLET SERIES FOR CREEP (GG) AT REFERENCE TEMPERATURE (TEMREF) OF 77.00000 ARE:
-.1543E-05 - .1086E-05 - .1254E-05 -.8227E-05 .3934E-05 -.2991E-04 .3962E-04

COMPUTED COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.174E-05 .210E-05 .302E-05 .427E-05 .576E-05 .767E-05 .112E-04 .151E-04 .196E-04 .288E-04 .386E-04

FOR PERIOD NO. 1 LAYER NO. AND TEMPERATURE ARE:

1 . 7000E+02

CREEP COMPLIANCES (CREEP) OF LAYER 1 AT TEMPERATURE (TEMP) OF 70.00000 ARE:
.157E-05 .163E-05 .186E-05 .239E-05 .355E-05 .484E-05 .649E-05 .886E-05 .130E-04 .165E-04 .230E-04

NUMBER OF LAYERS FOR BOTTOM TENSION (NLBT) = 0

NUMBER OF LAYERS FOR TOP COMPRESSION (NLTC) = 1

LAYER NO. FOR TOP COMPRESSION (LNTC) ARE: 3

LOAD REPETITIONS (TNLR) IN PERIOD 1 FOR EACH LOAD GROUP ARE: 3750.00

DAMAGE COEFFICENTS (FT) FOR TOP COMPRESSION OF LAYER 3 ARE: .1365E-08 .4477E+01

DAMAGE ANALYSIS OF PERIOD NO. 1 LOAD GROUP NO. 1

RADIAL VERTICAL VERTICAL VERTICAL RADIAL TANGENTIAL SHEAR VERTICAL RADIAL TANGENTIAL SHEAR
COORDINATE COORDINATE DISP STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
.00000 8.78010 .6345E-01 .2374E+02 .1899E+02 .1899E+02 .0000E+00 .1870E-02 .9350E-03 .9350E-03 0000E+00

AT TOP OF LAYER 3 COMPRESSIVE STRAIN = .1870E-02 ALLOWABLE LOAD REPETITIONS = .22330E+04 DAMAGE RATIO= .16793E+01

SUMMARY OF DAMAGE ANALYSIS

AT TOP OF LAYER 3 SUM OF DAMAGE RATIO= .16793E+01

MAXIMUM DAMAGE RATO= .16793E+01 DESIGN LIFE IN YEARS= .60

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* SECTION 6 DUAL TIRE LOAD 40 MPH HMA MR=250 KSI *

MATL = 3 FOR VISCOELASTIC LAYERED SYSTEM

NDAMA=1, SO DAMAGE ANALYSIS WILL BE PERFORMED

NUMBER OF PERIODS PER YEAR (NPY) = 1

NUMBER OF LOAD GROUPS (NLG) = 1

TOLERANCE FOR INTEGRATION (DEL) = .00100

NUMBER OF LAYERS (NL) = 3

NUMBER OF Z COORDINATES (NZ) = 1

LIMIT OF INTEGRATION CYCLES (ICL) = 80

COMPUTING CODE (NSTD) = 9

THICKNESS OF LAYERS (TH) ARE: 2.94000 5.84000

POISSON’S RATIOS OF LAYERS (PR) ARE: .35000 .30000 .30000

CONDITIONS OF INTERFACES (INT) ARE: 0 0

FOR PERIOD NO. 1 ELASTIC MODULI OF LAYERS ARE: .250000E+06 .250200E+05 .660000E+04

LOAD GROUP NO. 1 HAS 2 CONTACT AREAS
CONTACT RADIUS (CR) = 4.23000
CONTACT PRESSURE (CP)= 80.00000
NO. OF POINTS AT WHICH RESULTS ARE DESIRED (NPT) = 3
WHEEL SPACING ALONG X-AXIS (XW) = .00000
WHEEL SPACING ALONG Y-AXIS (YW) = 13.50000
POINT NO. AND X AND Y COORDIANTES ARE:
1 .00000 .00000 2 .00000 4.23 3 .00000 6.75000

DURATION OF MOVING LOAD(DUR) = .10000

NUMBER OF VISCOELASTIC LAYER (NVL) = 1

LAYER NUMBERS WHICH ARE VISCOELASTIC (LNV) = 1

CREEP TIMES (TYME) ARE:
.100E-02 .300E-02 .100E-01 .300E01 .100E+00 .300E+00 .100E+01 .300E+01 . 100E+02 .300E+02 .100E+03

FOR LAYER 1 TIME TEMPERATURE SHIFT FACTOR (BETA)= .11300 REFERENCE TEMPERATURE (TEMREF)= 77.00000

CREEP COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.163E-05 .221E-05 .308E-05 .417E-05 .580E-05 .785E-45 .109E-04 .148E-04 .206E-04 .279E-04 .389E-04

LAYER NO. 1 DIRICHLET SERIES FOR CREEP (GG) AT REFERENCE TEMPERATURE (TEMREF) OF 77.00000 ARE:
-.1561E-05 - .1042E-05 - .1290E-05 -.8239E-05 .3897E-05 -.2985E-04 .3962E-04

COMPUTED COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.174E-05 .210E-05 .303E-05 .427E-05 .576E-05 .768E-05 .112E-04 .151E-04 .197E-04 .288E-04 .386E-04

FOR PERIOD NO. 1 LAYER NO. AND TEMPERATURE ARE:
1 . 7000E+02

CREEP COMPLIANCES (CREEP) OF LAYER 1 AT TEMPERATURE (TEMP) OF 70.00000 ARE:
.157E-05 .163E-05 .185E-05 .239E-05 .355E-05 .483E-05 .649E-05 .888E-05 .130E-04 .166E-04 .230E-04

NUMBER OF LAYERS FOR BOTTOM TENSION (NLBT) = 0

NUMBER OF LAYERS FOR TOP COMPRESSION (NLTC) = 1

LAYER NO. FOR TOP COMPRESSION (LNTC) ARE: 3

LOAD REPETITIONS (TNLR) IN PERIOD 1 FOR EACH LOAD GROUP ARE: 3750.00

DAMAGE COEFFICENTS (FT) FOR TOP COMPRESSION OF LAYER 3 ARE: .1365E-08 .4477E+01

DAMAGE ANALYSIS OF PERIOD NO. 1 LOAD GROUP NO. 1

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
1 8.78010 .4604E-01 .1306E+02 .1306E+02 .1096E+02 .9929E+01 .1029E-02 .1029E-02 .4128E-03 .4128E-03

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL

NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
2 8.78010 .4851E-01 .1352E+02 .1352E+02 .1142E+02 .1021E+02 .1065E-02 .10653E-02 .4129E-03 .4129E-03

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
3 8.78010 .4881E-01 .1339E+02 .1339E+02 .1136E+02 .1007E+02 .1005E-02 .1005E-02 .3996E-03 .3996E-03

AT TOP OF LAYER 3 COMPRESSIVE STRAIN = .1065E-02 ALLOWABLE LOAD REPETITIONS = .27789E+05 DAMAGE RATIO= .13494E+00

SUMMARY OF DAMAGE ANALYSIS

AT TOP OF LAYER 3 SUM OF DAMAGE RATIO= .13494E+00

MAXIMUM DAMAGE RATO= .13494E+00 DESIGN LIFE IN YEARS= 7.41

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* SECTION 6 DUAL TIRE LOAD 60 MPH HMA MR=250 KSI *

MATL = 3 FOR VISCOELASTIC LAYERED SYSTEM

NDAMA=1, SO DAMAGE ANALYSIS WILL BE PERFORMED

NUMBER OF PERIODS PER YEAR (NPY) = 1

NUMBER OF LOAD GROUPS (NLG) = 1

TOLERANCE FOR INTEGRATION (DEL) = .00100

NUMBER OF LAYERS (NL) = 3

NUMBER OF Z COORDINATES (NZ) = 1

LIMIT OF INTEGRATION CYCLES (ICL) = 80

COMPUTING CODE (NSTD) = 9

THICKNESS OF LAYERS (TH) ARE: 2.94000 5.84000

POISSON'S RATIOS OF LAYERS (PR) ARE: .35000 .30000 .30000

CONDITIONS OF INTERFACES (INT) ARE: 0 0
FOR PERIOD NO. 1 ELASTIC MODULI OF LAYERS ARE: .250000E+06 .2502400E+05 .660000E+04

LOAD GROUP NO. 1 HAS 2 CONTACT AREAS
CONTACT RADIUS (CR) = 4.23000
CONTACT PRESSURE (CP)= 80.00000
NO. OF POINTS AT WHICH RESULTS ARE DESIRED (NPT) = 3
WHEEL SPACING ALONG X-AXIS (XW) = .00000
WHEEL SPACING ALONG Y-AXIS (YW) = 13.50000
POINT NO. AND X AND Y COORDIANTES ARE:
1 .00000 .00000 2 .00000 4.23 3 .00000 6.75000

DURATION OF MOVING LOAD(DUR) = .03500

NUMBER OF VISCOELASTIC LAYER (NVL) = 1

LAYER NUMBERS WHICH ARE VISCOELASTIC (LNV) = 1

CREEP TIMES (TYME) ARE:
.100E-02 .300E-02 .100E-01 .300E01 .100E+00 .300E+00 .100E+01 .300E+01 .100E+02 .300E+02 .100E+03

FOR LAYER 1 TIME TEMPERATURE SHIFT FACTOR (BETA)= .11300 REFERENCE TEMPERATURE (TEMREF)= 77.00000

CREEP COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.163E-05 .221E-05 .308E-05 .417E-05 .580E-05 .785E-45 .109E-04 .148E-04 .206E-04 .279E-04 .389E-04

LAYER NO. 1 DIRICHLET SERIES FOR CREEP (GG) AT REFERENCE TEMPERATURE (TEMREF) OF 77.00000 ARE:
-.1561E-05 - .1042E-05 - .1290E-05 -.8239E-05 .3897E-05 -.2985E-04 .3962E-04

COMPUTED COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.174E-05 .210E-05 .303E-05 .427E-05 .576E-05 .768E-05 .112E-04 .151E-04 .197E-04 .288E-04 .386E-04

FOR PERIOD NO. 1 LAYER NO. AND TEMPERATURE ARE:
1 . 7000E+02

CREEP COMPLIANCES (CREEP) OF LAYER 1 AT TEMPERATURE (TEMP) OF 70.00000 ARE:
.157E-05 .163E-05 .185E-05 .239E-05 .355E-05 .483E-05 .649E-05 .888E-05 .130E-04 .166E-04 .230E-04

NUMBER OF LAYERS FOR BOTTOM TENSION (NLBT) = 0

NUMBER OF LAYERS FOR TOP COMPRESSION (NLTC) = 1

LAYER NO. FOR TOP COMPRESSION (LNTC) ARE: 3

LOAD REPETITIONS (TNLR) IN PERIOD 1 FOR EACH LOAD GROUP ARE: 3750.00

DAMAGE COEFFICENTS (FT) FOR TOP COMPRESSION OF LAYER 3 ARE: .1365E-08 .4477E+01

DAMAGE ANALYSIS OF PERIOD NO. 1 LOAD GROUP NO. 1

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
1 8.78010 .4484E-01 .1214E+02 .1214E+02 .1017E+02 .9248E+01 .9565E-03 .9565E-03 .3870E-03 .3870E-03

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
2 8.78010 .4684E-01 .1265E+02 .1265E+02 .1065E+02 .9586E+01 .9963E-03 .9963E-03 .3938E-03 .3938E-03

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
3 8.78010 .4714E-01 .1257E+02 .1257E+02 .1062E+02 .9490E+01 .9902E-03 .9902E-03 .3840E-03 .3840E-03

AT TOP OF LAYER 3 COMPRESSIVE STRAIN = .9963E-03 ALLOWABLE LOAD REPETITIONS = .37434E+05 DAMAGE RATIO= .10018E+00

SUMMARY OF DAMAGE ANALYSIS

AT TOP OF LAYER 3 SUM OF DAMAGE RATIO= .10018E+00

MAXIMUM DAMAGE RATO= .10018E+00 DESIGN LIFE IN YEARS= 9.98

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* SECTION 6 PLATE LOAD HMA MR=370 KSI *

MATL = 3 FOR VISCOELASTIC LAYERED SYSTEM

NDAMA=1, SO DAMAGE ANALYSIS WILL BE PERFORMED

NUMBER OF PERIODS PER YEAR (NPY) = 1

NUMBER OF LOAD GROUPS (NLG) = 1

TOLERANCE FOR INTEGRATION (DEL) = .00100

NUMBER OF LAYERS (NL) = 3

NUMBER OF Z COORDINATES (NZ) = 0

LIMIT OF INTEGRATION CYCLES (ICL) = 80

COMPUTING CODE (NSTD) = 9

THICKNESS OF LAYERS (TH) ARE: 2.94000 5.84000

POISSON'S RATIOS OF LAYERS (PR) ARE: .35000 .30000 .30000

CONDITIONS OF INTERFACES (INT) ARE: 0 0

FOR PERIOD NO. 1 ELASTIC MODULI OF LAYERS ARE: .370000E+06 .250200E+05
.660000E+04

LOAD GROUP NO. 1 HAS 1 CONTACT AREAS
CONTACT RADIUS (CR) = 6.00000
CONTACT PRESSURE (CP)= 80.00000
RADIAL COORDINATES OF THE 1 POINTS (RC) ARE: .00000

DURATION OF MOVING LOAD (DUR) = 1.00000

NUMBER OF VISCOELASTIC LAYER (NVL) = 1

LAYER NUMBERS WHICH ARE VISCOELASTIC (LNV) = 1

CREEP TIMES (TYME) ARE:
.100E-02 .300E-02 .100E-01 .300E01 .100E+00 .300E+00 .100E+01 .300E+01 . 100E+02 .300E+02
.100E+03

FOR LAYER 1 TIME TEMPERATURE SHIFT FACTOR (BETA)= .11300 REFERENCE TEMPERATURE (TEMREF)= 77.00000

CREEP COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.589E-05 .676E-05 .776E-05 .891E-05 .102E-04 .117E-04 .134E-04 .153E-04 .177E-04 .200E-04 .232E-04

LAYER NO. 1 DIRICHLET SERIES FOR CREEP (GG) AT REFERENCE TEMPERATURE (TEMREF) OF 77.00000 ARE:
-.3015E-05 - .6485E-06 - .2508E-05 -.4060E-05 .5460E-06 -.8125E-05 .2336E-04

COMPUTED COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.605E-05 .656E-05 .776E-05 .899E-05 .101E-05 .117E-05 .135E-04 .154E-04 .173E-04 .203E-04 .231E-04

FOR PERIOD NO. 1 LAYER NO. AND TEMPERATURE ARE:
1 . 7000E+02

CREEP COMPLIANCES (CREEP) OF LAYER 1 AT TEMPERATURE (TEMP) OF 70.00000 ARE:
.580E-05 .590E-05 .622E-05 .696E-05 .835E-05 .940E-05 .108E-04 .123E-04 .144E-44 .161E-04 .185E-04

NUMBER OF LAYERS FOR BOTTOM TENSION (NLBT) = 0

NUMBER OF LAYERS FOR TOP COMPRESSION (NLTC) = 1

LAYER NO. FOR TOP COMPRESSION (LNTC) ARE: 3

LOAD REPETITIONS (TNLR) IN PERIOD 1 FOR EACH LOAD GROUP ARE: 3750.00

DAMAGE COEFFICENTS (FT) FOR TOP COMPRESSION OF LAYER 3 ARE: .1365E-08 .4477E+01

DAMAGE ANALYSIS OF PERIOD NO. 1 LOAD GROUP NO. 1

RADIAL VERTICAL VERTICAL VERTICAL RADIAL TANGENTIAL SHEAR VERTICAL RADIAL TANGENTIAL SHEAR
COORDINATE COORDINATE DISP STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
.00000 8.78010 .7008E-01 .2873E+02 .2298E+02 .2298E+02 .0000E+00 .2264E-02 .1132E-02 .1132E-02 0000E+00

AT TOP OF LAYER 3 COMPRESSIVE STRAIN = .2264E-02 ALLOWABLE LOAD REPETITIONS = .94990E+03 DAMAGE RATIO= .39478E+01

SUMMARY OF DAMAGE ANALYSIS

AT TOP OF LAYER 3 SUM OF DAMAGE RATIO= .39478E+01

MAXIMUM DAMAGE RATO= .39478E+01 DESIGN LIFE IN YEARS= .25

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* SECTION 6 DUAL TIRE LOAD 40 MPH HMA MR=370 KSI *

MATL = 3 FOR VISCOELASTIC LAYERED SYSTEM

NDAMA=1, SO DAMAGE ANALYSIS WILL BE PERFORMED

NUMBER OF PERIODS PER YEAR (NPY) = 1

NUMBER OF LOAD GROUPS (NLG) = 1

TOLERANCE FOR INTEGRATION (DEL) = .00100

NUMBER OF LAYERS (NL) = 3

NUMBER OF Z COORDINATES (NZ) = 1

LIMIT OF INTEGRATION CYCLES (ICL) = 80

COMPUTING CODE (NSTD) = 9

THICKNESS OF LAYERS (TH) ARE: 2.94000 5.84000

POISSON'S RATIOS OF LAYERS (PR) ARE: .35000 .30000 .30000

CONDITIONS OF INTERFACES (INT) ARE: 0 0

FOR PERIOD NO. 1 ELASTIC MODULI OF LAYERS ARE: .370000E+06 .250200E+05 .660000E+04

LOAD GROUP NO. 1 HAS 2 CONTACT AREAS
CONTACT RADIUS (CR) = 4.23000
CONTACT PRESSURE (CP)= 80.00000
NO. OF POINTS AT WHICH RESULTS ARE DESIRED (NPT) = 3
WHEEL SPACING ALONG X-AXIS (XW) = .00000
WHEEL SPACING ALONG Y-AXIS (YW) = 13.50000
POINT NO. AND X AND Y COORDIANTES ARE:
1 .00000 .00000 2 .00000 4.23 3 .00000 6.75000

DURATION OF MOVING LOAD(DUR) = .10000

NUMBER OF VISCOELASTIC LAYER (NVL) = 1

LAYER NUMBERS WHICH ARE VISCOELASTIC (LNV) = 1

CREEP TIMES (TYME) ARE:
.100E-02 .300E-02 .100E-01 .300E01 .100E+00 .300E+00 .100E+01 .300E+01 . 100E+02 .300E+02 .100E+03

FOR LAYER 1 TIME TEMPERATURE SHIFT FACTOR (BETA)= .11300 REFERENCE TEMPERATURE (TEMREF)= 77.00000

CREEP COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.589E-05 .676E-05 .776E-05 .891E-05 .102E-04 .117E-04 .134E-04 .153E-04 .177E-04 .200E-04 .232E-04

LAYER NO. 1 DIRICHLET SERIES FOR CREEP (GG) AT REFERENCE TEMPERATURE (TEMREF) OF 77.00000 ARE:
-.3015E-05 - .6485E-06 - .2508E-05 -.4060E-05 .5460E-06 -.8125E-05 .2336E-04

COMPUTED COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.605E-05 .656E-05 .776E-05 .899E-05 .101E-04 .117E-04 .135E-04 .154E-04 .173E-04 .203E-04 .231E-04

FOR PERIOD NO. 1 LAYER NO. AND TEMPERATURE ARE:
1 . 7000E+02

CREEP COMPLIANCES (CREEP) OF LAYER 1 AT TEMPERATURE (TEMP) OF 70.00000 ARE:
.580E-05 .590E-05 .622E-05 .696E-05 .835E-05 .940E-05 .108E-04 .123E-04 .144E-04 .161E-04 .185E-04

NUMBER OF LAYERS FOR BOTTOM TENSION (NLBT) = 0

NUMBER OF LAYERS FOR TOP COMPRESSION (NLTC) = 1

LAYER NO. FOR TOP COMPRESSION (LNTC) ARE: 3

LOAD REPETITIONS (TNLR) IN PERIOD 1 FOR EACH LOAD GROUP ARE: 3750.00

DAMAGE COEFFICENTS (FT) FOR TOP COMPRESSION OF LAYER 3 ARE: .1365E-08 .4477E+01

DAMAGE ANALYSIS OF PERIOD NO. 1 LOAD GROUP NO. 1

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN

1 8.78010 .5308E-01 .1783E+02 .1783E+02 .1505E+02 .1348E+02 .1405E-02 .1405E-02 .5481E-03 .5480E-03

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
2 8.78010 .5577E-01 .1760E+02 .1760E+02 .1515E+02 .1301E+02 .1387E-02 .1387E-02 .4830E-03 .4830E-03

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
3 8.78010 .5595E-01 .1709E+02 .1709E+02 .1485E+02 .1249E+02 .1347E-02 .1347E-02 .4407E-03 .4407E-03

AT TOP OF LAYER 3 COMPRESSIVE STRAIN = .1405E-02 ALLOWABLE LOAD REPETITIONS = .80400E+04 DAMAGE RATIO= .46642E+00

SUMMARY OF DAMAGE ANALYSIS

AT TOP OF LAYER 3 SUM OF DAMAGE RATIO= .46642E+00

MAXIMUM DAMAGE RATO= .46642E+00 DESIGN LIFE IN YEARS= 2.14

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* SECTION 6 DUAL TIRE LOAD 60 MPH HMA MR=370 KSI *

MATL = 3 FOR VISCOELASTIC LAYERED SYSTEM

NDAMA=1, SO DAMAGE ANALYSIS WILL BE PERFORMED

NUMBER OF PERIODS PER YEAR (NPY) = 1

NUMBER OF LOAD GROUPS (NLG) = 1

TOLERANCE FOR INTEGRATION (DEL) = .00100

NUMBER OF LAYERS (NL) = 3

NUMBER OF Z COORDINATES (NZ) = 1

LIMIT OF INTEGRATION CYCLES (ICL) = 80

COMPUTING CODE (NSTD) = 9

THICKNESS OF LAYERS (TH) ARE: 2.94000 5.84000

POISSON’S RATIOS OF LAYERS (PR) ARE: .35000 .30000 .30000

CONDITIONS OF INTERFACES (INT) ARE: 0 0
FOR PERIOD NO. 1 ELASTIC MODULI OF LAYERS ARE: .370000E+06 .250200E+05 .660000E+04

LOAD GROUP NO. 1 HAS 2 CONTACT AREAS
CONTACT RADIUS (CR) = 4.23000
CONTACT PRESSURE (CP)= 80.00000
NO. OF POINTS AT WHICH RESULTS ARE DESIRED (NPT) = 3
WHEEL SPACING ALONG X-AXIS (XW) = .00000
WHEEL SPACING ALONG Y-AXIS (YW) = 13.50000
POINT NO. AND X AND Y COORDIANTES ARE:

1 .00000 .00000 2 .00000 4.23 3 .00000 6.75000

DURATION OF MOVING LOAD(DUR) = .03500

NUMBER OF VISCOELASTIC LAYER (NVL) = 1

LAYER NUMBERS WHICH ARE VISCOELASTIC (LNV) = 1

CREEP TIMES (TYME) ARE:
.100E-02 .300E-02 .100E-01 .300E01 .100E+00 .300E+00 .100E+01 .300E+01 .100E+02 .300E+02 .100E+03

FOR LAYER 1 TIME TEMPERATURE SHIFT FACTOR (BETA)= .11300 REFERENCE TEMPERATURE (TEMREF)= 77.00000

CREEP COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.589E-05 .676E-05 .776E-05 .891E-05 .102E-04 .117E-45 .134E-04 .153E-04 .177E-04 .200E-04 .232E-04

LAYER NO. 1 DIRICHLET SERIES FOR CREEP (GG) AT REFERENCE TEMPERATURE (TEMREF) OF 77.00000 ARE:
-.3015E-05 - .6485E-06 - .2508E-05 -.4060E-05 .5460E-06 -.8125E-05 .2336E-04

COMPUTED COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.605E-05 .656E-05 .776E-05 .899E-05 .101E-04 .117E-04 .135E-04 .154E-04 .173E-04 .203E-04 .231E-04

FOR PERIOD NO. 1 LAYER NO. AND TEMPERATURE ARE:
1 . 7000E+02

CREEP COMPLIANCES (CREEP) OF LAYER 1 AT TEMPERATURE (TEMP) OF 70.00000 ARE:
.580E-05 .590E-05 .622E-05 .696E-05 .835E-05 .940E-05 .108E-04 .123E-04 .144E-04 .161E-04 .185E-04

NUMBER OF LAYERS FOR BOTTOM TENSION (NLBT) = 0

NUMBER OF LAYERS FOR TOP COMPRESSION (NLTC) = 1

LAYER NO. FOR TOP COMPRESSION (LNTC) ARE: 3

LOAD REPETITIONS (TNLR) IN PERIOD 1 FOR EACH LOAD GROUP ARE: 3750.00

DAMAGE COEFFICENTS (FT) FOR TOP COMPRESSION OF LAYER 3 ARE: .1365E-08 .4477E+01

DAMAGE ANALYSIS OF PERIOD NO. 1 LOAD GROUP NO. 1

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
1 8.78010 .5256E-01 .1743E+02 .1743E+02 .1471E+02 .1318E+02 .1374E-02 .1374E-02 .5365E-03 .5365E-03

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
2 8.78010 .5527E-01 .1730E+02 .1730E+02 .1487E+02 .1282E+02 .1363E-02 .1363E-02 .4796E-03 .4796E-03

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
3 8.78010 .5548E-01 .1684E+02 .1684E+02 .1460E+02 .1234E+02 .1327E-02 .1327E-02 .4407E-03 .4407E-03

AT TOP OF LAYER 3 COMPRESSIVE STRAIN = .1374E-02 ALLOWABLE LOAD REPETITIONS = .88927E+04   DAMAGE RATIO= .42169E+00

SUMMARY OF DAMAGE ANALYSIS

AT TOP OF LAYER 3   SUM OF DAMAGE RATIO= .42169E+00

MAXIMUM DAMAGE RATO= .42169E+00   DESIGN LIFE IN YEARS= 2.37

NUMBER OF PROBLEMS TO BE SOLVED = 6

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* SECTION 7 PLATE LOAD HMA MR=250 KSI *

MATL = 3 FOR VISCOELASTIC LAYERED SYSTEM

NDAMA=1, SO DAMAGE ANALYSIS WILL BE PERFORMED

NUMBER OF PERIODS PER YEAR (NPY) = 1

NUMBER OF LOAD GROUPS (NLG) = 1

TOLERANCE FOR INTEGRATION (DEL) = .00100

NUMBER OF LAYERS (NL) = 3

NUMBER OF Z COORDINATES (NZ) = 0

LIMIT OF INTEGRATION CYCLES (ICL) = 80

COMPUTING CODE (NSTD) = 9

THICKNESS OF LAYERS (TH) ARE: 2.78000 5.78000

POISSON’S RATIOS OF LAYERS (PR) ARE: .35000 .30000 .30000

CONDITIONS OF INTERFACES (INT) ARE: 0 0

FOR PERIOD NO. 1 ELASTIC MODULI OF LAYERS ARE: .250000E+06 .249200E+05 .630000E+04

LOAD GROUP NO. 1 HAS 1 CONTACT AREAS
CONTACT RADIUS (CR) = 6.00000
CONTACT PRESSURE (CP)= 80.00000
RADIAL COORDINATES OF THE 1 POINTS (RC) ARE: .00000

DURATION OF MOVING LOAD (DUR) = 1.00000

NUMBER OF VISCOELASTIC LAYER (NVL) = 1

LAYER NUMBERS WHICH ARE VISCOELASTIC (LNV) = 1

CREEP TIMES (TYME) ARE:
.100E-02 .300E-02 .100E-01 .300E01 .100E+00 .300E+00 .100E+01 .300E+01 . 100E+02 .300E+02 .100E+03

FOR LAYER 1 TIME TEMPERATURE SHIFT FACTOR (BETA)= .11300 REFERENCE TEMPERATURE (TEMREF)= 77.00000

CREEP COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.163E-05 .221E-05 .308E-05 .417E-05 .580E-05 .785E-05 .109E-04 .148E-04 .206E-04 .279E-04 .389E-04

LAYER NO. 1 DIRICHLET SERIES FOR CREEP (GG) AT REFERENCE TEMPERATURE (TEMREF) OF 77.00000 ARE:
-.1543E-05 - .1086E-05 - .1254E-05 -.8227E-05 .3934E-05 -.2991E-04 .3962E-04

COMPUTED COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.174E-05 .210E-05 .302E-05 .427E-05 .576E-05 .767E-05 .112E-04 .151E-04 .196E-04 .288E-04 .386E-04

FOR PERIOD NO. 1 LAYER NO. AND TEMPERATURE ARE:

1 . 7000E+02

CREEP COMPLIANCES (CREEP) OF LAYER 1 AT TEMPERATURE (TEMP) OF 70.00000 ARE:
.157E-05 .163E-05 .186E-05 .239E-05 .355E-05 .484E-05 .649E-05 .886E-05 .130E-04 .165E-04 .230E-04

NUMBER OF LAYERS FOR BOTTOM TENSION (NLBT) = 0

NUMBER OF LAYERS FOR TOP COMPRESSION (NLTC) = 1

LAYER NO. FOR TOP COMPRESSION (LNTC) ARE: 3

LOAD REPETITIONS (TNLR) IN PERIOD 1 FOR EACH LOAD GROUP ARE: 3750.00

DAMAGE COEFFICENTS (FT) FOR TOP COMPRESSION OF LAYER 3 ARE: .1365E-08 .4477E+01

DAMAGE ANALYSIS OF PERIOD NO. 1 LOAD GROUP NO. 1

RADIAL VERTICAL VERTICAL VERTICAL RADIAL TANGENTIAL SHEAR VERTICAL RADIAL TANGENTIAL SHEAR
COORDINATE COORDINATE DISP STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
.00000 8.56010 .6770E-01 .2460E+02 .1968E+02 .1968E+02 .0000E+00 .2030E-02 .1015E-02 .1015E-02 0000E+00

AT TOP OF LAYER 3 COMPRESSIVE STRAIN = .2030E-02 ALLOWABLE LOAD REPETITIONS = .15465E+04 DAMAGE RATIO= .24249E+01

SUMMARY OF DAMAGE ANALYSIS

AT TOP OF LAYER 3 SUM OF DAMAGE RATIO= .24249E+01

MAXIMUM DAMAGE RATO= .24249E+01 DESIGN LIFE IN YEARS= .41

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* SECTION 7 DUAL TIRE LOAD 40 MPH HMA MR=250 KSI *

MATL = 3 FOR VISCOELASTIC LAYERED SYSTEM

NDAMA=1, SO DAMAGE ANALYSIS WILL BE PERFORMED

NUMBER OF PERIODS PER YEAR (NPY) = 1

NUMBER OF LOAD GROUPS (NLG) = 1

TOLERANCE FOR INTEGRATION (DEL) = .00100

NUMBER OF LAYERS (NL) = 3

NUMBER OF Z COORDINATES (NZ) = 1

LIMIT OF INTEGRATION CYCLES (ICL) = 80

COMPUTING CODE (NSTD) = 9

THICKNESS OF LAYERS (TH) ARE: 2.78000 5.78000

POISSON'S RATIOS OF LAYERS (PR) ARE: .35000 .30000 .30000

CONDITIONS OF INTERFACES (INT) ARE: 0 0

FOR PERIOD NO. 1 ELASTIC MODULI OF LAYERS ARE: .250000E+06 .249200E+05 .630000E+04

LOAD GROUP NO. 1 HAS 2 CONTACT AREAS
CONTACT RADIUS (CR) = 4.23000
CONTACT PRESSURE (CP)= 80.00000
NO. OF POINTS AT WHICH RESULTS ARE DESIRED (NPT) = 3
WHEEL SPACING ALONG X-AXIS (XW) = .00000
WHEEL SPACING ALONG Y-AXIS (YW) = 13.50000
POINT NO. AND X AND Y COORDIANTES ARE:
1 .00000 .00000 2 .00000 4.23 3 .00000 6.75000

DURATION OF MOVING LOAD(DUR) = .10000

NUMBER OF VISCOELASTIC LAYER (NVL) = 1

LAYER NUMBERS WHICH ARE VISCOELASTIC (LNV) = 1

CREEP TIMES (TYME) ARE:
.100E-02 .300E-02 .100E-01 .300E01 .100E+00 .300E+00 .100E+01 .300E+01 . 100E+02 .300E+02 .100E+03

FOR LAYER 1 TIME TEMPERATURE SHIFT FACTOR (BETA)= .11300 REFERENCE TEMPERATURE (TEMREF)= 77.00000

CREEP COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.163E-05 .221E-05 .308E-05 .417E-05 .580E-05 .785E-45 .109E-04 .148E-04 .206E-04 .279E-04 .389E-04

LAYER NO. 1 DIRICHLET SERIES FOR CREEP (GG) AT REFERENCE TEMPERATURE (TEMREF) OF 77.00000 ARE:
-.1561E-05 - .1042E-05 - .1290E-05 -.8239E-05 .3897E-05 -.2985E-04 .3962E-04

COMPUTED COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.174E-05 .210E-05 .303E-05 .427E-05 .576E-05 .768E-05 .112E-04 .151E-04 .197E-04 .288E-04 .386E-04

FOR PERIOD NO. 1 LAYER NO. AND TEMPERATURE ARE:
1 . 7000E+02

CREEP COMPLIANCES (CREEP) OF LAYER 1 AT TEMPERATURE (TEMP) OF 70.00000 ARE:
.157E-05 .163E-05 .185E-05 .239E-05 .355E-05 .483E-05 .649E-05 .888E-05 .130E-04 .166E-04 .230E-04

NUMBER OF LAYERS FOR BOTTOM TENSION (NLBT) = 0

NUMBER OF LAYERS FOR TOP COMPRESSION (NLTC) = 1

LAYER NO. FOR TOP COMPRESSION (LNTC) ARE: 3

LOAD REPETITIONS (TNLR) IN PERIOD 1 FOR EACH LOAD GROUP ARE: 3750.00

DAMAGE COEFFICENTS (FT) FOR TOP COMPRESSION OF LAYER 3 ARE: .1365E-08 .4477E+01

DAMAGE ANALYSIS OF PERIOD NO. 1 LOAD GROUP NO. 1

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
1 8.56010 .4913E-01 .1358E+02 .1358E+02 .1148E+02 .1032E+02 .1121E-02 .1121E-02 .4479E-03 .4479E-03

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL

NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
2 8.56010 .5178E-01 .1400E+02 .1400E+02 .1185E+02 .1055E+02 .1156E-02 .1156E-02 .4432E-03 .4432E-03

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
3 8.56010 .5209E-01 .1385E+02 .1385E+02 .1178E+02 .1038E+02 .1143E-02 .1043E-02 .4268E-03 .4268E-03

AT TOP OF LAYER 3 COMPRESSIVE STRAIN = .1156E-02 ALLOWABLE LOAD REPETITIONS = .19268E+05 DAMAGE RATIO= .19462E+00

SUMMARY OF DAMAGE ANALYSIS

AT TOP OF LAYER 3 SUM OF DAMAGE RATIO= .19462E+00

MAXIMUM DAMAGE RATO= .19462E+00 DESIGN LIFE IN YEARS= 5.14

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* SECTION 7 DUAL TIRE LOAD 60 MPH HMA MR=250 KSI *

MATL = 3 FOR VISCOELASTIC LAYERED SYSTEM

NDAMA=1, SO DAMAGE ANALYSIS WILL BE PERFORMED

NUMBER OF PERIODS PER YEAR (NPY) = 1

NUMBER OF LOAD GROUPS (NLG) = 1

TOLERANCE FOR INTEGRATION (DEL) = .00100

NUMBER OF LAYERS (NL) = 3

NUMBER OF Z COORDINATES (NZ) = 1

LIMIT OF INTEGRATION CYCLES (ICL) = 80

COMPUTING CODE (NSTD) = 9

THICKNESS OF LAYERS (TH) ARE: 2.78000 5.78000

POISSON'S RATIOS OF LAYERS (PR) ARE: .35000 .30000 .30000

CONDITIONS OF INTERFACES (INT) ARE: 0 0
FOR PERIOD NO. 1 ELASTIC MODULI OF LAYERS ARE: .250000E+06 .249200E+05 .630000E+04

LOAD GROUP NO. 1 HAS 2 CONTACT AREAS
CONTACT RADIUS (CR) = 4.23000
CONTACT PRESSURE (CP)= 80.00000
NO. OF POINTS AT WHICH RESULTS ARE DESIRED (NPT) = 3
WHEEL SPACING ALONG X-AXIS (XW) = .00000
WHEEL SPACING ALONG Y-AXIS (YW) = 13.50000
POINT NO. AND X AND Y COORDIANTES ARE:
1 .00000 .00000 2 .00000 4.23 3 .00000 6.75000

DURATION OF MOVING LOAD(DUR) = .03500

NUMBER OF VISCOELASTIC LAYER (NVL) = 1

LAYER NUMBERS WHICH ARE VISCOELASTIC (LNV) = 1

CREEP TIMES (TYME) ARE:
.100E-02 .300E-02 .100E-01 .300E01 .100E+00 .300E+00 .100E+01 .300E+01 .100E+02 .300E+02 .100E+03

FOR LAYER 1 TIME TEMPERATURE SHIFT FACTOR (BETA)= .11300 REFERENCE TEMPERATURE (TEMREF)= 77.00000

CREEP COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.163E-05 .221E-05 .308E-05 .417E-05 .580E-05 .785E-45 .109E-04 .148E-04 .206E-04 .279E-04 .389E-04

LAYER NO. 1 DIRICHLET SERIES FOR CREEP (GG) AT REFERENCE TEMPERATURE (TEMREF) OF 77.00000 ARE:
-.1561E-05 - .1042E-05 - .1290E-05 -.8239E-05 .3897E-05 -.2985E-04 .3962E-04

COMPUTED COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.174E-05 .210E-05 .303E-05 .427E-05 .576E-05 .768E-05 .112E-04 .151E-04 .197E-04 .288E-04 .386E-04

FOR PERIOD NO. 1 LAYER NO. AND TEMPERATURE ARE:
1 . 7000E+02

CREEP COMPLIANCES (CREEP) OF LAYER 1 AT TEMPERATURE (TEMP) OF 70.00000 ARE:
.157E-05 .163E-05 .185E-05 .239E-05 .355E-05 .483E-05 .649E-05 .888E-05 .130E-04 .166E-04 .230E-04

NUMBER OF LAYERS FOR BOTTOM TENSION (NLBT) = 0

NUMBER OF LAYERS FOR TOP COMPRESSION (NLTC) = 1

LAYER NO. FOR TOP COMPRESSION (LNTC) ARE: 3

LOAD REPETITIONS (TNLR) IN PERIOD 1 FOR EACH LOAD GROUP ARE: 3750.00

DAMAGE COEFFICENTS (FT) FOR TOP COMPRESSION OF LAYER 3 ARE: .1365E-08 .4477E+01

DAMAGE ANALYSIS OF PERIOD NO. 1 LOAD GROUP NO. 1

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
1 8.56010 .4454E-01 .1266E+02 .1266E+02 .1062E+02 .9634E+01 .1045E-02 .1045E-02 .4208E-03 .4208E-03

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
2 8.56010 .5008E-01 .1314E+02 .1314E+02 .1109E+02 .9941E+01 .1085E-02 .1085E-02 .4242E-03 .4242E-03

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
3 8.56010 .5040E-01 .1304E+02 .1304E+02 .1104E+02 .9820E+01 .1076E-02 .1076E-02 .4120E-03 .4120E-03

AT TOP OF LAYER 3 COMPRESSIVE STRAIN = .1085E-02 ALLOWABLE LOAD REPETITIONS = .25584E+05 DAMAGE RATIO=
.14657E+00

SUMMARY OF DAMAGE ANALYSIS

AT TOP OF LAYER 3 SUM OF DAMAGE RATIO= .14657E+00

MAXIMUM DAMAGE RATO= .14657E+00 DESIGN LIFE IN YEARS= 6.82

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* SECTION 7 PLATE LOAD HMA MR=370 KSI *

MATL = 3 FOR VISCOELASTIC LAYERED SYSTEM

NDAMA=1, SO DAMAGE ANALYSIS WILL BE PERFORMED

NUMBER OF PERIODS PER YEAR (NPY) = 1

NUMBER OF LOAD GROUPS (NLG) = 1

TOLERANCE FOR INTEGRATION (DEL) = .00100

NUMBER OF LAYERS (NL) = 3

NUMBER OF Z COORDINATES (NZ) = 0

LIMIT OF INTEGRATION CYCLES (ICL) = 80

COMPUTING CODE (NSTD) = 9

THICKNESS OF LAYERS (TH) ARE: 2.94000 5.84000

POISSON'S RATIOS OF LAYERS (PR) ARE: .35000 .30000 .30000

CONDITIONS OF INTERFACES (INT) ARE: 0 0

FOR PERIOD NO. 1 ELASTIC MODULI OF LAYERS ARE: .370000E+06 .249200E+05
.630000E+04

LOAD GROUP NO. 1 HAS 1 CONTACT AREAS
CONTACT RADIUS (CR) = 6.00000
CONTACT PRESSURE (CP)= 80.00000
RADIAL COORDINATES OF THE 1 POINTS (RC) ARE: .00000

DURATION OF MOVING LOAD (DUR) = 1.00000

NUMBER OF VISCOELASTIC LAYER (NVL) = 1

LAYER NUMBERS WHICH ARE VISCOELASTIC (LNV) = 1

CREEP TIMES (TYME) ARE:
.100E-02 .300E-02 .100E-01 .300E01 .100E+00 .300E+00 .100E+01 .300E+01 . 100E+02 .300E+02
.100E+03

FOR LAYER 1 TIME TEMPERATURE SHIFT FACTOR (BETA)= .11300 REFERENCE TEMPERATURE (TEMREF)= 77.00000

CREEP COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.589E-05 .676E-05 .776E-05 .891E-05 .102E-04 .117E-04 .134E-04 .153E-04 .177E-04 .200E-04 .232E-04

LAYER NO. 1 DIRICHLET SERIES FOR CREEP (GG) AT REFERENCE TEMPERATURE (TEMREF) OF 77.00000 ARE:
-.3015E-05 - .6485E-06 - .2508E-05 -.4060E-05 .5460E-06 -.8125E-05 .2336E-04

COMPUTED COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.605E-05 .656E-05 .776E-05 .899E-05 .101E-05 .117E-05 .135E-04 .154E-04 .173E-04 .203E-04 .231E-04

FOR PERIOD NO. 1 LAYER NO. AND TEMPERATURE ARE:
1 . 7000E+02

CREEP COMPLIANCES (CREEP) OF LAYER 1 AT TEMPERATURE (TEMP) OF 70.00000 ARE:
.580E-05 .590E-05 .622E-05 .696E-05 .835E-05 .940E-05 .108E-04 .123E-04 .144E-44 .161E-04 .185E-04

NUMBER OF LAYERS FOR BOTTOM TENSION (NLBT) = 0

NUMBER OF LAYERS FOR TOP COMPRESSION (NLTC) = 1

LAYER NO. FOR TOP COMPRESSION (LNTC) ARE: 3

LOAD REPETITIONS (TNLR) IN PERIOD 1 FOR EACH LOAD GROUP ARE: 3750.00

DAMAGE COEFFICENTS (FT) FOR TOP COMPRESSION OF LAYER 3 ARE: .1365E-08 .4477E+01

DAMAGE ANALYSIS OF PERIOD NO. 1 LOAD GROUP NO. 1

RADIAL VERTICAL VERTICAL VERTICAL RADIAL TANGENTIAL SHEAR VERTICAL RADIAL TANGENTIAL SHEAR
COORDINATE COORDINATE DISP STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
.00000 8.56010 .7433E-01 .2944E+02 .2355E+02 .2355E+02 .0000E+00 .2430E-02 .1215E-02 .1215E-02 0000E+00

AT TOP OF LAYER 3 COMPRESSIVE STRAIN = .2430E-02 ALLOWABLE LOAD REPETITIONS = .69138E+03 DAMAGE RATIO= .54239E+01

SUMMARY OF DAMAGE ANALYSIS

AT TOP OF LAYER 3 SUM OF DAMAGE RATIO= .54239E+01

MAXIMUM DAMAGE RATO= .54239E+01 DESIGN LIFE IN YEARS= .18

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* SECTION 7 DUAL TIRE LOAD 40 MPH HMA MR=370 KSI *

MATL = 3 FOR VISCOELASTIC LAYERED SYSTEM

NDAMA=1, SO DAMAGE ANALYSIS WILL BE PERFORMED

NUMBER OF PERIODS PER YEAR (NPY) = 1

NUMBER OF LOAD GROUPS (NLG) = 1

TOLERANCE FOR INTEGRATION (DEL) = .00100

NUMBER OF LAYERS (NL) = 3

NUMBER OF Z COORDINATES (NZ) = 1

LIMIT OF INTEGRATION CYCLES (ICL) = 80

COMPUTING CODE (NSTD) = 9

THICKNESS OF LAYERS (TH) ARE: 2.78000 5.78000

POISSON'S RATIOS OF LAYERS (PR) ARE: .35000 .30000 .30000

CONDITIONS OF INTERFACES (INT) ARE: 0 0

FOR PERIOD NO. 1 ELASTIC MODULI OF LAYERS ARE: .370000E+06 .249200E+05
.630000E+04

LOAD GROUP NO. 1 HAS 2 CONTACT AREAS
CONTACT RADIUS (CR) = 4.23000
CONTACT PRESSURE (CP)= 80.00000
NO. OF POINTS AT WHICH RESULTS ARE DESIRED (NPT) = 3
WHEEL SPACING ALONG X-AXIS (XW) = .00000
WHEEL SPACING ALONG Y-AXIS (YW) = 13.50000
POINT NO. AND X AND Y COORDIANTES ARE:
1 .00000 .00000 2 .00000 4.23 3 .00000 6.75000

DURATION OF MOVING LOAD(DUR) = .10000

NUMBER OF VISCOELASTIC LAYER (NVL) = 1

LAYER NUMBERS WHICH ARE VISCOELASTIC (LNV) = 1

CREEP TIMES (TYME) ARE:
.100E-02 .300E-02 .100E-01 .300E01 .100E+00 .300E+00 .100E+01 .300E+01 . 100E+02 .300E+02
.100E+03

FOR LAYER 1 TIME TEMPERATURE SHIFT FACTOR (BETA)= .11300 REFERENCE TEMPERATURE (TEMREF)= 77.00000

CREEP COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.589E-05 .676E-05 .776E-05 .891E-05 .102E-04 .117E-04 .134E-04 .153E-04 .177E-04 .200E-04 .232E-04

LAYER NO. 1 DIRICHLET SERIES FOR CREEP (GG) AT REFERENCE TEMPERATURE (TEMREF) OF 77.00000 ARE:
-.3015E-05 - .6485E-06 - .2508E-05 -.4060E-05 .5460E-06 -.8125E-05 .2336E-04

COMPUTED COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.605E-05 .656E-05 .776E-05 .899E-05 .101E-04 .117E-04 .135E-04 .154E-04 .173E-04 .203E-04 .231E-04

FOR PERIOD NO. 1 LAYER NO. AND TEMPERATURE ARE:
1 . 7000E+02

CREEP COMPLIANCES (CREEP) OF LAYER 1 AT TEMPERATURE (TEMP) OF 70.00000 ARE:
.580E-05 .590E-05 .622E-05 .696E-05 .835E-05 .940E-05 .108E-04 .123E-04 .144E-04 .161E-04 .185E-04

NUMBER OF LAYERS FOR BOTTOM TENSION (NLBT) = 0

NUMBER OF LAYERS FOR TOP COMPRESSION (NLTC) = 1

LAYER NO. FOR TOP COMPRESSION (LNTC) ARE: 3

LOAD REPETITIONS (TNLR) IN PERIOD 1 FOR EACH LOAD GROUP ARE: 3750.00

DAMAGE COEFFECENTS (FT) FOR TOP COMPRESSION OF LAYER 3 ARE: .1365E-08 .4477E+01

DAMAGE ANALYSIS OF PERIOD NO. 1 LOAD GROUP NO. 1

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN

1 8.56010 .5623E-01 .1832E+02 .1832E+02 .1546E+02 .1385E+02 .1512E-02 .1512E-02 .5894E-03 .5894E-03

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
2 8.56010 .5901E-01 .1794E+02 .1794E+02 .1547E+02 .1323E+02 .1481E-02 .1481E-02 .5092E-03 .5092E-03

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
3 8.56010 .5917E-01 .1736E+02 .1736E+02 .1514E+02 .1265E+02 .1433E-02 .1433E-02 .4598E-03 .4598E-03

AT TOP OF LAYER 3 COMPRESSIVE STRAIN = .1512E-02 ALLOWABLE LOAD REPETITIONS = .57850E+04 DAMAGE RATIO= .64822E+00

SUMMARY OF DAMAGE ANALYSIS

AT TOP OF LAYER 3 SUM OF DAMAGE RATIO= .64822E+00

MAXIMUM DAMAGE RATO= .64822E+00 DESIGN LIFE IN YEARS= 1.54

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* SECTION 7 DUAL TIRE LOAD 60 MPH HMA MR=370 KSI *

MATL = 3 FOR VISCOELASTIC LAYERED SYSTEM

NDAMA=1, SO DAMAGE ANALYSIS WILL BE PERFORMED

NUMBER OF PERIODS PER YEAR (NPY) = 1

NUMBER OF LOAD GROUPS (NLG) = 1

TOLERANCE FOR INTEGRATION (DEL) = .00100

NUMBER OF LAYERS (NL) = 3

NUMBER OF Z COORDINATES (NZ) = 1

LIMIT OF INTEGRATION CYCLES (ICL) = 80

COMPUTING CODE (NSTD) = 9

THICKNESS OF LAYERS (TH) ARE: 2.78000 5.78000

POISSON’S RATIOS OF LAYERS (PR) ARE: .35000 .30000 .30000

CONDITIONS OF INTERFACES (INT) ARE: 0 0
FOR PERIOD NO. 1 ELASTIC MODULI OF LAYERS ARE: .370000E+06 .249200E+05 .630000E+04

LOAD GROUP NO. 1 HAS 2 CONTACT AREAS
CONTACT RADIUS (CR) = 4.23000
CONTACT PRESSURE (CP)= 80.00000
NO. OF POINTS AT WHICH RESULTS ARE DESIRED (NPT) = 3
WHEEL SPACING ALONG X-AXIS (XW) = .00000
WHEEL SPACING ALONG Y-AXIS (YW) = 13.50000
POINT NO. AND X AND Y COORDIANTES ARE:

1 .00000 .00000 2 .00000 4.23 3 .00000 6.75000

DURATION OF MOVING LOAD(DUR) = .03500

NUMBER OF VISCOELASTIC LAYER (NVL) = 1

LAYER NUMBERS WHICH ARE VISCOELASTIC (LNV) = 1

CREEP TIMES (TYME) ARE:
.100E-02 .300E-02 .100E-01 .300E01 .100E+00 .300E+00 .100E+01 .300E+01 .100E+02 .300E+02 .100E+03

FOR LAYER 1 TIME TEMPERATURE SHIFT FACTOR (BETA)= .11300 REFERENCE TEMPERATURE (TEMREF)= 77.00000

CREEP COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.589E-05 .676E-05 .776E-05 .891E-05 .102E-04 .117E-45 .134E-04 .153E-04 .177E-04 .200E-04 .232E-04

LAYER NO. 1 DIRICHLET SERIES FOR CREEP (GG) AT REFERENCE TEMPERATURE (TEMREF) OF 77.00000 ARE:
-.3015E-05 - .6485E-06 - .2508E-05 -.4060E-05 .5460E-06 -.8125E-05 .2336E-04

COMPUTED COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.605E-05 .656E-05 .776E-05 .899E-05 .101E-04 .117E-04 .135E-04 .154E-04 .173E-04 .203E-04 .231E-04

FOR PERIOD NO. 1 LAYER NO. AND TEMPERATURE ARE:
1 . 7000E+02

CREEP COMPLIANCES (CREEP) OF LAYER 1 AT TEMPERATURE (TEMP) OF 70.00000 ARE:
.580E-05 .590E-05 .622E-05 .696E-05 .835E-05 .940E-05 .108E-04 .123E-04 .144E-04 .161E-04 .185E-04

NUMBER OF LAYERS FOR BOTTOM TENSION (NLBT) = 0

NUMBER OF LAYERS FOR TOP COMPRESSION (NLTC) = 1

LAYER NO. FOR TOP COMPRESSION (LNTC) ARE: 3

LOAD REPETITIONS (TNLR) IN PERIOD 1 FOR EACH LOAD GROUP ARE: 3750.00

DAMAGE COEFFICENTS (FT) FOR TOP COMPRESSION OF LAYER 3 ARE: .1365E-08 .4477E+01

DAMAGE ANALYSIS OF PERIOD NO. 1 LOAD GROUP NO. 1

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
1 8.56010 .5572E-01 .1793E+02 .1793E+02 .1513E+02 .1356E+02 .1480E-02 .1480E-02 .5774E-03 .5774E-03

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
2 8.56010 .5853E-01 .1766E+02 .1766E+02 .1521E+02 .1305E+02 .1458E-02 .1458E-02 .5062E-03 .5062E-03

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
3 8.56010 .5871E-01 .1713E+02 .1713E+02 .1490E+02 .1251E+02 .1414E-02 .1414E-02 .4606E-03 .4606E-03

AT TOP OF LAYER 3 COMPRESSIVE STRAIN = .1480E-02 ALLOWABLE LOAD REPETITIONS = .63677E+04   DAMAGE RATIO= .58891E+00

SUMMARY OF DAMAGE ANALYSIS

AT TOP OF LAYER 3   SUM OF DAMAGE RATIO= .58891E+00

MAXIMUM DAMAGE RATO= .58891E+00   DESIGN LIFE IN YEARS= 1.70

NUMBER OF PROBLEMS TO BE SOLVED = 6

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* SECTION 9 PLATE LOAD HMA MR=250 KSI *

MATL = 3 FOR VISCOELASTIC LAYERED SYSTEM

NDAMA=1, SO DAMAGE ANALYSIS WILL BE PERFORMED

NUMBER OF PERIODS PER YEAR (NPY) = 1

NUMBER OF LOAD GROUPS (NLG) = 1

TOLERANCE FOR INTEGRATION (DEL) = .00100

NUMBER OF LAYERS (NL) = 3

NUMBER OF Z COORDINATES (NZ) = 0

LIMIT OF INTEGRATION CYCLES (ICL) = 80

COMPUTING CODE (NSTD) = 9

THICKNESS OF LAYERS (TH) ARE: 3.28000 8.28000

POISSON'S RATIOS OF LAYERS (PR) ARE: .35000 .30000 .30000

CONDITIONS OF INTERFACES (INT) ARE: 0 0

FOR PERIOD NO. 1 ELASTIC MODULI OF LAYERS ARE: .250000E+06 .305600E+05
.810000E+04

LOAD GROUP NO. 1 HAS 1 CONTACT AREAS
CONTACT RADIUS (CR) = 6.00000
CONTACT PRESSURE (CP)= 80.00000
RADIAL COORDINATES OF THE 1 POINTS (RC) ARE: .00000

DURATION OF MOVING LOAD (DUR) = 1.00000

NUMBER OF VISCOELASTIC LAYER (NVL) = 1

LAYER NUMBERS WHICH ARE VISCOELASTIC (LNV) = 1

CREEP TIMES (TYME) ARE:
.100E-02 .300E-02 .100E-01 .300E01 .100E+00 .300E+00 .100E+01 .300E+01 . 100E+02 .300E+02
.100E+03

FOR LAYER 1 TIME TEMPERATURE SHIFT FACTOR (BETA)= .11300 REFERENCE TEMPERATURE (TEMREF)= 77.00000

CREEP COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.163E-05 .221E-05 .308E-05 .417E-05 .580E-05 .785E-05 .109E-04 .148E-04 .206E-04 .279E-04 .389E-04

LAYER NO. 1 DIRICHLET SERIES FOR CREEP (GG) AT REFERENCE TEMPERATURE (TEMREF) OF 77.00000 ARE:
-.1543E-05 - .1086E-05 - .1254E-05 -.8227E-05 .3934E-05 -.2991E-04 .3962E-04

COMPUTED COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.174E-05 .210E-05 .302E-05 .427E-05 .576E-05 .767E-05 .112E-04 .151E-04 .196E-04 .288E-04 .386E-04

FOR PERIOD NO. 1 LAYER NO. AND TEMPERATURE ARE:

1 . 7000E+02

CREEP COMPLIANCES (CREEP) OF LAYER 1 AT TEMPERATURE (TEMP) OF 70.00000 ARE:
.157E-05 .163E-05 .186E-05 .239E-05 .355E-05 .484E-05 .649E-05 .886E-05 .130E-04 .165E-04 .230E-04

NUMBER OF LAYERS FOR BOTTOM TENSION (NLBT) = 0

NUMBER OF LAYERS FOR TOP COMPRESSION (NLTC) = 1

LAYER NO. FOR TOP COMPRESSION (LNTC) ARE: 3

LOAD REPETITIONS (TNLR) IN PERIOD 1 FOR EACH LOAD GROUP ARE: 3750.00

DAMAGE COEFFICENTS (FT) FOR TOP COMPRESSION OF LAYER 3 ARE: .1365E-08 .4477E+01

DAMAGE ANALYSIS OF PERIOD NO. 1 LOAD GROUP NO. 1

RADIAL VERTICAL VERTICAL VERTICAL RADIAL TANGENTIAL SHEAR VERTICAL RADIAL TANGENTIAL SHEAR
COORDINATE COORDINATE DISP STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
.00000 11.56010 .4380E-01 .1738E+02 .1390E+02 .1390E+02 .0000E+00 .1116E-02 .5578E-03 .5578E-03 0000E+00

AT TOP OF LAYER 3 COMPRESSIVE STRAIN = .1116E-02 ALLOWABLE LOAD REPETITIONS = .22548E+05 DAMAGE RATIO= .16631E+00

SUMMARY OF DAMAGE ANALYSIS

AT TOP OF LAYER 3 SUM OF DAMAGE RATIO= .16631E+00

MAXIMUM DAMAGE RATO= .16631E+00 DESIGN LIFE IN YEARS= 6.01

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* SECTION 9 DUAL TIRE LOAD 40 MPH HMA MR=250 KSI *

MATL = 3 FOR VISCOELASTIC LAYERED SYSTEM

NDAMA=1, SO DAMAGE ANALYSIS WILL BE PERFORMED

NUMBER OF PERIODS PER YEAR (NPY) = 1

NUMBER OF LOAD GROUPS (NLG) = 1

TOLERANCE FOR INTEGRATION (DEL) = .00100

NUMBER OF LAYERS (NL) = 3

NUMBER OF Z COORDINATES (NZ) = 1

LIMIT OF INTEGRATION CYCLES (ICL) = 80

COMPUTING CODE (NSTD) = 9

THICKNESS OF LAYERS (TH) ARE: 3.28000 8.28000

POISSON'S RATIOS OF LAYERS (PR) ARE: .35000 .30000 .30000

CONDITIONS OF INTERFACES (INT) ARE: 0 0

FOR PERIOD NO. 1 ELASTIC MODULI OF LAYERS ARE: .250000E+06 .305600E+05 .810000E+04

LOAD GROUP NO. 1 HAS 2 CONTACT AREAS
CONTACT RADIUS (CR) = 4.23000
CONTACT PRESSURE (CP)= 80.00000
NO. OF POINTS AT WHICH RESULTS ARE DESIRED (NPT) = 3
WHEEL SPACING ALONG X-AXIS (XW) = .00000
WHEEL SPACING ALONG Y-AXIS (YW) = 13.50000
POINT NO. AND X AND Y COORDIANTES ARE:
1 .00000 .00000 2 .00000 4.23 3 .00000 6.75000

DURATION OF MOVING LOAD(DUR) = .10000

NUMBER OF VISCOELASTIC LAYER (NVL) = 1

LAYER NUMBERS WHICH ARE VISCOELASTIC (LNV) = 1

CREEP TIMES (TYME) ARE:
.100E-02 .300E-02 .100E-01 .300E01 .100E+00 .300E+00 .100E+01 .300E+01 . 100E+02 .300E+02 .100E+03

FOR LAYER 1 TIME TEMPERATURE SHIFT FACTOR (BETA)= .11300 REFERENCE TEMPERATURE (TEMREF)= 77.00000

CREEP COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.163E-05 .221E-05 .308E-05 .417E-05 .580E-05 .785E-45 .109E-04 .148E-04 .206E-04 .279E-04 .389E-04

LAYER NO. 1 DIRICHLET SERIES FOR CREEP (GG) AT REFERENCE TEMPERATURE (TEMREF) OF 77.00000 ARE:
-.1561E-05 - .1042E-05 - .1290E-05 -.8239E-05 .3897E-05 -.2985E-04 .3962E-04

COMPUTED COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.174E-05 .210E-05 .303E-05 .427E-05 .576E-05 .768E-05 .112E-04 .151E-04 .197E-04 .288E-04 .386E-04

FOR PERIOD NO. 1 LAYER NO. AND TEMPERATURE ARE:
1 . 7000E+02

CREEP COMPLIANCES (CREEP) OF LAYER 1 AT TEMPERATURE (TEMP) OF 70.00000 ARE:
.157E-05 .163E-05 .185E-05 .239E-05 .355E-05 .483E-05 .649E-05 .888E-05 .130E-04 .166E-04 .230E-04

NUMBER OF LAYERS FOR BOTTOM TENSION (NLBT) = 0

NUMBER OF LAYERS FOR TOP COMPRESSION (NLTC) = 1

LAYER NO. FOR TOP COMPRESSION (LNTC) ARE: 3

LOAD REPETITIONS (TNLR) IN PERIOD 1 FOR EACH LOAD GROUP ARE: 3750.00

DAMAGE COEFFICENTS (FT) FOR TOP COMPRESSION OF LAYER 3 ARE: .1365E-08 .4477E+01

DAMAGE ANALYSIS OF PERIOD NO. 1 LOAD GROUP NO. 1

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
1 11.56010 .3367E-01 .1034E+02 .1034E+02 .8642E+01 .7894E+01 .6635E-03 .6635E-03 .2717E-03 .2717E-03

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL

NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
2 11.56010 .3546E-01 .1102E+02 .1102E+02 .9204E+01 .8432E+01 .7077E-03 .7077E-03 .2919E-03 .2919E-03

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
3 11.56010 .3572E-01 .1106E+02 .1106E+02 .9249E+01 .8451E+01 .7102E-03 .7102E-03 .2910E-03 .2910E-03

AT TOP OF LAYER 3 COMPRESSIVE STRAIN = .7102E-02 ALLOWABLE LOAD REPETITIONS = .17039E+06 DAMAGE RATIO= .22008E-01

SUMMARY OF DAMAGE ANALYSIS

AT TOP OF LAYER 3 SUM OF DAMAGE RATIO= .22008E-01

MAXIMUM DAMAGE RATO= .22008E-01 DESIGN LIFE IN YEARS= 45.44

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* SECTION 9 DUAL TIRE LOAD 60 MPH HMA MR=250 KSI *

MATL = 3 FOR VISCOELASTIC LAYERED SYSTEM

NDAMA=1, SO DAMAGE ANALYSIS WILL BE PERFORMED

NUMBER OF PERIODS PER YEAR (NPY) = 1

NUMBER OF LOAD GROUPS (NLG) = 1

TOLERANCE FOR INTEGRATION (DEL) = .00100

NUMBER OF LAYERS (NL) = 3

NUMBER OF Z COORDINATES (NZ) = 1

LIMIT OF INTEGRATION CYCLES (ICL) = 80

COMPUTING CODE (NSTD) = 9

THICKNESS OF LAYERS (TH) ARE: 3.2800 8.28000

POISSON’S RATIOS OF LAYERS (PR) ARE: .35000 .30000 .30000

CONDITIONS OF INTERFACES (INT) ARE: 0 0
FOR PERIOD NO. 1 ELASTIC MODULI OF LAYERS ARE: .250000E+06 .305600E+05 .810000E+04

LOAD GROUP NO. 1 HAS 2 CONTACT AREAS
CONTACT RADIUS (CR) = 4.23000
CONTACT PRESSURE (CP)= 80.00000
NO. OF POINTS AT WHICH RESULTS ARE DESIRED (NPT) = 3
WHEEL SPACING ALONG X-AXIS (XW) = .00000
WHEEL SPACING ALONG Y-AXIS (YW) = 13.50000
POINT NO. AND X AND Y COORDIANTES ARE:
1 .00000 .00000 2 .00000 4.23 3 .00000 6.75000

DURATION OF MOVING LOAD(DUR) = .03500

NUMBER OF VISCOELASTIC LAYER (NVL) = 1

LAYER NUMBERS WHICH ARE VISCOELASTIC (LNV) = 1

CREEP TIMES (TYME) ARE:
.100E-02 .300E-02 .100E-01 .300E01 .100E+00 .300E+00 .100E+01 .300E+01 .100E+02 .300E+02 .100E+03

FOR LAYER 1 TIME TEMPERATURE SHIFT FACTOR (BETA)= .11300 REFERENCE TEMPERATURE (TEMREF)= 77.00000

CREEP COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.163E-05 .221E-05 .308E-05 .417E-05 .580E-05 .785E-45 .109E-04 .148E-04 .206E-04 .279E-04 .389E-04

LAYER NO. 1 DIRICHLET SERIES FOR CREEP (GG) AT REFERENCE TEMPERATURE (TEMREF) OF 77.00000 ARE:
-.1561E-05 - .1042E-05 - .1290E-05 -.8239E-05 .3897E-05 -.2985E-04 .3962E-04

COMPUTED COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.174E-05 .210E-05 .303E-05 .427E-05 .576E-05 .768E-05 .112E-04 .151E-04 .197E-04 .288E-04 .386E-04

FOR PERIOD NO. 1 LAYER NO. AND TEMPERATURE ARE:
1 . 7000E+02

CREEP COMPLIANCES (CREEP) OF LAYER 1 AT TEMPERATURE (TEMP) OF 70.00000 ARE:
.157E-05 .163E-05 .185E-05 .239E-05 .355E-05 .483E-05 .649E-05 .888E-05 .130E-04 .166E-04 .230E-04

NUMBER OF LAYERS FOR BOTTOM TENSION (NLBT) = 0

NUMBER OF LAYERS FOR TOP COMPRESSION (NLTC) = 1

LAYER NO. FOR TOP COMPRESSION (LNTC) ARE: 3

LOAD REPETITIONS (TNLR) IN PERIOD 1 FOR EACH LOAD GROUP ARE: 3750.00

DAMAGE COEFFICENTS (FT) FOR TOP COMPRESSION OF LAYER 3 ARE: .1365E-08 .4477E+01

DAMAGE ANALYSIS OF PERIOD NO. 1 LOAD GROUP NO. 1

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
1 11.56010 .3274E-01 .9747E+01 .9747E+01 .8137E+01 .7457E+01 .6257E-03 .6257E-03 .2583E-03 .2583E-03

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
2 11.56010 .3444E-01 .1042E+02 .1042E+02 .8680E+01 .7993E+01 .6690E-03 .6690E-03 .2794E-03 .2794E-03

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
3 11.56010 .3469E-01 .1047E+02 .1047E+02 .8730E+01 .8024E+01 .6722E-03 .6722E-03 .2795E-03 .2795E-03

AT TOP OF LAYER 3 COMPRESSIVE STRAIN = .6722E-03 ALLOWABLE LOAD REPETITIONS = .21792E+06 DAMAGE RATIO= .17208E-01

SUMMARY OF DAMAGE ANALYSIS

AT TOP OF LAYER 3 SUM OF DAMAGE RATIO= .17208E-01

MAXIMUM DAMAGE RATO= .17208E-01 DESIGN LIFE IN YEARS= 58.11

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* SECTION 9 PLATE LOAD HMA MR=370 KSI *

MATL = 3 FOR VISCOELASTIC LAYERED SYSTEM

NDAMA=1, SO DAMAGE ANALYSIS WILL BE PERFORMED

NUMBER OF PERIODS PER YEAR (NPY) = 1

NUMBER OF LOAD GROUPS (NLG) = 1

TOLERANCE FOR INTEGRATION (DEL) = .00100

NUMBER OF LAYERS (NL) = 3

NUMBER OF Z COORDINATES (NZ) = 0

LIMIT OF INTEGRATION CYCLES (ICL) = 80

COMPUTING CODE (NSTD) = 9

THICKNESS OF LAYERS (TH) ARE: 3.28000 8.28000

POISSON'S RATIOS OF LAYERS (PR) ARE: .35000 .30000 .30000

CONDITIONS OF INTERFACES (INT) ARE: 0 0

FOR PERIOD NO. 1 ELASTIC MODULI OF LAYERS ARE: .370000E+06 .305600E+05
.810000E+04

LOAD GROUP NO. 1 HAS 1 CONTACT AREAS
CONTACT RADIUS (CR) = 6.00000
CONTACT PRESSURE (CP)= 80.00000
RADIAL COORDINATES OF THE 1 POINTS (RC) ARE: .00000

DURATION OF MOVING LOAD (DUR) = 1.00000

NUMBER OF VISCOELASTIC LAYER (NVL) = 1

LAYER NUMBERS WHICH ARE VISCOELASTIC (LNV) = 1

CREEP TIMES (TYME) ARE:
.100E-02 .300E-02 .100E-01 .300E01 .100E+00 .300E+00 .100E+01 .300E+01 . 100E+02 .300E+02
.100E+03

FOR LAYER 1 TIME TEMPERATURE SHIFT FACTOR (BETA)= .11300 REFERENCE TEMPERATURE (TEMREF)= 77.00000

CREEP COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.589E-05 .676E-05 .776E-05 .891E-05 .102E-04 .117E-04 .134E-04 .153E-04 .177E-04 .200E-04 .232E-04

LAYER NO. 1 DIRICHLET SERIES FOR CREEP (GG) AT REFERENCE TEMPERATURE (TEMREF) OF 77.00000 ARE:
-.3015E-05 - .6485E-06 - .2508E-05 -.4060E-05 .5460E-06 -.8125E-05 .2336E-04

COMPUTED COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.605E-05 .656E-05 .776E-05 .899E-05 .101E-05 .117E-05 .135E-04 .154E-04 .173E-04 .203E-04 .231E-04

FOR PERIOD NO. 1 LAYER NO. AND TEMPERATURE ARE:
1 . 7000E+02

CREEP COMPLIANCES (CREEP) OF LAYER 1 AT TEMPERATURE (TEMP) OF 70.00000 ARE:
.580E-05 .590E-05 .622E-05 .696E-05 .835E-05 .940E-05 .108E-04 .123E-04 .144E-44 .161E-04 .185E-04

NUMBER OF LAYERS FOR BOTTOM TENSION (NLBT) = 0

NUMBER OF LAYERS FOR TOP COMPRESSION (NLTC) = 1

LAYER NO. FOR TOP COMPRESSION (LNTC) ARE: 3

LOAD REPETITIONS (TNLR) IN PERIOD 1 FOR EACH LOAD GROUP ARE: 3750.00

DAMAGE COEFFICENTS (FT) FOR TOP COMPRESSION OF LAYER 3 ARE: .1365E-08 .4477E+01

DAMAGE ANALYSIS OF PERIOD NO. 1 LOAD GROUP NO. 1

RADIAL VERTICAL VERTICAL VERTICAL RADIAL TANGENTIAL SHEAR VERTICAL RADIAL TANGENTIAL SHEAR
COORDINATE COORDINATE DISP STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
.00000 11.56010 .4704E-01 .2010E+02 .1608E+02 .1608E+02 .0000E+00 .1290E-02 .6450E-03 .6450E-03 0000E+00

AT TOP OF LAYER 3 COMPRESSIVE STRAIN = .1290E-02 ALLOWABLE LOAD REPETITIONS = .11769E+05 DAMAGE RATIO= .31865E+00

SUMMARY OF DAMAGE ANALYSIS

AT TOP OF LAYER 3 SUM OF DAMAGE RATIO= .31865E+00

MAXIMUM DAMAGE RATO= .31865E+00 DESIGN LIFE IN YEARS= 3.14

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* SECTION 9 DUAL TIRE LOAD 40 MPH HMA MR=370 KSI *

MATL = 3 FOR VISCOELASTIC LAYERED SYSTEM

NDAMA=1, SO DAMAGE ANALYSIS WILL BE PERFORMED

NUMBER OF PERIODS PER YEAR (NPY) = 1

NUMBER OF LOAD GROUPS (NLG) = 1

TOLERANCE FOR INTEGRATION (DEL) = .00100

NUMBER OF LAYERS (NL) = 3

NUMBER OF Z COORDINATES (NZ) = 1

LIMIT OF INTEGRATION CYCLES (ICL) = 80

COMPUTING CODE (NSTD) = 9

THICKNESS OF LAYERS (TH) ARE: 3.28000 8.28000

POISSON'S RATIOS OF LAYERS (PR) ARE: .35000 .30000 .30000

CONDITIONS OF INTERFACES (INT) ARE: 0 0

FOR PERIOD NO. 1 ELASTIC MODULI OF LAYERS ARE: .370000E+06 .305600E+05 .810000E+04

LOAD GROUP NO. 1 HAS 2 CONTACT AREAS
CONTACT RADIUS (CR) = 4.23000
CONTACT PRESSURE (CP)= 80.00000
NO. OF POINTS AT WHICH RESULTS ARE DESIRED (NPT) = 3
WHEEL SPACING ALONG X-AXIS (XW) = .00000
WHEEL SPACING ALONG Y-AXIS (YW) = 13.50000
POINT NO. AND X AND Y COORDIANTES ARE:
1 .00000 .00000 2 .00000 4.23 3 .00000 6.75000

DURATION OF MOVING LOAD(DUR) = .10000

NUMBER OF VISCOELASTIC LAYER (NVL) = 1

LAYER NUMBERS WHICH ARE VISCOELASTIC (LNV) = 1

CREEP TIMES (TYME) ARE:
.100E-02 .300E-02 .100E-01 .300E01 .100E+00 .300E+00 .100E+01 .300E+01 . 100E+02 .300E+02 .100E+03

FOR LAYER 1 TIME TEMPERATURE SHIFT FACTOR (BETA)= .11300 REFERENCE TEMPERATURE (TEMREF)= 77.00000

CREEP COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.589E-05 .676E-05 .776E-05 .891E-05 .102E-04 .117E-04 .134E-04 .153E-04 .177E-04 .200E-04 .232E-04

LAYER NO. 1 DIRICHLET SERIES FOR CREEP (GG) AT REFERENCE TEMPERATURE (TEMREF) OF 77.00000 ARE:
-.3015E-05 - .6485E-06 - .2508E-05 -.4060E-05 .5460E-06 -.8125E-05 .2336E-04

COMPUTED COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.605E-05 .656E-05 .776E-05 .899E-05 .101E-04 .117E-04 .135E-04 .154E-04 .173E-04 .203E-04 .231E-04

FOR PERIOD NO. 1 LAYER NO. AND TEMPERATURE ARE:
1 . 7000E+02

CREEP COMPLIANCES (CREEP) OF LAYER 1 AT TEMPERATURE (TEMP) OF 70.00000 ARE:
.580E-05 .590E-05 .622E-05 .696E-05 .835E-05 .940E-05 .108E-04 .123E-04 .144E-04 .161E-04 .185E-04

NUMBER OF LAYERS FOR BOTTOM TENSION (NLBT) = 0

NUMBER OF LAYERS FOR TOP COMPRESSION (NLTC) = 1

LAYER NO. FOR TOP COMPRESSION (LNTC) ARE: 3

LOAD REPETITIONS (TNLR) IN PERIOD 1 FOR EACH LOAD GROUP ARE: 3750.00

DAMAGE COEFFECENTS (FT) FOR TOP COMPRESSION OF LAYER 3 ARE: .1365E-08 .4477E+01

DAMAGE ANALYSIS OF PERIOD NO. 1 LOAD GROUP NO. 1

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN

1 11.56010 .3750E-01 .1310E+02 .1310E+02 .1101E+02 .9944E+01 .8409E-03 .8409E-03 .3346E-03 .3346E-03

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR
MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
2 11.56010 .3957E-01 .1365E+02 .1365E+02 .1154E+02 .1030E+02 .8764E-03 .8764E-03 .3381E-03 .3381E-03

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR
MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
3 11.56010 .3983E-01 .1357E+02 .1357E+02 .1152E+02 .1019E+02 .8712E-03 .8712E-03 .3291E-03 .3291E-03

AT TOP OF LAYER 3 COMPRESSIVE STRAIN = .8764E-03 ALLOWABLE LOAD REPETITIONS =
.66465E+05 DAMAGE RATIO=
.56421E-01

SUMMARY OF DAMAGE ANALYSIS

AT TOP OF LAYER 3 SUM OF DAMAGE RATIO= .56421E-01

MAXIMUM DAMAGE RATO= .56421E-01 DESIGN LIFE IN YEARS= 17.72

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* SECTION 9 DUAL TIRE LOAD 60 MPH HMA MR=370 KSI *

MATL = 3 FOR VISCOELASTIC LAYERED SYSTEM

NDAMA=1, SO DAMAGE ANALYSIS WILL BE PERFORMED

NUMBER OF PERIODS PER YEAR (NPY) = 1

NUMBER OF LOAD GROUPS (NLG) = 1

TOLERANCE FOR INTEGRATION (DEL) = .00100

NUMBER OF LAYERS (NL) = 3

NUMBER OF Z COORDINATES (NZ) = 1

LIMIT OF INTEGRATION CYCLES (ICL) = 80

COMPUTING CODE (NSTD) = 9

THICKNESS OF LAYERS (TH) ARE: 3.28000 8.28000

POISSON’S RATIOS OF LAYERS (PR) ARE: .35000 .30000 .30000

CONDITIONS OF INTERFACES (INT) ARE: 0 0
FOR PERIOD NO. 1 ELASTIC MODULI OF LAYERS ARE: .370000E+06 .305600E+05
.810000E+04

LOAD GROUP NO. 1 HAS 2 CONTACT AREAS
CONTACT RADIUS (CR) = 4.23000
CONTACT PRESSURE (CP)= 80.00000
NO. OF POINTS AT WHICH RESULTS ARE DESIRED (NPT) = 3
WHEEL SPACING ALONG X-AXIS (XW) = .00000
WHEEL SPACING ALONG Y-AXIS (YW) = 13.50000

POINT NO. AND X AND Y COORDIANTES ARE:
1 .00000 .00000 2 .00000 4.23 3 .00000 6.75000

DURATION OF MOVING LOAD(DUR) = .03500

NUMBER OF VISCOELASTIC LAYER (NVL) = 1

LAYER NUMBERS WHICH ARE VISCOELASTIC (LNV) = 1

CREEP TIMES (TYME) ARE:
.100E-02 .300E-02 .100E-01 .300E01 .100E+00 .300E+00 .100E+01 .300E+01 .100E+02 .300E+02 .100E+03

FOR LAYER 1 TIME TEMPERATURE SHIFT FACTOR (BETA)= .11300 REFERENCE TEMPERATURE (TEMREF)= 77.00000

CREEP COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.589E-05 .676E-05 .776E-05 .891E-05 .102E-04 .117E-45 .134E-04 .153E-04 .177E-04 .200E-04 .232E-04

LAYER NO. 1 DIRICHLET SERIES FOR CREEP (GG) AT REFERENCE TEMPERATURE (TEMREF) OF 77.00000 ARE:
-.3015E-05 - .6485E-06 - .2508E-05 -.4060E-05 .5460E-06 -.8125E-05 .2336E-04

COMPUTED COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.605E-05 .656E-05 .776E-05 .899E-05 .101E-04 .117E-04 .135E-04 .154E-04 .173E-04 .203E-04 .231E-04

FOR PERIOD NO. 1 LAYER NO. AND TEMPERATURE ARE:
1 . 7000E+02

CREEP COMPLIANCES (CREEP) OF LAYER 1 AT TEMPERATURE (TEMP) OF 70.00000 ARE:
.580E-05 .590E-05 .622E-05 .696E-05 .835E-05 .940E-05 .108E-04 .123E-04 .144E-04 .161E-04 .185E-04

NUMBER OF LAYERS FOR BOTTOM TENSION (NLBT) = 0

NUMBER OF LAYERS FOR TOP COMPRESSION (NLTC) = 1

LAYER NO. FOR TOP COMPRESSION (LNTC) ARE: 3

LOAD REPETITIONS (TNLR) IN PERIOD 1 FOR EACH LOAD GROUP ARE: 3750.00

DAMAGE COEFFICENTS (FT) FOR TOP COMPRESSION OF LAYER 3 ARE: .1365E-08 .4477E+01

DAMAGE ANALYSIS OF PERIOD NO. 1 LOAD GROUP NO. 1

POINT NO.	VERTICAL COORDINATE	VERTICAL DISP.	VERTICAL STRESS	MAJOR PRINCIPAL STRESS	INTERMEDIATE PRINCIPAL STRESS	MINOR PRINCIPAL STRESS	VERTICAL STRAIN	MAJOR PRINCIPAL STRAIN	MINOR PRINCIPAL STRAIN	HORIZONTAL PRINCIPAL STRAIN
1	11.56010	.3725E-01	.1289E+02	.1289E+02	.1084E+02	.9790E+01	.8276E-03	.8276E-03	.3299E-03	.3299E-03

POINT NO.	VERTICAL COORDINATE	VERTICAL DISP.	VERTICAL STRESS	MAJOR PRINCIPAL STRESS	INTERMEDIATE PRINCIPAL STRESS	MINOR PRINCIPAL STRESS	VERTICAL STRAIN	MAJOR PRINCIPAL STRAIN	MINOR PRINCIPAL STRAIN	HORIZONTAL PRINCIPAL STRAIN
2	11.56010	.3931E-01	.1347E+02	.1347E+02	.1138E+02	.1017E+02	.8649E-03	.8649E-03	.3356E-03	.3356E-03

POINT NO.	VERTICAL COORDINATE	VERTICAL DISP.	VERTICAL STRESS	MAJOR PRINCIPAL STRESS	INTERMEDIATE PRINCIPAL STRESS	MINOR PRINCIPAL STRESS	VERTICAL STRAIN	MAJOR PRINCIPAL STRAIN	MINOR PRINCIPAL STRAIN	HORIZONTAL PRINCIPAL STRAIN
3	11.56010	.3957E-01	.1341E+02	.1341E+02	.1137E+02	.1009E+02	.8607E-03	.8608E-03	.3276E-03	.3276E-03

AT TOP OF LAYER 3 COMPRESSIVE STRAIN = .8649E-03 ALLOWABLE LOAD REPETITIONS = .70511E+05   DAMAGE RATIO= .53183E-01

SUMMARY OF DAMAGE ANALYSIS

AT TOP OF LAYER 3   SUM OF DAMAGE RATIO= .53183E-01

MAXIMUM DAMAGE RATO= .53183E-01   DESIGN LIFE IN YEARS= 18.80

NUMBER OF PROBLEMS TO BE SOLVED = 6

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* SECTION 10 PLATE LOAD HMA MR=250 KSI *

MATL = 3 FOR VISCOELASTIC LAYERED SYSTEM

NDAMA=1, SO DAMAGE ANALYSIS WILL BE PERFORMED

NUMBER OF PERIODS PER YEAR (NPY) = 1

NUMBER OF LOAD GROUPS (NLG) = 1

TOLERANCE FOR lNTEGRATION (DEL) = .00100

NUMBER OF LAYERS (NL) = 3

NUMBER OF Z COORDINATES (NZ) = 0

LIMIT OF INTEGRATION CYCLES (ICL) = 80

COMPUTING CODE (NSTD) = 9

THICKNESS OF LAYERS (TH) ARE: 2.80000 5.54000

POISSON'S RATIOS OF LAYERS (PR) ARE: .35000 .30000 .30000

CONDITIONS OF INTERFACES (INT) ARE: 0 0

FOR PERIOD NO. 1 ELASTIC MODULI OF LAYERS ARE: .250000E+06 .249700E+05 .645000E+04

LOAD GROUP NO. 1 HAS 1 CONTACT AREAS
CONTACT RADIUS (CR) = 6.00000
CONTACT PRESSURE (CP)= 80.00000
RADIAL COORDlNATES OF THE 1 POINTS (RC) ARE: .00000

DURATION OF MOVING LOAD (DUR) = 1.00000

NUMBER OF VISCOELASTIC LAYER (NVL) = 1

LAYER NUMBERS WHICH ARE VISCOELASTIC (LNV) = 1

CREEP TIMES (TYME) ARE:
.100E-02 .300E-02 .100E-01 .300E01 .100E+00 .300E+00 .100E+01 .300E+01 . 100E+02 .300E+02 .100E+03

FOR LAYER 1 TIME TEMPERATURE SHIFT FACTOR (BETA)= .11300 REFERENCE TEMPERATURE (TEMREF)= 77.00000

CREEP COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.163E-05 .221E-05 .308E-05 .417E-05 .580E-05 .785E-05 .109E-04 .148E-04 .206E-04 .279E-04 .389E-04

LAYER NO. 1 DIRICHLET SERIES FOR CREEP (GG) AT REFERENCE TEMPERATURE (TEMREF) OF 77.00000 ARE:
-.1543E-05 - .1086E-05 - .1254E-05 -.8227E-05 .3934E-05 -.2991E-04 .3962E-04

COMPUTED COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.174E-05 .210E-05 .302E-05 .427E-05 .576E-05 .767E-05 .112E-04 .151E-04 .196E-04 .288E-04 .386E-04

FOR PERIOD NO. 1 LAYER NO. AND TEMPERATURE ARE:

1 . 7000E+02

CREEP COMPLIANCES (CREEP) OF LAYER 1 AT TEMPERATURE (TEMP) OF 70.00000 ARE:
.157E-05 .163E-05 .186E-05 .239E-05 .355E-05 .484E-05 .649E-05 .886E-05 .130E-04 .165E-04 .230E-04

NUMBER OF LAYERS FOR BOTTOM TENSION (NLBT) = 0

NUMBER OF LAYERS FOR TOP COMPRESSION (NLTC) = 1

LAYER NO. FOR TOP COMPRESSION (LNTC) ARE: 3

LOAD REPETITIONS (TNLR) IN PERIOD 1 FOR EACH LOAD GROUP ARE: 3750.00

DAMAGE COEFFICENTS (FT) FOR TOP COMPRESSION OF LAYER 3 ARE: .1365E-08 .4477E+01

DAMAGE ANALYSIS OF PERIOD NO. 1 LOAD GROUP NO. 1

RADIAL VERTICAL VERTICAL VERTICAL RADIAL TANGENTIAL SHEAR VERTICAL RADIAL TANGENTIAL SHEAR
COORDINATE COORDINATE DISP STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
.00000 8.34010 .6726E-01 .2538E+02 .2031E+02 .2031E+02 .0000E+00 .2046E-02 .1023E-02 .1023E-02 0000E+00

AT TOP OF LAYER 3 COMPRESSIVE STRAIN = .2046E-02 ALLOWABLE LOAD REPETITIONS = .14922E+04 DAMAGE RATIO= .25130E+01

SUMMARY OF DAMAGE ANALYSIS

AT TOP OF LAYER 3 SUM OF DAMAGE RATIO= .25130E+01

MAXIMUM DAMAGE RATO= .25130E+01 DESIGN LIFE IN YEARS= .40

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* SECTION 10 DUAL TIRE LOAD 40 MPH HMA MR=250 KSI *

MATL = 3 FOR VISCOELASTIC LAYERED SYSTEM

NDAMA=1, SO DAMAGE ANALYSIS WILL BE PERFORMED

NUMBER OF PERIODS PER YEAR (NPY) = 1

NUMBER OF LOAD GROUPS (NLG) = 1

TOLERANCE FOR INTEGRATION (DEL) = .00100

NUMBER OF LAYERS (NL) = 3

NUMBER OF Z COORDINATES (NZ) = 1

LIMIT OF INTEGRATION CYCLES (ICL) = 80

COMPUTING CODE (NSTD) = 9

THICKNESS OF LAYERS (TH) ARE: 2.80000 5.54000

POISSON'S RATIOS OF LAYERS (PR) ARE: .35000 .30000 .30000

CONDITIONS OF INTERFACES (INT) ARE: 0 0

FOR PERIOD NO. 1 ELASTIC MODULI OF LAYERS ARE: .250000E+06 .249700E+05 .645000E+04

LOAD GROUP NO. 1 HAS 2 CONTACT AREAS
CONTACT RADIUS (CR) = 4.23000
CONTACT PRESSURE (CP)= 80.00000
NO. OF POINTS AT WHICH RESULTS ARE DESIRED (NPT) = 3
WHEEL SPACING ALONG X-AXIS (XW) = .00000
WHEEL SPACING ALONG Y-AXIS (YW) = 13.50000
POINT NO. AND X AND Y COORDIANTES ARE:
1 .00000 .00000 2 .00000 4.23 3 .00000 6.75000

DURATION OF MOVING LOAD(DUR) = .10000

NUMBER OF VISCOELASTIC LAYER (NVL) = 1

LAYER NUMBERS WHICH ARE VISCOELASTIC (LNV) = 1

CREEP TIMES (TYME) ARE:
.100E-02 .300E-02 .100E-01 .300E01 .100E+00 .300E+00 .100E+01 .300E+01 . 100E+02 .300E+02 .100E+03

FOR LAYER 1 TIME TEMPERATURE SHIFT FACTOR (BETA)= .11300 REFERENCE TEMPERATURE (TEMREF)= 77.00000

CREEP COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.163E-05 .221E-05 .308E-05 .417E-05 .580E-05 .785E-45 .109E-04 .148E-04 .206E-04 .279E-04 .389E-04

LAYER NO. 1 DIRICHLET SERIES FOR CREEP (GG) AT REFERENCE TEMPERATURE (TEMREF) OF 77.00000 ARE:
-.1561E-05 - .1042E-05 - .1290E-05 -.8239E-05 .3897E-05 -.2985E-04 .3962E-04

COMPUTED COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.174E-05 .210E-05 .303E-05 .427E-05 .576E-05 .768E-05 .112E-04 .151E-04 .197E-04 .288E-04 .386E-04

FOR PERIOD NO. 1 LAYER NO. AND TEMPERATURE ARE:
1 . 7000E+02

CREEP COMPLIANCES (CREEP) OF LAYER 1 AT TEMPERATURE (TEMP) OF 70.00000 ARE:
.157E-05 .163E-05 .185E-05 .239E-05 .355E-05 .483E-05 .649E-05 .888E-05 .130E-04 .166E-04 .230E-04

NUMBER OF LAYERS FOR BOTTOM TENSION (NLBT) = 0

NUMBER OF LAYERS FOR TOP COMPRESSION (NLTC) = 1

LAYER NO. FOR TOP COMPRESSION (LNTC) ARE: 3

LOAD REPETITIONS (TNLR) IN PERIOD 1 FOR EACH LOAD GROUP ARE: 3750.00

DAMAGE COEFFICENTS (FT) FOR TOP COMPRESSION OF LAYER 3 ARE: .1365E-08 .4477E+01

DAMAGE ANALYSIS OF PERIOD NO. 1 LOAD GROUP NO. 1

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
1 8.34010 .4846E-01 .1389E+02 .1389E+02 .1167E+02 .1055E+02 .1120E-02 .1120E-02 .4467E-03 .4467E-03

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL

NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
2 8.34010 .5106E-01 .1425E+02 .1425E+02 .1208E+02 .1072E+02 .1149E-02 .1149E-02 .4376E-03 .4376E-03

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
3 8.34010 .5136E-01 .1407E+02 .1407E+02 .1199E+02 .1053E+02 .1135E-02 .1135E-02 .4195E-03 .4195E-03

AT TOP OF LAYER 3 COMPRESSIVE STRAIN = .1149E-02 ALLOWABLE LOAD REPETITIONS = .19756E+05 DAMAGE RATIO= .18982E+00

SUMMARY OF DAMAGE ANALYSIS

AT TOP OF LAYER 3 SUM OF DAMAGE RATIO= .18982E+00

MAXIMUM DAMAGE RATO= .18982E+00 DESIGN LIFE IN YEARS= 5.27

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* SECTION 10 DUAL TIRE LOAD 60 MPH HMA MR=250 KSI *

MATL = 3 FOR VISCOELASTIC LAYERED SYSTEM

NDAMA=1, SO DAMAGE ANALYSIS WILL BE PERFORMED

NUMBER OF PERIODS PER YEAR (NPY) = 1

NUMBER OF LOAD GROUPS (NLG) = 1

TOLERANCE FOR INTEGRATION (DEL) = .00100

NUMBER OF LAYERS (NL) = 3

NUMBER OF Z COORDINATES (NZ) = 1

LIMIT OF INTEGRATION CYCLES (ICL) = 80

COMPUTING CODE (NSTD) = 9

THICKNESS OF LAYERS (TH) ARE: 2.80000 5.54000

POISSON'S RATIOS OF LAYERS (PR) ARE: .35000 .30000 .30000

CONDITIONS OF INTERFACES (INT) ARE: 0 0
FOR PERIOD NO. 1 ELASTIC MODULI OF LAYERS ARE: .250000E+06 .249700E+05 .645000E+04

LOAD GROUP NO. 1 HAS 2 CONTACT AREAS
CONTACT RADIUS (CR) = 4.23000
CONTACT PRESSURE (CP)= 80.00000
NO. OF POINTS AT WHICH RESULTS ARE DESIRED (NPT) = 3
WHEEL SPACING ALONG X-AXIS (XW) = .00000
WHEEL SPACING ALONG Y-AXIS (YW) = 13.50000
POINT NO. AND X AND Y COORDIANTES ARE:
1 .00000 .00000 2 .00000 4.23 3 .00000 6.75000

DURATION OF MOVING LOAD(DUR) = .03500

NUMBER OF VISCOELASTIC LAYER (NVL) = 1

LAYER NUMBERS WHICH ARE VISCOELASTIC (LNV) = 1

CREEP TIMES (TYME) ARE:
.100E-02 .300E-02 .100E-01 .300E01 .100E+00 .300E+00 .100E+01 .300E+01 .100E+02 .300E+02 .100E+03

FOR LAYER 1 TIME TEMPERATURE SHIFT FACTOR (BETA)= .11300 REFERENCE TEMPERATURE (TEMREF)= 77.00000

CREEP COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.163E-05 .221E-05 .308E-05 .417E-05 .580E-05 .785E-45 .109E-04 .148E-04 .206E-04 .279E-04 .389E-04

LAYER NO. 1 DIRICHLET SERIES FOR CREEP (GG) AT REFERENCE TEMPERATURE (TEMREF) OF 77.00000 ARE:
-.1561E-05 - .1042E-05 - .1290E-05 -.8239E-05 .3897E-05 -.2985E-04 .3962E-04

COMPUTED COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.174E-05 .210E-05 .303E-05 .427E-05 .576E-05 .768E-05 .112E-04 .151E-04 .197E-04 .288E-04 .386E-04

FOR PERIOD NO. 1 LAYER NO. AND TEMPERATURE ARE:
1 . 7000E+02

CREEP COMPLIANCES (CREEP) OF LAYER 1 AT TEMPERATURE (TEMP) OF 70.00000 ARE:
.157E-05 .163E-05 .185E-05 .239E-05 .355E-05 .483E-05 .649E-05 .888E-05 .130E-04 .166E-04 .230E-04

NUMBER OF LAYERS FOR BOTTOM TENSION (NLBT) = 0

NUMBER OF LAYERS FOR TOP COMPRESSION (NLTC) = 1

LAYER NO. FOR TOP COMPRESSION (LNTC) ARE: 3

LOAD REPETITIONS (TNLR) IN PERIOD 1 FOR EACH LOAD GROUP ARE: 3750.00

DAMAGE COEFFICENTS (FT) FOR TOP COMPRESSION OF LAYER 3 ARE: .1365E-08 .4477E+01

DAMAGE ANALYSIS OF PERIOD NO. 1 LOAD GROUP NO. 1

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
1 8.34010 .4685E-01 .1292E+02 .1292E+02 .1084E+02 .9828E+01 .1041E-02 .1041E-02 .4188E-03 .4188E-03

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
2 8.34010 .4934E-01 .1336E+02 .1336E+02 .1128E+02 .1009E+02 .1077E-02 .1077E-02 .4186E-03 .4186E-03

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
3 8.34010 .4964E-01 .1323E+02 .1323E+02 .1122E+02 .9949E+01 .1067E-02 .1067E-02 .4049E-03 .4049E-03

AT TOP OF LAYER 3 COMPRESSIVE STRAIN = .1077E-02 ALLOWABLE LOAD REPETITIONS = .26422E+05 DAMAGE RATIO=
.14193E+00

SUMMARY OF DAMAGE ANALYSIS

AT TOP OF LAYER 3 SUM OF DAMAGE RATIO= .14193E+00

MAXIMUM DAMAGE RATO= .14193E+00 DESIGN LIFE IN YEARS= 7.05

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* SECTION 10 PLATE LOAD HMA MR=370 KSI *

MATL = 3 FOR VISCOELASTIC LAYERED SYSTEM

NDAMA=1, SO DAMAGE ANALYSIS WILL BE PERFORMED

NUMBER OF PERIODS PER YEAR (NPY) = 1

NUMBER OF LOAD GROUPS (NLG) = 1

TOLERANCE FOR INTEGRATION (DEL) = .00100

NUMBER OF LAYERS (NL) = 3

NUMBER OF Z COORDINATES (NZ) = 0

LIMIT OF INTEGRATION CYCLES (ICL) = 80

COMPUTING CODE (NSTD) = 9

THICKNESS OF LAYERS (TH) ARE: 2.80000 5.54000

POISSON'S RATIOS OF LAYERS (PR) ARE: .35000 .30000 .30000

CONDITIONS OF INTERFACES (INT) ARE: 0 0

FOR PERIOD NO. 1 ELASTIC MODULI OF LAYERS ARE: .370000E+06 .249700E+05 .645000E+04

LOAD GROUP NO. 1 HAS 1 CONTACT AREAS
CONTACT RADIUS (CR) = 6.00000
CONTACT PRESSURE (CP)= 80.00000
RADIAL COORDINATES OF THE 1 POINTS (RC) ARE: .00000

DURATION OF MOVING LOAD (DUR) = 1.00000

NUMBER OF VISCOELASTIC LAYER (NVL) = 1

LAYER NUMBERS WHICH ARE VISCOELASTIC (LNV) = 1

CREEP TIMES (TYME) ARE:
.100E-02 .300E-02 .100E-01 .300E01 .100E+00 .300E+00 .100E+01 .300E+01 . 100E+02 .300E+02 .100E+03

FOR LAYER 1 TIME TEMPERATURE SHIFT FACTOR (BETA)= .11300 REFERENCE TEMPERATURE (TEMREF)= 77.00000

CREEP COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.589E-05 .676E-05 .776E-05 .891E-05 .102E-04 .117E-04 .134E-04 .153E-04 .177E-04 .200E-04 .232E-04

LAYER NO. 1 DIRICHLET SERIES FOR CREEP (GG) AT REFERENCE TEMPERATURE (TEMREF) OF 77.00000 ARE:
-.3015E-05 - .6485E-06 - .2508E-05 -.4060E-05 .5460E-06 -.8125E-05 .2336E-04

COMPUTED COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.605E-05 .656E-05 .776E-05 .899E-05 .101E-05 .117E-05 .135E-04 .154E-04 .173E-04 .203E-04 .231E-04

FOR PERIOD NO. 1 LAYER NO. AND TEMPERATURE ARE:
1 . 7000E+02

CREEP COMPLIANCES (CREEP) OF LAYER 1 AT TEMPERATURE (TEMP) OF 70.00000 ARE:
.580E-05 .590E-05 .622E-05 .696E-05 .835E-05 .940E-05 .108E-04 .123E-04 .144E-44 .161E-04 .185E-04

NUMBER OF LAYERS FOR BOTTOM TENSION (NLBT) = 0

NUMBER OF LAYERS FOR TOP COMPRESSION (NLTC) = 1

LAYER NO. FOR TOP COMPRESSION (LNTC) ARE: 3

LOAD REPETITIONS (TNLR) IN PERIOD 1 FOR EACH LOAD GROUP ARE: 3750.00

DAMAGE COEFFICENTS (FT) FOR TOP COMPRESSION OF LAYER 3 ARE: .1365E-08 .4477E+01

DAMAGE ANALYSIS OF PERIOD NO. 1 LOAD GROUP NO. 1

RADIAL VERTICAL VERTICAL VERTICAL RADIAL TANGENTIAL SHEAR VERTICAL RADIAL TANGENTIAL SHEAR
COORDINATE COORDINATE DISP STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
.00000 8.34010 .7419E-01 .3062E+02 .2449E+02 .3449E+02 .0000E+00 .2468E-02 .1234E-02 .1234E-02 0000E+00

AT TOP OF LAYER 3 COMPRESSIVE STRAIN = .2468E-02 ALLOWABLE LOAD REPETITIONS = .64461E+03 DAMAGE RATIO= .58175E+01

SUMMARY OF DAMAGE ANALYSIS

AT TOP OF LAYER 3 SUM OF DAMAGE RATIO= .58175E+01

MAXIMUM DAMAGE RATO= .58175E+01 DESIGN LIFE IN YEARS= .17

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* SECTION 10 DUAL TIRE LOAD 40 MPH HMA MR=370 KSI *

MATL = 3 FOR VISCOELASTIC LAYERED SYSTEM

NDAMA=1, SO DAMAGE ANALYSIS WILL BE PERFORMED

NUMBER OF PERIODS PER YEAR (NPY) = 1

NUMBER OF LOAD GROUPS (NLG) = 1

TOLERANCE FOR INTEGRATION (DEL) = .00100

NUMBER OF LAYERS (NL) = 3

NUMBER OF Z COORDINATES (NZ) = 1

LIMIT OF INTEGRATION CYCLES (ICL) = 80

COMPUTING CODE (NSTD) = 9

THICKNESS OF LAYERS (TH) ARE: 2.80000 5.54000

POISSON'S RATIOS OF LAYERS (PR) ARE: .35000 .30000 .30000

CONDITIONS OF INTERFACES (INT) ARE: 0 0

FOR PERIOD NO. 1 ELASTIC MODULI OF LAYERS ARE: .370000E+06 .249700E+05 .645000E+04

LOAD GROUP NO. 1 HAS 2 CONTACT AREAS
CONTACT RADIUS (CR) = 4.23000
CONTACT PRESSURE (CP)= 80.00000
NO. OF POINTS AT WHICH RESULTS ARE DESIRED (NPT) = 3
WHEEL SPACING ALONG X-AXIS (XW) = .00000
WHEEL SPACING ALONG Y-AXIS (YW) = 13.50000
POINT NO. AND X AND Y COORDIANTES ARE:
1 .00000 .00000 2 .00000 4.23 3 .00000 6.75000

DURATION OF MOVING LOAD(DUR) = .10000

NUMBER OF VISCOELASTIC LAYER (NVL) = 1

LAYER NUMBERS WHICH ARE VISCOELASTIC (LNV) = 1

CREEP TIMES (TYME) ARE:
.100E-02 .300E-02 .100E-01 .300E01 .100E+00 .300E+00 .100E+01 .300E+01 . 100E+02 .300E+02 .100E+03

FOR LAYER 1 TIME TEMPERATURE SHIFT FACTOR (BETA)= .11300 REFERENCE TEMPERATURE (TEMREF)= 77.00000

CREEP COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.589E-05 .676E-05 .776E-05 .891E-05 .102E-04 .117E-04 .134E-04 .153E-04 .177E-04 .200E-04 .232E-04

LAYER NO. 1 DIRICHLET SERIES FOR CREEP (GG) AT REFERENCE TEMPERATURE (TEMREF) OF 77.00000 ARE:
-.3015E-05 - .6485E-06 - .2508E-05 -.4060E-05 .5460E-06 -.8125E-05 .2336E-04

COMPUTED COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.605E-05 .656E-05 .776E-05 .899E-05 .101E-04 .117E-04 .135E-04 .154E-04 .173E-04 .203E-04 .231E-04

FOR PERIOD NO. 1 LAYER NO. AND TEMPERATURE ARE:
1 . 7000E+02

CREEP COMPLIANCES (CREEP) OF LAYER 1 AT TEMPERATURE (TEMP) OF 70.00000 ARE:
.580E-05 .590E-05 .622E-05 .696E-05 .835E-05 .940E-05 .108E-04 .123E-04 .144E-04 .161E-04 .185E-04

NUMBER OF LAYERS FOR BOTTOM TENSION (NLBT) = 0

NUMBER OF LAYERS FOR TOP COMPRESSION (NLTC) = 1

LAYER NO. FOR TOP COMPRESSION (LNTC) ARE: 3

LOAD REPETITIONS (TNLR) IN PERIOD 1 FOR EACH LOAD GROUP ARE: 3750.00

DAMAGE COEFFICENTS (FT) FOR TOP COMPRESSION OF LAYER 3 ARE: .1365E-08 .4477E+01

DAMAGE ANALYSIS OF PERIOD NO. 1 LOAD GROUP NO. 1

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN

1 8.34010 .5578E-01 .1895E+02 .1895E+02 .1600E+02 .1432E+02 .1528E-02 .5947E-03 .3346E-03 .5947E-03

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
2 8.34010 .5847E-01 .1842E+02 .1842E+02 .1592E+02 .1355E+02 .1485E-02 .1485E-02 .5035E-03 .5035E-03

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
3 8.34010 .5859E-01 .1776E+02 .1776E+02 .1553E+02 .1289E+02 .1432E-02 .1432E-02 .4497E-03 .4497E-03

AT TOP OF LAYER 3 COMPRESSIVE STRAIN = .1528E-02 ALLOWABLE LOAD REPETITIONS = .55222E+04 DAMAGE RATIO= .67908E+00

SUMMARY OF DAMAGE ANALYSIS

AT TOP OF LAYER 3 SUM OF DAMAGE RATIO= .67908E+00

MAXIMUM DAMAGE RATO= .67908E+00 DESIGN LIFE IN YEARS= 1.47

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* SECTION 10 DUAL TIRE LOAD 60 MPH HMA MR=370 KSI *

MATL = 3 FOR VISCOELASTIC LAYERED SYSTEM

NDAMA=1, SO DAMAGE ANALYSIS WILL BE PERFORMED

NUMBER OF PERIODS PER YEAR (NPY) = 1

NUMBER OF LOAD GROUPS (NLG) = 1

TOLERANCE FOR INTEGRATION (DEL) = .00100

NUMBER OF LAYERS (NL) = 3

NUMBER OF Z COORDINATES (NZ) = 1

LIMIT OF INTEGRATION CYCLES (ICL) = 80

COMPUTING CODE (NSTD) = 9

THICKNESS OF LAYERS (TH) ARE:2.80000 5.54000

POISSON'S RATIOS OF LAYERS (PR) ARE: .35000 .30000 .30000

CONDITIONS OF INTERFACES (INT) ARE: 0 0
FOR PERIOD NO. 1 ELASTIC MODULI OF LAYERS ARE: .370000E+06 .249700E+05 .645000E+04

LOAD GROUP NO. 1 HAS 2 CONTACT AREAS
CONTACT RADIUS (CR) = 4.23000
CONTACT PRESSURE (CP)= 80.00000
NO. OF POINTS AT WHICH RESULTS ARE DESIRED (NPT) = 3
WHEEL SPACING ALONG X-AXIS (XW) = .00000
WHEEL SPACING ALONG Y-AXIS (YW) = 13.50000

POINT NO. AND X AND Y COORDIANTES ARE:
1 .00000 .00000 2 .00000 4.23 3 .00000 6.75000

DURATION OF MOVING LOAD(DUR) = .03500

NUMBER OF VISCOELASTIC LAYER (NVL) = 1

LAYER NUMBERS WHICH ARE VISCOELASTIC (LNV) = 1

CREEP TIMES (TYME) ARE:
.100E-02 .300E-02 .100E-01 .300E01 .100E+00 .300E+00 .100E+01 .300E+01 .100E+02 .300E+02 .100E+03

FOR LAYER 1 TIME TEMPERATURE SHIFT FACTOR (BETA)= .11300 REFERENCE TEMPERATURE (TEMREF)= 77.00000

CREEP COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.589E-05 .676E-05 .776E-05 .891E-05 .102E-04 .117E-45 .134E-04 .153E-04 .177E-04 .200E-04 .232E-04

LAYER NO. 1 DIRICHLET SERIES FOR CREEP (GG) AT REFERENCE TEMPERATURE (TEMREF) OF 77.00000 ARE:
-.3015E-05 - .6485E-06 - .2508E-05 -.4060E-05 .5460E-06 -.8125E-05 .2336E-04

COMPUTED COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.605E-05 .656E-05 .776E-05 .899E-05 .101E-04 .117E-04 .135E-04 .154E-04 .173E-04 .203E-04 .231E-04

FOR PERIOD NO. 1 LAYER NO. AND TEMPERATURE ARE:
1 . 7000E+02

CREEP COMPLIANCES (CREEP) OF LAYER 1 AT TEMPERATURE (TEMP) OF 70.00000 ARE:
.580E-05 .590E-05 .622E-05 .696E-05 .835E-05 .940E-05 .108E-04 .123E-04 .144E-04 .161E-04 .185E-04

NUMBER OF LAYERS FOR BOTTOM TENSION (NLBT) = 0

NUMBER OF LAYERS FOR TOP COMPRESSION (NLTC) = 1

LAYER NO. FOR TOP COMPRESSION (LNTC) ARE: 3

LOAD REPETITIONS (TNLR) IN PERIOD 1 FOR EACH LOAD GROUP ARE: 3750.00

DAMAGE COEFFICENTS (FT) FOR TOP COMPRESSION OF LAYER 3 ARE: .1365E-08 .4477E+01

DAMAGE ANALYSIS OF PERIOD NO. 1 LOAD GROUP NO. 1

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
1 8.34010 .5524E-01 .1853E+02 .1853E+02 .1564E+02 .1400E+02 .1494E-02 .1494E-02 .5820E-03 .5820E-03

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
2 8.34010 .5797E-01 .1812E+02 .1812E+02 .1563E+02 .1335E+02 .1461E-02 .1461E-02 .5006E-03 .5006E-03

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
3 8.34010 .5811E-01 .1752E+02 .1752E+02 .1528E+02 .1275E+02 .1412E-02 .1412E-02 .4509E-03 .4509E-03

AT TOP OF LAYER 3 COMPRESSIVE STRAIN = .1494E-02 ALLOWABLE LOAD REPETITIONS = .61074E+04   DAMAGE RATIO= .61401E+00

SUMMARY OF DAMAGE ANALYSIS

AT TOP OF LAYER 3   SUM OF DAMAGE RATIO= .61401E+00

MAXIMUM DAMAGE RATO= .61401E+00   DESIGN LIFE IN YEARS= 1.63

NUMBER OF PROBLEMS TO BE SOLVED = 6

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* SECTION 11 PLATE LOAD HMA MR=250 KSI *

MATL = 3 FOR VISCOELASTIC LAYERED SYSTEM

NDAMA=1, SO DAMAGE ANALYSIS WILL BE PERFORMED

NUMBER OF PERIODS PER YEAR (NPY) = 1

NUMBER OF LOAD GROUPS (NLG) = 1

TOLERANCE FOR INTEGRATION (DEL) = .00100

NUMBER OF LAYERS (NL) = 3

NUMBER OF Z COORDINATES (NZ) = 0

LIMIT OF INTEGRATION CYCLES (ICL) = 80

COMPUTING CODE (NSTD) = 9

THICKNESS OF LAYERS (TH) ARE: 2.86000 5.94000

POISSON'S RATIOS OF LAYERS (PR) ARE: .35000 .30000 .30000

CONDITIONS OF INTERFACES (INT) ARE: 0 0

FOR PERIOD NO. 1 ELASTIC MODULI OF LAYERS ARE: .250000E+06 .250200E+05
.660000E+04

LOAD GROUP NO. 1 HAS 1 CONTACT AREAS
CONTACT RADIUS (CR) = 6.00000
CONTACT PRESSURE (CP)= 80.00000
RADIAL COORDINATES OF THE 1 POINTS (RC) ARE: .00000

DURATION OF MOVING LOAD (DUR) = 1.00000

NUMBER OF VISCOELASTIC LAYER (NVL) = 1

LAYER NUMBERS WHICH ARE VISCOELASTIC (LNV) = 1

CREEP TIMES (TYME) ARE:
.100E-02 .300E-02 .100E-01 .300E01 .100E+00 .300E+00 .100E+01 .300E+01 . 100E+02 .300E+02
.100E+03

FOR LAYER 1 TIME TEMPERATURE SHIFT FACTOR (BETA)= .11300 REFERENCE TEMPERATURE
(TEMREF)= 77.00000

CREEP COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.163E-05 .221E-05 .308E-05 .417E-05 .580E-05 .785E-05 .109E-04 .148E-04 .206E-04 .279E-04 .389E-04

LAYER NO. 1 DIRICHLET SERIES FOR CREEP (GG) AT REFERENCE TEMPERATURE (TEMREF) OF
77.00000 ARE:
-.1543E-05 - .1086E-05 - .1254E-05 -.8227E-05 .3934E-05 -.2991E-04 .3962E-04

COMPUTED COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.174E-05 .210E-05 .302E-05 .427E-05 .576E-05 .767E-05 .112E-04 .151E-04 .196E-04 .288E-04 .386E-04

FOR PERIOD NO. 1 LAYER NO. AND TEMPERATURE ARE:

1 . 7000E+02

CREEP COMPLIANCES (CREEP) OF LAYER 1 AT TEMPERATURE (TEMP) OF 70.00000 ARE:
.157E-05 .163E-05 .186E-05 .239E-05 .355E-05 .484E-05 .649E-05 .886E-05 .130E-04 .165E-04 .230E-04

NUMBER OF LAYERS FOR BOTTOM TENSION (NLBT) = 0

NUMBER OF LAYERS FOR TOP COMPRESSION (NLTC) = 1

LAYER NO. FOR TOP COMPRESSION (LNTC) ARE: 3

LOAD REPETITIONS (TNLR) IN PERIOD 1 FOR EACH LOAD GROUP ARE: 3750.00

DAMAGE COEFFICENTS (FT) FOR TOP COMPRESSION OF LAYER 3 ARE: .1365E-08 .4477E+01

DAMAGE ANALYSIS OF PERIOD NO. 1 LOAD GROUP NO. 1

RADIAL VERTICAL VERTICAL VERTICAL RADIAL TANGENTIAL SHEAR VERTICAL RADIAL TANGENTIAL SHEAR
COORDINATE COORDINATE DISP STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
.00000 8.80010 .6386E-01 .2403E+02 .1923E+02 .1923E+02 .0000E+00 .1894E-02 .9467E-03 .9467E-03 0000E+00

AT TOP OF LAYER 3 COMPRESSIVE STRAIN = .1894E-02 ALLOWABLE LOAD REPETITIONS = .21122E+04 DAMAGE RATIO= .17754E+01

SUMMARY OF DAMAGE ANALYSIS

AT TOP OF LAYER 3 SUM OF DAMAGE RATIO= .17754E+01

MAXIMUM DAMAGE RATO= .17754E+01 DESIGN LIFE IN YEARS= .56

----
* SECTION 11 DUAL TIRE LOAD 40 MPH HMA MR=250 KSI *

MATL = 3 FOR VISCOELASTIC LAYERED SYSTEM

NDAMA=1, SO DAMAGE ANALYSIS WILL BE PERFORMED

NUMBER OF PERIODS PER YEAR (NPY) = 1

NUMBER OF LOAD GROUPS (NLG) = 1

TOLERANCE FOR INTEGRATION (DEL) = .00100

NUMBER OF LAYERS (NL) = 3

NUMBER OF Z COORDINATES (NZ) = 1

LIMIT OF INTEGRATION CYCLES (ICL) = 80

COMPUTING CODE (NSTD) = 9

THICKNESS OF LAYERS (TH) ARE: 2.86000 5.94000

POISSON’S RATIOS OF LAYERS (PR) ARE: .35000 .30000 .30000

CONDITIONS OF INTERFACES (INT) ARE: 0 0

FOR PERIOD NO. 1 ELASTIC MODULI OF LAYERS ARE: .250000E+06 .250200E+05 .660000E+04

LOAD GROUP NO. 1 HAS 2 CONTACT AREAS
CONTACT RADIUS (CR) = 4.23000
CONTACT PRESSURE (CP)= 80.00000
NO. OF POINTS AT WHICH RESULTS ARE DESIRED (NPT) = 3
WHEEL SPACING ALONG X-AXIS (XW) = .00000
WHEEL SPACING ALONG Y-AXIS (YW) = 13.50000
POINT NO. AND X AND Y COORDIANTES ARE:
1 .00000 .00000 2 .00000 4.23 3 .00000 6.75000

DURATION OF MOVING LOAD(DUR) = .10000

NUMBER OF VISCOELASTIC LAYER (NVL) = 1

LAYER NUMBERS WHICH ARE VISCOELASTIC (LNV) = 1

CREEP TIMES (TYME) ARE:
.100E-02 .300E-02 .100E-01 .300E01 .100E+00 .300E+00 .100E+01 .300E+01 . 100E+02 .300E+02 .100E+03

FOR LAYER 1 TIME TEMPERATURE SHIFT FACTOR (BETA)= .11300 REFERENCE TEMPERATURE (TEMREF)= 77.00000

CREEP COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.163E-05 .221E-05 .308E-05 .417E-05 .580E-05 .785E-45 .109E-04 .148E-04 .206E-04 .279E-04 .389E-04

LAYER NO. 1 DIRICHLET SERIES FOR CREEP (GG) AT REFERENCE TEMPERATURE (TEMREF) OF 77.00000 ARE:
-.1561E-05 - .1042E-05 - .1290E-05 -.8239E-05 .3897E-05 -.2985E-04 .3962E-04

COMPUTED COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.174E-05 .210E-05 .303E-05 .427E-05 .576E-05 .768E-05 .112E-04 .151E-04 .197E-04 .288E-04 .386E-04

FOR PERIOD NO. 1 LAYER NO. AND TEMPERATURE ARE:
1 . 7000E+02

CREEP COMPLIANCES (CREEP) OF LAYER 1 AT TEMPERATURE (TEMP) OF 70.00000 ARE:
.157E-05 .163E-05 .185E-05 .239E-05 .355E-05 .483E-05 .649E-05 .888E-05 .130E-04 .166E-04 .230E-04

NUMBER OF LAYERS FOR BOTTOM TENSION (NLBT) = 0

NUMBER OF LAYERS FOR TOP COMPRESSION (NLTC) = 1

LAYER NO. FOR TOP COMPRESSION (LNTC) ARE: 3

LOAD REPETITIONS (TNLR) IN PERIOD 1 FOR EACH LOAD GROUP ARE: 3750.00

DAMAGE COEFFICENTS (FT) FOR TOP COMPRESSION OF LAYER 3 ARE: .1365E-08 .4477E+01

DAMAGE ANALYSIS OF PERIOD NO. 1 LOAD GROUP NO. 1

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
1 8.80010 .4896E-01 .1375E+02 .1375E+02 .1163E+02 .1038E+02 .1084E-02 .1084E-02 .4185E-03 .4185E-03

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL

NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
2 8.80010 .5106E-01 .1425E+02 .1425E+02 .1208E+02 .1072E+02 .1149E-02 .1149E-02 .4376E-03 .4376E-03

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR
MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
3 8.80010 .4927E-01 .1363E+02 .1363E+02 .1157E+02 .1023E+02 .1074E-02 .1074E-02 .4047E-03 .4047E-03

AT TOP OF LAYER 3 COMPRESSIVE STRAIN = .1084E-02 ALLOWABLE LOAD REPETITIONS =
.25715E+05 DAMAGE RATIO=
.14583E+00

SUMMARY OF DAMAGE ANALYSIS

AT TOP OF LAYER 3 SUM OF DAMAGE RATIO= .14583E+00

MAXIMUM DAMAGE RATO= .14583E+00 DESIGN LIFE IN YEARS= 6.86

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* SECTION 11 DUAL TIRE LOAD 60 MPH HMA MR=250 KSI *

MATL = 3 FOR VISCOELASTIC LAYERED SYSTEM

NDAMA=1, SO DAMAGE ANALYSIS WILL BE PERFORMED

NUMBER OF PERIODS PER YEAR (NPY) = 1

NUMBER OF LOAD GROUPS (NLG) = 1

TOLERANCE FOR INTEGRATION (DEL) = .00100

NUMBER OF LAYERS (NL) = 3

NUMBER OF Z COORDINATES (NZ) = 1

LIMIT OF INTEGRATION CYCLES (ICL) = 80

COMPUTING CODE (NSTD) = 9

THICKNESS OF LAYERS (TH) ARE: 2.86000 5.94000

POISSON'S RATIOS OF LAYERS (PR) ARE: .35000 .30000 .30000

CONDITIONS OF INTERFACES (INT) ARE: 0 0
FOR PERIOD NO. 1 ELASTIC MODULI OF LAYERS ARE: .250000E+06 .250200E+05
.660000E+04

LOAD GROUP NO. 1 HAS 2 CONTACT AREAS
CONTACT RADIUS (CR) = 4.23000
CONTACT PRESSURE (CP)= 80.00000
NO. OF POINTS AT WHICH RESULTS ARE DESIRED (NPT) = 3
WHEEL SPACING ALONG X-AXIS (XW) = .00000
WHEEL SPACING ALONG Y-AXIS (YW) = 13.50000
POINT NO. AND X AND Y COORDIANTES ARE:
1 .00000 .00000 2 .00000 4.23 3 .00000 6.75000

DURATION OF MOVING LOAD(DUR) = .03500

NUMBER OF VISCOELASTIC LAYER (NVL) = 1

LAYER NUMBERS WHICH ARE VISCOELASTIC (LNV) = 1

CREEP TIMES (TYME) ARE:
.100E-02 .300E-02 .100E-01 .300E01 .100E+00 .300E+00 .100E+01 .300E+01 .100E+02 .300E+02 .100E+03

FOR LAYER 1 TIME TEMPERATURE SHIFT FACTOR (BETA)= .11300 REFERENCE TEMPERATURE (TEMREF)= 77.00000

CREEP COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.163E-05 .221E-05 .308E-05 .417E-05 .580E-05 .785E-45 .109E-04 .148E-04 .206E-04 .279E-04 .389E-04

LAYER NO. 1 DIRICHLET SERIES FOR CREEP (GG) AT REFERENCE TEMPERATURE (TEMREF) OF 77.00000 ARE:
-.1561E-05 - .1042E-05 - .1290E-05 -.8239E-05 .3897E-05 -.2985E-04 .3962E-04

COMPUTED COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.174E-05 .210E-05 .303E-05 .427E-05 .576E-05 .768E-05 .112E-04 .151E-04 .197E-04 .288E-04 .386E-04

FOR PERIOD NO. 1 LAYER NO. AND TEMPERATURE ARE:
1 . 7000E+02

CREEP COMPLIANCES (CREEP) OF LAYER 1 AT TEMPERATURE (TEMP) OF 70.00000 ARE:
.157E-05 .163E-05 .185E-05 .239E-05 .355E-05 .483E-05 .649E-05 .888E-05 .130E-04 .166E-04 .230E-04

NUMBER OF LAYERS FOR BOTTOM TENSION (NLBT) = 0

NUMBER OF LAYERS FOR TOP COMPRESSION (NLTC) = 1

LAYER NO. FOR TOP COMPRESSION (LNTC) ARE: 3

LOAD REPETITIONS (TNLR) IN PERIOD 1 FOR EACH LOAD GROUP ARE: 3750.00

DAMAGE COEFFICENTS (FT) FOR TOP COMPRESSION OF LAYER 3 ARE: .1365E-08 .4477E+01

DAMAGE ANALYSIS OF PERIOD NO. 1 LOAD GROUP NO. 1

POINT NO.	VERTICAL COORDINATE	VERTICAL DISP.	VERTICAL STRESS	MAJOR PRINCIPAL STRESS	INTERMEDIATE PRINCIPAL STRESS	MINOR PRINCIPAL STRESS	VERTICAL STRAIN	MAJOR PRINCIPAL STRAIN	MINOR PRINCIPAL STRAIN	HORIZONTAL PRINCIPAL STRAIN
1	8.80010	.4493E-01	.1238E+02	.1238E+02	.1038E+02	.9429E+01	.9757E-03	.9757E-03	.3937E-03	.3937E-03

POINT NO.	VERTICAL COORDINATE	VERTICAL DISP.	VERTICAL STRESS	MAJOR PRINCIPAL STRESS	INTERMEDIATE PRINCIPAL STRESS	MINOR PRINCIPAL STRESS	VERTICAL STRAIN	MAJOR PRINCIPAL STRAIN	MINOR PRINCIPAL STRAIN	HORIZONTAL PRINCIPAL STRAIN
2	8.80010	.4734E-01	.1290E+02	.1290E+02	.1087E+02	.9771E+01	.1016E-02	.1016E-02	.4001E-03	.4001E-03

POINT NO.	VERTICAL COORDINATE	VERTICAL DISP.	VERTICAL STRESS	MAJOR PRINCIPAL STRESS	INTERMEDIATE PRINCIPAL STRESS	MINOR PRINCIPAL STRESS	VERTICAL STRAIN	MAJOR PRINCIPAL STRAIN	MINOR PRINCIPAL STRAIN	HORIZONTAL PRINCIPAL STRAIN
3	8.80010	.4765E-01	.1282E+02	.1282E+02	.1084E+02	.9671E+01	.1010E-02	.1010E-02	.3899E-03	.3900E-03

AT TOP OF LAYER 3 COMPRESSIVE STRAIN = .1016E-02 ALLOWABLE LOAD REPETITIONS = .34241E+05 DAMAGE RATIO= .10952E+00

SUMMARY OF DAMAGE ANALYSIS

AT TOP OF LAYER 3 SUM OF DAMAGE RATIO= .10952E+00

MAXIMUM DAMAGE RATO= .10952E+00 DESIGN LIFE IN YEARS= 9.13

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* SECTION 11 PLATE LOAD HMA MR=370 KSI *

MATL = 3 FOR VISCOELASTIC LAYERED SYSTEM

NDAMA=1, SO DAMAGE ANALYSIS WILL BE PERFORMED

NUMBER OF PERIODS PER YEAR (NPY) = 1

NUMBER OF LOAD GROUPS (NLG) = 1

TOLERANCE FOR INTEGRATION (DEL) = .00100

NUMBER OF LAYERS (NL) = 3

NUMBER OF Z COORDINATES (NZ) = 0

LIMIT OF INTEGRATION CYCLES (ICL) = 80

COMPUTING CODE (NSTD) = 9

THICKNESS OF LAYERS (TH) ARE: 2.86000 5.94000

POISSON'S RATIOS OF LAYERS (PR) ARE: .35000 .30000 .30000

CONDITIONS OF INTERFACES (INT) ARE: 0 0

FOR PERIOD NO. 1 ELASTIC MODULI OF LAYERS ARE: .370000E+06 .250200E+05
.660000E+04

LOAD GROUP NO. 1 HAS 1 CONTACT AREAS
CONTACT RADIUS (CR) = 6.00000
CONTACT PRESSURE (CP)= 80.00000
RADIAL COORDINATES OF THE 1 POINTS (RC) ARE: .00000

DURATION OF MOVING LOAD (DUR) = 1.00000

NUMBER OF VISCOELASTIC LAYER (NVL) = 1

LAYER NUMBERS WHICH ARE VISCOELASTIC (LNV) = 1

CREEP TIMES (TYME) ARE:
.100E-02 .300E-02 .100E-01 .300E01 .100E+00 .300E+00 .100E+01 .300E+01 . 100E+02 .300E+02
.100E+03

FOR LAYER 1 TIME TEMPERATURE SHIFT FACTOR (BETA)= .11300 REFERENCE TEMPERATURE (TEMREF)= 77.00000

CREEP COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.589E-05 .676E-05 .776E-05 .891E-05 .102E-04 .117E-04 .134E-04 .153E-04 .177E-04 .200E-04 .232E-04

LAYER NO. 1 DIRICHLET SERIES FOR CREEP (GG) AT REFERENCE TEMPERATURE (TEMREF) OF 77.00000 ARE:
-.3015E-05 - .6485E-06 - .2508E-05 -.4060E-05 .5460E-06 -.8125E-05 .2336E-04

COMPUTED COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.605E-05 .656E-05 .776E-05 .899E-05 .101E-05 .117E-05 .135E-04 .154E-04 .173E-04 .203E-04 .231E-04

FOR PERIOD NO. 1 LAYER NO. AND TEMPERATURE ARE:
1 . 7000E+02

CREEP COMPLIANCES (CREEP) OF LAYER 1 AT TEMPERATURE (TEMP) OF 70.00000 ARE:
.580E-05 .590E-05 .622E-05 .696E-05 .835E-05 .940E-05 .108E-04 .123E-04 .144E-44 .161E-04 .185E-04

NUMBER OF LAYERS FOR BOTTOM TENSION (NLBT) = 0

NUMBER OF LAYERS FOR TOP COMPRESSION (NLTC) = 1

LAYER NO. FOR TOP COMPRESSION (LNTC) ARE: 3

LOAD REPETITIONS (TNLR) IN PERIOD 1 FOR EACH LOAD GROUP ARE: 3750.00

DAMAGE COEFFICENTS (FT) FOR TOP COMPRESSION OF LAYER 3 ARE: .1365E-08 .4477E+01

DAMAGE ANALYSIS OF PERIOD NO. 1 LOAD GROUP NO. 1

RADIAL VERTICAL VERTICAL VERTICAL RADIAL TANGENTIAL SHEAR VERTICAL RADIAL TANGENTIAL SHEAR
COORDINATE COORDINATE DISP STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
.00000 8.80010 .7017E-01 .2882E+02 .2306E+02 .3306E+02 .0000E+00 .2271E-02 .1135E-02 .1135E-02 0000E+00

AT TOP OF LAYER 3 COMPRESSIVE STRAIN = .2271E-02 ALLOWABLE LOAD REPETITIONS = .93667E+03 DAMAGE RATIO= .40035E+01

SUMMARY OF DAMAGE ANALYSIS

AT TOP OF LAYER 3 SUM OF DAMAGE RATIO= .40035E+01

MAXIMUM DAMAGE RATO= .40035E+01 DESIGN LIFE IN YEARS= .25

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* SECTION 11 DUAL TIRE LOAD 40 MPH HMA MR=370 KSI *

MATL = 3 FOR VISCOELASTIC LAYERED SYSTEM

NDAMA=1, SO DAMAGE ANALYSIS WILL BE PERFORMED

NUMBER OF PERIODS PER YEAR (NPY) = 1

NUMBER OF LOAD GROUPS (NLG) = 1

TOLERANCE FOR INTEGRATION (DEL) = .00100

NUMBER OF LAYERS (NL) = 3

NUMBER OF Z COORDINATES (NZ) = 1

LIMIT OF INTEGRATION CYCLES (ICL) = 80

COMPUTING CODE (NSTD) = 9

THICKNESS OF LAYERS (TH) ARE: 2.86000 5.94000

POISSON'S RATIOS OF LAYERS (PR) ARE: .35000 .30000 .30000

CONDITIONS OF INTERFACES (INT) ARE: 0 0

FOR PERIOD NO. 1 ELASTIC MODULI OF LAYERS ARE: .370000E+06 .250200E+05 .660000E+04

LOAD GROUP NO. 1 HAS 2 CONTACT AREAS
CONTACT RADIUS (CR) = 4.23000
CONTACT PRESSURE (CP)= 80.00000
NO. OF POINTS AT WHICH RESULTS ARE DESIRED (NPT) = 3
WHEEL SPACING ALONG X-AXIS (XW) = .00000
WHEEL SPACING ALONG Y-AXIS (YW) = 13.50000
POINT NO. AND X AND Y COORDIANTES ARE:
1 .00000 .00000 2 .00000 4.23 3 .00000 6.75000

DURATION OF MOVING LOAD(DUR) = .10000

NUMBER OF VISCOELASTIC LAYER (NVL) = 1

LAYER NUMBERS WHICH ARE VISCOELASTIC (LNV) = 1

CREEP TIMES (TYME) ARE:
.100E-02 .300E-02 .100E-01 .300E01 .100E+00 .300E+00 .100E+01 .300E+01 . 100E+02 .300E+02 .100E+03

FOR LAYER 1 TIME TEMPERATURE SHIFT FACTOR (BETA)= .11300 REFERENCE TEMPERATURE (TEMREF)= 77.00000

CREEP COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.589E-05 .676E-05 .776E-05 .891E-05 .102E-04 .117E-04 .134E-04 .153E-04 .177E-04 .200E-04 .232E-04

LAYER NO. 1 DIRICHLET SERIES FOR CREEP (GG) AT REFERENCE TEMPERATURE (TEMREF) OF 77.00000 ARE:
-.3015E-05 - .6485E-06 - .2508E-05 -.4060E-05 .5460E-06 -.8125E-05 .2336E-04

COMPUTED COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.605E-05 .656E-05 .776E-05 .899E-05 .101E-04 .117E-04 .135E-04 .154E-04 .173E-04 .203E-04 .231E-04

FOR PERIOD NO. 1 LAYER NO. AND TEMPERATURE ARE:
1 . 7000E+02

CREEP COMPLIANCES (CREEP) OF LAYER 1 AT TEMPERATURE (TEMP) OF 70.00000 ARE:
.580E-05 .590E-05 .622E-05 .696E-05 .835E-05 .940E-05 .108E-04 .123E-04 .144E-04 .161E-04 .185E-04

NUMBER OF LAYERS FOR BOTTOM TENSION (NLBT) = 0

NUMBER OF LAYERS FOR TOP COMPRESSION (NLTC) = 1

LAYER NO. FOR TOP COMPRESSION (LNTC) ARE: 3

LOAD REPETITIONS (TNLR) IN PERIOD 1 FOR EACH LOAD GROUP ARE: 3750.00

DAMAGE COEFFICENTS (FT) FOR TOP COMPRESSION OF LAYER 3 ARE: .1365E-08 .4477E+01

DAMAGE ANALYSIS OF PERIOD NO. 1 LOAD GROUP NO. 1

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN

1 8.80010 .5320E-01 .1793E+02 .1793E+02 .1513E+02 .1356E+02 .1413E-02 .1413E-03 .5509E-03 .5509E-03

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR
MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
2 8.80010 .5589E-01 .1768E+02 .1768E+02 .1522E+02 .1306E+02 .1393E-02 .1393E-02 .4838E-03 .4838E-03

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR
MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
3 8.80010 .5607E-01 .1716E+02 .1716E+02 .1492E+02 .1253E+02 .1352E-02 .1352E-02 .4407E-03 .4407E-03

AT TOP OF LAYER 3 COMPRESSIVE STRAIN = .1413E-02 ALLOWABLE LOAD REPETITIONS =
.78384E+04 DAMAGE RATIO=
.47841E+00

SUMMARY OF DAMAGE ANALYSIS

AT TOP OF LAYER 3 SUM OF DAMAGE RATIO= .47841E+00

MAXIMUM DAMAGE RATO= .47841E+00 DESIGN LIFE IN YEARS= 2.09

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* SECTION 11 DUAL TIRE LOAD 60 MPH HMA MR=370 KSI *

MATL = 3 FOR VISCOELASTIC LAYERED SYSTEM

NDAMA=1, SO DAMAGE ANALYSIS WILL BE PERFORMED

NUMBER OF PERIODS PER YEAR (NPY) = 1

NUMBER OF LOAD GROUPS (NLG) = 1

TOLERANCE FOR INTEGRATION (DEL) = .00100

NUMBER OF LAYERS (NL) = 3

NUMBER OF Z COORDINATES (NZ) = 1

LIMIT OF INTEGRATION CYCLES (ICL) = 80

COMPUTING CODE (NSTD) = 9

THICKNESS OF LAYERS (TH) ARE: 2.86000 5.94000

POISSON'S RATIOS OF LAYERS (PR) ARE: .35000 .30000 .30000

CONDITIONS OF INTERFACES (INT) ARE: 0 0
FOR PERIOD NO. 1 ELASTIC MODULI OF LAYERS ARE: .370000E+06 .250200E+05
.660000E+04

LOAD GROUP NO. 1 HAS 2 CONTACT AREAS
CONTACT RADIUS (CR) = 4.23000
CONTACT PRESSURE (CP)= 80.00000
NO. OF POINTS AT WHICH RESULTS ARE DESIRED (NPT) = 3
WHEEL SPACING ALONG X-AXIS (XW) = .00000
WHEEL SPACING ALONG Y-AXIS (YW) = 13.50000

POINT NO. AND X AND Y COORDIANTES ARE:
1 .00000 .00000 2 .00000 4.23 3 .00000 6.75000

DURATION OF MOVING LOAD(DUR) = .03500

NUMBER OF VISCOELASTIC LAYER (NVL) = 1

LAYER NUMBERS WHICH ARE VISCOELASTIC (LNV) = 1

CREEP TIMES (TYME) ARE:
.100E-02 .300E-02 .100E-01 .300E01 .100E+00 .300E+00 .100E+01 .300E+01 .100E+02 .300E+02 .100E+03

FOR LAYER 1 TIME TEMPERATURE SHIFT FACTOR (BETA)= .11300 REFERENCE TEMPERATURE (TEMREF)= 77.00000

CREEP COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.589E-05 .676E-05 .776E-05 .891E-05 .102E-04 .117E-45 .134E-04 .153E-04 .177E-04 .200E-04 .232E-04

LAYER NO. 1 DIRICHLET SERIES FOR CREEP (GG) AT REFERENCE TEMPERATURE (TEMREF) OF 77.00000 ARE:
-.3015E-05 - .6485E-06 - .2508E-05 -.4060E-05 .5460E-06 -.8125E-05 .2336E-04

COMPUTED COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.605E-05 .656E-05 .776E-05 .899E-05 .101E-04 .117E-04 .135E-04 .154E-04 .173E-04 .203E-04 .231E-04

FOR PERIOD NO. 1 LAYER NO. AND TEMPERATURE ARE:
1 . 7000E+02

CREEP COMPLIANCES (CREEP) OF LAYER 1 AT TEMPERATURE (TEMP) OF 70.00000 ARE:
.580E-05 .590E-05 .622E-05 .696E-05 .835E-05 .940E-05 .108E-04 .123E-04 .144E-04 .161E-04 .185E-04

NUMBER OF LAYERS FOR BOTTOM TENSION (NLBT) = 0

NUMBER OF LAYERS FOR TOP COMPRESSION (NLTC) = 1

LAYER NO. FOR TOP COMPRESSION (LNTC) ARE: 3

LOAD REPETITIONS (TNLR) IN PERIOD 1 FOR EACH LOAD GROUP ARE: 3750.00

DAMAGE COEFFICENTS (FT) FOR TOP COMPRESSION OF LAYER 3 ARE: .1365E-08 .4477E+01

DAMAGE ANALYSIS OF PERIOD NO. 1 LOAD GROUP NO. 1

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
1 8.80010 .5272E-01 .1755E+02 .1755E+02 .1481E+02 .1327E+02 .1383E-02 .1383E-02 .5397E-03 .5397E-03

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
2 8.80010 .5543E-01 .1740E+02 .1740E+02 .1496E+02 .1288E+02 .1371E-02 .1371E-02 .4807E-03 .4807E-03

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
3 8.80010 .5562E-01 .1693E+02 .1693E+02 .1469E+02 .1239E+02 .1334E-02 .1334E-02 .4410E-03 .4410E-03

AT TOP OF LAYER 3 COMPRESSIVE STRAIN = .1383E-02 ALLOWABLE LOAD REPETITIONS =
.86299E+04   DAMAGE RATIO=
.43454E+00

SUMMARY OF DAMAGE ANALYSIS

AT TOP OF LAYER 3   SUM OF DAMAGE RATIO= .43454E+00

MAXIMUM DAMAGE RATO= .43454E+00   DESIGN LIFE IN YEARS= 2.30

NUMBER OF PROBLEMS TO BE SOLVED = 6

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* SECTION 12 PLATE LOAD HMA MR=250 KSI *

MATL = 3 FOR VISCOELASTIC LAYERED SYSTEM

NDAMA=1, SO DAMAGE ANALYSIS WILL BE PERFORMED

NUMBER OF PERIODS PER YEAR (NPY) = 1

NUMBER OF LOAD GROUPS (NLG) = 1

TOLERANCE FOR INTEGRATION (DEL) = .00100

NUMBER OF LAYERS (NL) = 3

NUMBER OF Z COORDINATES (NZ) = 0

LIMIT OF INTEGRATION CYCLES (ICL) = 80

COMPUTING CODE (NSTD) = 9

THICKNESS OF LAYERS (TH) ARE: 3.08000 5.58000

POISSON'S RATIOS OF LAYERS (PR) ARE: .35000 .30000 .30000

CONDITIONS OF INTERFACES (INT) ARE: 0 0

FOR PERIOD NO. 1 ELASTIC MODULI OF LAYERS ARE: .250000E+06 .251100E+05 .690000E+04

LOAD GROUP NO. 1 HAS 1 CONTACT AREAS
CONTACT RADIUS (CR) = 6.00000
CONTACT PRESSURE (CP)= 80.00000
RADIAL COORDINATES OF THE 1 POINTS (RC) ARE: .00000

DURATION OF MOVING LOAD (DUR) = 1.00000

NUMBER OF VISCOELASTIC LAYER (NVL) = 1

LAYER NUMBERS WHICH ARE VISCOELASTIC (LNV) = 1

CREEP TIMES (TYME) ARE:
.100E-02 .300E-02 .100E-01 .300E01 .100E+00 .300E+00 .100E+01 .300E+01 . 100E+02 .300E+02 .100E+03

FOR LAYER 1 TIME TEMPERATURE SHIFT FACTOR (BETA)= .11300 REFERENCE TEMPERATURE (TEMREF)= 77.00000

CREEP COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.163E-05 .221E-05 .308E-05 .417E-05 .580E-05 .785E-05 .109E-04 .148E-04 .206E-04 .279E-04 .389E-04

LAYER NO. 1 DIRICHLET SERIES FOR CREEP (GG) AT REFERENCE TEMPERATURE (TEMREF) OF 77.00000 ARE:
-.1543E-05 - .1086E-05 - .1254E-05 -.8227E-05 .3934E-05 -.2991E-04 .3962E-04

COMPUTED COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.174E-05 .210E-05 .302E-05 .427E-05 .576E-05 .767E-05 .112E-04 .151E-04 .196E-04 .288E-04 .386E-04

FOR PERIOD NO. 1 LAYER NO. AND TEMPERATURE ARE:

1 . 7000E+02

CREEP COMPLIANCES (CREEP) OF LAYER 1 AT TEMPERATURE (TEMP) OF 70.00000 ARE:
.157E-05 .163E-05 .186E-05 .239E-05 .355E-05 .484E-05 .649E-05 .886E-05 .130E-04 .165E-04 .230E-04

NUMBER OF LAYERS FOR BOTTOM TENSION (NLBT) = 0

NUMBER OF LAYERS FOR TOP COMPRESSION (NLTC) = 1

LAYER NO. FOR TOP COMPRESSION (LNTC) ARE: 3

LOAD REPETITIONS (TNLR) IN PERIOD 1 FOR EACH LOAD GROUP ARE: 3750.00

DAMAGE COEFFICENTS (FT) FOR TOP COMPRESSION OF LAYER 3 ARE: .1365E-08 .4477E+01

DAMAGE ANALYSIS OF PERIOD NO. 1 LOAD GROUP NO. 1

RADIAL VERTICAL VERTICAL VERTICAL RADIAL TANGENTIAL SHEAR VERTICAL RADIAL TANGENTIAL SHEAR
COORDINATE COORDINATE DISP STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
.00000 8.66010 .6083E-01 .2384E+02 .1907E+02 .1907E+02 .0000E+00 .1796E-02 .8982E-03 .8982E-03 0000E+00

AT TOP OF LAYER 3 COMPRESSIVE STRAIN = .1796E-02 ALLOWABLE LOAD REPETITIONS = .26735E+04 DAMAGE RATIO= .14027E+01

SUMMARY OF DAMAGE ANALYSIS

AT TOP OF LAYER 3 SUM OF DAMAGE RATIO= .14027E+01

MAXIMUM DAMAGE RATO= .14027E+01 DESIGN LIFE IN YEARS= .71

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* SECTION 12 DUAL TIRE LOAD 40 MPH HMA MR=250 KSI *

MATL = 3 FOR VISCOELASTIC LAYERED SYSTEM

NDAMA=1, SO DAMAGE ANALYSIS WILL BE PERFORMED

NUMBER OF PERIODS PER YEAR (NPY) = 1

NUMBER OF LOAD GROUPS (NLG) = 1

TOLERANCE FOR INTEGRATION (DEL) = .00100

NUMBER OF LAYERS (NL) = 3

NUMBER OF Z COORDINATES (NZ) = 1

LIMIT OF INTEGRATION CYCLES (ICL) = 80

COMPUTING CODE (NSTD) = 9

THICKNESS OF LAYERS (TH) ARE: 3.08000 5.58000

POISSON’S RATIOS OF LAYERS (PR) ARE: .35000 .30000 .30000

CONDITIONS OF INTERFACES (INT) ARE: 0 0

FOR PERIOD NO. 1 ELASTIC MODULI OF LAYERS ARE: .250000E+06 .251100E+05 .690000E+04

LOAD GROUP NO. 1 HAS 2 CONTACT AREAS
CONTACT RADIUS (CR) = 4.23000
CONTACT PRESSURE (CP)= 80.00000
NO. OF POINTS AT WHICH RESULTS ARE DESIRED (NPT) = 3
WHEEL SPACING ALONG X-AXIS (XW) = .00000
WHEEL SPACING ALONG Y-AXIS (YW) = 13.50000
POINT NO. AND X AND Y COORDIANTES ARE:
1 .00000 .00000 2 .00000 4.23 3 .00000 6.75000

DURATION OF MOVING LOAD(DUR) = .10000

NUMBER OF VISCOELASTIC LAYER (NVL) = 1

LAYER NUMBERS WHICH ARE VISCOELASTIC (LNV) = 1

CREEP TIMES (TYME) ARE:
.100E-02 .300E-02 .100E-01 .300E01 .100E+00 .300E+00 .100E+01 .300E+01 . 100E+02 .300E+02 .100E+03

FOR LAYER 1 TIME TEMPERATURE SHIFT FACTOR (BETA)= .11300 REFERENCE TEMPERATURE (TEMREF)= 77.00000

CREEP COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.163E-05 .221E-05 .308E-05 .417E-05 .580E-05 .785E-45 .109E-04 .148E-04 .206E-04 .279E-04 .389E-04

LAYER NO. 1 DIRICHLET SERIES FOR CREEP (GG) AT REFERENCE TEMPERATURE (TEMREF) OF 77.00000 ARE:
-.1561E-05 - .1042E-05 - .1290E-05 -.8239E-05 .3897E-05 -.2985E-04 .3962E-04

COMPUTED COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.174E-05 .210E-05 .303E-05 .427E-05 .576E-05 .768E-05 .112E-04 .151E-04 .197E-04 .288E-04 .386E-04

FOR PERIOD NO. 1 LAYER NO. AND TEMPERATURE ARE:
1 . 7000E+02

CREEP COMPLIANCES (CREEP) OF LAYER 1 AT TEMPERATURE (TEMP) OF 70.00000 ARE:
.157E-05 .163E-05 .185E-05 .239E-05 .355E-05 .483E-05 .649E-05 .888E-05 .130E-04 .166E-04 .230E-04

NUMBER OF LAYERS FOR BOTTOM TENSION (NLBT) = 0

NUMBER OF LAYERS FOR TOP COMPRESSION (NLTC) = 1

LAYER NO. FOR TOP COMPRESSION (LNTC) ARE: 3

LOAD REPETITIONS (TNLR) IN PERIOD 1 FOR EACH LOAD GROUP ARE: 3750.00

DAMAGE COEFFICENTS (FT) FOR TOP COMPRESSION OF LAYER 3 ARE: .1365E-08 .4477E+01

DAMAGE ANALYSIS OF PERIOD NO. 1 LOAD GROUP NO. 1

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
1 8.66010 .4382E-01 .1295E+02 .1295E+02 .1087E+02 .9853E+01 .9759E-03 .9759E-03 .3925E-03 .3925E-03

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL

NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
2 8.66010 .4614E-01 .1338E+02 .1338E+02 .1130E+02 .1010E+02 .1008E-02 .1008E-02 .3911E-03 .3911E-03

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR
MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
3 8.66010 .4642E-01 .1324E+02 .1324E+02 .1124E+02 .9952E+01 .9981E-03 .9981E-03 .3779E-03 .3779E-03

AT TOP OF LAYER 3 COMPRESSIVE STRAIN = .1008E-02 ALLOWABLE LOAD REPETITIONS =
.35530E+05 DAMAGE RATIO=
.10555E+00

SUMMARY OF DAMAGE ANALYSIS

AT TOP OF LAYER 3 SUM OF DAMAGE RATIO= .10555E+00

MAXIMUM DAMAGE RATO= .10555E+00 DESIGN LIFE IN YEARS= 9.47

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* SECTION 12 DUAL TIRE LOAD 60 MPH HMA MR=250 KSI *

MATL = 3 FOR VISCOELASTIC LAYERED SYSTEM

NDAMA=1, SO DAMAGE ANALYSIS WILL BE PERFORMED

NUMBER OF PERIODS PER YEAR (NPY) = 1

NUMBER OF LOAD GROUPS (NLG) = 1

TOLERANCE FOR INTEGRATION (DEL) = .00100

NUMBER OF LAYERS (NL) = 3

NUMBER OF Z COORDINATES (NZ) = 1

LIMIT OF INTEGRATION CYCLES (ICL) = 80

COMPUTING CODE (NSTD) = 9

THICKNESS OF LAYERS (TH) ARE: 3.08000 5.58000

POISSON'S RATIOS OF LAYERS (PR) ARE: .35000 .30000 .30000

CONDITIONS OF INTERFACES (INT) ARE: 0 0
FOR PERIOD NO. 1 ELASTIC MODULI OF LAYERS ARE: .250000E+06 .251100E+05
.690000E+04

LOAD GROUP NO. 1 HAS 2 CONTACT AREAS
CONTACT RADIUS (CR) = 4.23000
CONTACT PRESSURE (CP)= 80.00000
NO. OF POINTS AT WHICH RESULTS ARE DESIRED (NPT) = 3
WHEEL SPACING ALONG X-AXIS (XW) = .00000
WHEEL SPACING ALONG Y-AXIS (YW) = 13.50000
POINT NO. AND X AND Y COORDIANTES ARE:
1 .00000 .00000 2 .00000 4.23 3 .00000 6.75000

DURATION OF MOVING LOAD(DUR) = .03500

NUMBER OF VISCOELASTIC LAYER (NVL) = 1

LAYER NUMBERS WHICH ARE VISCOELASTIC (LNV) = 1

CREEP TIMES (TYME) ARE:
.100E-02 .300E-02 .100E-01 .300E01 .100E+00 .300E+00 .100E+01 .300E+01 .100E+02 .300E+02 .100E+03

FOR LAYER 1 TIME TEMPERATURE SHIFT FACTOR (BETA)= .11300 REFERENCE TEMPERATURE (TEMREF)= 77.00000

CREEP COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.163E-05 .221E-05 .308E-05 .417E-05 .580E-05 .785E-45 .109E-04 .148E-04 .206E-04 .279E-04 .389E-04

LAYER NO. 1 DIRICHLET SERIES FOR CREEP (GG) AT REFERENCE TEMPERATURE (TEMREF) OF 77.00000 ARE:
-.1561E-05 - .1042E-05 - .1290E-05 -.8239E-05 .3897E-05 -.2985E-04 .3962E-04

COMPUTED COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.174E-05 .210E-05 .303E-05 .427E-05 .576E-05 .768E-05 .112E-04 .151E-04 .197E-04 .288E-04 .386E-04

FOR PERIOD NO. 1 LAYER NO. AND TEMPERATURE ARE:
1 . 7000E+02

CREEP COMPLIANCES (CREEP) OF LAYER 1 AT TEMPERATURE (TEMP) OF 70.00000 ARE:
.157E-05 .163E-05 .185E-05 .239E-05 .355E-05 .483E-05 .649E-05 .888E-05 .130E-04 .166E-04 .230E-04

NUMBER OF LAYERS FOR BOTTOM TENSION (NLBT) = 0

NUMBER OF LAYERS FOR TOP COMPRESSION (NLTC) = 1

LAYER NO. FOR TOP COMPRESSION (LNTC) ARE: 3

LOAD REPETITIONS (TNLR) IN PERIOD 1 FOR EACH LOAD GROUP ARE: 3750.00

DAMAGE COEFFICENTS (FT) FOR TOP COMPRESSION OF LAYER 3 ARE: .1365E-08 .4477E+01

DAMAGE ANALYSIS OF PERIOD NO. 1 LOAD GROUP NO. 1

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR
MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
1 8.66010 .4224E-01 .1199E+02 .1199E+02 .1004E+02 .9139E+01 .9036E-03 .9036E-03 .3666E-03 .3666E-03

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR
MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
2 8.66010 .4445E-01 .1246E+02 .1246E+02 .1049E+02 .9449E+01 .9392E-03 .9392E-03 .3716E-03 .3716E-03

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR
MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
3 8.66010 .4473E-01 .1237E+02 .1237E+02 .1045E+02 .9345E+01 .9362E-03 .9362E-03 .3618E-03 .3618E-03

AT TOP OF LAYER 3 COMPRESSIVE STRAIN = .9392E-03 ALLOWABLE LOAD REPETITIONS =
.48774E+05 DAMAGE RATIO=
.76885E-01

SUMMARY OF DAMAGE ANALYSIS

AT TOP OF LAYER 3 SUM OF DAMAGE RATIO= .76885E-01

MAXIMUM DAMAGE RATO= .76885E-01 DESIGN LIFE IN YEARS= 13.01

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* SECTION 12 PLATE LOAD HMA MR=370 KSI *

MATL = 3 FOR VISCOELASTIC LAYERED SYSTEM

NDAMA=1, SO DAMAGE ANALYSIS WILL BE PERFORMED

NUMBER OF PERIODS PER YEAR (NPY) = 1

NUMBER OF LOAD GROUPS (NLG) = 1

TOLERANCE FOR INTEGRATION (DEL) = .00100

NUMBER OF LAYERS (NL) = 3

NUMBER OF Z COORDINATES (NZ) = 0

LIMIT OF INTEGRATION CYCLES (ICL) = 80

COMPUTING CODE (NSTD) = 9

THICKNESS OF LAYERS (TH) ARE: 3.08000 5.58000

POISSON’S RATIOS OF LAYERS (PR) ARE: .35000 .30000 .30000

CONDITIONS OF INTERFACES (INT) ARE: 0 0

FOR PERIOD NO. 1 ELASTIC MODULI OF LAYERS ARE: .370000E+06 .251100E+05 .690000E+04

LOAD GROUP NO. 1 HAS 1 CONTACT AREAS
CONTACT RADIUS (CR) = 6.00000
CONTACT PRESSURE (CP)= 80.00000
RADIAL COORDINATES OF THE 1 POINTS (RC) ARE: .00000

DURATION OF MOVING LOAD (DUR) = 1.00000

NUMBER OF VISCOELASTIC LAYER (NVL) = 1

LAYER NUMBERS WHICH ARE VISCOELASTIC (LNV) = 1

CREEP TIMES (TYME) ARE:
.100E-02 .300E-02 .100E-01 .300E01 .100E+00 .300E+00 .100E+01 .300E+01 . 100E+02 .300E+02 .100E+03

FOR LAYER 1 TIME TEMPERATURE SHIFT FACTOR (BETA)= .11300 REFERENCE TEMPERATURE (TEMREF)= 77.00000

CREEP COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.589E-05 .676E-05 .776E-05 .891E-05 .102E-04 .117E-04 .134E-04 .153E-04 .177E-04 .200E-04 .232E-04

LAYER NO. 1 DIRICHLET SERIES FOR CREEP (GG) AT REFERENCE TEMPERATURE (TEMREF) OF 77.00000 ARE:
-.3015E-05 - .6485E-06 - .2508E-05 -.4060E-05 .5460E-06 -.8125E-05 .2336E-04

COMPUTED COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.605E-05 .656E-05 .776E-05 .899E-05 .101E-05 .117E-05 .135E-04 .154E-04 .173E-04 .203E-04 .231E-04

FOR PERIOD NO. 1 LAYER NO. AND TEMPERATURE ARE:
1 . 7000E+02

CREEP COMPLIANCES (CREEP) OF LAYER 1 AT TEMPERATURE (TEMP) OF 70.00000 ARE:
.580E-05 .590E-05 .622E-05 .696E-05 .835E-05 .940E-05 .108E-04 .123E-04 .144E-44 .161E-04 .185E-04

NUMBER OF LAYERS FOR BOTTOM TENSION (NLBT) = 0

NUMBER OF LAYERS FOR TOP COMPRESSION (NLTC) = 1

LAYER NO. FOR TOP COMPRESSION (LNTC) ARE: 3

LOAD REPETITIONS (TNLR) IN PERIOD 1 FOR EACH LOAD GROUP ARE: 3750.00

DAMAGE COEFFICENTS (FT) FOR TOP COMPRESSION OF LAYER 3 ARE: .1365E-08 .4477E+01

DAMAGE ANALYSIS OF PERIOD NO. 1 LOAD GROUP NO. 1

RADIAL VERTICAL VERTICAL VERTICAL RADIAL TANGENTIAL SHEAR VERTICAL RADIAL TANGENTIAL SHEAR
COORDINATE COORDINATE DISP STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
.00000 8.66010 .6788E-01 .2936E+02 .2348E+02 .2348E+02 .0000E+00 .2212E-02 .1106E-02 .1106E-02 0000E+00

AT TOP OF LAYER 3 COMPRESSIVE STRAIN = .2212E-02 ALLOWABLE LOAD REPETITIONS = .10523E+04 DAMAGE RATIO= .35636E+01

SUMMARY OF DAMAGE ANALYSIS

AT TOP OF LAYER 3 SUM OF DAMAGE RATIO= .35636E+01

MAXIMUM DAMAGE RATO= .35636E+01 DESIGN LIFE IN YEARS= .28

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* SECTION 12 DUAL TIRE LOAD 40 MPH HMA MR=370 KSI *

MATL = 3 FOR VISCOELASTIC LAYERED SYSTEM

NDAMA=1, SO DAMAGE ANALYSIS WILL BE PERFORMED

NUMBER OF PERIODS PER YEAR (NPY) = 1

NUMBER OF LOAD GROUPS (NLG) = 1

TOLERANCE FOR INTEGRATION (DEL) = .00100

NUMBER OF LAYERS (NL) = 3

NUMBER OF Z COORDINATES (NZ) = 1

LIMIT OF INTEGRATION CYCLES (ICL) = 80

COMPUTING CODE (NSTD) = 9

THICKNESS OF LAYERS (TH) ARE: 3.08000 5.58000

POISSON'S RATIOS OF LAYERS (PR) ARE: .35000 .30000 .30000

CONDITIONS OF INTERFACES (INT) ARE: 0 0

FOR PERIOD NO. 1 ELASTIC MODULI OF LAYERS ARE: .370000E+06 .251100E+05 .690000E+04

LOAD GROUP NO. 1 HAS 2 CONTACT AREAS
CONTACT RADIUS (CR) = 4.23000
CONTACT PRESSURE (CP)= 80.00000
NO. OF POINTS AT WHICH RESULTS ARE DESIRED (NPT) = 3
WHEEL SPACING ALONG X-AXIS (XW) = .00000
WHEEL SPACING ALONG Y-AXIS (YW) = 13.50000
POINT NO. AND X AND Y COORDIANTES ARE:
1 .00000 .00000 2 .00000 4.23 3 .00000 6.75000

DURATION OF MOVING LOAD(DUR) = .10000

NUMBER OF VISCOELASTIC LAYER (NVL) = 1

LAYER NUMBERS WHICH ARE VISCOELASTIC (LNV) = 1

CREEP TIMES (TYME) ARE:
.100E-02 .300E-02 .100E-01 .300E01 .100E+00 .300E+00 .100E+01 .300E+01 . 100E+02 .300E+02 .100E+03

FOR LAYER 1 TIME TEMPERATURE SHIFT FACTOR (BETA)= .11300 REFERENCE TEMPERATURE (TEMREF)= 77.00000

CREEP COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.589E-05 .676E-05 .776E-05 .891E-05 .102E-04 .117E-04 .134E-04 .153E-04 .177E-04 .200E-04 .232E-04

LAYER NO. 1 DIRICHLET SERIES FOR CREEP (GG) AT REFERENCE TEMPERATURE (TEMREF) OF 77.00000 ARE:
-.3015E-05 - .6485E-06 - .2508E-05 -.4060E-05 .5460E-06 -.8125E-05 .2336E-04

COMPUTED COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.605E-05 .656E-05 .776E-05 .899E-05 .101E-04 .117E-04 .135E-04 .154E-04 .173E-04 .203E-04 .231E-04

FOR PERIOD NO. 1 LAYER NO. AND TEMPERATURE ARE:
1 . 7000E+02

CREEP COMPLIANCES (CREEP) OF LAYER 1 AT TEMPERATURE (TEMP) OF 70.00000 ARE:
.580E-05 .590E-05 .622E-05 .696E-05 .835E-05 .940E-05 .108E-04 .123E-04 .144E-04 .161E-04 .185E-04

NUMBER OF LAYERS FOR BOTTOM TENSION (NLBT) = 0

NUMBER OF LAYERS FOR TOP COMPRESSION (NLTC) = 1

LAYER NO. FOR TOP COMPRESSION (LNTC) ARE: 3

LOAD REPETITIONS (TNLR) IN PERIOD 1 FOR EACH LOAD GROUP ARE: 3750.00

DAMAGE COEFFICENTS (FT) FOR TOP COMPRESSION OF LAYER 3 ARE: .1365E-08 .4477E+01

DAMAGE ANALYSIS OF PERIOD NO. 1 LOAD GROUP NO. 1

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN

1 8.66010 .5112E-01 .1809E+02 .1809E+02 .1526E+02 .1367E+02 .1363E-02 .1363E-02 .5315E-03 .5315E-03

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
2 8.66010 .5369E-01 .1780E+02 .1780E+02 .1533E+02 .1315E+02 .1342E-02 .1342E-02 .4651E-03 .4651E-03

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
3 8.66010 .5386E-01 .1726E+02 .1726E+02 .1502E+02 .1260E+02 .1301E-02 .1301E-02 .4226E-03 .4226E-03

AT TOP OF LAYER 3 COMPRESSIVE STRAIN = .1363E-02 ALLOWABLE LOAD REPETITIONS = .92027E+04 DAMAGE RATIO= .40749E+00

SUMMARY OF DAMAGE ANALYSIS

AT TOP OF LAYER 3 SUM OF DAMAGE RATIO= .40749E+00

MAXIMUM DAMAGE RATO= .40749E+00 DESIGN LIFE IN YEARS= 2.45

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* SECTION 12 DUAL TIRE LOAD 60 MPH HMA MR=370 KSI *

MATL = 3 FOR VISCOELASTIC LAYERED SYSTEM

NDAMA=1, SO DAMAGE ANALYSIS WILL BE PERFORMED

NUMBER OF PERIODS PER YEAR (NPY) = 1

NUMBER OF LOAD GROUPS (NLG) = 1

TOLERANCE FOR INTEGRATION (DEL) = .00100

NUMBER OF LAYERS (NL) = 3

NUMBER OF Z COORDINATES (NZ) = 1

LIMIT OF INTEGRATION CYCLES (ICL) = 80

COMPUTING CODE (NSTD) = 9

THICKNESS OF LAYERS (TH) ARE: 3.08000 5.58000

POISSON'S RATIOS OF LAYERS (PR) ARE: .35000 .30000 .30000

CONDITIONS OF INTERFACES (INT) ARE: 0 0
FOR PERIOD NO. 1 ELASTIC MODULI OF LAYERS ARE: .370000E+06 .251100E+05 .690000E+04

LOAD GROUP NO. 1 HAS 2 CONTACT AREAS
CONTACT RADIUS (CR) = 4.23000
CONTACT PRESSURE (CP)= 80.00000
NO. OF POINTS AT WHICH RESULTS ARE DESIRED (NPT) = 3
WHEEL SPACING ALONG X-AXIS (XW) = .00000
WHEEL SPACING ALONG Y-AXIS (YW) = 13.50000

POINT NO. AND X AND Y COORDIANTES ARE:
1 .00000 .00000 2 .00000 4.23 3 .00000 6.75000

DURATION OF MOVING LOAD(DUR) = .03500

NUMBER OF VISCOELASTIC LAYER (NVL) = 1

LAYER NUMBERS WHICH ARE VISCOELASTIC (LNV) = 1

CREEP TIMES (TYME) ARE:
.100E-02 .300E-02 .100E-01 .300E01 .100E+00 .300E+00 .100E+01 .300E+01 .100E+02 .300E+02 .100E+03

FOR LAYER 1 TIME TEMPERATURE SHIFT FACTOR (BETA)= .11300 REFERENCE TEMPERATURE (TEMREF)= 77.00000

CREEP COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.589E-05 .676E-05 .776E-05 .891E-05 .102E-04 .117E-45 .134E-04 .153E-04 .177E-04 .200E-04 .232E-04

LAYER NO. 1 DIRICHLET SERIES FOR CREEP (GG) AT REFERENCE TEMPERATURE (TEMREF) OF 77.00000 ARE:
-.3015E-05 - .6485E-06 - .2508E-05 -.4060E-05 .5460E-06 -.8125E-05 .2336E-04

COMPUTED COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.605E-05 .656E-05 .776E-05 .899E-05 .101E-04 .117E-04 .135E-04 .154E-04 .173E-04 .203E-04 .231E-04

FOR PERIOD NO. 1 LAYER NO. AND TEMPERATURE ARE:
1 . 7000E+02

CREEP COMPLIANCES (CREEP) OF LAYER 1 AT TEMPERATURE (TEMP) OF 70.00000 ARE:
.580E-05 .590E-05 .622E-05 .696E-05 .835E-05 .940E-05 .108E-04 .123E-04 .144E-04 .161E-04 .185E-04

NUMBER OF LAYERS FOR BOTTOM TENSION (NLBT) = 0

NUMBER OF LAYERS FOR TOP COMPRESSION (NLTC) = 1

LAYER NO. FOR TOP COMPRESSION (LNTC) ARE: 3

LOAD REPETITIONS (TNLR) IN PERIOD 1 FOR EACH LOAD GROUP ARE: 3750.00

DAMAGE COEFFICENTS (FT) FOR TOP COMPRESSION OF LAYER 3 ARE: .1365E-08 .4477E+01

DAMAGE ANALYSIS OF PERIOD NO. 1 LOAD GROUP NO. 1

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
1 8.66010 .5057E-01 .1765E+02 .1765E+02 .1489E+02 .1334E+02 .1330E-02 .1330E-02 .5194E-03 .5194E-03

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
2 8.66010 .5543E-01 .1740E+02 .1740E+02 .1496E+02 .1288E+02 .1371E-02 .1371E-02 .4807E-03 .4807E-03

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
3 8.66010 .5316E-01 .1747E+02 .1747E+02 .1502E+02 .1293E+02 .1316E-02 .1316E-02 .4613E-03 .4613E-03

AT TOP OF LAYER 3 COMPRESSIVE STRAIN = .1330E-02 ALLOWABLE LOAD REPETITIONS =
.10273E+05   DAMAGE RATIO=
.36505E+00

SUMMARY OF DAMAGE ANALYSIS

AT TOP OF LAYER 3   SUM OF DAMAGE RATIO= .36505E+00

MAXIMUM DAMAGE RATO= .36505E+00   DESIGN LIFE IN YEARS= 2.74

NUMBER OF PROBLEMS TO BE SOLVED = 6

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* SECTION 13 PLATE LOAD HMA MR=250 KSI *

MATL = 3 FOR VISCOELASTIC LAYERED SYSTEM

NDAMA=1, SO DAMAGE ANALYSIS WILL BE PERFORMED

NUMBER OF PERIODS PER YEAR (NPY) = 1

NUMBER OF LOAD GROUPS (NLG) = 1

TOLERANCE FOR INTEGRATION (DEL) = .00100

NUMBER OF LAYERS (NL) = 3

NUMBER OF Z COORDINATES (NZ) = 0

LIMIT OF INTEGRATION CYCLES (ICL) = 80

COMPUTING CODE (NSTD) = 9

THICKNESS OF LAYERS (TH) ARE: 2.40000 7.68000

POISSON'S RATIOS OF LAYERS (PR) ARE: .35000 .30000 .30000

CONDITIONS OF INTERFACES (INT) ARE: 0 0

FOR PERIOD NO. 1 ELASTIC MODULI OF LAYERS ARE: .250000E+06 .249200E+05
.630000E+04

LOAD GROUP NO. 1 HAS 1 CONTACT AREAS
CONTACT RADIUS (CR) = 6.00000
CONTACT PRESSURE (CP)= 80.00000
RADIAL COORDINATES OF THE 1 POINTS (RC) ARE: .00000

DURATION OF MOVING LOAD (DUR) = 1.00000

NUMBER OF VISCOELASTIC LAYER (NVL) = 1

LAYER NUMBERS WHICH ARE VISCOELASTIC (LNV) = 1

CREEP TIMES (TYME) ARE:
.100E-02 .300E-02 .100E-01 .300E01 .100E+00 .300E+00 .100E+01 .300E+01 . 100E+02 .300E+02
.100E+03

FOR LAYER 1 TIME TEMPERATURE SHIFT FACTOR (BETA)= .11300 REFERENCE TEMPERATURE (TEMREF)= 77.00000

CREEP COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.163E-05 .221E-05 .308E-05 .417E-05 .580E-05 .785E-05 .109E-04 .148E-04 .206E-04 .279E-04 .389E-04

LAYER NO. 1 DIRICHLET SERIES FOR CREEP (GG) AT REFERENCE TEMPERATURE (TEMREF) OF 77.00000 ARE:
-.1543E-05 - .1086E-05 - .1254E-05 -.8227E-05 .3934E-05 -.2991E-04 .3962E-04

COMPUTED COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.174E-05 .210E-05 .302E-05 .427E-05 .576E-05 .767E-05 .112E-04 .151E-04 .196E-04 .288E-04 .386E-04

FOR PERIOD NO. 1 LAYER NO. AND TEMPERATURE ARE:

1 . 7000E+02

CREEP COMPLIANCES (CREEP) OF LAYER 1 AT TEMPERATURE (TEMP) OF 70.00000 ARE:
.157E-05 .163E-05 .186E-05 .239E-05 .355E-05 .484E-05 .649E-05 .886E-05 .130E-04 .165E-04 .230E-04

NUMBER OF LAYERS FOR BOTTOM TENSION (NLBT) = 0

NUMBER OF LAYERS FOR TOP COMPRESSION (NLTC) = 1

LAYER NO. FOR TOP COMPRESSION (LNTC) ARE: 3

LOAD REPETITIONS (TNLR) IN PERIOD 1 FOR EACH LOAD GROUP ARE: 3750.00

DAMAGE COEFFICENTS (FT) FOR TOP COMPRESSION OF LAYER 3 ARE: .1365E-08 .4477E+01

DAMAGE ANALYSIS OF PERIOD NO. 1 LOAD GROUP NO. 1

RADIAL VERTICAL VERTICAL VERTICAL RADIAL TANGENTIAL SHEAR VERTICAL RADIAL TANGENTIAL SHEAR
COORDINATE COORDINATE DISP STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
.00000 10.08010 .6241E-01 .2127E+02 .1701E+02 .1701E+02 .0000E+00 .1756E-02 .8777E-03 .8777E-03 0000E+00

AT TOP OF LAYER 3 COMPRESSIVE STRAIN = .1756E-02 ALLOWABLE LOAD REPETITIONS = .29637E+04 DAMAGE RATIO= .12653E+01

SUMMARY OF DAMAGE ANALYSIS

AT TOP OF LAYER 3 SUM OF DAMAGE RATIO= .12653E+01

MAXIMUM DAMAGE RATO= .12653E+01 DESIGN LIFE IN YEARS= .79

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* SECTION 13 DUAL TIRE LOAD 40 MPH HMA MR=250 KSI *

MATL = 3 FOR VISCOELASTIC LAYERED SYSTEM

NDAMA=1, SO DAMAGE ANALYSIS WILL BE PERFORMED

NUMBER OF PERIODS PER YEAR (NPY) = 1

NUMBER OF LOAD GROUPS (NLG) = 1

TOLERANCE FOR INTEGRATION (DEL) = .00100

NUMBER OF LAYERS (NL) = 3

NUMBER OF Z COORDINATES (NZ) = 1

LIMIT OF INTEGRATION CYCLES (ICL) = 80

COMPUTING CODE (NSTD) = 9

THICKNESS OF LAYERS (TH) ARE: 2.40000 7.68000

POISSON’S RATIOS OF LAYERS (PR) ARE: .35000 .30000 .30000

CONDITIONS OF INTERFACES (INT) ARE: 0 0

FOR PERIOD NO. 1 ELASTIC MODULI OF LAYERS ARE: .250000E+06 .249200E+05
.630000E+04

LOAD GROUP NO. 1 HAS 2 CONTACT AREAS
CONTACT RADIUS (CR) = 4.23000
CONTACT PRESSURE (CP)= 80.00000
NO. OF POINTS AT WHICH RESULTS ARE DESIRED (NPT) = 3
WHEEL SPACING ALONG X-AXIS (XW) = .00000
WHEEL SPACING ALONG Y-AXIS (YW) = 13.50000
POINT NO. AND X AND Y COORDIANTES ARE:
1 .00000 .00000 2 .00000 4.23 3 .00000 6.75000

DURATION OF MOVING LOAD(DUR) = .10000

NUMBER OF VISCOELASTIC LAYER (NVL) = 1

LAYER NUMBERS WHICH ARE VISCOELASTIC (LNV) = 1

CREEP TIMES (TYME) ARE:
.100E-02 .300E-02 .100E-01 .300E01 .100E+00 .300E+00 .100E+01 .300E+01 . 100E+02 .300E+02
.100E+03

FOR LAYER 1 TIME TEMPERATURE SHIFT FACTOR (BETA)= .11300 REFERENCE TEMPERATURE (TEMREF)= 77.00000

CREEP COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.163E-05 .221E-05 .308E-05 .417E-05 .580E-05 .785E-45 .109E-04 .148E-04 .206E-04 .279E-04 .389E-04

LAYER NO. 1 DIRICHLET SERIES FOR CREEP (GG) AT REFERENCE TEMPERATURE (TEMREF) OF 77.00000 ARE:
-.1561E-05 - .1042E-05 - .1290E-05 -.8239E-05 .3897E-05 -.2985E-04 .3962E-04

COMPUTED COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.174E-05 .210E-05 .303E-05 .427E-05 .576E-05 .768E-05 .112E-04 .151E-04 .197E-04 .288E-04 .386E-04

FOR PERIOD NO. 1 LAYER NO. AND TEMPERATURE ARE:
1 . 7000E+02

CREEP COMPLIANCES (CREEP) OF LAYER 1 AT TEMPERATURE (TEMP) OF 70.00000 ARE:
.157E-05 .163E-05 .185E-05 .239E-05 .355E-05 .483E-05 .649E-05 .888E-05 .130E-04 .166E-04 .230E-04

NUMBER OF LAYERS FOR BOTTOM TENSION (NLBT) = 0

NUMBER OF LAYERS FOR TOP COMPRESSION (NLTC) = 1

LAYER NO. FOR TOP COMPRESSION (LNTC) ARE: 3

LOAD REPETITIONS (TNLR) IN PERIOD 1 FOR EACH LOAD GROUP ARE: 3750.00

DAMAGE COEFFICENTS (FT) FOR TOP COMPRESSION OF LAYER 3 ARE: .1365E-08 .4477E+01

DAMAGE ANALYSIS OF PERIOD NO. 1 LOAD GROUP NO. 1

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR
MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
1 10.08010 .4767E-01 .1269E+02 .1269E+02 .1066E+02 .9645E+01 .1048E-02 .1048E-02 .4187E-03 .4187E-03

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR
MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL

NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
2 10.08010 .5033E-01 .1332E+02 .1332E+02 .1123E+02 .1008E+02 .1099E-02 .1099E-02 .4305E-03 .4305E-03

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
3 10.08010 .5068E-01 .1327E+02 .1327E+02 .1123E+02 .1001E+02 .1096E-02 .1096E-02 .4217E-03 .4217E-03

AT TOP OF LAYER 3 COMPRESSIVE STRAIN = .1099E-02 ALLOWABLE LOAD REPETITIONS = .24089E+05 DAMAGE RATIO= .15567E+00

SUMMARY OF DAMAGE ANALYSIS

AT TOP OF LAYER 3 SUM OF DAMAGE RATIO= .15567E+00

MAXIMUM DAMAGE RATO= .15567E+00 DESIGN LIFE IN YEARS= 6.42

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* SECTION 13 DUAL TIRE LOAD 60 MPH HMA MR=250 KSI *

MATL = 3 FOR VISCOELASTIC LAYERED SYSTEM

NDAMA=1, SO DAMAGE ANALYSIS WILL BE PERFORMED

NUMBER OF PERIODS PER YEAR (NPY) = 1

NUMBER OF LOAD GROUPS (NLG) = 1

TOLERANCE FOR INTEGRATION (DEL) = .00100

NUMBER OF LAYERS (NL) = 3

NUMBER OF Z COORDINATES (NZ) = 1

LIMIT OF INTEGRATION CYCLES (ICL) = 80

COMPUTING CODE (NSTD) = 9

THICKNESS OF LAYERS (TH) ARE: 2.40000 7.68000

POISSON'S RATIOS OF LAYERS (PR) ARE: .35000 .30000 .30000

CONDITIONS OF INTERFACES (INT) ARE: 0 0
FOR PERIOD NO. 1 ELASTIC MODULI OF LAYERS ARE: .250000E+06 .249200E+05 .630000E+04

LOAD GROUP NO. 1 HAS 2 CONTACT AREAS
CONTACT RADIUS (CR) = 4.23000
CONTACT PRESSURE (CP)= 80.00000
NO. OF POINTS AT WHICH RESULTS ARE DESIRED (NPT) = 3
WHEEL SPACING ALONG X-AXIS (XW) = .00000
WHEEL SPACING ALONG Y-AXIS (YW) = 13.50000
POINT NO. AND X AND Y COORDIANTES ARE:
1 .00000 .00000 2 .00000 4.23 3 .00000 6.75000

DURATION OF MOVING LOAD(DUR) = .03500

NUMBER OF VISCOELASTIC LAYER (NVL) = 1

LAYER NUMBERS WHICH ARE VISCOELASTIC (LNV) = 1

CREEP TIMES (TYME) ARE:
.100E-02 .300E-02 .100E-01 .300E01 .100E+00 .300E+00 .100E+01 .300E+01 .100E+02 .300E+02 .100E+03

FOR LAYER 1 TIME TEMPERATURE SHIFT FACTOR (BETA)= .11300 REFERENCE TEMPERATURE (TEMREF)= 77.00000

CREEP COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.163E-05 .221E-05 .308E-05 .417E-05 .580E-05 .785E-45 .109E-04 .148E-04 .206E-04 .279E-04 .389E-04

LAYER NO. 1 DIRICHLET SERIES FOR CREEP (GG) AT REFERENCE TEMPERATURE (TEMREF) OF 77.00000 ARE:
-.1561E-05 - .1042E-05 - .1290E-05 -.8239E-05 .3897E-05 -.2985E-04 .3962E-04

COMPUTED COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.174E-05 .210E-05 .303E-05 .427E-05 .576E-05 .768E-05 .112E-04 .151E-04 .197E-04 .288E-04 .386E-04

FOR PERIOD NO. 1 LAYER NO. AND TEMPERATURE ARE:
1 . 7000E+02

CREEP COMPLIANCES (CREEP) OF LAYER 1 AT TEMPERATURE (TEMP) OF 70.00000 ARE:
.157E-05 .163E-05 .185E-05 .239E-05 .355E-05 .483E-05 .649E-05 .888E-05 .130E-04 .166E-04 .230E-04

NUMBER OF LAYERS FOR BOTTOM TENSION (NLBT) = 0

NUMBER OF LAYERS FOR TOP COMPRESSION (NLTC) = 1

LAYER NO. FOR TOP COMPRESSION (LNTC) ARE: 3

LOAD REPETITIONS (TNLR) IN PERIOD 1 FOR EACH LOAD GROUP ARE: 3750.00

DAMAGE COEFFICENTS (FT) FOR TOP COMPRESSION OF LAYER 3 ARE: .1365E-08 .4477E+01

DAMAGE ANALYSIS OF PERIOD NO. 1 LOAD GROUP NO. 1

POINT NO.	VERTICAL COORDINATE	VERTICAL DISP.	VERTICAL STRESS	MAJOR PRINCIPAL STRESS	INTERMEDIATE PRINCIPAL STRESS	MINOR PRINCIPAL STRESS	VERTICAL STRAIN	MAJOR PRINCIPAL STRAIN	MINOR PRINCIPAL STRAIN	HORIZONTAL PRINCIPAL STRAIN
1	10.08010	.4667E-01	.1210E+02	.1210E+02	.1016E+02	.9206E+01	.9989E-03	.9989E-03	.4014E-03	.4014E-03

POINT NO.	VERTICAL COORDINATE	VERTICAL DISP.	VERTICAL STRESS	MAJOR PRINCIPAL STRESS	INTERMEDIATE PRINCIPAL STRESS	MINOR PRINCIPAL STRESS	VERTICAL STRAIN	MAJOR PRINCIPAL STRAIN	MINOR PRINCIPAL STRAIN	HORIZONTAL PRINCIPAL STRAIN
2	10.08010	.4926E-01	.1277E+02	.1277E+02	.1074E+02	.9693E+01	.1054E-02	.1054E-02	.4189E-03	.4189E-03

POINT NO.	VERTICAL COORDINATE	VERTICAL DISP.	VERTICAL STRESS	MAJOR PRINCIPAL STRESS	INTERMEDIATE PRINCIPAL STRESS	MINOR PRINCIPAL STRESS	VERTICAL STRAIN	MAJOR PRINCIPAL STRAIN	MINOR PRINCIPAL STRAIN	HORIZONTAL PRINCIPAL STRAIN
3	10.08010	.4962E-01	.1276E+02	.1276E+02	.1076E+02	.9655E+01	.1053E-02	.1053E-02	.4128E-03	.4128E-03

AT TOP OF LAYER 3 COMPRESSIVE STRAIN = .1054E-02 ALLOWABLE LOAD REPETITIONS = .290734E+05 DAMAGE RATIO= .12899E+00

SUMMARY OF DAMAGE ANALYSIS

AT TOP OF LAYER 3 SUM OF DAMAGE RATIO= .12899E+00

MAXIMUM DAMAGE RATO= .12899E+00 DESIGN LIFE IN YEARS= 7.75

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* SECTION 13 PLATE LOAD HMA MR=370 KSI *

MATL = 3 FOR VISCOELASTIC LAYERED SYSTEM

NDAMA=1, SO DAMAGE ANALYSIS WILL BE PERFORMED

NUMBER OF PERIODS PER YEAR (NPY) = 1

NUMBER OF LOAD GROUPS (NLG) = 1

TOLERANCE FOR INTEGRATION (DEL) = .00100

NUMBER OF LAYERS (NL) = 3

NUMBER OF Z COORDINATES (NZ) = 0

LIMIT OF INTEGRATION CYCLES (ICL) = 80

COMPUTING CODE (NSTD) = 9

THICKNESS OF LAYERS (TH) ARE: 2.40000 7.68000

POISSON'S RATIOS OF LAYERS (PR) ARE: .35000 .30000 .30000

CONDITIONS OF INTERFACES (INT) ARE: 0 0

FOR PERIOD NO. 1 ELASTIC MODULI OF LAYERS ARE: .370000E+06 .249200E+05
.630000E+04

LOAD GROUP NO. 1 HAS 1 CONTACT AREAS
CONTACT RADIUS (CR) = 6.00000
CONTACT PRESSURE (CP)= 80.00000
RADIAL COORDINATES OF THE 1 POINTS (RC) ARE: .00000

DURATION OF MOVING LOAD (DUR) = 1.00000

NUMBER OF VISCOELASTIC LAYER (NVL) = 1

LAYER NUMBERS WHICH ARE VISCOELASTIC (LNV) = 1

CREEP TIMES (TYME) ARE:
.100E-02 .300E-02 .100E-01 .300E01 .100E+00 .300E+00 .100E+01 .300E+01 . 100E+02 .300E+02
.100E+03

FOR LAYER 1 TIME TEMPERATURE SHIFT FACTOR (BETA)= .11300 REFERENCE TEMPERATURE
(TEMREF)= 77.00000

CREEP COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.589E-05 .676E-05 .776E-05 .891E-05 .102E-04 .117E-04 .134E-04 .153E-04 .177E-04 .200E-04 .232E-04

LAYER NO. 1 DIRICHLET SERIES FOR CREEP (GG) AT REFERENCE TEMPERATURE (TEMREF) OF
77.00000 ARE:
-.3015E-05 - .6485E-06 - .2508E-05 -.4060E-05 .5460E-06 -.8125E-05 .2336E-04

COMPUTED COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.605E-05 .656E-05 .776E-05 .899E-05 .101E-05 .117E-05 .135E-04 .154E-04 .173E-04 .203E-04 .231E-04

FOR PERIOD NO. 1 LAYER NO. AND TEMPERATURE ARE:
1 . 7000E+02

CREEP COMPLIANCES (CREEP) OF LAYER 1 AT TEMPERATURE (TEMP) OF 70.00000 ARE:
.580E-05 .590E-05 .622E-05 .696E-05 .835E-05 .940E-05 .108E-04 .123E-04 .144E-44 .161E-04 .185E-04

NUMBER OF LAYERS FOR BOTTOM TENSION (NLBT) = 0

NUMBER OF LAYERS FOR TOP COMPRESSION (NLTC) = 1

LAYER NO. FOR TOP COMPRESSION (LNTC) ARE: 3

LOAD REPETITIONS (TNLR) IN PERIOD 1 FOR EACH LOAD GROUP ARE: 3750.00

DAMAGE COEFFICENTS (FT) FOR TOP COMPRESSION OF LAYER 3 ARE: .1365E-08 .4477E+01

DAMAGE ANALYSIS OF PERIOD NO. 1 LOAD GROUP NO. 1

RADIAL VERTICAL VERTICAL VERTICAL RADIAL TANGENTIAL SHEAR VERTICAL RADIAL TANGENTIAL SHEAR
COORDINATE COORDINATE DISP STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
.00000 10.08010 .6571E-01 .2368E+02 .1894E+02 .1894E+02 .0000E+00 .1955E-02 .9773E-03 .9773E-03 0000E+00

AT TOP OF LAYER 3 COMPRESSIVE STRAIN = .1955E-02 ALLOWABLE LOAD REPETITIONS = .18321E+04 DAMAGE RATIO= .20468E+01

SUMMARY OF DAMAGE ANALYSIS

AT TOP OF LAYER 3 SUM OF DAMAGE RATIO= .20468E+01

MAXIMUM DAMAGE RATO= .20468E+01 DESIGN LIFE IN YEARS= .49

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* SECTION 13 DUAL TIRE LOAD 40 MPH HMA MR=370 KSI *

MATL = 3 FOR VISCOELASTIC LAYERED SYSTEM

NDAMA=1, SO DAMAGE ANALYSIS WILL BE PERFORMED

NUMBER OF PERIODS PER YEAR (NPY) = 1

NUMBER OF LOAD GROUPS (NLG) = 1

TOLERANCE FOR INTEGRATION (DEL) = .00100

NUMBER OF LAYERS (NL) = 3

NUMBER OF Z COORDINATES (NZ) = 1

LIMIT OF INTEGRATION CYCLES (ICL) = 80

COMPUTING CODE (NSTD) = 9

THICKNESS OF LAYERS (TH) ARE: 2.40000 7.68000

POISSON’S RATIOS OF LAYERS (PR) ARE: .35000 .30000 .30000

CONDITIONS OF INTERFACES (INT) ARE: 0 0

FOR PERIOD NO. 1 ELASTIC MODULI OF LAYERS ARE: .370000E+06 .249200E+05 .630000E+04

LOAD GROUP NO. 1 HAS 2 CONTACT AREAS
CONTACT RADIUS (CR) = 4.23000
CONTACT PRESSURE (CP)= 80.00000
NO. OF POINTS AT WHICH RESULTS ARE DESIRED (NPT) = 3
WHEEL SPACING ALONG X-AXIS (XW) = .00000
WHEEL SPACING ALONG Y-AXIS (YW) = 13.50000
POINT NO. AND X AND Y COORDIANTES ARE:
1 .00000 .00000 2 .00000 4.23 3 .00000 6.75000

DURATION OF MOVING LOAD(DUR) = .10000

NUMBER OF VISCOELASTIC LAYER (NVL) = 1

LAYER NUMBERS WHICH ARE VISCOELASTIC (LNV) = 1

CREEP TIMES (TYME) ARE:
.100E-02 .300E-02 .100E-01 .300E01 .100E+00 .300E+00 .100E+01 .300E+01 . 100E+02 .300E+02 .100E+03

FOR LAYER 1 TIME TEMPERATURE SHIFT FACTOR (BETA)= .11300 REFERENCE TEMPERATURE (TEMREF)= 77.00000

CREEP COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.589E-05 .676E-05 .776E-05 .891E-05 .102E-04 .117E-04 .134E-04 .153E-04 .177E-04 .200E-04 .232E-04

LAYER NO. 1 DIRICHLET SERIES FOR CREEP (GG) AT REFERENCE TEMPERATURE (TEMREF) OF 77.00000 ARE:
-.3015E-05 - .6485E-06 - .2508E-05 -.4060E-05 .5460E-06 -.8125E-05 .2336E-04

COMPUTED COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.605E-05 .656E-05 .776E-05 .899E-05 .101E-04 .117E-04 .135E-04 .154E-04 .173E-04 .203E-04 .231E-04

FOR PERIOD NO. 1 LAYER NO. AND TEMPERATURE ARE:
1 . 7000E+02

CREEP COMPLIANCES (CREEP) OF LAYER 1 AT TEMPERATURE (TEMP) OF 70.00000 ARE:
.580E-05 .590E-05 .622E-05 .696E-05 .835E-05 .940E-05 .108E-04 .123E-04 .144E-04 .161E-04 .185E-04

NUMBER OF LAYERS FOR BOTTOM TENSION (NLBT) = 0

NUMBER OF LAYERS FOR TOP COMPRESSION (NLTC) = 1

LAYER NO. FOR TOP COMPRESSION (LNTC) ARE: 3

LOAD REPETITIONS (TNLR) IN PERIOD 1 FOR EACH LOAD GROUP ARE: 3750.00

DAMAGE COEFFICENTS (FT) FOR TOP COMPRESSION OF LAYER 3 ARE: .1365E-08 .4477E+01

DAMAGE ANALYSIS OF PERIOD NO. 1 LOAD GROUP NO. 1

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN

1 10.08010 .5167E-01 .1535E+02 .1535E+02 .1294E+02 .1163E+02 .1267E-02 .1267E-02 .4989E-03 .4989E-03

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR
MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
2 10.08010 .5435E-01 .1549E+02 .1549E+02 .1324E+02 .1155E+02 .1279E-02 .1279E-02 .4651E-03 .4651E-03

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR
MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
3 10.08010 .5461E-01 .1520E+02 .1520E+02 .1308E+02 .1124E+02 .1255E-02 .1255E-02 .4373E-03 .4373E-03

AT TOP OF LAYER 3 COMPRESSIVE STRAIN = .1279E-02 ALLOWABLE LOAD REPETITIONS =
.12252E+05 DAMAGE RATIO=
.30606E+00

SUMMARY OF DAMAGE ANALYSIS

AT TOP OF LAYER 3 SUM OF DAMAGE RATIO= .30606E+00

MAXIMUM DAMAGE RATO= .30606E+00 DESIGN LIFE IN YEARS= 3.27

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* SECTION 13 DUAL TIRE LOAD 60 MPH HMA MR=370 KSI *

MATL = 3 FOR VISCOELASTIC LAYERED SYSTEM

NDAMA=1, SO DAMAGE ANALYSIS WILL BE PERFORMED

NUMBER OF PERIODS PER YEAR (NPY) = 1

NUMBER OF LOAD GROUPS (NLG) = 1

TOLERANCE FOR INTEGRATION (DEL) = .00100

NUMBER OF LAYERS (NL) = 3

NUMBER OF Z COORDINATES (NZ) = 1

LIMIT OF INTEGRATION CYCLES (ICL) = 80

COMPUTING CODE (NSTD) = 9

THICKNESS OF LAYERS (TH) ARE: 2.40000 7.68000

POISSON’S RATIOS OF LAYERS (PR) ARE: .35000 .30000 .30000

CONDITIONS OF INTERFACES (INT) ARE: 0 0
FOR PERIOD NO. 1 ELASTIC MODULI OF LAYERS ARE: .370000E+06 .249200E+05
.630000E+04

LOAD GROUP NO. 1 HAS 2 CONTACT AREAS
CONTACT RADIUS (CR) = 4.23000
CONTACT PRESSURE (CP)= 80.00000
NO. OF POINTS AT WHICH RESULTS ARE DESIRED (NPT) = 3
WHEEL SPACING ALONG X-AXIS (XW) = .00000
WHEEL SPACING ALONG Y-AXIS (YW) = 13.50000

POINT NO. AND X AND Y COORDIANTES ARE:
1 .00000 .00000 2 .00000 4.23 3 .00000 6.75000

DURATION OF MOVING LOAD(DUR) = .03500

NUMBER OF VISCOELASTIC LAYER (NVL) = 1

LAYER NUMBERS WHICH ARE VISCOELASTIC (LNV) = 1

CREEP TIMES (TYME) ARE:
.100E-02 .300E-02 .100E-01 .300E01 .100E+00 .300E+00 .100E+01 .300E+01 .100E+02 .300E+02 .100E+03

FOR LAYER 1 TIME TEMPERATURE SHIFT FACTOR (BETA)= .11300 REFERENCE TEMPERATURE (TEMREF)= 77.00000

CREEP COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.589E-05 .676E-05 .776E-05 .891E-05 .102E-04 .117E-45 .134E-04 .153E-04 .177E-04 .200E-04 .232E-04

LAYER NO. 1 DIRICHLET SERIES FOR CREEP (GG) AT REFERENCE TEMPERATURE (TEMREF) OF 77.00000 ARE:
-.3015E-05 - .6485E-06 - .2508E-05 -.4060E-05 .5460E-06 -.8125E-05 .2336E-04

COMPUTED COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.605E-05 .656E-05 .776E-05 .899E-05 .101E-04 .117E-04 .135E-04 .154E-04 .173E-04 .203E-04 .231E-04

FOR PERIOD NO. 1 LAYER NO. AND TEMPERATURE ARE:
1 . 7000E+02

CREEP COMPLIANCES (CREEP) OF LAYER 1 AT TEMPERATURE (TEMP) OF 70.00000 ARE:
.580E-05 .590E-05 .622E-05 .696E-05 .835E-05 .940E-05 .108E-04 .123E-04 .144E-04 .161E-04 .185E-04

NUMBER OF LAYERS FOR BOTTOM TENSION (NLBT) = 0

NUMBER OF LAYERS FOR TOP COMPRESSION (NLTC) = 1

LAYER NO. FOR TOP COMPRESSION (LNTC) ARE: 3

LOAD REPETITIONS (TNLR) IN PERIOD 1 FOR EACH LOAD GROUP ARE: 3750.00

DAMAGE COEFFICENTS (FT) FOR TOP COMPRESSION OF LAYER 3 ARE: .1365E-08 .4477E+01

DAMAGE ANALYSIS OF PERIOD NO. 1 LOAD GROUP NO. 1

POINT NO.	VERTICAL COORDINATE	VERTICAL DISP.	VERTICAL STRESS	MAJOR PRINCIPAL STRESS	INTERMEDIATE PRINCIPAL STRESS	MINOR PRINCIPAL STRESS	VERTICAL STRAIN	MAJOR PRINCIPAL STRAIN	MINOR PRINCIPAL STRAIN	HORIZONTAL PRINCIPAL STRAIN
1	10.08010	.5141E-01	.1516E+02	.1516E+02	.1277E+02	.1149E+02	.1251E-02	.1251E-02	.4929E-03	.4929E-03

POINT NO.	VERTICAL COORDINATE	VERTICAL DISP.	VERTICAL STRESS	MAJOR PRINCIPAL STRESS	INTERMEDIATE PRINCIPAL STRESS	MINOR PRINCIPAL STRESS	VERTICAL STRAIN	MAJOR PRINCIPAL STRAIN	MINOR PRINCIPAL STRAIN	HORIZONTAL PRINCIPAL STRAIN
2	10.08010	.5412E-01	.1536E+02	.1536E+02	.1311E+02	.1146E+02	.1268E-02	.1268E-02	.4638E-03	.4638E-03

POINT NO.	VERTICAL COORDINATE	VERTICAL DISP.	VERTICAL STRESS	MAJOR PRINCIPAL STRESS	INTERMEDIATE PRINCIPAL STRESS	MINOR PRINCIPAL STRESS	VERTICAL STRAIN	MAJOR PRINCIPAL STRAIN	MINOR PRINCIPAL STRAIN	HORIZONTAL PRINCIPAL STRAIN
3	10.08010	.5439E-01	.1509E+02	.1509E+02	.1297E+02	.1118E+02	.1246E-02	.1246E-02	.4379E-03	.4379E-03

AT TOP OF LAYER 3 COMPRESSIVE STRAIN = .1268E-02 ALLOWABLE LOAD REPETITIONS =
.12739E+05   DAMAGE RATIO=
.29438E+00

SUMMARY OF DAMAGE ANALYSIS

AT TOP OF LAYER 3   SUM OF DAMAGE RATIO= .29438E+00

MAXIMUM DAMAGE RATO= .29438E+00   DESIGN LIFE IN YEARS= 3.40

NUMBER OF PROBLEMS TO BE SOLVED = 6

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* SECTION 14 PLATE LOAD HMA MR=250 KSI *

MATL = 3 FOR VISCOELASTIC LAYERED SYSTEM

NDAMA=1, SO DAMAGE ANALYSIS WILL BE PERFORMED

NUMBER OF PERIODS PER YEAR (NPY) = 1

NUMBER OF LOAD GROUPS (NLG) = 1

TOLERANCE FOR INTEGRATION (DEL) = .00100

NUMBER OF LAYERS (NL) = 3

NUMBER OF Z COORDINATES (NZ) = 0

LIMIT OF INTEGRATION CYCLES (ICL) = 80

COMPUTING CODE (NSTD) = 9

THICKNESS OF LAYERS (TH) ARE: 3.09000 8.74000

POISSON'S RATIOS OF LAYERS (PR) ARE: .35000 .30000 .30000

CONDITIONS OF INTERFACES (INT) ARE: 0 0

FOR PERIOD NO. 1 ELASTIC MODULI OF LAYERS ARE: .250000E+06 .250600E+05 .675000E+04

LOAD GROUP NO. 1 HAS 1 CONTACT AREAS
CONTACT RADIUS (CR) = 6.00000
CONTACT PRESSURE (CP)= 80.00000
RADIAL COORDINATES OF THE 1 POINTS (RC) ARE: .00000

DURATION OF MOVING LOAD (DUR) = 1.00000

NUMBER OF VISCOELASTIC LAYER (NVL) = 1

LAYER NUMBERS WHICH ARE VISCOELASTIC (LNV) = 1

CREEP TIMES (TYME) ARE:
.100E-02 .300E-02 .100E-01 .300E01 .100E+00 .300E+00 .100E+01 .300E+01 . 100E+02 .300E+02 .100E+03

FOR LAYER 1 TIME TEMPERATURE SHIFT FACTOR (BETA)= .11300 REFERENCE TEMPERATURE (TEMREF)= 77.00000

CREEP COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.163E-05 .221E-05 .308E-05 .417E-05 .580E-05 .785E-05 .109E-04 .148E-04 .206E-04 .279E-04 .389E-04

LAYER NO. 1 DIRICHLET SERIES FOR CREEP (GG) AT REFERENCE TEMPERATURE (TEMREF) OF 77.00000 ARE:
-.1543E-05 - .1086E-05 - .1254E-05 -.8227E-05 .3934E-05 -.2991E-04 .3962E-04

COMPUTED COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.174E-05 .210E-05 .302E-05 .427E-05 .576E-05 .767E-05 .112E-04 .151E-04 .196E-04 .288E-04 .386E-04

FOR PERIOD NO. 1 LAYER NO. AND TEMPERATURE ARE:

1 . 7000E+02

CREEP COMPLIANCES (CREEP) OF LAYER 1 AT TEMPERATURE (TEMP) OF 70.00000 ARE:
.157E-05 .163E-05 .186E-05 .239E-05 .355E-05 .484E-05 .649E-05 .886E-05 .130E-04 .165E-04 .230E-04

NUMBER OF LAYERS FOR BOTTOM TENSION (NLBT) = 0

NUMBER OF LAYERS FOR TOP COMPRESSION (NLTC) = 1

LAYER NO. FOR TOP COMPRESSION (LNTC) ARE: 3

LOAD REPETITIONS (TNLR) IN PERIOD 1 FOR EACH LOAD GROUP ARE: 3750.00

DAMAGE COEFFICENTS (FT) FOR TOP COMPRESSION OF LAYER 3 ARE: .1365E-08 .4477E+01

DAMAGE ANALYSIS OF PERIOD NO. 1 LOAD GROUP NO. 1

RADIAL VERTICAL VERTICAL VERTICAL RADIAL TANGENTIAL SHEAR VERTICAL RADIAL TANGENTIAL SHEAR
COORDINATE COORDINATE DISP STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
.00000 11.83010 .5114E-01 .1649E+02 .1319E+02 .1319E+02 .0000E+00 .1270E-02 .6352E-03 .6352E-03 0000E+00

AT TOP OF LAYER 3 COMPRESSIVE STRAIN = .11270E-02 ALLOWABLE LOAD REPETITIONS = .12611E+04 DAMAGE RATIO= .29735E+00

SUMMARY OF DAMAGE ANALYSIS

AT TOP OF LAYER 3 SUM OF DAMAGE RATIO= .29735E+00

MAXIMUM DAMAGE RATO= .29735E+00 DESIGN LIFE IN YEARS= 3.36

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* SECTION 14 DUAL TIRE LOAD 40 MPH HMA MR=250 KSI *

MATL = 3 FOR VISCOELASTIC LAYERED SYSTEM

NDAMA=1, SO DAMAGE ANALYSIS WILL BE PERFORMED

NUMBER OF PERIODS PER YEAR (NPY) = 1

NUMBER OF LOAD GROUPS (NLG) = 1

TOLERANCE FOR INTEGRATION (DEL) = .00100

NUMBER OF LAYERS (NL) = 3

NUMBER OF Z COORDINATES (NZ) = 1

LIMIT OF INTEGRATION CYCLES (ICL) = 80

COMPUTING CODE (NSTD) = 9

THICKNESS OF LAYERS (TH) ARE: 3.09000 8.74000

POISSON’S RATIOS OF LAYERS (PR) ARE: .35000 .30000 .30000

CONDITIONS OF INTERFACES (INT) ARE: 0 0

FOR PERIOD NO. 1 ELASTIC MODULI OF LAYERS ARE: .250000E+06 .250600E+05 .675000E+04

LOAD GROUP NO. 1 HAS 2 CONTACT AREAS
CONTACT RADIUS (CR) = 4.23000
CONTACT PRESSURE (CP)= 80.00000
NO. OF POINTS AT WHICH RESULTS ARE DESIRED (NPT) = 3
WHEEL SPACING ALONG X-AXIS (XW) = .00000
WHEEL SPACING ALONG Y-AXIS (YW) = 13.50000
POINT NO. AND X AND Y COORDIANTES ARE:
1 .00000 .00000 2 .00000 4.23 3 .00000 6.75000

DURATION OF MOVING LOAD(DUR) = .10000

NUMBER OF VISCOELASTIC LAYER (NVL) = 1

LAYER NUMBERS WHICH ARE VISCOELASTIC (LNV) = 1

CREEP TIMES (TYME) ARE:
.100E-02 .300E-02 .100E-01 .300E01 .100E+00 .300E+00 .100E+01 .300E+01 . 100E+02 .300E+02 .100E+03

FOR LAYER 1 TIME TEMPERATURE SHIFT FACTOR (BETA)= .11300 REFERENCE TEMPERATURE (TEMREF)= 77.00000

CREEP COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.163E-05 .221E-05 .308E-05 .417E-05 .580E-05 .785E-45 .109E-04 .148E-04 .206E-04 .279E-04 .389E-04

LAYER NO. 1 DIRICHLET SERIES FOR CREEP (GG) AT REFERENCE TEMPERATURE (TEMREF) OF 77.00000 ARE:
-.1561E-05 - .1042E-05 - .1290E-05 -.8239E-05 .3897E-05 -.2985E-04 .3962E-04

COMPUTED COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.174E-05 .210E-05 .303E-05 .427E-05 .576E-05 .768E-05 .112E-04 .151E-04 .197E-04 .288E-04 .386E-04

FOR PERIOD NO. 1 LAYER NO. AND TEMPERATURE ARE:
1 . 7000E+02

CREEP COMPLIANCES (CREEP) OF LAYER 1 AT TEMPERATURE (TEMP) OF 70.00000 ARE:
.157E-05 .163E-05 .185E-05 .239E-05 .355E-05 .483E-05 .649E-05 .888E-05 .130E-04 .166E-04 .230E-04

NUMBER OF LAYERS FOR BOTTOM TENSION (NLBT) = 0

NUMBER OF LAYERS FOR TOP COMPRESSION (NLTC) = 1

LAYER NO. FOR TOP COMPRESSION (LNTC) ARE: 3

LOAD REPETITIONS (TNLR) IN PERIOD 1 FOR EACH LOAD GROUP ARE: 3750.00

DAMAGE COEFFICENTS (FT) FOR TOP COMPRESSION OF LAYER 3 ARE: .1365E-08 .4477E+01

DAMAGE ANALYSIS OF PERIOD NO. 1 LOAD GROUP NO. 1

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
1 11.83010 .3967E-01 .9939E+01 .9939E+01 .8304E+01 .7598E+01 .7657E-03 .7657E-03 .3148E-03 .3148E-03

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL

NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
2 11.83010 .4177E-01 .1064E+02 .1064E+02 .8870E+02 .8158E+02 .8199E-03 .8199E-03 .3414E-03 .3414E-03

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR
MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
3 11.83010 .4208E-01 .1070E+02 .1070E+02 .8924E+02 .8193E+02 .8242E-03 .8242E-03 .3417E-03 .3417E-03

AT TOP OF LAYER 3 COMPRESSIVE STRAIN = .8242E-03 ALLOWABLE LOAD REPETITIONS =
.87514E+05 DAMAGE RATIO=
.42850E-01

SUMMARY OF DAMAGE ANALYSIS

AT TOP OF LAYER 3 SUM OF DAMAGE RATIO= .42850E-01

MAXIMUM DAMAGE RATO= .42850E-01 DESIGN LIFE IN YEARS= 23.34

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* SECTION 14 DUAL TIRE LOAD 60 MPH HMA MR=250 KSI *

MATL = 3 FOR VISCOELASTIC LAYERED SYSTEM

NDAMA=1, SO DAMAGE ANALYSIS WILL BE PERFORMED

NUMBER OF PERIODS PER YEAR (NPY) = 1

NUMBER OF LOAD GROUPS (NLG) = 1

TOLERANCE FOR INTEGRATION (DEL) = .00100

NUMBER OF LAYERS (NL) = 3

NUMBER OF Z COORDINATES (NZ) = 1

LIMIT OF INTEGRATION CYCLES (ICL) = 80

COMPUTING CODE (NSTD) = 9

THICKNESS OF LAYERS (TH) ARE: 3.09000 8.74000

POISSON'S RATIOS OF LAYERS (PR) ARE: .35000 .30000 .30000

CONDITIONS OF INTERFACES (INT) ARE: 0 0
FOR PERIOD NO. 1 ELASTIC MODULI OF LAYERS ARE: .250000E+06 .250600E+05
.675000E+04

LOAD GROUP NO. 1 HAS 2 CONTACT AREAS
CONTACT RADIUS (CR) = 4.23000
CONTACT PRESSURE (CP)= 80.00000
NO. OF POINTS AT WHICH RESULTS ARE DESIRED (NPT) = 3
WHEEL SPACING ALONG X-AXIS (XW) = .00000
WHEEL SPACING ALONG Y-AXIS (YW) = 13.50000
POINT NO. AND X AND Y COORDIANTES ARE:
1 .00000 .00000 2 .00000 4.23 3 .00000 6.75000

DURATION OF MOVING LOAD(DUR) = .03500

NUMBER OF VISCOELASTIC LAYER (NVL) = 1

LAYER NUMBERS WHICH ARE VISCOELASTIC (LNV) = 1

CREEP TIMES (TYME) ARE:
.100E-02 .300E-02 .100E-01 .300E01 .100E+00 .300E+00 .100E+01 .300E+01 .100E+02 .300E+02 .100E+03

FOR LAYER 1 TIME TEMPERATURE SHIFT FACTOR (BETA)= .11300 REFERENCE TEMPERATURE (TEMREF)= 77.00000

CREEP COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.163E-05 .221E-05 .308E-05 .417E-05 .580E-05 .785E-45 .109E-04 .148E-04 .206E-04 .279E-04 .389E-04

LAYER NO. 1 DIRICHLET SERIES FOR CREEP (GG) AT REFERENCE TEMPERATURE (TEMREF) OF 77.00000 ARE:
-.1561E-05 - .1042E-05 - .1290E-05 -.8239E-05 .3897E-05 -.2985E-04 .3962E-04

COMPUTED COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.174E-05 .210E-05 .303E-05 .427E-05 .576E-05 .768E-05 .112E-04 .151E-04 .197E-04 .288E-04 .386E-04

FOR PERIOD NO. 1 LAYER NO. AND TEMPERATURE ARE:
1 . 7000E+02

CREEP COMPLIANCES (CREEP) OF LAYER 1 AT TEMPERATURE (TEMP) OF 70.00000 ARE:
.157E-05 .163E-05 .185E-05 .239E-05 .355E-05 .483E-05 .649E-05 .888E-05 .130E-04 .166E-04 .230E-04

NUMBER OF LAYERS FOR BOTTOM TENSION (NLBT) = 0

NUMBER OF LAYERS FOR TOP COMPRESSION (NLTC) = 1

LAYER NO. FOR TOP COMPRESSION (LNTC) ARE: 3

LOAD REPETITIONS (TNLR) IN PERIOD 1 FOR EACH LOAD GROUP ARE: 3750.00

DAMAGE COEFFICENTS (FT) FOR TOP COMPRESSION OF LAYER 3 ARE: .1365E-08 .4477E+01

DAMAGE ANALYSIS OF PERIOD NO. 1 LOAD GROUP NO. 1

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR
MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
1 11.83010 .3863E-01 .9395E+01 .9395E+01 .7837E+01 .7194E+01 .7238E-03 .7238E-03 .2999E-03 .2999E-03

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR
MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
2 11.83010 .4062E-01 .1008E+02 .1008E+02 .8380E+02 .7746E+01 .7765E-03 .7765E-03 .3272E-03 .3272E-03

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR
MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
3 11.83010 .4092E-01 .1014E+02 .1014E+02 .8438E+01 .7790E+01 .7814E-03 .7814E-03 .3283E-03 .3283E-03

AT TOP OF LAYER 3 COMPRESSIVE STRAIN = .7814E-03 ALLOWABLE LOAD REPETITIONS =
.11111E+06 DAMAGE RATIO=
.33751E-01

SUMMARY OF DAMAGE ANALYSIS

AT TOP OF LAYER 3 SUM OF DAMAGE RATIO= .33751E-01

MAXIMUM DAMAGE RATO= .33751E-01 DESIGN LIFE IN YEARS= 29.63

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* SECTION 14 PLATE LOAD HMA MR=370 KSI *

MATL = 3 FOR VISCOELASTIC LAYERED SYSTEM

NDAMA=1, SO DAMAGE ANALYSIS WILL BE PERFORMED

NUMBER OF PERIODS PER YEAR (NPY) = 1

NUMBER OF LOAD GROUPS (NLG) = 1

TOLERANCE FOR INTEGRATION (DEL) = .00100

NUMBER OF LAYERS (NL) = 3

NUMBER OF Z COORDINATES (NZ) = 0

LIMIT OF INTEGRATION CYCLES (ICL) = 80

COMPUTING CODE (NSTD) = 9

THICKNESS OF LAYERS (TH) ARE: 3.09000 8.74000

POISSON'S RATIOS OF LAYERS (PR) ARE: .35000 .30000 .30000

CONDITIONS OF INTERFACES (INT) ARE: 0 0

FOR PERIOD NO. 1 ELASTIC MODULI OF LAYERS ARE: .370000E+06 .250600E+05 .675000E+04

LOAD GROUP NO. 1 HAS 1 CONTACT AREAS
CONTACT RADIUS (CR) = 6.00000
CONTACT PRESSURE (CP)= 80.00000
RADIAL COORDINATES OF THE 1 POINTS (RC) ARE: .00000

DURATION OF MOVING LOAD (DUR) = 1.00000

NUMBER OF VISCOELASTIC LAYER (NVL) = 1

LAYER NUMBERS WHICH ARE VISCOELASTIC (LNV) = 1

CREEP TIMES (TYME) ARE:
.100E-02 .300E-02 .100E-01 .300E01 .100E+00 .300E+00 .100E+01 .300E+01 . 100E+02 .300E+02 .100E+03

FOR LAYER 1 TIME TEMPERATURE SHIFT FACTOR (BETA)= .11300 REFERENCE TEMPERATURE (TEMREF)= 77.00000

CREEP COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.589E-05 .676E-05 .776E-05 .891E-05 .102E-04 .117E-04 .134E-04 .153E-04 .177E-04 .200E-04 .232E-04

LAYER NO. 1 DIRICHLET SERIES FOR CREEP (GG) AT REFERENCE TEMPERATURE (TEMREF) OF 77.00000 ARE:
-.3015E-05 - .6485E-06 - .2508E-05 -.4060E-05 .5460E-06 -.8125E-05 .2336E-04

COMPUTED COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.605E-05 .656E-05 .776E-05 .899E-05 .101E-05 .117E-05 .135E-04 .154E-04 .173E-04 .203E-04 .231E-04

FOR PERIOD NO. 1 LAYER NO. AND TEMPERATURE ARE:
1 . 7000E+02

CREEP COMPLIANCES (CREEP) OF LAYER 1 AT TEMPERATURE (TEMP) OF 70.00000 ARE:
.580E-05 .590E-05 .622E-05 .696E-05 .835E-05 .940E-05 .108E-04 .123E-04 .144E-44 .161E-04 .185E-04

NUMBER OF LAYERS FOR BOTTOM TENSION (NLBT) = 0

NUMBER OF LAYERS FOR TOP COMPRESSION (NLTC) = 1

LAYER NO. FOR TOP COMPRESSION (LNTC) ARE: 3

LOAD REPETITIONS (TNLR) IN PERIOD 1 FOR EACH LOAD GROUP ARE: 3750.00

DAMAGE COEFFICENTS (FT) FOR TOP COMPRESSION OF LAYER 3 ARE: .1365E-08 .4477E+01

DAMAGE ANALYSIS OF PERIOD NO. 1 LOAD GROUP NO. 1

RADIAL VERTICAL VERTICAL VERTICAL RADIAL TANGENTIAL SHEAR VERTICAL RADIAL TANGENTIAL SHEAR
COORDINATE COORDINATE DISP STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
.00000 11.83010 .5472E-01 .1896E+02 .1517E+02 .1517E+02 .0000E+00 .1461E-02 .7303E-03 .7303E-03 0000E+00

AT TOP OF LAYER 3 COMPRESSIVE STRAIN = .1461E-02 ALLOWABLE LOAD REPETITIONS = .67530E+04 DAMAGE RATIO= .55531E+00

SUMMARY OF DAMAGE ANALYSIS

AT TOP OF LAYER 3 SUM OF DAMAGE RATIO= .55531E+00

MAXIMUM DAMAGE RATO= .55531E+00 DESIGN LIFE IN YEARS= 1.8

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* SECTION 14 DUAL TIRE LOAD 40 MPH HMA MR=370 KSI *

MATL = 3 FOR VISCOELASTIC LAYERED SYSTEM

NDAMA=1, SO DAMAGE ANALYSIS WILL BE PERFORMED

NUMBER OF PERIODS PER YEAR (NPY) = 1

NUMBER OF LOAD GROUPS (NLG) = 1

TOLERANCE FOR INTEGRATION (DEL) = .00100

NUMBER OF LAYERS (NL) = 3

NUMBER OF Z COORDINATES (NZ) = 1

LIMIT OF INTEGRATION CYCLES (ICL) = 80

COMPUTING CODE (NSTD) = 9

THICKNESS OF LAYERS (TH) ARE: 3.09000 8.74000

POISSON'S RATIOS OF LAYERS (PR) ARE: .35000 .30000 .30000

CONDITIONS OF INTERFACES (INT) ARE: 0 0

FOR PERIOD NO. 1 ELASTIC MODULI OF LAYERS ARE: .370000E+06 .250600E+05
.675000E+04

LOAD GROUP NO. 1 HAS 2 CONTACT AREAS
CONTACT RADIUS (CR) = 4.23000
CONTACT PRESSURE (CP)= 80.00000
NO. OF POINTS AT WHICH RESULTS ARE DESIRED (NPT) = 3
WHEEL SPACING ALONG X-AXIS (XW) = .00000
WHEEL SPACING ALONG Y-AXIS (YW) = 13.50000
POINT NO. AND X AND Y COORDIANTES ARE:
1 .00000 .00000 2 .00000 4.23 3 .00000 6.75000

DURATION OF MOVING LOAD(DUR) = .10000

NUMBER OF VISCOELASTIC LAYER (NVL) = 1

LAYER NUMBERS WHICH ARE VISCOELASTIC (LNV) = 1

CREEP TIMES (TYME) ARE:
.100E-02 .300E-02 .100E-01 .300E01 .100E+00 .300E+00 .100E+01 .300E+01 . 100E+02 .300E+02
.100E+03

FOR LAYER 1 TIME TEMPERATURE SHIFT FACTOR (BETA)= .11300 REFERENCE TEMPERATURE (TEMREF)= 77.00000

CREEP COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.589E-05 .676E-05 .776E-05 .891E-05 .102E-04 .117E-04 .134E-04 .153E-04 .177E-04 .200E-04 .232E-04

LAYER NO. 1 DIRICHLET SERIES FOR CREEP (GG) AT REFERENCE TEMPERATURE (TEMREF) OF 77.00000 ARE:
-.3015E-05 - .6485E-06 - .2508E-05 -.4060E-05 .5460E-06 -.8125E-05 .2336E-04

COMPUTED COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.605E-05 .656E-05 .776E-05 .899E-05 .101E-04 .117E-04 .135E-04 .154E-04 .173E-04 .203E-04 .231E-04

FOR PERIOD NO. 1 LAYER NO. AND TEMPERATURE ARE:
1 . 7000E+02

CREEP COMPLIANCES (CREEP) OF LAYER 1 AT TEMPERATURE (TEMP) OF 70.00000 ARE:
.580E-05 .590E-05 .622E-05 .696E-05 .835E-05 .940E-05 .108E-04 .123E-04 .144E-04 .161E-04 .185E-04

NUMBER OF LAYERS FOR BOTTOM TENSION (NLBT) = 0

NUMBER OF LAYERS FOR TOP COMPRESSION (NLTC) = 1

LAYER NO. FOR TOP COMPRESSION (LNTC) ARE: 3

LOAD REPETITIONS (TNLR) IN PERIOD 1 FOR EACH LOAD GROUP ARE: 3750.00

DAMAGE COEFFICENTS (FT) FOR TOP COMPRESSION OF LAYER 3 ARE: .1365E-08 .4477E+01

DAMAGE ANALYSIS OF PERIOD NO. 1 LOAD GROUP NO. 1

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN

1 11.83010 .4396E-01 .1246E+02 .1246E+02 .1047E+02 .9469E+01 .9601E-03 .9601E-03 .3836E-03 .3836E-03

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR
MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
2 11.83010 .4639E-01 .1308E+02 .1308E+02 .1103E+02 .9893E+01 .1008E-02 .1008E-02 .3941E-03 .3941E-03

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR
MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
3 11.83010 .4671E-01 .1304E+02 .1304E+02 .1103E+02 .9828E+02 .1004E-02 .1004E-02 .3863E-03 .3863E-03

AT TOP OF LAYER 3 COMPRESSIVE STRAIN = .1008E-02 ALLOWABLE LOAD REPETITIONS =
.35610E+05 DAMAGE RATIO=
.10531E+00

SUMMARY OF DAMAGE ANALYSIS

AT TOP OF LAYER 3 SUM OF DAMAGE RATIO= .10531E+00

MAXIMUM DAMAGE RATO= .10531E+00 DESIGN LIFE IN YEARS= 9.50

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* SECTION 14 DUAL TIRE LOAD 60 MPH HMA MR=370 KSI *

MATL = 3 FOR VISCOELASTIC LAYERED SYSTEM

NDAMA=1, SO DAMAGE ANALYSIS WILL BE PERFORMED

NUMBER OF PERIODS PER YEAR (NPY) = 1

NUMBER OF LOAD GROUPS (NLG) = 1

TOLERANCE FOR INTEGRATION (DEL) = .00100

NUMBER OF LAYERS (NL) = 3

NUMBER OF Z COORDINATES (NZ) = 1

LIMIT OF INTEGRATION CYCLES (ICL) = 80

COMPUTING CODE (NSTD) = 9

THICKNESS OF LAYERS (TH) ARE: 3.09000 8.74000

POISSON'S RATIOS OF LAYERS (PR) ARE: .35000 .30000 .30000

CONDITIONS OF INTERFACES (INT) ARE: 0 0
FOR PERIOD NO. 1 ELASTIC MODULI OF LAYERS ARE: .370000E+06 .250600E+05
.675000E+04

LOAD GROUP NO. 1 HAS 2 CONTACT AREAS
CONTACT RADIUS (CR) = 4.23000
CONTACT PRESSURE (CP)= 80.00000
NO. OF POINTS AT WHICH RESULTS ARE DESIRED (NPT) = 3
WHEEL SPACING ALONG X-AXIS (XW) = .00000
WHEEL SPACING ALONG Y-AXIS (YW) = 13.50000

POINT NO. AND X AND Y COORDIANTES ARE:
1 .00000 .00000 2 .00000 4.23 3 .00000 6.75000

DURATION OF MOVING LOAD(DUR) = .03500

NUMBER OF VISCOELASTIC LAYER (NVL) = 1

LAYER NUMBERS WHICH ARE VISCOELASTIC (LNV) = 1

CREEP TIMES (TYME) ARE:
.100E-02 .300E-02 .100E-01 .300E01 .100E+00 .300E+00 .100E+01 .300E+01 .100E+02 .300E+02 .100E+03

FOR LAYER 1 TIME TEMPERATURE SHIFT FACTOR (BETA)= .11300 REFERENCE TEMPERATURE (TEMREF)= 77.00000

CREEP COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.589E-05 .676E-05 .776E-05 .891E-05 .102E-04 .117E-45 .134E-04 .153E-04 .177E-04 .200E-04 .232E-04

LAYER NO. 1 DIRICHLET SERIES FOR CREEP (GG) AT REFERENCE TEMPERATURE (TEMREF) OF 77.00000 ARE:
-.3015E-05 - .6485E-06 - .2508E-05 -.4060E-05 .5460E-06 -.8125E-05 .2336E-04

COMPUTED COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.605E-05 .656E-05 .776E-05 .899E-05 .101E-04 .117E-04 .135E-04 .154E-04 .173E-04 .203E-04 .231E-04

FOR PERIOD NO. 1 LAYER NO. AND TEMPERATURE ARE:
1 . 7000E+02

CREEP COMPLIANCES (CREEP) OF LAYER 1 AT TEMPERATURE (TEMP) OF 70.00000 ARE:
.580E-05 .590E-05 .622E-05 .696E-05 .835E-05 .940E-05 .108E-04 .123E-04 .144E-04 .161E-04 .185E-04

NUMBER OF LAYERS FOR BOTTOM TENSION (NLBT) = 0

NUMBER OF LAYERS FOR TOP COMPRESSION (NLTC) = 1

LAYER NO. FOR TOP COMPRESSION (LNTC) ARE: 3

LOAD REPETITIONS (TNLR) IN PERIOD 1 FOR EACH LOAD GROUP ARE: 3750.00

DAMAGE COEFFICENTS (FT) FOR TOP COMPRESSION OF LAYER 3 ARE: .1365E-08 .4477E+01

DAMAGE ANALYSIS OF PERIOD NO. 1 LOAD GROUP NO. 1

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
1 11.83010 .4368E-01 .1227E+02 .1227E+02 .1031E+02 .9329E+01 .9456E-03 .9456E-03 .3784E-03 .3784E-03

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
2 11.83010 .4610E-01 .1291E+02 .1291E+02 .1088E+02 .9780E+01 .9948E-03 .9948E-03 .3913E-03 .3913E-03

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
3 11.83010 .4642E-01 .1289E+02 .1289E+02 .1089E+02 .9727E+01 .9927E-03 .9927E-03 .3844E-03 .3844E-03

AT TOP OF LAYER 3 COMPRESSIVE STRAIN = .9948E-03 ALLOWABLE LOAD REPETITIONS =
.37686E+05   DAMAGE RATIO=
.99505E-01

SUMMARY OF DAMAGE ANALYSIS

AT TOP OF LAYER 3   SUM OF DAMAGE RATIO= .99505E-01

MAXIMUM DAMAGE RATO= .99505E-01   DESIGN LIFE IN YEARS= 10.05

NUMBER OF PROBLEMS TO BE SOLVED = 6

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* SECTION 15 PLATE LOAD HMA MR=250 KSI *

MATL = 3 FOR VISCOELASTIC LAYERED SYSTEM

NDAMA=1, SO DAMAGE ANALYSIS WILL BE PERFORMED

NUMBER OF PERIODS PER YEAR (NPY) = 1

NUMBER OF LOAD GROUPS (NLG) = 1

TOLERANCE FOR INTEGRATION (DEL) = .00100

NUMBER OF LAYERS (NL) = 3

NUMBER OF Z COORDINATES (NZ) = 0

LIMIT OF INTEGRATION CYCLES (ICL) = 80

COMPUTING CODE (NSTD) = 9

THICKNESS OF LAYERS (TH) ARE: 2.92000 5.16000

POISSON'S RATIOS OF LAYERS (PR) ARE: .35000 .30000 .30000

CONDITIONS OF INTERFACES (INT) ARE: 0 0

FOR PERIOD NO. 1 ELASTIC MODULI OF LAYERS ARE: .250000E+06 .238900E+05
.300000E+04

LOAD GROUP NO. 1 HAS 1 CONTACT AREAS
CONTACT RADIUS (CR) = 6.00000
CONTACT PRESSURE (CP)= 80.00000
RADIAL COORDINATES OF THE 1 POINTS (RC) ARE: .00000

DURATION OF MOVING LOAD (DUR) = 1.00000

NUMBER OF VISCOELASTIC LAYER (NVL) = 1

LAYER NUMBERS WHICH ARE VISCOELASTIC (LNV) = 1

CREEP TIMES (TYME) ARE:
.100E-02 .300E-02 .100E-01 .300E01 .100E+00 .300E+00 .100E+01 .300E+01 . 100E+02 .300E+02
.100E+03

FOR LAYER 1 TIME TEMPERATURE SHIFT FACTOR (BETA)= .11300 REFERENCE TEMPERATURE (TEMREF)= 77.00000

CREEP COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.163E-05 .221E-05 .308E-05 .417E-05 .580E-05 .785E-05 .109E-04 .148E-04 .206E-04 .279E-04 .389E-04

LAYER NO. 1 DIRICHLET SERIES FOR CREEP (GG) AT REFERENCE TEMPERATURE (TEMREF) OF 77.00000 ARE:
-.1543E-05 - .1086E-05 - .1254E-05 -.8227E-05 .3934E-05 -.2991E-04 .3962E-04

COMPUTED COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.174E-05 .210E-05 .302E-05 .427E-05 .576E-05 .767E-05 .112E-04 .151E-04 .196E-04 .288E-04 .386E-04

FOR PERIOD NO. 1 LAYER NO. AND TEMPERATURE ARE:

1 . 7000E+02

CREEP COMPLIANCES (CREEP) OF LAYER 1 AT TEMPERATURE (TEMP) OF 70.00000 ARE:
.157E-05 .163E-05 .186E-05 .239E-05 .355E-05 .484E-05 .649E-05 .886E-05 .130E-04 .165E-04 .230E-04

NUMBER OF LAYERS FOR BOTTOM TENSION (NLBT) = 0

NUMBER OF LAYERS FOR TOP COMPRESSION (NLTC) = 1

LAYER NO. FOR TOP COMPRESSION (LNTC) ARE: 3

LOAD REPETITIONS (TNLR) IN PERIOD 1 FOR EACH LOAD GROUP ARE: 3750.00

DAMAGE COEFFICENTS (FT) FOR TOP COMPRESSION OF LAYER 3 ARE: .1365E-08 .4477E+01

DAMAGE ANALYSIS OF PERIOD NO. 1 LOAD GROUP NO. 1

RADIAL VERTICAL VERTICAL VERTICAL RADIAL TANGENTIAL SHEAR VERTICAL RADIAL TANGENTIAL SHEAR
COORDINATE COORDINATE DISP STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
.00000 8.08010 .1197E+00 .1798E+02 .1438E+02 .1438E+02 .0000E+00 .3116E-02 .1558E-02 .1558E-02 0000E+00

AT TOP OF LAYER 3 COMPRESSIVE STRAIN = .3116E-02 ALLOWABLE LOAD REPETITIONS = .22721E+03 DAMAGE RATIO= .16505E+02

SUMMARY OF DAMAGE ANALYSIS

AT TOP OF LAYER 3 SUM OF DAMAGE RATIO= .16505E+02

MAXIMUM DAMAGE RATO= .16505E+02 DESIGN LIFE IN YEARS= 0.06

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* SECTION 15 DUAL TIRE LOAD 40 MPH HMA MR=250 KSI *

MATL = 3 FOR VISCOELASTIC LAYERED SYSTEM

NDAMA=1, SO DAMAGE ANALYSIS WILL BE PERFORMED

NUMBER OF PERIODS PER YEAR (NPY) = 1

NUMBER OF LOAD GROUPS (NLG) = 1

TOLERANCE FOR INTEGRATION (DEL) = .00100

NUMBER OF LAYERS (NL) = 3

NUMBER OF Z COORDINATES (NZ) = 1

LIMIT OF INTEGRATION CYCLES (ICL) = 80

COMPUTING CODE (NSTD) = 9

THICKNESS OF LAYERS (TH) ARE: 2.92000 5.16000

POISSON’S RATIOS OF LAYERS (PR) ARE: .35000 .30000 .30000

CONDITIONS OF INTERFACES (INT) ARE: 0 0

FOR PERIOD NO. 1 ELASTIC MODULI OF LAYERS ARE: .250000E+06 .238900E+05
.300000E+04

LOAD GROUP NO. 1 HAS 2 CONTACT AREAS
CONTACT RADIUS (CR) = 4.23000
CONTACT PRESSURE (CP)= 80.00000
NO. OF POINTS AT WHICH RESULTS ARE DESIRED (NPT) = 3
WHEEL SPACING ALONG X-AXIS (XW) = .00000
WHEEL SPACING ALONG Y-AXIS (YW) = 13.50000
POINT NO. AND X AND Y COORDIANTES ARE:
1 .00000 .00000 2 .00000 4.23 3 .00000 6.75000

DURATION OF MOVING LOAD(DUR) = .10000

NUMBER OF VISCOELASTIC LAYER (NVL) = 1

LAYER NUMBERS WHICH ARE VISCOELASTIC (LNV) = 1

CREEP TIMES (TYME) ARE:
.100E-02 .300E-02 .100E-01 .300E01 .100E+00 .300E+00 .100E+01 .300E+01 . 100E+02 .300E+02
.100E+03

FOR LAYER 1 TIME TEMPERATURE SHIFT FACTOR (BETA)= .11300 REFERENCE TEMPERATURE (TEMREF)= 77.00000

CREEP COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.163E-05 .221E-05 .308E-05 .417E-05 .580E-05 .785E-45 .109E-04 .148E-04 .206E-04 .279E-04 .389E-04

LAYER NO. 1 DIRICHLET SERIES FOR CREEP (GG) AT REFERENCE TEMPERATURE (TEMREF) OF 77.00000 ARE:
-.1561E-05 - .1042E-05 - .1290E-05 -.8239E-05 .3897E-05 -.2985E-04 .3962E-04

COMPUTED COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.174E-05 .210E-05 .303E-05 .427E-05 .576E-05 .768E-05 .112E-04 .151E-04 .197E-04 .288E-04 .386E-04

FOR PERIOD NO. 1 LAYER NO. AND TEMPERATURE ARE:
1 . 7000E+02

CREEP COMPLIANCES (CREEP) OF LAYER 1 AT TEMPERATURE (TEMP) OF 70.00000 ARE:
.157E-05 .163E-05 .185E-05 .239E-05 .355E-05 .483E-05 .649E-05 .888E-05 .130E-04 .166E-04 .230E-04

NUMBER OF LAYERS FOR BOTTOM TENSION (NLBT) = 0

NUMBER OF LAYERS FOR TOP COMPRESSION (NLTC) = 1

LAYER NO. FOR TOP COMPRESSION (LNTC) ARE: 3

LOAD REPETITIONS (TNLR) IN PERIOD 1 FOR EACH LOAD GROUP ARE: 3750.00

DAMAGE COEFFICENTS (FT) FOR TOP COMPRESSION OF LAYER 3 ARE: .1365E-08 .4477E+01

DAMAGE ANALYSIS OF PERIOD NO. 1 LOAD GROUP NO. 1

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
1 8.08010 .8824E-01 .9996E+01 .9996E+01 .8338E+01 .7655E+01 .1733E-02 .1733E-02 .7184E-03 .7184E-03

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL

NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
2 8.08010 .9238E-01 .1037E+02 .1037E+02 .8680E+01 .7905E+01 .1797E-02 .1797E-02 .7303E-03 .7303E-03

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
3 8.08010 .9290E-01 .1030E+02 .1030E+02 .8651E+01 .7824E+01 .1785E-02 .1785E-02 .7131E-03 .7131E-03

AT TOP OF LAYER 3 COMPRESSIVE STRAIN = .1797E-02 ALLOWABLE LOAD REPETITIONS = .26716E+04 DAMAGE RATIO= .14037E+01

SUMMARY OF DAMAGE ANALYSIS

AT TOP OF LAYER 3 SUM OF DAMAGE RATIO= .14037E+01

MAXIMUM DAMAGE RATO= .14037E+01 DESIGN LIFE IN YEARS= .71

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* SECTION 15 DUAL TIRE LOAD 60 MPH HMA MR=250 KSI *

MATL = 3 FOR VISCOELASTIC LAYERED SYSTEM

NDAMA=1, SO DAMAGE ANALYSIS WILL BE PERFORMED

NUMBER OF PERIODS PER YEAR (NPY) = 1

NUMBER OF LOAD GROUPS (NLG) = 1

TOLERANCE FOR INTEGRATION (DEL) = .00100

NUMBER OF LAYERS (NL) = 3

NUMBER OF Z COORDINATES (NZ) = 1

LIMIT OF INTEGRATION CYCLES (ICL) = 80

COMPUTING CODE (NSTD) = 9

THICKNESS OF LAYERS (TH) ARE: 2.92000 5.16000

POISSON’S RATIOS OF LAYERS (PR) ARE: .35000 .30000 .30000

CONDITIONS OF INTERFACES (INT) ARE: 0 0
FOR PERIOD NO. 1 ELASTIC MODULI OF LAYERS ARE: .250000E+06 .238900E+05 .300000E+04

LOAD GROUP NO. 1 HAS 2 CONTACT AREAS
CONTACT RADIUS (CR) = 4.23000
CONTACT PRESSURE (CP)= 80.00000
NO. OF POINTS AT WHICH RESULTS ARE DESIRED (NPT) = 3
WHEEL SPACING ALONG X-AXIS (XW) = .00000
WHEEL SPACING ALONG Y-AXIS (YW) = 13.50000
POINT NO. AND X AND Y COORDIANTES ARE:
1 .00000 .00000 2 .00000 4.23 3 .00000 6.75000

DURATION OF MOVING LOAD(DUR) = .03500

NUMBER OF VISCOELASTIC LAYER (NVL) = 1

LAYER NUMBERS WHICH ARE VISCOELASTIC (LNV) = 1

CREEP TIMES (TYME) ARE:
.100E-02 .300E-02 .100E-01 .300E01 .100E+00 .300E+00 .100E+01 .300E+01 .100E+02 .300E+02 .100E+03

FOR LAYER 1 TIME TEMPERATURE SHIFT FACTOR (BETA)= .11300 REFERENCE TEMPERATURE (TEMREF)= 77.00000

CREEP COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.163E-05 .221E-05 .308E-05 .417E-05 .580E-05 .785E-45 .109E-04 .148E-04 .206E-04 .279E-04 .389E-04

LAYER NO. 1 DIRICHLET SERIES FOR CREEP (GG) AT REFERENCE TEMPERATURE (TEMREF) OF 77.00000 ARE:
-.1561E-05 - .1042E-05 - .1290E-05 -.8239E-05 .3897E-05 -.2985E-04 .3962E-04

COMPUTED COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.174E-05 .210E-05 .303E-05 .427E-05 .576E-05 .768E-05 .112E-04 .151E-04 .197E-04 .288E-04 .386E-04

FOR PERIOD NO. 1 LAYER NO. AND TEMPERATURE ARE:
1 . 7000E+02

CREEP COMPLIANCES (CREEP) OF LAYER 1 AT TEMPERATURE (TEMP) OF 70.00000 ARE:
.157E-05 .163E-05 .185E-05 .239E-05 .355E-05 .483E-05 .649E-05 .888E-05 .130E-04 .166E-04 .230E-04

NUMBER OF LAYERS FOR BOTTOM TENSION (NLBT) = 0

NUMBER OF LAYERS FOR TOP COMPRESSION (NLTC) = 1

LAYER NO. FOR TOP COMPRESSION (LNTC) ARE: 3

LOAD REPETITIONS (TNLR) IN PERIOD 1 FOR EACH LOAD GROUP ARE: 3750.00

DAMAGE COEFFICENTS (FT) FOR TOP COMPRESSION OF LAYER 3 ARE: .1365E-08 .4477E+01

DAMAGE ANALYSIS OF PERIOD NO. 1 LOAD GROUP NO. 1

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
1 8.08010 .38471E-01 .9195E+01 .9195E+01 .7656E+01 .7055E+01 .1594E-02 .1594E-02 .6666E-03 .6666E-03

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
2 8.08010 .8854E-01 .9570E+01 .9570E+01 .7989E+01 .7323E+01 .1659E-02 .1659E-02 .6849E-03 .6849E-03

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
3 8.08010 .8905E-01 .9526E+01 .9526E+01 .7974E+01 .7267E+01 .1651E-02 .1651E-02 .6723E-03 .6723E-03

AT TOP OF LAYER 3 COMPRESSIVE STRAIN = .1659E-02 ALLOWABLE LOAD REPETITIONS = .38200E+04 DAMAGE RATIO= .98167E+00

SUMMARY OF DAMAGE ANALYSIS

AT TOP OF LAYER 3 SUM OF DAMAGE RATIO= .98167E+00

MAXIMUM DAMAGE RATO= .98167E+00 DESIGN LIFE IN YEARS= 1.02

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* SECTION 15 PLATE LOAD HMA MR=370 KSI *

MATL = 3 FOR VISCOELASTIC LAYERED SYSTEM

NDAMA=1, SO DAMAGE ANALYSIS WILL BE PERFORMED

NUMBER OF PERIODS PER YEAR (NPY) = 1

NUMBER OF LOAD GROUPS (NLG) = 1

TOLERANCE FOR INTEGRATION (DEL) = .00100

NUMBER OF LAYERS (NL) = 3

NUMBER OF Z COORDINATES (NZ) = 0

LIMIT OF INTEGRATION CYCLES (ICL) = 80

COMPUTING CODE (NSTD) = 9

THICKNESS OF LAYERS (TH) ARE: 2.92000 5.16000

POISSON'S RATIOS OF LAYERS (PR) ARE: .35000 .30000 .30000

CONDITIONS OF INTERFACES (INT) ARE: 0 0

FOR PERIOD NO. 1 ELASTIC MODULI OF LAYERS ARE: .370000E+06 .238900E+05
.300000E+04

LOAD GROUP NO. 1 HAS 1 CONTACT AREAS
CONTACT RADIUS (CR) = 6.00000
CONTACT PRESSURE (CP)= 80.00000
RADIAL COORDINATES OF THE 1 POINTS (RC) ARE: .00000

DURATION OF MOVING LOAD (DUR) = 1.00000

NUMBER OF VISCOELASTIC LAYER (NVL) = 1

LAYER NUMBERS WHICH ARE VISCOELASTIC (LNV) = 1

CREEP TIMES (TYME) ARE:
.100E-02 .300E-02 .100E-01 .300E01 .100E+00 .300E+00 .100E+01 .300E+01 . 100E+02 .300E+02
.100E+03

FOR LAYER 1 TIME TEMPERATURE SHIFT FACTOR (BETA)= .11300 REFERENCE TEMPERATURE (TEMREF)= 77.00000

CREEP COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.589E-05 .676E-05 .776E-05 .891E-05 .102E-04 .117E-04 .134E-04 .153E-04 .177E-04 .200E-04 .232E-04

LAYER NO. 1 DIRICHLET SERIES FOR CREEP (GG) AT REFERENCE TEMPERATURE (TEMREF) OF 77.00000 ARE:
-.3015E-05 - .6485E-06 - .2508E-05 -.4060E-05 .5460E-06 -.8125E-05 .2336E-04

COMPUTED COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.605E-05 .656E-05 .776E-05 .899E-05 .101E-05 .117E-05 .135E-04 .154E-04 .173E-04 .203E-04 .231E-04

FOR PERIOD NO. 1 LAYER NO. AND TEMPERATURE ARE:
1 . 7000E+02

CREEP COMPLIANCES (CREEP) OF LAYER 1 AT TEMPERATURE (TEMP) OF 70.00000 ARE:
.580E-05 .590E-05 .622E-05 .696E-05 .835E-05 .940E-05 .108E-04 .123E-04 .144E-44 .161E-04 .185E-04

NUMBER OF LAYERS FOR BOTTOM TENSION (NLBT) = 0

NUMBER OF LAYERS FOR TOP COMPRESSION (NLTC) = 1

LAYER NO. FOR TOP COMPRESSION (LNTC) ARE: 3

LOAD REPETITIONS (TNLR) IN PERIOD 1 FOR EACH LOAD GROUP ARE: 3750.00

DAMAGE COEFFICENTS (FT) FOR TOP COMPRESSION OF LAYER 3 ARE: .1365E-08 .4477E+01

DAMAGE ANALYSIS OF PERIOD NO. 1 LOAD GROUP NO. 1

RADIAL VERTICAL VERTICAL VERTICAL RADIAL TANGENTIAL SHEAR VERTICAL RADIAL TANGENTIAL SHEAR
COORDINATE COORDINATE DISP STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
.00000 8.08010 .1349E+00 .2254E+02 .1803E+02 .1803E+02 .0000E+00 .3907E-02 .1953E-02 .1953E-02 0000E+00

AT TOP OF LAYER 3 COMPRESSIVE STRAIN = .3907E-02 ALLOWABLE LOAD REPETITIONS = .82489E+02 DAMAGE RATIO= .45461E+02

SUMMARY OF DAMAGE ANALYSIS

AT TOP OF LAYER 3 SUM OF DAMAGE RATIO= .45461E+02

MAXIMUM DAMAGE RATO= .45461E+02 DESIGN LIFE IN YEARS= .02

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* SECTION 15 DUAL TIRE LOAD 40 MPH HMA MR=370 KSI *

MATL = 3 FOR VISCOELASTIC LAYERED SYSTEM

NDAMA=1, SO DAMAGE ANALYSIS WILL BE PERFORMED

NUMBER OF PERIODS PER YEAR (NPY) = 1

NUMBER OF LOAD GROUPS (NLG) = 1

TOLERANCE FOR INTEGRATION (DEL) = .00100

NUMBER OF LAYERS (NL) = 3

NUMBER OF Z COORDINATES (NZ) = 1

LIMIT OF INTEGRATION CYCLES (ICL) = 80

COMPUTING CODE (NSTD) = 9

THICKNESS OF LAYERS (TH) ARE: 2.92000 5.16000

POISSON'S RATIOS OF LAYERS (PR) ARE: .35000 .30000 .30000

CONDITIONS OF INTERFACES (INT) ARE: 0 0

FOR PERIOD NO. 1 ELASTIC MODULI OF LAYERS ARE: .370000E+06 .238900E+05
.300000E+04

LOAD GROUP NO. 1 HAS 2 CONTACT AREAS
CONTACT RADIUS (CR) = 4.23000
CONTACT PRESSURE (CP)= 80.00000
NO. OF POINTS AT WHICH RESULTS ARE DESIRED (NPT) = 3
WHEEL SPACING ALONG X-AXIS (XW) = .00000
WHEEL SPACING ALONG Y-AXIS (YW) = 13.50000
POINT NO. AND X AND Y COORDIANTES ARE:
1 .00000 .00000 2 .00000 4.23 3 .00000 6.75000

DURATION OF MOVING LOAD(DUR) = .10000

NUMBER OF VISCOELASTIC LAYER (NVL) = 1

LAYER NUMBERS WHICH ARE VISCOELASTIC (LNV) = 1

CREEP TIMES (TYME) ARE:
.100E-02 .300E-02 .100E-01 .300E01 .100E+00 .300E+00 .100E+01 .300E+01 . 100E+02 .300E+02
.100E+03

FOR LAYER 1 TIME TEMPERATURE SHIFT FACTOR (BETA)= .11300 REFERENCE TEMPERATURE (TEMREF)= 77.00000

CREEP COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.589E-05 .676E-05 .776E-05 .891E-05 .102E-04 .117E-04 .134E-04 .153E-04 .177E-04 .200E-04 .232E-04

LAYER NO. 1 DIRICHLET SERIES FOR CREEP (GG) AT REFERENCE TEMPERATURE (TEMREF) OF 77.00000 ARE:
-.3015E-05 - .6485E-06 - .2508E-05 -.4060E-05 .5460E-06 -.8125E-05 .2336E-04

COMPUTED COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.605E-05 .656E-05 .776E-05 .899E-05 .101E-04 .117E-04 .135E-04 .154E-04 .173E-04 .203E-04 .231E-04

FOR PERIOD NO. 1 LAYER NO. AND TEMPERATURE ARE:
1 . 7000E+02

CREEP COMPLIANCES (CREEP) OF LAYER 1 AT TEMPERATURE (TEMP) OF 70.00000 ARE:
.580E-05 .590E-05 .622E-05 .696E-05 .835E-05 .940E-05 .108E-04 .123E-04 .144E-04 .161E-04 .185E-04

NUMBER OF LAYERS FOR BOTTOM TENSION (NLBT) = 0

NUMBER OF LAYERS FOR TOP COMPRESSION (NLTC) = 1

LAYER NO. FOR TOP COMPRESSION (LNTC) ARE: 3

LOAD REPETITIONS (TNLR) IN PERIOD 1 FOR EACH LOAD GROUP ARE: 3750.00

DAMAGE COEFFICENTS (FT) FOR TOP COMPRESSION OF LAYER 3 ARE: .1365E-08 .4477E+01

DAMAGE ANALYSIS OF PERIOD NO. 1 LOAD GROUP NO. 1

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR
MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN

1 8.08010 .1049E+00 .1433E+02 .1433E+02 .1203E+02 .1089E+02 .2843E-02 .2483E-02 .9936E-03 .9936E-03

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
2 8.08010 .1101E+00 .1440E+02 .1440E+02 .1225E+02 .1078E+02 .2495E-02 .2495E-02 .9279E-03 .9279E-03

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
3 8.08010 .1106E+00 .1409E+02 .1409E+02 .1208E+02 .1046E+02 .2442E-02 .2442E-02 .8703E-03 .8703E-03

AT TOP OF LAYER 3 COMPRESSIVE STRAIN = .2495E-02 ALLOWABLE LOAD REPETITIONS = .61405E+03 DAMAGE RATIO= .61070E+01

SUMMARY OF DAMAGE ANALYSIS

AT TOP OF LAYER 3 SUM OF DAMAGE RATIO= .61070E+01

MAXIMUM DAMAGE RATO= .61070E+01 DESIGN LIFE IN YEARS= 0.16

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* SECTION 15 DUAL TIRE LOAD 60 MPH HMA MR=370 KSI *

MATL = 3 FOR VISCOELASTIC LAYERED SYSTEM

NDAMA=1, SO DAMAGE ANALYSIS WILL BE PERFORMED

NUMBER OF PERIODS PER YEAR (NPY) = 1

NUMBER OF LOAD GROUPS (NLG) = 1

TOLERANCE FOR INTEGRATION (DEL) = .00100

NUMBER OF LAYERS (NL) = 3

NUMBER OF Z COORDINATES (NZ) = 1

LIMIT OF INTEGRATION CYCLES (ICL) = 80

COMPUTING CODE (NSTD) = 9

THICKNESS OF LAYERS (TH) ARE: 2.92000 5.16000

POISSON'S RATIOS OF LAYERS (PR) ARE: .35000 .30000 .30000

CONDITIONS OF INTERFACES (INT) ARE: 0 0
FOR PERIOD NO. 1 ELASTIC MODULI OF LAYERS ARE: .370000E+06 .238900E+05 .300000E+04

LOAD GROUP NO. 1 HAS 2 CONTACT AREAS
CONTACT RADIUS (CR) = 4.23000
CONTACT PRESSURE (CP)= 80.00000
NO. OF POINTS AT WHICH RESULTS ARE DESIRED (NPT) = 3
WHEEL SPACING ALONG X-AXIS (XW) = .00000
WHEEL SPACING ALONG Y-AXIS (YW) = 13.50000

POINT NO. AND X AND Y COORDIANTES ARE:
1 .00000 .00000 2 .00000 4.23 3 .00000 6.75000

DURATION OF MOVING LOAD(DUR) = .03500

NUMBER OF VISCOELASTIC LAYER (NVL) = 1

LAYER NUMBERS WHICH ARE VISCOELASTIC (LNV) = 1

CREEP TIMES (TYME) ARE:
.100E-02 .300E-02 .100E-01 .300E01 .100E+00 .300E+00 .100E+01 .300E+01 .100E+02 .300E+02 .100E+03

FOR LAYER 1 TIME TEMPERATURE SHIFT FACTOR (BETA)= .11300 REFERENCE TEMPERATURE (TEMREF)= 77.00000

CREEP COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.589E-05 .676E-05 .776E-05 .891E-05 .102E-04 .117E-45 .134E-04 .153E-04 .177E-04 .200E-04 .232E-04

LAYER NO. 1 DIRICHLET SERIES FOR CREEP (GG) AT REFERENCE TEMPERATURE (TEMREF) OF 77.00000 ARE:
-.3015E-05 - .6485E-06 - .2508E-05 -.4060E-05 .5460E-06 -.8125E-05 .2336E-04

COMPUTED COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.605E-05 .656E-05 .776E-05 .899E-05 .101E-04 .117E-04 .135E-04 .154E-04 .173E-04 .203E-04 .231E-04

FOR PERIOD NO. 1 LAYER NO. AND TEMPERATURE ARE:
1 . 7000E+02

CREEP COMPLIANCES (CREEP) OF LAYER 1 AT TEMPERATURE (TEMP) OF 70.00000 ARE:
.580E-05 .590E-05 .622E-05 .696E-05 .835E-05 .940E-05 .108E-04 .123E-04 .144E-04 .161E-04 .185E-04

NUMBER OF LAYERS FOR BOTTOM TENSION (NLBT) = 0

NUMBER OF LAYERS FOR TOP COMPRESSION (NLTC) = 1

LAYER NO. FOR TOP COMPRESSION (LNTC) ARE: 3

LOAD REPETITIONS (TNLR) IN PERIOD 1 FOR EACH LOAD GROUP ARE: 3750.00

DAMAGE COEFFICENTS (FT) FOR TOP COMPRESSION OF LAYER 3 ARE: .1365E-08 .4477E+01

DAMAGE ANALYSIS OF PERIOD NO. 1 LOAD GROUP NO. 1

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
1 8.08010 .1036E+00 .1396E+02 .1396E+02 .1172E+02 .1061E+02 .2419E-02 .2419E-02 .9700E-03 .9700E-03

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
2 8.08010 .1088E+00 .1408E+02 .1408E+02 .1197E+02 .1056E+02 .2440E-02 .2440E-02 .9151E-03 .9151E-03

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
3 8.08010 .1093E+00 .1380E+02 .1380E+02 .1181E+02 .1027E+02 .2392E-02 .2392E-02 .8625E-03 .8625E-03

AT TOP OF LAYER 3 COMPRESSIVE STRAIN = .2440E-02 ALLOWABLE LOAD REPETITIONS =
.67850E+03 DAMAGE RATIO=
.55269E+01

SUMMARY OF DAMAGE ANALYSIS

AT TOP OF LAYER 3 SUM OF DAMAGE RATIO= .55269E+01

MAXIMUM DAMAGE RATO= .55269E+01 DESIGN LIFE IN YEARS= .18

NUMBER OF PROBLEMS TO BE SOLVED = 6

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* SECTION 16 PLATE LOAD HMA MR=250 KSI *

MATL = 3 FOR VISCOELASTIC LAYERED SYSTEM

NDAMA=1, SO DAMAGE ANALYSIS WILL BE PERFORMED

NUMBER OF PERIODS PER YEAR (NPY) = 1

NUMBER OF LOAD GROUPS (NLG) = 1

TOLERANCE FOR INTEGRATION (DEL) = .00100

NUMBER OF LAYERS (NL) = 3

NUMBER OF Z COORDINATES (NZ) = 0

LIMIT OF INTEGRATION CYCLES (ICL) = 80

COMPUTING CODE (NSTD) = 9

THICKNESS OF LAYERS (TH) ARE: 3.66000 4.79000

POISSON'S RATIOS OF LAYERS (PR) ARE: .35000 .30000 .30000

CONDITIONS OF INTERFACES (INT) ARE: 0 0

FOR PERIOD NO. 1 ELASTIC MODULI OF LAYERS ARE: .250000E+06 .238900E+05
.330000E+04

LOAD GROUP NO. 1 HAS 1 CONTACT AREAS
CONTACT RADIUS (CR) = 6.00000
CONTACT PRESSURE (CP)= 80.00000
RADIAL COORDINATES OF THE 1 POINTS (RC) ARE: .00000

DURATION OF MOVING LOAD (DUR) = 1.00000

NUMBER OF VISCOELASTIC LAYER (NVL) = 1

LAYER NUMBERS WHICH ARE VISCOELASTIC (LNV) = 1

CREEP TIMES (TYME) ARE:
.100E-02 .300E-02 .100E-01 .300E01 .100E+00 .300E+00 .100E+01 .300E+01 . 100E+02 .300E+02
.100E+03

FOR LAYER 1 TIME TEMPERATURE SHIFT FACTOR (BETA)= .11300 REFERENCE TEMPERATURE
(TEMREF)= 77.00000

CREEP COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.163E-05 .221E-05 .308E-05 .417E-05 .580E-05 .785E-05 .109E-04 .148E-04 .206E-04 .279E-04 .389E-04

LAYER NO. 1 DIRICHLET SERIES FOR CREEP (GG) AT REFERENCE TEMPERATURE (TEMREF) OF
77.00000 ARE:
-.1543E-05 - .1086E-05 - .1254E-05 -.8227E-05 .3934E-05 -.2991E-04 .3962E-04

COMPUTED COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.174E-05 .210E-05 .302E-05 .427E-05 .576E-05 .767E-05 .112E-04 .151E-04 .196E-04 .288E-04 .386E-04

FOR PERIOD NO. 1 LAYER NO. AND TEMPERATURE ARE:

1 . 7000E+02

CREEP COMPLIANCES (CREEP) OF LAYER 1 AT TEMPERATURE (TEMP) OF 70.00000 ARE:
.157E-05 .163E-05 .186E-05 .239E-05 .355E-05 .484E-05 .649E-05 .886E-05 .130E-04 .165E-04 .230E-04

NUMBER OF LAYERS FOR BOTTOM TENSION (NLBT) = 0

NUMBER OF LAYERS FOR TOP COMPRESSION (NLTC) = 1

LAYER NO. FOR TOP COMPRESSION (LNTC) ARE: 3

LOAD REPETITIONS (TNLR) IN PERIOD 1 FOR EACH LOAD GROUP ARE: 3750.00

DAMAGE COEFFICENTS (FT) FOR TOP COMPRESSION OF LAYER 3 ARE: .1365E-08 .4477E+01

DAMAGE ANALYSIS OF PERIOD NO. 1 LOAD GROUP NO. 1

RADIAL VERTICAL VERTICAL VERTICAL RADIAL TANGENTIAL SHEAR VERTICAL RADIAL TANGENTIAL SHEAR
COORDINATE COORDINATE DISP STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
.00000 8.45010 .9865E-01 .1501E+02 .1201E+02 .1201E+02 .0000E+00 .2366E-02 .1183E-02 .1183E-02 0000E+00

AT TOP OF LAYER 3 COMPRESSIVE STRAIN = .2366E-02 ALLOWABLE LOAD REPETITIONS = .77952E+03 DAMAGE RATIO= .48106E+01

SUMMARY OF DAMAGE ANALYSIS

AT TOP OF LAYER 3 SUM OF DAMAGE RATIO= .48106E+01

MAXIMUM DAMAGE RATO= .48106E+01 DESIGN LIFE IN YEARS= 0.21

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* SECTION 16 DUAL TIRE LOAD 40 MPH HMA MR=250 KSI *

MATL = 3 FOR VISCOELASTIC LAYERED SYSTEM

NDAMA=1, SO DAMAGE ANALYSIS WILL BE PERFORMED

NUMBER OF PERIODS PER YEAR (NPY) = 1

NUMBER OF LOAD GROUPS (NLG) = 1

TOLERANCE FOR INTEGRATION (DEL) = .00100

NUMBER OF LAYERS (NL) = 3

NUMBER OF Z COORDINATES (NZ) = 1

LIMIT OF INTEGRATION CYCLES (ICL) = 80

COMPUTING CODE (NSTD) = 9

THICKNESS OF LAYERS (TH) ARE: 3.66000 4.79000

POISSON’S RATIOS OF LAYERS (PR) ARE: .35000 .30000 .30000

CONDITIONS OF INTERFACES (INT) ARE: 0 0

FOR PERIOD NO. 1 ELASTIC MODULI OF LAYERS ARE: .250000E+06 .238900E+05 .330000E+04

LOAD GROUP NO. 1 HAS 2 CONTACT AREAS
CONTACT RADIUS (CR) = 4.23000
CONTACT PRESSURE (CP)= 80.00000
NO. OF POINTS AT WHICH RESULTS ARE DESIRED (NPT) = 3
WHEEL SPACING ALONG X-AXIS (XW) = .00000
WHEEL SPACING ALONG Y-AXIS (YW) = 13.50000
POINT NO. AND X AND Y COORDIANTES ARE:
1 .00000 .00000 2 .00000 4.23 3 .00000 6.75000

DURATION OF MOVING LOAD(DUR) = .10000

NUMBER OF VISCOELASTIC LAYER (NVL) = 1

LAYER NUMBERS WHICH ARE VISCOELASTIC (LNV) = 1

CREEP TIMES (TYME) ARE:
.100E-02 .300E-02 .100E-01 .300E01 .100E+00 .300E+00 .100E+01 .300E+01 . 100E+02 .300E+02 .100E+03

FOR LAYER 1 TIME TEMPERATURE SHIFT FACTOR (BETA)= .11300 REFERENCE TEMPERATURE (TEMREF)= 77.00000

CREEP COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.163E-05 .221E-05 .308E-05 .417E-05 .580E-05 .785E-45 .109E-04 .148E-04 .206E-04 .279E-04 .389E-04

LAYER NO. 1 DIRICHLET SERIES FOR CREEP (GG) AT REFERENCE TEMPERATURE (TEMREF) OF 77.00000 ARE:
-.1561E-05 - .1042E-05 - .1290E-05 -.8239E-05 .3897E-05 -.2985E-04 .3962E-04

COMPUTED COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.174E-05 .210E-05 .303E-05 .427E-05 .576E-05 .768E-05 .112E-04 .151E-04 .197E-04 .288E-04 .386E-04

FOR PERIOD NO. 1 LAYER NO. AND TEMPERATURE ARE:
1 . 7000E+02

CREEP COMPLIANCES (CREEP) OF LAYER 1 AT TEMPERATURE (TEMP) OF 70.00000 ARE:
.157E-05 .163E-05 .185E-05 .239E-05 .355E-05 .483E-05 .649E-05 .888E-05 .130E-04 .166E-04 .230E-04

NUMBER OF LAYERS FOR BOTTOM TENSION (NLBT) = 0

NUMBER OF LAYERS FOR TOP COMPRESSION (NLTC) = 1

LAYER NO. FOR TOP COMPRESSION (LNTC) ARE: 3

LOAD REPETITIONS (TNLR) IN PERIOD 1 FOR EACH LOAD GROUP ARE: 3750.00

DAMAGE COEFFICENTS (FT) FOR TOP COMPRESSION OF LAYER 3 ARE: .1365E-08 .4477E+01

DAMAGE ANALYSIS OF PERIOD NO. 1 LOAD GROUP NO. 1

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
1 8.45010 .7224E-01 .8166E+01 .8166E+01 .6782E+01 .6283E+01 .1287E-02 .1287E-02 .5451E-03 .5451E-03

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL

NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
2 8.45010 .7524E-01 .8464E+01 .8464E+01 .7048E+01 .6494E+01 .1334E-02 .1334E-02 .5576E-03 .5576E-03

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR
MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
3 8.45010 .7563E-01 .8418E+01 .8418E+01 .7030E+01 .6440E+01 .1327E-02 .1327E-02 .5470E-03 .5470E-03

AT TOP OF LAYER 3 COMPRESSIVE STRAIN = .1334E-02 ALLOWABLE LOAD REPETITIONS =
.10143E+05 DAMAGE RATIO=
.36970E+00

SUMMARY OF DAMAGE ANALYSIS

AT TOP OF LAYER 3 SUM OF DAMAGE RATIO= .36970E+00

MAXIMUM DAMAGE RATO= .36970E+00 DESIGN LIFE IN YEARS= 2.70

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* SECTION 16 DUAL TIRE LOAD 60 MPH HMA MR=250 KSI *

MATL = 3 FOR VISCOELASTIC LAYERED SYSTEM

NDAMA=1, SO DAMAGE ANALYSIS WILL BE PERFORMED

NUMBER OF PERIODS PER YEAR (NPY) = 1

NUMBER OF LOAD GROUPS (NLG) = 1

TOLERANCE FOR INTEGRATION (DEL) = .00100

NUMBER OF LAYERS (NL) = 3

NUMBER OF Z COORDINATES (NZ) = 1

LIMIT OF INTEGRATION CYCLES (ICL) = 80

COMPUTING CODE (NSTD) = 9

THICKNESS OF LAYERS (TH) ARE: 3.66000 4.79000

POISSON'S RATIOS OF LAYERS (PR) ARE: .35000 .30000 .30000

CONDITIONS OF INTERFACES (INT) ARE: 0 0
FOR PERIOD NO. 1 ELASTIC MODULI OF LAYERS ARE: .250000E+06 .238900E+05
.330000E+04

LOAD GROUP NO. 1 HAS 2 CONTACT AREAS
CONTACT RADIUS (CR) = 4.23000
CONTACT PRESSURE (CP)= 80.00000
NO. OF POINTS AT WHICH RESULTS ARE DESIRED (NPT) = 3
WHEEL SPACING ALONG X-AXIS (XW) = .00000
WHEEL SPACING ALONG Y-AXIS (YW) = 13.50000
POINT NO. AND X AND Y COORDIANTES ARE:
1 .00000 .00000 2 .00000 4.23 3 .00000 6.75000

DURATION OF MOVING LOAD(DUR) = .03500

NUMBER OF VISCOELASTIC LAYER (NVL) = 1

LAYER NUMBERS WHICH ARE VISCOELASTIC (LNV) = 1

CREEP TIMES (TYME) ARE:
.100E-02 .300E-02 .100E-01 .300E01 .100E+00 .300E+00 .100E+01 .300E+01 .100E+02 .300E+02 .100E+03

FOR LAYER 1 TIME TEMPERATURE SHIFT FACTOR (BETA)= .11300 REFERENCE TEMPERATURE (TEMREF)= 77.00000

CREEP COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.163E-05 .221E-05 .308E-05 .417E-05 .580E-05 .785E-45 .109E-04 .148E-04 .206E-04 .279E-04 .389E-04

LAYER NO. 1 DIRICHLET SERIES FOR CREEP (GG) AT REFERENCE TEMPERATURE (TEMREF) OF 77.00000 ARE:
-.1561E-05 - .1042E-05 - .1290E-05 -.8239E-05 .3897E-05 -.2985E-04 .3962E-04

COMPUTED COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.174E-05 .210E-05 .303E-05 .427E-05 .576E-05 .768E-05 .112E-04 .151E-04 .197E-04 .288E-04 .386E-04

FOR PERIOD NO. 1 LAYER NO. AND TEMPERATURE ARE:
1 . 7000E+02

CREEP COMPLIANCES (CREEP) OF LAYER 1 AT TEMPERATURE (TEMP) OF 70.00000 ARE:
.157E-05 .163E-05 .185E-05 .239E-05 .355E-05 .483E-05 .649E-05 .888E-05 .130E-04 .166E-04 .230E-04

NUMBER OF LAYERS FOR BOTTOM TENSION (NLBT) = 0

NUMBER OF LAYERS FOR TOP COMPRESSION (NLTC) = 1

LAYER NO. FOR TOP COMPRESSION (LNTC) ARE: 3

LOAD REPETITIONS (TNLR) IN PERIOD 1 FOR EACH LOAD GROUP ARE: 3750.00

DAMAGE COEFFICENTS (FT) FOR TOP COMPRESSION OF LAYER 3 ARE: .1365E-08 .4477E+01

DAMAGE ANALYSIS OF PERIOD NO. 1 LOAD GROUP NO. 1

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
1 8.45010 .6878E-01 .7401E+01 .7401E+01 .6135E+01 .5707E+01 .1166E-02 .1166E-02 .4988E-03 .4988E-03

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
2 8.45010 .7150E-01 .7688E+01 .7688E+01 .6383E+01 .5917E+01 .1211E-02 .1211E-02 .5139E-03 .5139E-03

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
3 8.45010 .7186E-01 .7659E+01 .7659E+01 .6374E+01 .5880E+01 .1207E-02 .1207E-02 .5062E-03 .5062E-03

AT TOP OF LAYER 3 COMPRESSIVE STRAIN = .1211E-02 ALLOWABLE LOAD REPETITIONS = .15602E+05 DAMAGE RATIO= .24035E+00

SUMMARY OF DAMAGE ANALYSIS

AT TOP OF LAYER 3 SUM OF DAMAGE RATIO= .24035E+00

MAXIMUM DAMAGE RATO= .24035E+00 DESIGN LIFE IN YEARS= 4.16

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* SECTION 16 PLATE LOAD HMA MR=370 KSI *

MATL = 3 FOR VISCOELASTIC LAYERED SYSTEM

NDAMA=1, SO DAMAGE ANALYSIS WILL BE PERFORMED

NUMBER OF PERIODS PER YEAR (NPY) = 1

NUMBER OF LOAD GROUPS (NLG) = 1

TOLERANCE FOR INTEGRATION (DEL) = .00100

NUMBER OF LAYERS (NL) = 3

NUMBER OF Z COORDINATES (NZ) = 0

LIMIT OF INTEGRATION CYCLES (ICL) = 80

COMPUTING CODE (NSTD) = 9

THICKNESS OF LAYERS (TH) ARE: 3.66000 4.79000

POISSON'S RATIOS OF LAYERS (PR) ARE: .35000 .30000 .30000

CONDITIONS OF INTERFACES (INT) ARE: 0 0

FOR PERIOD NO. 1 ELASTIC MODULI OF LAYERS ARE: .370000E+06 .238900E+05 .330000E+04

LOAD GROUP NO. 1 HAS 1 CONTACT AREAS
CONTACT RADIUS (CR) = 6.00000
CONTACT PRESSURE (CP)= 80.00000
RADIAL COORDINATES OF THE 1 POINTS (RC) ARE: .00000

DURATION OF MOVING LOAD (DUR) = 1.00000

NUMBER OF VISCOELASTIC LAYER (NVL) = 1

LAYER NUMBERS WHICH ARE VISCOELASTIC (LNV) = 1

CREEP TIMES (TYME) ARE:
.100E-02 .300E-02 .100E-01 .300E01 .100E+00 .300E+00 .100E+01 .300E+01 . 100E+02 .300E+02 .100E+03

FOR LAYER 1 TIME TEMPERATURE SHIFT FACTOR (BETA)= .11300 REFERENCE TEMPERATURE (TEMREF)= 77.00000

CREEP COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.589E-05 .676E-05 .776E-05 .891E-05 .102E-04 .117E-04 .134E-04 .153E-04 .177E-04 .200E-04 .232E-04

LAYER NO. 1 DIRICHLET SERIES FOR CREEP (GG) AT REFERENCE TEMPERATURE (TEMREF) OF 77.00000 ARE:
-.3015E-05 - .6485E-06 - .2508E-05 -.4060E-05 .5460E-06 -.8125E-05 .2336E-04

COMPUTED COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.605E-05 .656E-05 .776E-05 .899E-05 .101E-05 .117E-05 .135E-04 .154E-04 .173E-04 .203E-04 .231E-04

FOR PERIOD NO. 1 LAYER NO. AND TEMPERATURE ARE:
1 . 7000E+02

CREEP COMPLIANCES (CREEP) OF LAYER 1 AT TEMPERATURE (TEMP) OF 70.00000 ARE:
.580E-05 .590E-05 .622E-05 .696E-05 .835E-05 .940E-05 .108E-04 .123E-04 .144E-44 .161E-04 .185E-04

NUMBER OF LAYERS FOR BOTTOM TENSION (NLBT) = 0

NUMBER OF LAYERS FOR TOP COMPRESSION (NLTC) = 1

LAYER NO. FOR TOP COMPRESSION (LNTC) ARE: 3

LOAD REPETITIONS (TNLR) IN PERIOD 1 FOR EACH LOAD GROUP ARE: 3750.00

DAMAGE COEFFICENTS (FT) FOR TOP COMPRESSION OF LAYER 3 ARE: .1365E-08 .4477E+01

DAMAGE ANALYSIS OF PERIOD NO. 1 LOAD GROUP NO. 1

RADIAL VERTICAL VERTICAL VERTICAL RADIAL TANGENTIAL SHEAR VERTICAL RADIAL TANGENTIAL SHEAR
COORDINATE COORDINATE DISP STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
.00000 8.45010 .1155E+00 .2016E+02 .1613E+02 .1613E+02 .0000E+00 .3177E-02 .1588E-02 .1588E-02 0000E+00

AT TOP OF LAYER 3 COMPRESSIVE STRAIN = .3177E-02 ALLOWABLE LOAD REPETITIONS = .20823E+03 DAMAGE RATIO= .18009E+02

SUMMARY OF DAMAGE ANALYSIS

AT TOP OF LAYER 3 SUM OF DAMAGE RATIO= .18009E+02

MAXIMUM DAMAGE RATO= .18009E+02 DESIGN LIFE IN YEARS= .06

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* SECTION 16 DUAL TIRE LOAD 40 MPH HMA MR=370 KSI *

MATL = 3 FOR VISCOELASTIC LAYERED SYSTEM

NDAMA=1, SO DAMAGE ANALYSIS WILL BE PERFORMED

NUMBER OF PERIODS PER YEAR (NPY) = 1

NUMBER OF LOAD GROUPS (NLG) = 1

TOLERANCE FOR INTEGRATION (DEL) = .00100

NUMBER OF LAYERS (NL) = 3

NUMBER OF Z COORDINATES (NZ) = 1

LIMIT OF INTEGRATION CYCLES (ICL) = 80

COMPUTING CODE (NSTD) = 9

THICKNESS OF LAYERS (TH) ARE: 3.66000 4.79000

POISSON'S RATIOS OF LAYERS (PR) ARE: .35000 .30000 .30000

CONDITIONS OF INTERFACES (INT) ARE: 0 0

FOR PERIOD NO. 1 ELASTIC MODULI OF LAYERS ARE: .370000E+06 .238900E+05 .330000E+04

LOAD GROUP NO. 1 HAS 2 CONTACT AREAS
CONTACT RADIUS (CR) = 4.23000
CONTACT PRESSURE (CP)= 80.00000
NO. OF POINTS AT WHICH RESULTS ARE DESIRED (NPT) = 3
WHEEL SPACING ALONG X-AXIS (XW) = .00000
WHEEL SPACING ALONG Y-AXIS (YW) = 13.50000
POINT NO. AND X AND Y COORDIANTES ARE:
1 .00000 .00000 2 .00000 4.23 3 .00000 6.75000

DURATION OF MOVING LOAD(DUR) = .10000

NUMBER OF VISCOELASTIC LAYER (NVL) = 1

LAYER NUMBERS WHICH ARE VISCOELASTIC (LNV) = 1

CREEP TIMES (TYME) ARE:
.100E-02 .300E-02 .100E-01 .300E01 .100E+00 .300E+00 .100E+01 .300E+01 . 100E+02 .300E+02 .100E+03

FOR LAYER 1 TIME TEMPERATURE SHIFT FACTOR (BETA)= .11300 REFERENCE TEMPERATURE (TEMREF)= 77.00000

CREEP COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.589E-05 .676E-05 .776E-05 .891E-05 .102E-04 .117E-04 .134E-04 .153E-04 .177E-04 .200E-04 .232E-04

LAYER NO. 1 DIRICHLET SERIES FOR CREEP (GG) AT REFERENCE TEMPERATURE (TEMREF) OF 77.00000 ARE:
-.3015E-05 - .6485E-06 - .2508E-05 -.4060E-05 .5460E-06 -.8125E-05 .2336E-04

COMPUTED COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.605E-05 .656E-05 .776E-05 .899E-05 .101E-04 .117E-04 .135E-04 .154E-04 .173E-04 .203E-04 .231E-04

FOR PERIOD NO. 1 LAYER NO. AND TEMPERATURE ARE:
1 . 7000E+02

CREEP COMPLIANCES (CREEP) OF LAYER 1 AT TEMPERATURE (TEMP) OF 70.00000 ARE:
.580E-05 .590E-05 .622E-05 .696E-05 .835E-05 .940E-05 .108E-04 .123E-04 .144E-04 .161E-04 .185E-04

NUMBER OF LAYERS FOR BOTTOM TENSION (NLBT) = 0

NUMBER OF LAYERS FOR TOP COMPRESSION (NLTC) = 1

LAYER NO. FOR TOP COMPRESSION (LNTC) ARE: 3

LOAD REPETITIONS (TNLR) IN PERIOD 1 FOR EACH LOAD GROUP ARE: 3750.00

DAMAGE COEFFICENTS (FT) FOR TOP COMPRESSION OF LAYER 3 ARE: .1365E-08 .4477E+01

DAMAGE ANALYSIS OF PERIOD NO. 1 LOAD GROUP NO. 1

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN

1 8.45010 .8989E+00 .1270E+02 .1270E+02 .1064E+02 .9676E+02 .2001E-02 .2001E-02 .8110E-03 .8110E-03

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR
MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
2 8.45010 .9428E+00 .1288E+02 .1288E+02 .1090E+02 .9075E+01 .2030E-02 .2030E-02 .7790E-03 .7790E-03

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR
MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
3 8.45010 .9473E-01 .1266E+02 .1266E+02 .1078E+02 .9476E+01 .1995E-02 .1995E-02 .7406E-03 .7406E-03

AT TOP OF LAYER 3 COMPRESSIVE STRAIN = .2030E-02 ALLOWABLE LOAD REPETITIONS =
.15486+04 DAMAGE RATIO=
.24215E+01

SUMMARY OF DAMAGE ANALYSIS

AT TOP OF LAYER 3 SUM OF DAMAGE RATIO= .24215E+01

MAXIMUM DAMAGE RATO= .24215E+01 DESIGN LIFE IN YEARS= .41

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* SECTION 16 DUAL TIRE LOAD 60 MPH HMA MR=370 KSI *

MATL = 3 FOR VISCOELASTIC LAYERED SYSTEM

NDAMA=1, SO DAMAGE ANALYSIS WILL BE PERFORMED

NUMBER OF PERIODS PER YEAR (NPY) = 1

NUMBER OF LOAD GROUPS (NLG) = 1

TOLERANCE FOR INTEGRATION (DEL) = .00100

NUMBER OF LAYERS (NL) = 3

NUMBER OF Z COORDINATES (NZ) = 1

LIMIT OF INTEGRATION CYCLES (ICL) = 80

COMPUTING CODE (NSTD) = 9

THICKNESS OF LAYERS (TH) ARE: 3.66000 4.79000

POISSON'S RATIOS OF LAYERS (PR) ARE: .35000 .30000 .30000

CONDITIONS OF INTERFACES (INT) ARE: 0 0
FOR PERIOD NO. 1 ELASTIC MODULI OF LAYERS ARE: .370000E+06 .238900E+05
.330000E+04

LOAD GROUP NO. 1 HAS 2 CONTACT AREAS
CONTACT RADIUS (CR) = 4.23000
CONTACT PRESSURE (CP)= 80.00000
NO. OF POINTS AT WHICH RESULTS ARE DESIRED (NPT) = 3
WHEEL SPACING ALONG X-AXIS (XW) = .00000
WHEEL SPACING ALONG Y-AXIS (YW) = 13.50000

POINT NO. AND X AND Y COORDIANTES ARE:
1 .00000 .00000 2 .00000 4.23 3 .00000 6.75000

DURATION OF MOVING LOAD(DUR) = .03500

NUMBER OF VISCOELASTIC LAYER (NVL) = 1

LAYER NUMBERS WHICH ARE VISCOELASTIC (LNV) = 1

CREEP TIMES (TYME) ARE:
.100E-02 .300E-02 .100E-01 .300E01 .100E+00 .300E+00 .100E+01 .300E+01 .100E+02 .300E+02 .100E+03

FOR LAYER 1 TIME TEMPERATURE SHIFT FACTOR (BETA)= .11300 REFERENCE TEMPERATURE (TEMREF)= 77.00000

CREEP COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.589E-05 .676E-05 .776E-05 .891E-05 .102E-04 .117E-45 .134E-04 .153E-04 .177E-04 .200E-04 .232E-04

LAYER NO. 1 DIRICHLET SERIES FOR CREEP (GG) AT REFERENCE TEMPERATURE (TEMREF) OF 77.00000 ARE:
-.3015E-05 - .6485E-06 - .2508E-05 -.4060E-05 .5460E-06 -.8125E-05 .2336E-04

COMPUTED COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.605E-05 .656E-05 .776E-05 .899E-05 .101E-04 .117E-04 .135E-04 .154E-04 .173E-04 .203E-04 .231E-04

FOR PERIOD NO. 1 LAYER NO. AND TEMPERATURE ARE:
1 . 7000E+02

CREEP COMPLIANCES (CREEP) OF LAYER 1 AT TEMPERATURE (TEMP) OF 70.00000 ARE:
.580E-05 .590E-05 .622E-05 .696E-05 .835E-05 .940E-05 .108E-04 .123E-04 .144E-04 .161E-04 .185E-04

NUMBER OF LAYERS FOR BOTTOM TENSION (NLBT) = 0

NUMBER OF LAYERS FOR TOP COMPRESSION (NLTC) = 1

LAYER NO. FOR TOP COMPRESSION (LNTC) ARE: 3

LOAD REPETITIONS (TNLR) IN PERIOD 1 FOR EACH LOAD GROUP ARE: 3750.00

DAMAGE COEFFICENTS (FT) FOR TOP COMPRESSION OF LAYER 3 ARE: .1365E-08 .4477E+01

DAMAGE ANALYSIS OF PERIOD NO. 1 LOAD GROUP NO. 1

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
1 8.45010 .8844E-01 .1227E+02 .1227E+02 .1027E+02 .9359E+01 .1934E-02 .1934E-02 .7865E-03 .7865E-03

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
2 8.45010 .9273E-01 .1249E+02 .1249E+02 .1055E+02 .9426E+01 .1968E-02 .1968E-02 .7619E-03 .7619E-03

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
3 8.45010 .9319E-01 .1229E+02 .1229E+02 .1045E+02 .9221E+02 .1937E-02 .1937E-02 .7272E-03 .7272E-03

AT TOP OF LAYER 3 COMPRESSIVE STRAIN = .1968E-02 ALLOWABLE LOAD REPETITIONS =
.17791E+04   DAMAGE RATIO=
.21078E+01

SUMMARY OF DAMAGE ANALYSIS

AT TOP OF LAYER 3   SUM OF DAMAGE RATIO= .21078E+01

MAXIMUM DAMAGE RATO= .21078E+01   DESIGN LIFE IN YEARS= .47

NUMBER OF PROBLEMS TO BE SOLVED = 6

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* SECTION 17 PLATE LOAD HMA MR=250 KSI *

MATL = 3 FOR VISCOELASTIC LAYERED SYSTEM

NDAMA=1, SO DAMAGE ANALYSIS WILL BE PERFORMED

NUMBER OF PERIODS PER YEAR (NPY) = 1

NUMBER OF LOAD GROUPS (NLG) = 1

TOLERANCE FOR INTEGRATION (DEL) = .00100

NUMBER OF LAYERS (NL) = 3

NUMBER OF Z COORDINATES (NZ) = 0

LIMIT OF INTEGRATION CYCLES (ICL) = 80

COMPUTING CODE (NSTD) = 9

THICKNESS OF LAYERS (TH) ARE: 2.89000 4.26000

POISSON'S RATIOS OF LAYERS (PR) ARE: .35000 .30000 .30000

CONDITIONS OF INTERFACES (INT) ARE: 0 0

FOR PERIOD NO. 1 ELASTIC MODULI OF LAYERS ARE: .250000E+06 .238700E+05
.330000E+04

LOAD GROUP NO. 1 HAS 1 CONTACT AREAS
CONTACT RADIUS (CR) = 6.00000
CONTACT PRESSURE (CP)= 80.00000
RADIAL COORDINATES OF THE 1 POINTS (RC) ARE: .00000

DURATION OF MOVING LOAD (DUR) = 1.00000

NUMBER OF VISCOELASTIC LAYER (NVL) = 1

LAYER NUMBERS WHICH ARE VISCOELASTIC (LNV) = 1

CREEP TIMES (TYME) ARE:
.100E-02 .300E-02 .100E-01 .300E01 .100E+00 .300E+00 .100E+01 .300E+01 . 100E+02 .300E+02
.100E+03

FOR LAYER 1 TIME TEMPERATURE SHIFT FACTOR (BETA)= .11300 REFERENCE TEMPERATURE
(TEMREF)= 77.00000

CREEP COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.163E-05 .221E-05 .308E-05 .417E-05 .580E-05 .785E-05 .109E-04 .148E-04 .206E-04 .279E-04 .389E-04

LAYER NO. 1 DIRICHLET SERIES FOR CREEP (GG) AT REFERENCE TEMPERATURE (TEMREF) OF
77.00000 ARE:
-.1543E-05 - .1086E-05 - .1254E-05 -.8227E-05 .3934E-05 -.2991E-04 .3962E-04

COMPUTED COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.174E-05 .210E-05 .302E-05 .427E-05 .576E-05 .767E-05 .112E-04 .151E-04 .196E-04 .288E-04 .386E-04

FOR PERIOD NO. 1 LAYER NO. AND TEMPERATURE ARE:

1 . 7000E+02

CREEP COMPLIANCES (CREEP) OF LAYER 1 AT TEMPERATURE (TEMP) OF 70.00000 ARE:
.157E-05 .163E-05 .186E-05 .239E-05 .355E-05 .484E-05 .649E-05 .886E-05 .130E-04 .165E-04 .230E-04

NUMBER OF LAYERS FOR BOTTOM TENSION (NLBT) = 0

NUMBER OF LAYERS FOR TOP COMPRESSION (NLTC) = 1

LAYER NO. FOR TOP COMPRESSION (LNTC) ARE: 3

LOAD REPETITIONS (TNLR) IN PERIOD 1 FOR EACH LOAD GROUP ARE: 3750.00

DAMAGE COEFFICENTS (FT) FOR TOP COMPRESSION OF LAYER 3 ARE: .1365E-08 .4477E+01

DAMAGE ANALYSIS OF PERIOD NO. 1 LOAD GROUP NO. 1

RADIAL VERTICAL VERTICAL VERTICAL RADIAL TANGENTIAL SHEAR VERTICAL RADIAL TANGENTIAL SHEAR
COORDINATE COORDINATE DISP STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
.00000 7.15010 .1178E+00 .2086E+02 .1669E+02 .1669E+02 .0000E+00 .3287E-02 .1643E-02 .1643E-02 0000E+00

AT TOP OF LAYER 3 COMPRESSIVE STRAIN = .3287E-02 ALLOWABLE LOAD REPETITIONS = .17886E+03 DAMAGE RATIO= .20966E+02

SUMMARY OF DAMAGE ANALYSIS

AT TOP OF LAYER 3 SUM OF DAMAGE RATIO= .20966E+02

MAXIMUM DAMAGE RATO= .20966E+02 DESIGN LIFE IN YEARS= .05

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* SECTION 17 DUAL TIRE LOAD 40 MPH HMA MR=250 KSI *

MATL = 3 FOR VISCOELASTIC LAYERED SYSTEM

NDAMA=1, SO DAMAGE ANALYSIS WILL BE PERFORMED

NUMBER OF PERIODS PER YEAR (NPY) = 1

NUMBER OF LOAD GROUPS (NLG) = 1

TOLERANCE FOR INTEGRATION (DEL) = .00100

NUMBER OF LAYERS (NL) = 3

NUMBER OF Z COORDINATES (NZ) = 1

LIMIT OF INTEGRATION CYCLES (ICL) = 80

COMPUTING CODE (NSTD) = 9

THICKNESS OF LAYERS (TH) ARE: 2.89000 4.26000

POISSON’S RATIOS OF LAYERS (PR) ARE: .35000 .30000 .30000

CONDITIONS OF INTERFACES (INT) ARE: 0 0

FOR PERIOD NO. 1 ELASTIC MODULI OF LAYERS ARE: .250000E+06 .238700E+05 .330000E+04

LOAD GROUP NO. 1 HAS 2 CONTACT AREAS
CONTACT RADIUS (CR) = 4.23000
CONTACT PRESSURE (CP)= 80.00000
NO. OF POINTS AT WHICH RESULTS ARE DESIRED (NPT) = 3
WHEEL SPACING ALONG X-AXIS (XW) = .00000
WHEEL SPACING ALONG Y-AXIS (YW) = 13.50000
POINT NO. AND X AND Y COORDIANTES ARE:
1 .00000 .00000 2 .00000 4.23 3 .00000 6.75000

DURATION OF MOVING LOAD(DUR) = .10000

NUMBER OF VISCOELASTIC LAYER (NVL) = 1

LAYER NUMBERS WHICH ARE VISCOELASTIC (LNV) = 1

CREEP TIMES (TYME) ARE:
.100E-02 .300E-02 .100E-01 .300E01 .100E+00 .300E+00 .100E+01 .300E+01 . 100E+02 .300E+02 .100E+03

FOR LAYER 1 TIME TEMPERATURE SHIFT FACTOR (BETA)= .11300 REFERENCE TEMPERATURE (TEMREF)= 77.00000

CREEP COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.163E-05 .221E-05 .308E-05 .417E-05 .580E-05 .785E-45 .109E-04 .148E-04 .206E-04 .279E-04 .389E-04

LAYER NO. 1 DIRICHLET SERIES FOR CREEP (GG) AT REFERENCE TEMPERATURE (TEMREF) OF 77.00000 ARE:
-.1561E-05 - .1042E-05 - .1290E-05 -.8239E-05 .3897E-05 -.2985E-04 .3962E-04

COMPUTED COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.174E-05 .210E-05 .303E-05 .427E-05 .576E-05 .768E-05 .112E-04 .151E-04 .197E-04 .288E-04 .386E-04

FOR PERIOD NO. 1 LAYER NO. AND TEMPERATURE ARE:
1 . 7000E+02

CREEP COMPLIANCES (CREEP) OF LAYER 1 AT TEMPERATURE (TEMP) OF 70.00000 ARE:
.157E-05 .163E-05 .185E-05 .239E-05 .355E-05 .483E-05 .649E-05 .888E-05 .130E-04 .166E-04 .230E-04

NUMBER OF LAYERS FOR BOTTOM TENSION (NLBT) = 0

NUMBER OF LAYERS FOR TOP COMPRESSION (NLTC) = 1

LAYER NO. FOR TOP COMPRESSION (LNTC) ARE: 3

LOAD REPETITIONS (TNLR) IN PERIOD 1 FOR EACH LOAD GROUP ARE: 3750.00

DAMAGE COEFFICENTS (FT) FOR TOP COMPRESSION OF LAYER 3 ARE: .1365E-08 .4477E+01

DAMAGE ANALYSIS OF PERIOD NO. 1 LOAD GROUP NO. 1

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
1 7.15010 .8426E-01 .1121E+02 .1121E+02 .9369E+01 .8571E+01 .1767E-02 .1767E-02 .7263E-03 .7263E-03

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL

NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
2 7.15010 .8861E-01 .1146E+02 .1146E+02 .9648E+01 .8690E+01 .1806E-02 .1806E-02 .7141E-03 .7141E-03

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR
MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
3 7.15010 .8906E-01 .1131E+02 .1131E+02 .9564E+01 .8525E+01 .1781E-02 .1781E-02 .6860E-03 .6860E-03

AT TOP OF LAYER 3 COMPRESSIVE STRAIN = .1806E-02 ALLOWABLE LOAD REPETITIONS = .126105E+04 DAMAGE RATIO=
.14365E+01

SUMMARY OF DAMAGE ANALYSIS

AT TOP OF LAYER 3 SUM OF DAMAGE RATIO= .14365E+01

MAXIMUM DAMAGE RATO= .14365E+01 DESIGN LIFE IN YEARS= .70

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* SECTION 17 DUAL TIRE LOAD 60 MPH HMA MR=250 KSI *

MATL = 3 FOR VISCOELASTIC LAYERED SYSTEM

NDAMA=1, SO DAMAGE ANALYSIS WILL BE PERFORMED

NUMBER OF PERIODS PER YEAR (NPY) = 1

NUMBER OF LOAD GROUPS (NLG) = 1

TOLERANCE FOR INTEGRATION (DEL) = .00100

NUMBER OF LAYERS (NL) = 3

NUMBER OF Z COORDINATES (NZ) = 1

LIMIT OF INTEGRATION CYCLES (ICL) = 80

COMPUTING CODE (NSTD) = 9

THICKNESS OF LAYERS (TH) ARE: 2.89000 4.26000

POISSON’S RATIOS OF LAYERS (PR) ARE: .35000 .30000 .30000

CONDITIONS OF INTERFACES (INT) ARE: 0 0
FOR PERIOD NO. 1 ELASTIC MODULI OF LAYERS ARE: .250000E+06 .238700E+05
.330000E+04

LOAD GROUP NO. 1 HAS 2 CONTACT AREAS
CONTACT RADIUS (CR) = 4.23000
CONTACT PRESSURE (CP)= 80.00000
NO. OF POINTS AT WHICH RESULTS ARE DESIRED (NPT) = 3
WHEEL SPACING ALONG X-AXIS (XW) = .00000
WHEEL SPACING ALONG Y-AXIS (YW) = 13.50000
POINT NO. AND X AND Y COORDIANTES ARE:
1 .00000 .00000 2 .00000 4.23 3 .00000 6.75000

DURATION OF MOVING LOAD(DUR) = .03500

NUMBER OF VISCOELASTIC LAYER (NVL) = 1

LAYER NUMBERS WHICH ARE VISCOELASTIC (LNV) = 1

CREEP TIMES (TYME) ARE:
.100E-02 .300E-02 .100E-01 .300E01 .100E+00 .300E+00 .100E+01 .300E+01 .100E+02 .300E+02 .100E+03

FOR LAYER 1 TIME TEMPERATURE SHIFT FACTOR (BETA)= .11300 REFERENCE TEMPERATURE (TEMREF)= 77.00000

CREEP COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.163E-05 .221E-05 .308E-05 .417E-05 .580E-05 .785E-45 .109E-04 .148E-04 .206E-04 .279E-04 .389E-04

LAYER NO. 1 DIRICHLET SERIES FOR CREEP (GG) AT REFERENCE TEMPERATURE (TEMREF) OF 77.00000 ARE:
-.1561E-05 - .1042E-05 - .1290E-05 -.8239E-05 .3897E-05 -.2985E-04 .3962E-04

COMPUTED COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.174E-05 .210E-05 .303E-05 .427E-05 .576E-05 .768E-05 .112E-04 .151E-04 .197E-04 .288E-04 .386E-04

FOR PERIOD NO. 1 LAYER NO. AND TEMPERATURE ARE:
1 . 7000E+02

CREEP COMPLIANCES (CREEP) OF LAYER 1 AT TEMPERATURE (TEMP) OF 70.00000 ARE:
.157E-05 .163E-05 .185E-05 .239E-05 .355E-05 .483E-05 .649E-05 .888E-05 .130E-04 .166E-04 .230E-04

NUMBER OF LAYERS FOR BOTTOM TENSION (NLBT) = 0

NUMBER OF LAYERS FOR TOP COMPRESSION (NLTC) = 1

LAYER NO. FOR TOP COMPRESSION (LNTC) ARE: 3

LOAD REPETITIONS (TNLR) IN PERIOD 1 FOR EACH LOAD GROUP ARE: 3750.00

DAMAGE COEFFICENTS (FT) FOR TOP COMPRESSION OF LAYER 3 ARE: .1365E-08 .4477E+01

DAMAGE ANALYSIS OF PERIOD NO. 1 LOAD GROUP NO. 1

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
1 7.15010 .8475E-01 .1054E+02 .1054E+02 .8840E+01 .8023E+01 .1661E-02 .1661E-02 .6693E-03 .6693E-03

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
2 7.15010 .8475E-01 .1054E+02 .1054E+02 .8840E+01 .8023E+01 .1661E-02 .1661E-02 .6693E-03 .6693E-03

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
3 7.15010 .5819E-01 .1043E+02 .1043E+02 .8782E+01 .7901E+01 .1643E-02 .1643E-02 .6480E-03 .6480E-03

AT TOP OF LAYER 3 COMPRESSIVE STRAIN = .1661E-02 ALLOWABLE LOAD REPETITIONS = .38002E+04 DAMAGE RATIO= .98678E+00

SUMMARY OF DAMAGE ANALYSIS

AT TOP OF LAYER 3 SUM OF DAMAGE RATIO= .98678E+00

MAXIMUM DAMAGE RATO= .98678E+00 DESIGN LIFE IN YEARS= 1.01

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* SECTION 17 PLATE LOAD HMA MR=370 KSI *

MATL = 3 FOR VISCOELASTIC LAYERED SYSTEM

NDAMA=1, SO DAMAGE ANALYSIS WILL BE PERFORMED

NUMBER OF PERIODS PER YEAR (NPY) = 1

NUMBER OF LOAD GROUPS (NLG) = 1

TOLERANCE FOR INTEGRATION (DEL) = .00100

NUMBER OF LAYERS (NL) = 3

NUMBER OF Z COORDINATES (NZ) = 0

LIMIT OF INTEGRATION CYCLES (ICL) = 80

COMPUTING CODE (NSTD) = 9

THICKNESS OF LAYERS (TH) ARE: 2.89000 4.26000

POISSON'S RATIOS OF LAYERS (PR) ARE: .35000 .30000 .30000

CONDITIONS OF INTERFACES (INT) ARE: 0 0

FOR PERIOD NO. 1 ELASTIC MODULI OF LAYERS ARE: .370000E+06 .238700E+05
.330000E+04

LOAD GROUP NO. 1 HAS 1 CONTACT AREAS
CONTACT RADIUS (CR) = 6.00000
CONTACT PRESSURE (CP)= 80.00000
RADIAL COORDINATES OF THE 1 POINTS (RC) ARE: .00000

DURATION OF MOVING LOAD (DUR) = 1.00000

NUMBER OF VISCOELASTIC LAYER (NVL) = 1

LAYER NUMBERS WHICH ARE VISCOELASTIC (LNV) = 1

CREEP TIMES (TYME) ARE:
.100E-02 .300E-02 .100E-01 .300E01 .100E+00 .300E+00 .100E+01 .300E+01 . 100E+02 .300E+02
.100E+03

FOR LAYER 1 TIME TEMPERATURE SHIFT FACTOR (BETA)= .11300 REFERENCE TEMPERATURE (TEMREF)= 77.00000

CREEP COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.589E-05 .676E-05 .776E-05 .891E-05 .102E-04 .117E-04 .134E-04 .153E-04 .177E-04 .200E-04 .232E-04

LAYER NO. 1 DIRICHLET SERIES FOR CREEP (GG) AT REFERENCE TEMPERATURE (TEMREF) OF 77.00000 ARE:
-.3015E-05 - .6485E-06 - .2508E-05 -.4060E-05 .5460E-06 -.8125E-05 .2336E-04

COMPUTED COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.605E-05 .656E-05 .776E-05 .899E-05 .101E-05 .117E-05 .135E-04 .154E-04 .173E-04 .203E-04 .231E-04

FOR PERIOD NO. 1 LAYER NO. AND TEMPERATURE ARE:
1 . 7000E+02

CREEP COMPLIANCES (CREEP) OF LAYER 1 AT TEMPERATURE (TEMP) OF 70.00000 ARE:
.580E-05 .590E-05 .622E-05 .696E-05 .835E-05 .940E-05 .108E-04 .123E-04 .144E-44 .161E-04 .185E-04

NUMBER OF LAYERS FOR BOTTOM TENSION (NLBT) = 0

NUMBER OF LAYERS FOR TOP COMPRESSION (NLTC) = 1

LAYER NO. FOR TOP COMPRESSION (LNTC) ARE: 3

LOAD REPETITIONS (TNLR) IN PERIOD 1 FOR EACH LOAD GROUP ARE: 3750.00

DAMAGE COEFFICENTS (FT) FOR TOP COMPRESSION OF LAYER 3 ARE: .1365E-08 .4477E+01

DAMAGE ANALYSIS OF PERIOD NO. 1 LOAD GROUP NO. 1

RADIAL VERTICAL VERTICAL VERTICAL RADIAL TANGENTIAL SHEAR VERTICAL RADIAL TANGENTIAL SHEAR
COORDINATE COORDINATE DISP STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
.00000 7.15010 .1351E+00 .2691E+02 .2153E+02 .2153E+02 .0000E+00 .4241E-02 .2120E-02 .2120E-02 0000E+00

AT TOP OF LAYER 3 COMPRESSIVE STRAIN = .4241E-02 ALLOWABLE LOAD REPETITIONS = .57167E+02 DAMAGE RATIO= .65597E+02

SUMMARY OF DAMAGE ANALYSIS

AT TOP OF LAYER 3 SUM OF DAMAGE RATIO= .65597E+02

MAXIMUM DAMAGE RATO= .65597E+02 DESIGN LIFE IN YEARS= .02

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* SECTION 17 DUAL TIRE LOAD 40 MPH HMA MR=370 KSI *

MATL = 3 FOR VISCOELASTIC LAYERED SYSTEM

NDAMA=1, SO DAMAGE ANALYSIS WILL BE PERFORMED

NUMBER OF PERIODS PER YEAR (NPY) = 1

NUMBER OF LOAD GROUPS (NLG) = 1

TOLERANCE FOR INTEGRATION (DEL) = .00100

NUMBER OF LAYERS (NL) = 3

NUMBER OF Z COORDINATES (NZ) = 1

LIMIT OF INTEGRATION CYCLES (ICL) = 80

COMPUTING CODE (NSTD) = 9

THICKNESS OF LAYERS (TH) ARE: 2.89000 4.26000

POISSON’S RATIOS OF LAYERS (PR) ARE: .35000 .30000 .30000

CONDITIONS OF INTERFACES (INT) ARE: 0 0

FOR PERIOD NO. 1 ELASTIC MODULI OF LAYERS ARE: .370000E+06 .238700E+05
.330000E+04

LOAD GROUP NO. 1 HAS 2 CONTACT AREAS
CONTACT RADIUS (CR) = 4.23000
CONTACT PRESSURE (CP)= 80.00000
NO. OF POINTS AT WHICH RESULTS ARE DESIRED (NPT) = 3
WHEEL SPACING ALONG X-AXIS (XW) = .00000
WHEEL SPACING ALONG Y-AXIS (YW) = 13.50000
POINT NO. AND X AND Y COORDIANTES ARE:
1 .00000 .00000 2 .00000 4.23 3 .00000 6.75000

DURATION OF MOVING LOAD(DUR) = .10000

NUMBER OF VISCOELASTIC LAYER (NVL) = 1

LAYER NUMBERS WHICH ARE VISCOELASTIC (LNV) = 1

CREEP TIMES (TYME) ARE:
.100E-02 .300E-02 .100E-01 .300E01 .100E+00 .300E+00 .100E+01 .300E+01 . 100E+02 .300E+02
.100E+03

FOR LAYER 1 TIME TEMPERATURE SHIFT FACTOR (BETA)= .11300 REFERENCE TEMPERATURE (TEMREF)= 77.00000

CREEP COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.589E-05 .676E-05 .776E-05 .891E-05 .102E-04 .117E-04 .134E-04 .153E-04 .177E-04 .200E-04 .232E-04

LAYER NO. 1 DIRICHLET SERIES FOR CREEP (GG) AT REFERENCE TEMPERATURE (TEMREF) OF 77.00000 ARE:
-.3015E-05 - .6485E-06 - .2508E-05 -.4060E-05 .5460E-06 -.8125E-05 .2336E-04

COMPUTED COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.605E-05 .656E-05 .776E-05 .899E-05 .101E-04 .117E-04 .135E-04 .154E-04 .173E-04 .203E-04 .231E-04

FOR PERIOD NO. 1 LAYER NO. AND TEMPERATURE ARE:
1 . 7000E+02

CREEP COMPLIANCES (CREEP) OF LAYER 1 AT TEMPERATURE (TEMP) OF 70.00000 ARE:
.580E-05 .590E-05 .622E-05 .696E-05 .835E-05 .940E-05 .108E-04 .123E-04 .144E-04 .161E-04 .185E-04

NUMBER OF LAYERS FOR BOTTOM TENSION (NLBT) = 0

NUMBER OF LAYERS FOR TOP COMPRESSION (NLTC) = 1

LAYER NO. FOR TOP COMPRESSION (LNTC) ARE: 3

LOAD REPETITIONS (TNLR) IN PERIOD 1 FOR EACH LOAD GROUP ARE: 3750.00

DAMAGE COEFFICENTS (FT) FOR TOP COMPRESSION OF LAYER 3 ARE: .1365E-08 .4477E+01

DAMAGE ANALYSIS OF PERIOD NO. 1 LOAD GROUP NO. 1

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR
MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN

1 7.15010 .1022E+00 .1688E+02 .1688E+02 .1404E+02 .1266E+02 .2629E-02 .2629E-02 .1042E-03 .1042E-03

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR
MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
2 7.15010 .1071E+00 .1632E+02 .1632E+02 .1401E+02 .1210E+02 .2571E-02 .2571E-02 .9088E-03 .9088E-03

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR
MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
3 7.15010 .1073E+00 .1576E+02 .1576E+02 .1367E+02 .1154E+02 .2483E-02 .2483E-02 .8209E-03 .8209E-03

AT TOP OF LAYER 3 COMPRESSIVE STRAIN = .2629E-02 ALLOWABLE LOAD REPETITIONS =
.48597+03 DAMAGE RATIO=
.77166E+01

SUMMARY OF DAMAGE ANALYSIS

AT TOP OF LAYER 3 SUM OF DAMAGE RATIO= .77166E+01

MAXIMUM DAMAGE RATO= .77166E+01 DESIGN LIFE IN YEARS= .13

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* SECTION 17 DUAL TIRE LOAD 60 MPH HMA MR=370 KSI *

MATL = 3 FOR VISCOELASTIC LAYERED SYSTEM

NDAMA=1, SO DAMAGE ANALYSIS WILL BE PERFORMED

NUMBER OF PERIODS PER YEAR (NPY) = 1

NUMBER OF LOAD GROUPS (NLG) = 1

TOLERANCE FOR INTEGRATION (DEL) = .00100

NUMBER OF LAYERS (NL) = 3

NUMBER OF Z COORDINATES (NZ) = 1

LIMIT OF INTEGRATION CYCLES (ICL) = 80

COMPUTING CODE (NSTD) = 9

THICKNESS OF LAYERS (TH) ARE: 2.89000 4.26000

POISSON'S RATIOS OF LAYERS (PR) ARE: .35000 .30000 .30000

CONDITIONS OF INTERFACES (INT) ARE: 0 0
FOR PERIOD NO. 1 ELASTIC MODULI OF LAYERS ARE: .370000E+06 .238700E+05
.330000E+04

LOAD GROUP NO. 1 HAS 2 CONTACT AREAS
CONTACT RADIUS (CR) = 4.23000
CONTACT PRESSURE (CP)= 80.00000
NO. OF POINTS AT WHICH RESULTS ARE DESIRED (NPT) = 3
WHEEL SPACING ALONG X-AXIS (XW) = .00000
WHEEL SPACING ALONG Y-AXIS (YW) = 13.50000

POINT NO. AND X AND Y COORDIANTES ARE:
1 .00000 .00000 2 .00000 4.23 3 .00000 6.75000

DURATION OF MOVING LOAD(DUR) = .03500

NUMBER OF VISCOELASTIC LAYER (NVL) = 1

LAYER NUMBERS WHICH ARE VISCOELASTIC (LNV) = 1

CREEP TIMES (TYME) ARE:
.100E-02 .300E-02 .100E-01 .300E01 .100E+00 .300E+00 .100E+01 .300E+01 .100E+02 .300E+02 .100E+03

FOR LAYER 1 TIME TEMPERATURE SHIFT FACTOR (BETA)= .11300 REFERENCE TEMPERATURE (TEMREF)= 77.00000

CREEP COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.589E-05 .676E-05 .776E-05 .891E-05 .102E-04 .117E-45 .134E-04 .153E-04 .177E-04 .200E-04 .232E-04

LAYER NO. 1 DIRICHLET SERIES FOR CREEP (GG) AT REFERENCE TEMPERATURE (TEMREF) OF 77.00000 ARE:
-.3015E-05 - .6485E-06 - .2508E-05 -.4060E-05 .5460E-06 -.8125E-05 .2336E-04

COMPUTED COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.605E-05 .656E-05 .776E-05 .899E-05 .101E-04 .117E-04 .135E-04 .154E-04 .173E-04 .203E-04 .231E-04

FOR PERIOD NO. 1 LAYER NO. AND TEMPERATURE ARE:
1 . 7000E+02

CREEP COMPLIANCES (CREEP) OF LAYER 1 AT TEMPERATURE (TEMP) OF 70.00000 ARE:
.580E-05 .590E-05 .622E-05 .696E-05 .835E-05 .940E-05 .108E-04 .123E-04 .144E-04 .161E-04 .185E-04

NUMBER OF LAYERS FOR BOTTOM TENSION (NLBT) = 0

NUMBER OF LAYERS FOR TOP COMPRESSION (NLTC) = 1

LAYER NO. FOR TOP COMPRESSION (LNTC) ARE: 3

LOAD REPETITIONS (TNLR) IN PERIOD 1 FOR EACH LOAD GROUP ARE: 3750.00

DAMAGE COEFFICENTS (FT) FOR TOP COMPRESSION OF LAYER 3 ARE: .1365E-08 .4477E+01

DAMAGE ANALYSIS OF PERIOD NO. 1 LOAD GROUP NO. 1

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
1 7.15010 .1008E+00 .1619E+02 .1619E+02 .1362E+02 .1229E+02 .2551E-02 .2551E-02 .1013E-02 .1013E-02

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
2 7.15010 .1057E+00 .1592E+02 .1592E+02 .1364E+02 .1183E+02 .2508E-02 .2508E-02 .8965E-03 .8965E-03

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
3 7.15010 .1060E+00 .1541E+02 .1541E+02 .1334E+02 .1132E+02 .2428E-02 .2428E-02 .8161E-03 .8161E-03

AT TOP OF LAYER 3 COMPRESSIVE STRAIN = .2551E-02 ALLOWABLE LOAD REPETITIONS =
.55614E+03   DAMAGE RATIO=
.67429E+01

SUMMARY OF DAMAGE ANALYSIS

AT TOP OF LAYER 3   SUM OF DAMAGE RATIO= .67429E+01

MAXIMUM DAMAGE RATO= .67429E+01   DESIGN LIFE IN YEARS= .15

NUMBER OF PROBLEMS TO BE SOLVED = 6

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* SECTION 18 PLATE LOAD HMA MR=250 KSI *

MATL = 3 FOR VISCOELASTIC LAYERED SYSTEM

NDAMA=1, SO DAMAGE ANALYSIS WILL BE PERFORMED

NUMBER OF PERIODS PER YEAR (NPY) = 1

NUMBER OF LOAD GROUPS (NLG) = 1

TOLERANCE FOR INTEGRATION (DEL) = .00100

NUMBER OF LAYERS (NL) = 3

NUMBER OF Z COORDINATES (NZ) = 0

LIMIT OF INTEGRATION CYCLES (ICL) = 80

COMPUTING CODE (NSTD) = 9

THICKNESS OF LAYERS (TH) ARE: 2.98000 6.11000

POISSON'S RATIOS OF LAYERS (PR) ARE: .35000 .30000 .30000

CONDITIONS OF INTERFACES (INT) ARE: 0 0

FOR PERIOD NO. 1 ELASTIC MODULI OF LAYERS ARE: .250000E+06 .237400E+05
.300000E+04

LOAD GROUP NO. 1 HAS 1 CONTACT AREAS
CONTACT RADIUS (CR) = 6.00000
CONTACT PRESSURE (CP)= 80.00000
RADIAL COORDINATES OF THE 1 POINTS (RC) ARE: .00000

DURATION OF MOVING LOAD (DUR) = 1.00000

NUMBER OF VISCOELASTIC LAYER (NVL) = 1

LAYER NUMBERS WHICH ARE VISCOELASTIC (LNV) = 1

CREEP TIMES (TYME) ARE:
.100E-02 .300E-02 .100E-01 .300E01 .100E+00 .300E+00 .100E+01 .300E+01 . 100E+02 .300E+02
.100E+03

FOR LAYER 1 TIME TEMPERATURE SHIFT FACTOR (BETA)= .11300 REFERENCE TEMPERATURE
(TEMREF)= 77.00000

CREEP COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.163E-05 .221E-05 .308E-05 .417E-05 .580E-05 .785E-05 .109E-04 .148E-04 .206E-04 .279E-04 .389E-04

LAYER NO. 1 DIRICHLET SERIES FOR CREEP (GG) AT REFERENCE TEMPERATURE (TEMREF) OF
77.00000 ARE:
-.1543E-05 - .1086E-05 - .1254E-05 -.8227E-05 .3934E-05 -.2991E-04 .3962E-04

COMPUTED COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.174E-05 .210E-05 .302E-05 .427E-05 .576E-05 .767E-05 .112E-04 .151E-04 .196E-04 .288E-04 .386E-04

FOR PERIOD NO. 1 LAYER NO. AND TEMPERATURE ARE:

1 . 7000E+02

CREEP COMPLIANCES (CREEP) OF LAYER 1 AT TEMPERATURE (TEMP) OF 70.00000 ARE:
.157E-05 .163E-05 .186E-05 .239E-05 .355E-05 .484E-05 .649E-05 .886E-05 .130E-04 .165E-04 .230E-04

NUMBER OF LAYERS FOR BOTTOM TENSION (NLBT) = 0

NUMBER OF LAYERS FOR TOP COMPRESSION (NLTC) = 1

LAYER NO. FOR TOP COMPRESSION (LNTC) ARE: 3

LOAD REPETITIONS (TNLR) IN PERIOD 1 FOR EACH LOAD GROUP ARE: 3750.00

DAMAGE COEFFICENTS (FT) FOR TOP COMPRESSION OF LAYER 3 ARE: .1365E-08 .4477E+01

DAMAGE ANALYSIS OF PERIOD NO. 1 LOAD GROUP NO. 1

RADIAL VERTICAL VERTICAL VERTICAL RADIAL TANGENTIAL SHEAR VERTICAL RADIAL TANGENTIAL SHEAR
COORDINATE COORDINATE DISP STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
.00000 9.09010 .1120E+00 .1585E+02 .1268E+02 .1268E+02 .0000E+00 .2747E-02 .1373E-02 .1373E-02 0000E+00

AT TOP OF LAYER 3 COMPRESSIVE STRAIN = .2747E-02 ALLOWABLE LOAD REPETITIONS = .39927E+03 DAMAGE RATIO= .93921E+01

SUMMARY OF DAMAGE ANALYSIS

AT TOP OF LAYER 3 SUM OF DAMAGE RATIO= .93921E+01

MAXIMUM DAMAGE RATO= .93921E+01 DESIGN LIFE IN YEARS= .11

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* SECTION 18 DUAL TIRE LOAD 40 MPH HMA MR=250 KSI *

MATL = 3 FOR VISCOELASTIC LAYERED SYSTEM

NDAMA=1, SO DAMAGE ANALYSIS WILL BE PERFORMED

NUMBER OF PERIODS PER YEAR (NPY) = 1

NUMBER OF LOAD GROUPS (NLG) = 1

TOLERANCE FOR INTEGRATION (DEL) = .00100

NUMBER OF LAYERS (NL) = 3

NUMBER OF Z COORDINATES (NZ) = 1

LIMIT OF INTEGRATION CYCLES (ICL) = 80

COMPUTING CODE (NSTD) = 9

THICKNESS OF LAYERS (TH) ARE: 2.98000 6.11000

POISSON’S RATIOS OF LAYERS (PR) ARE: .35000 .30000 .30000

CONDITIONS OF INTERFACES (INT) ARE: 0 0

FOR PERIOD NO. 1 ELASTIC MODULI OF LAYERS ARE: .250000E+06 .237400E+05 .300000E+04

LOAD GROUP NO. 1 HAS 2 CONTACT AREAS
CONTACT RADIUS (CR) = 4.23000
CONTACT PRESSURE (CP)= 80.00000
NO. OF POINTS AT WHICH RESULTS ARE DESIRED (NPT) = 3
WHEEL SPACING ALONG X-AXIS (XW) = .00000
WHEEL SPACING ALONG Y-AXIS (YW) = 13.50000
POINT NO. AND X AND Y COORDIANTES ARE:
1 .00000 .00000 2 .00000 4.23 3 .00000 6.75000

DURATION OF MOVING LOAD(DUR) = .10000

NUMBER OF VISCOELASTIC LAYER (NVL) = 1

LAYER NUMBERS WHICH ARE VISCOELASTIC (LNV) = 1

CREEP TIMES (TYME) ARE:
.100E-02 .300E-02 .100E-01 .300E01 .100E+00 .300E+00 .100E+01 .300E+01 . 100E+02 .300E+02 .100E+03

FOR LAYER 1 TIME TEMPERATURE SHIFT FACTOR (BETA)= .11300 REFERENCE TEMPERATURE (TEMREF)= 77.00000

CREEP COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.163E-05 .221E-05 .308E-05 .417E-05 .580E-05 .785E-45 .109E-04 .148E-04 .206E-04 .279E-04 .389E-04

LAYER NO. 1 DIRICHLET SERIES FOR CREEP (GG) AT REFERENCE TEMPERATURE (TEMREF) OF 77.00000 ARE:
-.1561E-05 - .1042E-05 - .1290E-05 -.8239E-05 .3897E-05 -.2985E-04 .3962E-04

COMPUTED COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.174E-05 .210E-05 .303E-05 .427E-05 .576E-05 .768E-05 .112E-04 .151E-04 .197E-04 .288E-04 .386E-04

FOR PERIOD NO. 1 LAYER NO. AND TEMPERATURE ARE:
1 . 7000E+02

CREEP COMPLIANCES (CREEP) OF LAYER 1 AT TEMPERATURE (TEMP) OF 70.00000 ARE:
.157E-05 .163E-05 .185E-05 .239E-05 .355E-05 .483E-05 .649E-05 .888E-05 .130E-04 .166E-04 .230E-04

NUMBER OF LAYERS FOR BOTTOM TENSION (NLBT) = 0

NUMBER OF LAYERS FOR TOP COMPRESSION (NLTC) = 1

LAYER NO. FOR TOP COMPRESSION (LNTC) ARE: 3

LOAD REPETITIONS (TNLR) IN PERIOD 1 FOR EACH LOAD GROUP ARE: 3750.00

DAMAGE COEFFICENTS (FT) FOR TOP COMPRESSION OF LAYER 3 ARE: .1365E-08 .4477E+01

DAMAGE ANALYSIS OF PERIOD NO. 1 LOAD GROUP NO. 1

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
1 9.09010 .8453E-01 .9112E+01 .9112E+01 .7590E+01 .6989E+01 .1579E-02 .1579E-02 .6594E-03 .6594E-03

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL

NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
2 9.09010 .8845E-01 .9556E+01 .9556E+01 .7969E+01 .7320E+01 .1656E-02 .1656E-02 .6875E-03 .6875E-03

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
3 9.09010 .8900E-01 .9541E+01 .9541E+01 .7974E+01 .7291E+01 .1654E-02 .1654E-02 .6789E-03 .6789E-03

AT TOP OF LAYER 3 COMPRESSIVE STRAIN = .1656E-02 ALLOWABLE LOAD REPETITIONS = .38449E+04 DAMAGE RATIO= .97531E+00

SUMMARY OF DAMAGE ANALYSIS

AT TOP OF LAYER 3 SUM OF DAMAGE RATIO= .97531E+00

MAXIMUM DAMAGE RATO= .97531E+00 DESIGN LIFE IN YEARS= 1.03

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* SECTION 17 DUAL TIRE LOAD 60 MPH HMA MR=250 KSI *

MATL = 3 FOR VISCOELASTIC LAYERED SYSTEM

NDAMA=1, SO DAMAGE ANALYSIS WILL BE PERFORMED

NUMBER OF PERIODS PER YEAR (NPY) = 1

NUMBER OF LOAD GROUPS (NLG) = 1

TOLERANCE FOR INTEGRATION (DEL) = .00100

NUMBER OF LAYERS (NL) = 3

NUMBER OF Z COORDINATES (NZ) = 1

LIMIT OF INTEGRATION CYCLES (ICL) = 80

COMPUTING CODE (NSTD) = 9

THICKNESS OF LAYERS (TH) ARE: 2.98000 6.11000

POISSON'S RATIOS OF LAYERS (PR) ARE: .35000 .30000 .30000

CONDITIONS OF INTERFACES (INT) ARE: 0 0
FOR PERIOD NO. 1 ELASTIC MODULI OF LAYERS ARE: .250000E+06 .237400E+05 .300000E+04

LOAD GROUP NO. 1 HAS 2 CONTACT AREAS
CONTACT RADIUS (CR) = 4.23000
CONTACT PRESSURE (CP)= 80.00000
NO. OF POINTS AT WHICH RESULTS ARE DESIRED (NPT) = 3
WHEEL SPACING ALONG X-AXIS (XW) = .00000
WHEEL SPACING ALONG Y-AXIS (YW) = 13.50000
POINT NO. AND X AND Y COORDIANTES ARE:
1 .00000 .00000 2 .00000 4.23 3 .00000 6.75000

DURATION OF MOVING LOAD(DUR) = .03500

NUMBER OF VISCOELASTIC LAYER (NVL) = 1

LAYER NUMBERS WHICH ARE VISCOELASTIC (LNV) = 1

CREEP TIMES (TYME) ARE:
.100E-02 .300E-02 .100E-01 .300E01 .100E+00 .300E+00 .100E+01 .300E+01 .100E+02 .300E+02 .100E+03

FOR LAYER 1 TIME TEMPERATURE SHIFT FACTOR (BETA)= .11300 REFERENCE TEMPERATURE (TEMREF)= 77.00000

CREEP COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.163E-05 .221E-05 .308E-05 .417E-05 .580E-05 .785E-45 .109E-04 .148E-04 .206E-04 .279E-04 .389E-04

LAYER NO. 1 DIRICHLET SERIES FOR CREEP (GG) AT REFERENCE TEMPERATURE (TEMREF) OF 77.00000 ARE:
-.1561E-05 - .1042E-05 - .1290E-05 -.8239E-05 .3897E-05 -.2985E-04 .3962E-04

COMPUTED COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.174E-05 .210E-05 .303E-05 .427E-05 .576E-05 .768E-05 .112E-04 .151E-04 .197E-04 .288E-04 .386E-04

FOR PERIOD NO. 1 LAYER NO. AND TEMPERATURE ARE:
1 . 7000E+02

CREEP COMPLIANCES (CREEP) OF LAYER 1 AT TEMPERATURE (TEMP) OF 70.00000 ARE:
.157E-05 .163E-05 .185E-05 .239E-05 .355E-05 .483E-05 .649E-05 .888E-05 .130E-04 .166E-04 .230E-04

NUMBER OF LAYERS FOR BOTTOM TENSION (NLBT) = 0

NUMBER OF LAYERS FOR TOP COMPRESSION (NLTC) = 1

LAYER NO. FOR TOP COMPRESSION (LNTC) ARE: 3

LOAD REPETITIONS (TNLR) IN PERIOD 1 FOR EACH LOAD GROUP ARE: 3750.00

DAMAGE COEFFICENTS (FT) FOR TOP COMPRESSION OF LAYER 3 ARE: .1365E-08 .4477E+01

DAMAGE ANALYSIS OF PERIOD NO. 1 LOAD GROUP NO. 1

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
1 9.09010 .8139E-01 .8436E+01 .8436E+01 .7015E+01 .6482E+01 .1462E-02 .1462E-02 .6156E-03 .6156E-03

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
2 9.09010 .8504E-01 .8868E+01 .8868E+01 .7376E+01 .6813E+01 .1537E-02 .1537E-02 .6466E-03 .6466E-03

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
3 9.09010 .8555E-01 .8867E+01 .8867E+01 .7388E+01 .6800E+01 .1537E-02 .1537E-02 .6410E-03 .6410E-03

AT TOP OF LAYER 3 COMPRESSIVE STRAIN = .1537E-02 ALLOWABLE LOAD REPETITIONS = .53716E+04 DAMAGE RATIO=
.69812E+00

SUMMARY OF DAMAGE ANALYSIS

AT TOP OF LAYER 3 SUM OF DAMAGE RATIO= .69812E+00

MAXIMUM DAMAGE RATO= .69812E+00 DESIGN LIFE IN YEARS= 1.43

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* SECTION 18 PLATE LOAD HMA MR=370 KSI *

MATL = 3 FOR VISCOELASTIC LAYERED SYSTEM

NDAMA=1, SO DAMAGE ANALYSIS WILL BE PERFORMED

NUMBER OF PERIODS PER YEAR (NPY) = 1

NUMBER OF LOAD GROUPS (NLG) = 1

TOLERANCE FOR INTEGRATION (DEL) = .00100

NUMBER OF LAYERS (NL) = 3

NUMBER OF Z COORDINATES (NZ) = 0

LIMIT OF INTEGRATION CYCLES (ICL) = 80

COMPUTING CODE (NSTD) = 9

THICKNESS OF LAYERS (TH) ARE: 2.98000 6.11000

POISSON'S RATIOS OF LAYERS (PR) ARE: .35000 .30000 .30000

CONDITIONS OF INTERFACES (INT) ARE: 0 0

FOR PERIOD NO. 1 ELASTIC MODULI OF LAYERS ARE: .370000E+06 .237400E+05
.300000E+04

LOAD GROUP NO. 1 HAS 1 CONTACT AREAS
CONTACT RADIUS (CR) = 6.00000
CONTACT PRESSURE (CP)= 80.00000
RADIAL COORDINATES OF THE 1 POINTS (RC) ARE: .00000

DURATION OF MOVING LOAD (DUR) = 1.00000

NUMBER OF VISCOELASTIC LAYER (NVL) = 1

LAYER NUMBERS WHICH ARE VISCOELASTIC (LNV) = 1

CREEP TIMES (TYME) ARE:
.100E-02 .300E-02 .100E-01 .300E01 .100E+00 .300E+00 .100E+01 .300E+01 . 100E+02 .300E+02
.100E+03

FOR LAYER 1 TIME TEMPERATURE SHIFT FACTOR (BETA)= .11300 REFERENCE TEMPERATURE
(TEMREF)= 77.00000

CREEP COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.589E-05 .676E-05 .776E-05 .891E-05 .102E-04 .117E-04 .134E-04 .153E-04 .177E-04 .200E-04 .232E-04

LAYER NO. 1 DIRICHLET SERIES FOR CREEP (GG) AT REFERENCE TEMPERATURE (TEMREF) OF
77.00000 ARE:
-.3015E-05 - .6485E-06 - .2508E-05 -.4060E-05 .5460E-06 -.8125E-05 .2336E-04

COMPUTED COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.605E-05 .656E-05 .776E-05 .899E-05 .101E-05 .117E-05 .135E-04 .154E-04 .173E-04 .203E-04 .231E-04

FOR PERIOD NO. 1 LAYER NO. AND TEMPERATURE ARE:
1 . 7000E+02

CREEP COMPLIANCES (CREEP) OF LAYER 1 AT TEMPERATURE (TEMP) OF 70.00000 ARE:
.580E-05 .590E-05 .622E-05 .696E-05 .835E-05 .940E-05 .108E-04 .123E-04 .144E-44 .161E-04 .185E-04

NUMBER OF LAYERS FOR BOTTOM TENSION (NLBT) = 0

NUMBER OF LAYERS FOR TOP COMPRESSION (NLTC) = 1

LAYER NO. FOR TOP COMPRESSION (LNTC) ARE: 3

LOAD REPETITIONS (TNLR) IN PERIOD 1 FOR EACH LOAD GROUP ARE: 3750.00

DAMAGE COEFFICENTS (FT) FOR TOP COMPRESSION OF LAYER 3 ARE: .1365E-08 .4477E+01

DAMAGE ANALYSIS OF PERIOD NO. 1 LOAD GROUP NO. 1

RADIAL VERTICAL VERTICAL VERTICAL RADIAL TANGENTIAL SHEAR VERTICAL RADIAL TANGENTIAL SHEAR
COORDINATE COORDINATE DISP STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
.00000 9.09010 .1242E+00 .1936E+02 .1549E+02 .1549E+02 .0000E+00 .3356E-02 .1678E-02 .1678E-02 0000E+00

AT TOP OF LAYER 3 COMPRESSIVE STRAIN = .3356E-02 ALLOWABLE LOAD REPETITIONS = .16296E+02 DAMAGE RATIO= .23012E+02

SUMMARY OF DAMAGE ANALYSIS

AT TOP OF LAYER 3 SUM OF DAMAGE RATIO= .23012E+02

MAXIMUM DAMAGE RATO= .23012E+02 DESIGN LIFE IN YEARS= .04

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* SECTION 17 DUAL TIRE LOAD 40 MPH HMA MR=370 KSI *

MATL = 3 FOR VISCOELASTIC LAYERED SYSTEM

NDAMA=1, SO DAMAGE ANALYSIS WILL BE PERFORMED

NUMBER OF PERIODS PER YEAR (NPY) = 1

NUMBER OF LOAD GROUPS (NLG) = 1

TOLERANCE FOR INTEGRATION (DEL) = .00100

NUMBER OF LAYERS (NL) = 3

NUMBER OF Z COORDINATES (NZ) = 1

LIMIT OF INTEGRATION CYCLES (ICL) = 80

COMPUTING CODE (NSTD) = 9

THICKNESS OF LAYERS (TH) ARE: 2.98000 6.11000

POISSON'S RATIOS OF LAYERS (PR) ARE: .35000 .30000 .30000

CONDITIONS OF INTERFACES (INT) ARE: 0 0

FOR PERIOD NO. 1 ELASTIC MODULI OF LAYERS ARE: .370000E+06 .237400E+05 .300000E+04

LOAD GROUP NO. 1 HAS 2 CONTACT AREAS
CONTACT RADIUS (CR) = 4.23000
CONTACT PRESSURE (CP)= 80.00000
NO. OF POINTS AT WHICH RESULTS ARE DESIRED (NPT) = 3
WHEEL SPACING ALONG X-AXIS (XW) = .00000
WHEEL SPACING ALONG Y-AXIS (YW) = 13.50000
POINT NO. AND X AND Y COORDIANTES ARE:
1 .00000 .00000 2 .00000 4.23 3 .00000 6.75000

DURATION OF MOVING LOAD(DUR) = .10000

NUMBER OF VISCOELASTIC LAYER (NVL) = 1

LAYER NUMBERS WHICH ARE VISCOELASTIC (LNV) = 1

CREEP TIMES (TYME) ARE:
.100E-02 .300E-02 .100E-01 .300E01 .100E+00 .300E+00 .100E+01 .300E+01 . 100E+02 .300E+02 .100E+03

FOR LAYER 1 TIME TEMPERATURE SHIFT FACTOR (BETA)= .11300 REFERENCE TEMPERATURE (TEMREF)= 77.00000

CREEP COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.589E-05 .676E-05 .776E-05 .891E-05 .102E-04 .117E-04 .134E-04 .153E-04 .177E-04 .200E-04 .232E-04

LAYER NO. 1 DIRICHLET SERIES FOR CREEP (GG) AT REFERENCE TEMPERATURE (TEMREF) OF 77.00000 ARE:
-.3015E-05 - .6485E-06 - .2508E-05 -.4060E-05 .5460E-06 -.8125E-05 .2336E-04

COMPUTED COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.605E-05 .656E-05 .776E-05 .899E-05 .101E-04 .117E-04 .135E-04 .154E-04 .173E-04 .203E-04 .231E-04

FOR PERIOD NO. 1 LAYER NO. AND TEMPERATURE ARE:
1 . 7000E+02

CREEP COMPLIANCES (CREEP) OF LAYER 1 AT TEMPERATURE (TEMP) OF 70.00000 ARE:
.580E-05 .590E-05 .622E-05 .696E-05 .835E-05 .940E-05 .108E-04 .123E-04 .144E-04 .161E-04 .185E-04

NUMBER OF LAYERS FOR BOTTOM TENSION (NLBT) = 0

NUMBER OF LAYERS FOR TOP COMPRESSION (NLTC) = 1

LAYER NO. FOR TOP COMPRESSION (LNTC) ARE: 3

LOAD REPETITIONS (TNLR) IN PERIOD 1 FOR EACH LOAD GROUP ARE: 3750.00

DAMAGE COEFFICENTS (FT) FOR TOP COMPRESSION OF LAYER 3 ARE: .1365E-08 .4477E+01

DAMAGE ANALYSIS OF PERIOD NO. 1 LOAD GROUP NO. 1

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN

1 9.09010 .9870E-01 .1259E+02 .1259E+02 .1506E+02 .9590E+01 .2183E-02 .2183E-02 .8813E-03 .8813E-03

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR
MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
2 9.09010 .1037E+00 .1290E+02 .1290E+02 .1091E+02 .9727E+02 .2235E-02 .2235E-02 .8620E-03 .8620E-03

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR
MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
3 9.09010 .1042E+00 .1273E+02 .1273E+02 .1082E+02 .9548E+01 .2207E-02 .2207E-02 .8272E-03 .8272E-03

AT TOP OF LAYER 3 COMPRESSIVE STRAIN = .2235E-02 ALLOWABLE LOAD REPETITIONS =
.10049+04 DAMAGE RATIO=
.37318E+01

SUMMARY OF DAMAGE ANALYSIS

AT TOP OF LAYER 3 SUM OF DAMAGE RATIO= .37318E+01

MAXIMUM DAMAGE RATO= .37318E+01 DESIGN LIFE IN YEARS= .27

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* SECTION 18 DUAL TIRE LOAD 60 MPH HMA MR=370 KSI *

MATL = 3 FOR VISCOELASTIC LAYERED SYSTEM

NDAMA=1, SO DAMAGE ANALYSIS WILL BE PERFORMED

NUMBER OF PERIODS PER YEAR (NPY) = 1

NUMBER OF LOAD GROUPS (NLG) = 1

TOLERANCE FOR INTEGRATION (DEL) = .00100

NUMBER OF LAYERS (NL) = 3

NUMBER OF Z COORDINATES (NZ) = 1

LIMIT OF INTEGRATION CYCLES (ICL) = 80

COMPUTING CODE (NSTD) = 9

THICKNESS OF LAYERS (TH) ARE: 2.98000 6.11000

POISSON'S RATIOS OF LAYERS (PR) ARE: .35000 .30000 .30000

CONDITIONS OF INTERFACES (INT) ARE: 0 0
FOR PERIOD NO. 1 ELASTIC MODULI OF LAYERS ARE: .370000E+06 .237400E+05
.300000E+04

LOAD GROUP NO. 1 HAS 2 CONTACT AREAS
CONTACT RADIUS (CR) = 4.23000
CONTACT PRESSURE (CP)= 80.00000
NO. OF POINTS AT WHICH RESULTS ARE DESIRED (NPT) = 3
WHEEL SPACING ALONG X-AXIS (XW) = .00000
WHEEL SPACING ALONG Y-AXIS (YW) = 13.50000

POINT NO. AND X AND Y COORDIANTES ARE:
1 .00000 .00000 2 .00000 4.23 3 .00000 6.75000

DURATION OF MOVING LOAD(DUR) = .03500

NUMBER OF VISCOELASTIC LAYER (NVL) = 1

LAYER NUMBERS WHICH ARE VISCOELASTIC (LNV) = 1

CREEP TIMES (TYME) ARE:
.100E-02 .300E-02 .100E-01 .300E01 .100E+00 .300E+00 .100E+01 .300E+01 .100E+02 .300E+02 .100E+03

FOR LAYER 1 TIME TEMPERATURE SHIFT FACTOR (BETA)= .11300 REFERENCE TEMPERATURE (TEMREF)= 77.00000

CREEP COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.589E-05 .676E-05 .776E-05 .891E-05 .102E-04 .117E-45 .134E-04 .153E-04 .177E-04 .200E-04 .232E-04

LAYER NO. 1 DIRICHLET SERIES FOR CREEP (GG) AT REFERENCE TEMPERATURE (TEMREF) OF 77.00000 ARE:
-.3015E-05 - .6485E-06 - .2508E-05 -.4060E-05 .5460E-06 -.8125E-05 .2336E-04

COMPUTED COMPLIANCES (CREEP) AT REFERENCE TEEMPERATURE (TEMREF) OF 77.00000 ARE:
.605E-05 .656E-05 .776E-05 .899E-05 .101E-04 .117E-04 .135E-04 .154E-04 .173E-04 .203E-04 .231E-04

FOR PERIOD NO. 1 LAYER NO. AND TEMPERATURE ARE:
1 . 7000E+02

CREEP COMPLIANCES (CREEP) OF LAYER 1 AT TEMPERATURE (TEMP) OF 70.00000 ARE:
.580E-05 .590E-05 .622E-05 .696E-05 .835E-05 .940E-05 .108E-04 .123E-04 .144E-04 .161E-04 .185E-04

NUMBER OF LAYERS FOR BOTTOM TENSION (NLBT) = 0

NUMBER OF LAYERS FOR TOP COMPRESSION (NLTC) = 1

LAYER NO. FOR TOP COMPRESSION (LNTC) ARE: 3

LOAD REPETITIONS (TNLR) IN PERIOD 1 FOR EACH LOAD GROUP ARE: 3750.00

DAMAGE COEFFICENTS (FT) FOR TOP COMPRESSION OF LAYER 3 ARE: .1365E-08 .4477E+01

DAMAGE ANALYSIS OF PERIOD NO. 1 LOAD GROUP NO. 1

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
1 9.09010 .9768E-01 .1231E+02 .1231E+02 .1032E+02 .9379E+01 .2134E-02 .2134E-02 .8633E-03 .8633E-03

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
2 9.09010 .1026E+00 .1264E+02 .1264E+02 .1068E+02 .9550E+01 .2192E-02 .2192E-02 .8509E-03 .8509E-03

POINT VERTICAL VERTICAL VERTICAL MAJOR INTERMEDIATE MINOR VERTICAL MAJOR MINOR HORIZONTAL
PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL PRINCIPAL
NO. COORDINATE DISP. STRESS STRESS STRESS STRESS STRAIN STRAIN STRAIN STRAIN
3 9.09010 .1032E+00 .1250E+02 .1250E+02 .1061E+02 .9390E+01 .2167E-02 .2167E-02 .8193E-03 .8193E-03

AT TOP OF LAYER 3 COMPRESSIVE STRAIN = .2192E-02 ALLOWABLE LOAD REPETITIONS =
.10977E+03   DAMAGE RATIO=
.34164E+01

SUMMARY OF DAMAGE ANALYSIS

AT TOP OF LAYER 3   SUM OF DAMAGE RATIO= .34164E+01

MAXIMUM DAMAGE RATO= .34164E+01   DESIGN LIFE IN YEARS= .29

Appendix D - Dual Tire to ESAL Conversion Data

Conversion from Dual Tire Loads to ESAL - Section No. 3 @ 40 mph
Complete load data
HMA M_R = 250 ksi

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	L_x (kips)	β_x	β_{18}	$-G_t$	Log $[W_{tx}/W_{t18}]$	EALF	W_{18}
1	200	14.2	2840	7621	15.24	4.276	6.833	0.089	0.3185	0.4803	1364
2	200	14.2	2840	8497	16.99	5.797	6.833	0.089	0.1108	0.7747	2200
3	200	14.2	2840	8834	17.67	6.477	6.833	0.089	0.0360	0.9205	2614
4	200	14.2	2840	8774	17.55	6.352	6.833	0.089	0.0491	0.8931	2536
5	200	14.2	2840	8726	17.45	6.253	6.833	0.089	0.0597	0.8716	2475
6	200	14.2	2840	8922	17.84	6.664	6.833	0.089	0.0168	0.9620	2732
7	200	14.2	2840	8593	17.19	5.985	6.833	0.089	0.0892	0.8142	2312
8	200	14.2	2840	8967	17.93	6.762	6.833	0.089	0.0071	0.9838	2794
sum	1600									Total ESAL =	19029

Load Data to 1.0 in displacement - Section No. 3 @ 40 mph
Displacement during seating load (25 cycles) = 0.10 in

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	L_x (kips)	β_x	β_{18}	$-G_t$	Log $[W_{tx}/W_{t18}]$	EALF	W_{18}
1	175	14.2	2485	7621	15.24	4.276	6.833	0.089	0.3185	0.4803	1194
2	200	14.2	2840	8497	16.99	5.797	6.833	0.089	0.1108	0.7747	2200
3	200	14.2	2840	8834	17.67	6.477	6.833	0.089	0.0360	0.9205	2614
4	200	14.2	2840	8774	17.55	6.352	6.833	0.089	0.0491	0.8931	2536
5	200	14.2	2840	8726	17.45	6.253	6.833	0.089	0.0597	0.8716	2475
6	200	14.2	2840	8922	17.84	6.664	6.833	0.089	0.0168	0.9620	2732
7	200	14.2	2840	8593	17.19	5.985	6.833	0.089	0.0892	0.8142	2312
8	215	14.2	3053	8967	17.93	6.762	6.833	0.089	0.0071	0.9838	3003
sum	1590									Total ESAL =	19068

Conversion from Dual Tire Loads to ESAL - Section No. 3 @ 60 mph
Complete load data
HMA M_R = 250 ksi

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	L_x (kips)	β_x	β_{18}	$-G_t$	Log $[W_{tx}/W_{t18}]$	EALF	W_{18}
1	200	19.1	3820	7621	15.24	4.276	6.833	0.089	0.3185	0.4803	1835
2	200	19.1	3820	8497	16.99	5.797	6.833	0.089	0.1108	0.7747	2960
3	200	19.1	3820	8834	17.67	6.477	6.833	0.089	0.0360	0.9205	3516
4	200	19.1	3820	8774	17.55	6.352	6.833	0.089	0.0491	0.8931	3412
5	200	19.1	3820	8726	17.45	6.253	6.833	0.089	0.0597	0.8716	3330
6	200	19.1	3820	8922	17.84	6.664	6.833	0.089	0.0168	0.9620	3675
7	200	19.1	3820	8593	17.19	5.985	6.833	0.089	0.0892	0.8142	3110
8	200	19.1	3820	8967	17.93	6.762	6.833	0.089	0.0071	0.9838	3758
sum	1600									Total ESAL =	25595

Load Data to 1.0 in displacement - Section No. 3 @ 60 mph
Displacement during seating load (25 cycles) = 0.10 in

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	L_x (kips)	β_x	β_{18}	$-G_t$	Log $[W_{tx}/W_{t18}]$	EALF	W_{18}
1	175	19.1	3342.5	7621	15.24	4.276	6.833	0.089	0.3185	0.4803	1605
2	200	19.1	3820	8497	16.99	5.797	6.833	0.089	0.1108	0.7747	2960
3	200	19.1	3820	8834	17.67	6.477	6.833	0.089	0.0360	0.9205	3516
4	200	19.1	3820	8774	17.55	6.352	6.833	0.089	0.0491	0.8931	3412
5	200	19.1	3820	8726	17.45	6.253	6.833	0.089	0.0597	0.8716	3330
6	200	19.1	3820	8922	17.84	6.664	6.833	0.089	0.0168	0.9620	3675
7	200	19.1	3820	8593	17.19	5.985	6.833	0.089	0.0892	0.8142	3110
8	215	19.1	4106.5	8967	17.93	6.762	6.833	0.089	0.0071	0.9838	4040
sum	1590									Total ESAL =	25648

Conversion from Dual Tire Loads to ESAL - Section No. 3' @ 40 mph
Complete load data
HMA M_R = 370 ksi

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	L_x (kips)	β_x	β_{18}	$-G_t$	Log $[W_{tx}/W_{t18}]$	EALF	W_{18}
1	200	8.8	1760	7621	15.24	3.12	4.915	0.089	0.3159	0.4832	850
2	200	8.8	1760	8497	16.99	4.187	4.915	0.089	0.1100	0.7762	1366
3	200	8.8	1760	8834	17.67	4.665	4.915	0.089	0.0357	0.9211	1621
4	200	8.8	1760	8774	17.55	4.577	4.915	0.089	0.0488	0.8938	1573
5	200	8.8	1760	8726	17.45	4.507	4.915	0.089	0.0592	0.8725	1536
6	200	8.8	1760	8922	17.84	4.796	4.915	0.089	0.0167	0.9623	1694
7	200	8.8	1760	8593	17.19	4.319	4.915	0.089	0.0886	0.8155	1435
8	200	8.8	1760	8967	17.93	4.864	4.915	0.089	0.0071	0.9839	1732
sum	1600									Total ESAL =	11807

Load Data to 1.0 in displacement ESAL - Section No. 3' @ 40 mph
Displacement during seating load (25 cycles) = 0.10 in

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	L_x (kips)	β_x	β_{18}	$-G_t$	Log $[W_{tx}/W_{t18}]$	EALF	W_{18}
1	175	8.8	1540	7621	15.24	3.12	4.915	0.089	0.3159	0.4832	744
2	200	8.8	1760	8497	16.99	4.187	4.915	0.089	0.1100	0.7762	1366
3	200	8.8	1760	8834	17.67	4.665	4.915	0.089	0.0357	0.9211	1621
4	200	8.8	1760	8774	17.55	4.577	4.915	0.089	0.0488	0.8938	1573
5	200	8.8	1760	8726	17.45	4.507	4.915	0.089	0.0592	0.8725	1536
6	200	8.8	1760	8922	17.84	4.796	4.915	0.089	0.0167	0.9623	1694
7	200	8.8	1760	8593	17.19	4.319	4.915	0.089	0.0886	0.8155	1435
8	215	8.8	1892	8967	17.93	4.864	4.915	0.089	0.0071	0.9839	1862
sum	1590									Total ESAL =	11830

Conversion from Dual Tire Loads to ESAL - Section No. 3' @ 60 mph
Complete load data
HMA M_R = 370 ksi

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	L_x (kips)	β_x	β_{18}	$-G_t$	Log $[W_{tx}/W_{t18}]$	EALF	W_{18}
1	200	9.8	1960	7621	15.24	3.12	4.915	0.089	0.3159	0.4832	947
2	200	9.8	1960	8497	16.99	4.187	4.915	0.089	0.1100	0.7762	1521
3	200	9.8	1960	8834	17.67	4.665	4.915	0.089	0.0357	0.9211	1805
4	200	9.8	1960	8774	17.55	4.577	4.915	0.089	0.0488	0.8938	1752
5	200	9.8	1960	8726	17.45	4.507	4.915	0.089	0.0592	0.8725	1710
6	200	9.8	1960	8922	17.84	4.796	4.915	0.089	0.0167	0.9623	1886
7	200	9.8	1960	8593	17.19	4.319	4.915	0.089	0.0886	0.8155	1598
8	200	9.8	1960	8967	17.93	4.864	4.915	0.089	0.0071	0.9839	1928
sum	1600									Total ESAL =	13149

Load Data to 1.0 in displacement - Section No. 3' @ 60 mph
Displacement during seating load (25 cycles) = 0.10 in

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	L_x (kips)	β_x	β_{18}	$-G_t$	Log $[W_{tx}/W_{t18}]$	EALF	W_{18}
1	175	9.8	1715	7621	15.24	3.12	4.915	0.089	0.3159	0.4832	829
2	200	9.8	1960	8497	16.99	4.187	4.915	0.089	0.1100	0.7762	1521
3	200	9.8	1960	8834	17.67	4.665	4.915	0.089	0.0357	0.9211	1805
4	200	9.8	1960	8774	17.55	4.577	4.915	0.089	0.0488	0.8938	1752
5	200	9.8	1960	8726	17.45	4.507	4.915	0.089	0.0592	0.8725	1710
6	200	9.8	1960	8922	17.84	4.796	4.915	0.089	0.0167	0.9623	1886
7	200	9.8	1960	8593	17.19	4.319	4.915	0.089	0.0886	0.8155	1598
8	215	9.8	2107	8967	17.93	4.864	4.915	0.089	0.0071	0.9839	2073
sum	1590									Total ESAL =	13175

Conversion from Dual Tire Loads to ESAL - Section No. 4 @ 40 mph
Complete load data
HMA M_R = 250 ksi

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	L_x (kips)	β_x	β_{18}	$-G_t$	Log $[W_{tx}/W_{t18}]$	EALF	W_{18}
1	200	14.4	2880	7266	14.53	2.592	4.603	0.089	0.4043	0.3942	1135
2	100	14.4	1440	8403	16.81	3.808	4.603	0.089	0.1310	0.7396	1065
3	200	14.4	2880	8618	17.24	4.081	4.603	0.089	0.0829	0.8262	2380
4	200	14.4	2880	8834	17.67	4.370	4.603	0.089	0.0356	0.9212	2653
5	200	14.4	2880	9149	18.3	4.819	4.603	0.089	-0.0315	1.0752	3097
6	200	14.4	2880	8892	17.78	4.450	4.603	0.089	0.0231	0.9481	2731
7	200	14.4	2880	9165	18.33	4.843	4.603	0.089	-0.0349	1.0836	3121
8	200	14.4	2880	9052	18.1	4.677	4.603	0.089	-0.0110	1.0258	2954
sum	1500									Total ESAL =	19135

Load Data to 1.0 in displacement ESAL - Section No. 4 @ 40 mph
Displacement during seating load (25 cycles) = 0.10 in

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	L_x (kips)	β_x	β_{18}	$-G_t$	Log $[W_{tx}/W_{t18}]$	EALF	W_{18}
1	175	14.4	2520	7621	15.24	2.932	4.603	0.089	0.3153	0.4839	1219
2	100	14.4	1440	8497	16.99	3.925	4.603	0.089	0.1098	0.7765	1118
3	200	14.4	2880	8834	17.67	4.370	4.603	0.089	0.0356	0.9212	2653
4	200	14.4	2880	8774	17.55	4.288	4.603	0.089	0.0487	0.8940	2575
5	205	14.4	2952	8726	17.45	4.224	4.603	0.089	0.0591	0.8727	2576
sum	880									Total ESAL =	10142

Conversion from Dual Tire Loads to ESAL - Section No. 4 @ 60 mph
Complete load data
HMA M_R = 250 ksi

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	L_x (kips)	β_x	β_{18}	$-G_t$	Log $[W_{tx}/W_{t18}]$	EALF	W_{18}
1	200	20.6	4120	7266	14.53	2.592	4.603	0.089	0.4043	0.3942	1624
2	200	20.6	4120	8403	16.81	3.808	4.603	0.089	0.1310	0.7396	3047
3	200	20.6	4120	8618	17.24	4.081	4.603	0.089	0.0829	0.8262	3404
4	200	20.6	4120	8834	17.67	4.370	4.603	0.089	0.0356	0.9212	3795
5	200	20.6	4120	9149	18.3	4.819	4.603	0.089	-0.0315	1.0752	4430
6	200	20.6	4120	8892	17.78	4.450	4.603	0.089	0.0231	0.9481	3906
7	200	20.6	4120	9165	18.33	4.843	4.603	0.089	-0.0349	1.0836	4464
8	200	20.6	4120	9052	18.1	4.677	4.603	0.089	-0.0110	1.0258	4226
sum	1600									Total ESAL =	28898

Load Data to 1.0 in displacement- Section No. 4 @ 60 mph
Displacement during seating load (25 cycles) = 0.10 in

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	L_x (kips)	β_x	β_{18}	$-G_t$	Log $[W_{tx}/W_{t18}]$	EALF	W_{18}
1	175	20.6	3605	7621	15.24	2.932	4.603	0.089	0.3153	0.4839	1744
2	100	20.6	2060	8497	16.99	3.925	4.603	0.089	0.1098	0.7765	1600
3	200	20.6	4120	8834	17.67	4.370	4.603	0.089	0.0356	0.9212	3795
4	200	20.6	4120	8774	17.55	4.288	4.603	0.089	0.0487	0.8940	3683
5	205	20.6	4223	8726	17.45	4.224	4.603	0.089	0.0591	0.8727	3685
sum	880									Total ESAL =	14508

Conversion from Dual Tire Loads to ESAL - Section No. 4' @ 40 mph
Complete load data
HMA M_R = 370 ksi

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	L_x (kips)	β_x	β_{18}	$-G_t$	Log $[W_{tx}/W_{t18}]$	EALF	W_{18}
1	200	8.9	1780	7266	14.53	1.903	3.283	0.089	0.3996	0.3985	709
2	100	8.9	890	8403	16.81	2.737	3.283	0.089	0.1296	0.7420	660
3	200	8.9	1780	8618	17.24	2.925	3.283	0.089	0.0821	0.8278	1474
4	200	8.9	1780	8834	17.67	3.123	3.283	0.089	0.0353	0.9220	1641
5	200	8.9	1780	9149	18.3	3.431	3.283	0.089	-0.0312	1.0745	1913
6	200	8.9	1780	8892	17.78	3.178	3.283	0.089	0.0229	0.9487	1689
7	200	8.9	1780	9165	18.33	3.448	3.283	0.089	-0.0345	1.0827	1927
8	200	8.9	1780	9052	18.1	3.334	3.283	0.089	-0.0109	1.0255	1825
sum	1500									Total ESAL =	11838

Load Data to 1.0 in displacement ESAL - Section No. 4' @ 40 mph
Displacement during seating load (25 cycles) = 0.10 in

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	L_x (kips)	β_x	β_{18}	$-G_t$	Log $[W_{tx}/W_{t18}]$	EALF	W_{18}
1	175	8.9	1557.5	7621	15.24	2.137	3.283	0.089	0.3117	0.4878	760
2	100	8.9	890	8497	16.99	2.818	3.283	0.089	0.1087	0.7786	693
3	200	8.9	1780	8834	17.67	3.123	3.283	0.089	0.0353	0.9220	1641
4	200	8.9	1780	8774	17.55	3.067	3.283	0.089	0.0482	0.8950	1593
5	205	8.9	1824.5	8726	17.45	3.023	3.283	0.089	0.0586	0.8739	1594
sum	880									Total ESAL =	6281

Conversion from Dual Tire Loads to ESAL - Section No. 4' @ 60 mph
Complete load data
HMA M_R = 370 ksi

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	L_x (kips)	β_x	β_{18}	$-G_t$	Log $[W_{tx}/W_{t18}]$	EALF	W_{18}
1	200	9.9	1980	7266	14.53	1.903	3.283	0.089	0.3996	0.3985	789
2	200	9.9	1980	8403	16.81	2.737	3.283	0.089	0.1296	0.7420	1469
3	200	9.9	1980	8618	17.24	2.925	3.283	0.089	0.0821	0.8278	1639
4	200	9.9	1980	8834	17.67	3.123	3.283	0.089	0.0353	0.9220	1825
5	200	9.9	1980	9149	18.3	3.431	3.283	0.089	-0.0312	1.0745	2127
6	200	9.9	1980	8892	17.78	3.178	3.283	0.089	0.0229	0.9487	1878
7	200	9.9	1980	9165	18.33	3.448	3.283	0.089	-0.0345	1.0827	2144
8	200	9.9	1980	9052	18.1	3.334	3.283	0.089	-0.0109	1.0255	2031
sum	1600									Total ESAL =	13903

Load Data to 1.0 in displacement ESAL - Section No. 4' @ 60 mph
Displacement during seating load (25 cycles) = 0.10 in

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	L_x (kips)	β_x	β_{18}	$-G_t$	Log $[W_{tx}/W_{t18}]$	EALF	W_{18}
1	175	9.9	1732.5	7621	15.24	2.137	3.283	0.089	0.3117	0.4878	845
2	100	9.9	990	8497	16.99	2.818	3.283	0.089	0.1087	0.7786	771
3	200	9.9	1980	8834	17.67	3.123	3.283	0.089	0.0353	0.9220	1825
4	200	9.9	1980	8774	17.55	3.067	3.283	0.089	0.0482	0.8950	1772
5	205	9.9	2029.5	8726	17.45	3.023	3.283	0.089	0.0586	0.8739	1774
sum	880									Total ESAL =	6987

Conversion from Dual Tire Loads to ESAL - Section No. 5 @ 40 mph
Complete load data
HMA M_R = 250 ksi

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	L_x (kips)	β_x	β_{18}	$-G_t$	Log $[W_{tx}/W_{t18}]$	EALF	W_{18}
1	27	16.8	454	7100	14.20	2.989	5.723	0.089	0.4500	0.3548	161
2	29	16.8	487	7317	14.63	3.236	5.723	0.089	0.3937	0.4039	197
3	200	16.8	3360	7050	14.10	2.935	5.723	0.089	0.4632	0.3442	1157
4	200	16.8	3360	7756	15.51	3.783	5.723	0.089	0.2840	0.5200	1747
5	200	16.8	3360	7800	15.60	3.842	5.723	0.089	0.2733	0.5330	1791
6	178	16.8	2990	8032	16.06	4.162	5.723	0.089	0.2177	0.6057	1811
7	200	16.8	3360	7548	15.10	3.515	5.723	0.089	0.3353	0.4621	1553
8	200	16.8	3360	7838	15.68	3.893	5.723	0.089	0.2641	0.5444	1829
9	200	16.8	3360	7557	15.11	3.527	5.723	0.089	0.3330	0.4645	1561
10	200	16.8	3360	7444	14.89	3.387	5.723	0.089	0.3614	0.4351	1462
sum	1634									Total ESAL =	13268

Load Data to 1.0 in displacement ESAL - Section No. 5 @ 40 mph
Displacement during seating load (25 cycles) = 0.08 in

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	L_x (kips)	β_x	β_{18}	$-G_t$	Log $[W_{tx}/W_{t18}]$	EALF	W_{18}
1	2	16.8	34	7100	14.20	2.989	5.723	0.089	0.4500	0.3548	12
2	29	16.8	487	7317	14.63	3.236	5.723	0.089	0.3937	0.4039	197
3	200	16.8	3360	7050	14.10	2.935	5.723	0.089	0.4632	0.3442	1157
4	200	16.8	3360	7756	15.51	3.783	5.723	0.089	0.2840	0.5200	1747
5	200	16.8	3360	7800	15.60	3.842	5.723	0.089	0.2733	0.5330	1791
6	178	16.8	2990	8032	16.06	4.162	5.723	0.089	0.2177	0.6057	1811
7	200	16.8	3360	7548	15.10	3.515	5.723	0.089	0.3353	0.4621	1553
8	200	16.8	3360	7838	15.68	3.893	5.723	0.089	0.2641	0.5444	1829
9	200	16.8	3360	7557	15.11	3.527	5.723	0.089	0.3330	0.4645	1561
10	1516	16.8	25469	7444	14.89	3.387	5.723	0.089	0.3614	0.4351	11082
sum	2925									Total ESAL =	22739

Conversion from Dual Tire Loads to ESAL - Section No. 5 @ 60 mph
Complete load data
HMA M_R = 250 ksi

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	L_x (kips)	β_x	β_{18}	$-G_t$	Log $[W_{tx}/W_{t18}]$	EALF	W_{18}
1	27	23.3	629	7100	14.20	2.989	5.723	0.089	0.4500	0.3548	223
2	29	23.3	676	7317	14.63	3.236	5.723	0.089	0.3937	0.4039	273
3	200	23.3	4660	7050	14.10	2.935	5.723	0.089	0.4632	0.3442	1604
4	200	23.3	4660	7756	15.51	3.783	5.723	0.089	0.2840	0.5200	2423
5	200	23.3	4660	7800	15.60	3.842	5.723	0.089	0.2733	0.5330	2484
6	178	23.3	4147	8032	16.06	4.162	5.723	0.089	0.2177	0.6057	2512
7	200	23.3	4660	7548	15.10	3.515	5.723	0.089	0.3353	0.4621	2153
8	200	23.3	4660	7838	15.68	3.893	5.723	0.089	0.2641	0.5444	2537
9	200	23.3	4660	7557	15.11	3.527	5.723	0.089	0.3330	0.4645	2164
10	200	23.3	4660	7444	14.89	3.387	5.723	0.089	0.3614	0.4351	2028
sum	1634									Total ESAL =	18401

Load Data to 1.0 in displacement ESAL - Section No. 5 @ 60 mph
Displacement during seating load (25 cycles) = 0.08 in

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	L_x (kips)	β_x	β_{18}	$-G_t$	Log $[W_{tx}/W_{t18}]$	EALF	W_{18}
1	2	23.3	47	7100	14.20	2.989	5.723	0.089	0.4500	0.3548	17
2	29	23.3	676	7317	14.63	3.236	5.723	0.089	0.3937	0.4039	273
3	200	23.3	4660	7050	14.10	2.935	5.723	0.089	0.4632	0.3442	1604
4	200	23.3	4660	7756	15.51	3.783	5.723	0.089	0.2840	0.5200	2423
5	200	23.3	4660	7800	15.60	3.842	5.723	0.089	0.2733	0.5330	2484
6	178	23.3	4147	8032	16.06	4.162	5.723	0.089	0.2177	0.6057	2512
7	200	23.3	4660	7548	15.10	3.515	5.723	0.089	0.3353	0.4621	2153
8	200	23.3	4660	7838	15.68	3.893	5.723	0.089	0.2641	0.5444	2537
9	200	23.3	4660	7557	15.11	3.527	5.723	0.089	0.3330	0.4645	2164
10	1516	23.3	35323	7444	14.89	3.387	5.723	0.089	0.3614	0.4351	15370
sum	2925									Total ESAL =	31537

Conversion from Dual Tire Loads to ESAL - Section No. 5' @ 40 mph
Complete load data
HMA M_R = 370 ksi

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	L_x (kips)	β_x	β_{18}	$-G_t$	Log $[W_{tx}/W_{t18}]$	EALF	W_{18}
1	27	9.2	248	7100	14.20	2.146	3.99	0.089	0.4450	0.3589	89
2	29	9.2	267	7317	14.63	2.312	3.99	0.089	0.3895	0.4079	109
3	200	9.2	1840	7050	14.10	2.109	3.99	0.089	0.4581	0.3483	641
4	200	9.2	1840	7756	15.51	2.681	3.99	0.089	0.2811	0.5235	963
5	200	9.2	1840	7800	15.60	2.721	3.99	0.089	0.2705	0.5364	987
6	178	9.2	1638	8032	16.06	2.937	3.99	0.089	0.2156	0.6087	997
7	200	9.2	1840	7548	15.10	2.501	3.99	0.089	0.3318	0.4658	857
8	200	9.2	1840	7838	15.68	2.755	3.99	0.089	0.2614	0.5477	1008
9	200	9.2	1840	7557	15.11	2.509	3.99	0.089	0.3296	0.4682	862
10	200	9.2	1840	7444	14.89	2.415	3.99	0.089	0.3576	0.4390	808
sum	1634									Total ESAL =	7320

Load Data to 1.0 in displacement ESAL - Section No. 5' @ 40 mph
Displacement during seating load (25 cycles) = 0.08 in

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	L_x (kips)	β_x	β_{18}	$-G_t$	Log $[W_{tx}/W_{t18}]$	EALF	W_{18}
1	2	9.2	18	7100	14.20	2.146	3.99	0.089	0.4450	0.3589	7
2	29	9.2	267	7317	14.63	2.312	3.99	0.089	0.3895	0.4079	109
3	200	9.2	1840	7050	14.10	2.109	3.99	0.089	0.4581	0.3483	641
4	200	9.2	1840	7756	15.51	2.681	3.99	0.089	0.2811	0.5235	963
5	200	9.2	1840	7800	15.60	2.721	3.99	0.089	0.2705	0.5364	987
6	178	9.2	1638	8032	16.06	2.937	3.99	0.089	0.2156	0.6087	997
7	200	9.2	1840	7548	15.10	2.501	3.99	0.089	0.3318	0.4658	857
8	200	9.2	1840	7838	15.68	2.755	3.99	0.089	0.2614	0.5477	1008
9	200	9.2	1840	7557	15.11	2.509	3.99	0.089	0.3296	0.4682	862
10	1516	9.2	13947	7444	14.89	2.415	3.99	0.089	0.3576	0.4390	6122
sum	2925									Total ESAL =	12552

Conversion from Dual Tire Loads to ESAL - Section No. 5' @ 60 mph
Complete load data
HMA M_R = 370 ksi

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	L_x (kips)	β_x	β_{18}	$-G_t$	Log $[W_{tx}/W_{t18}]$	EALF	W_{18}
1	27	10.4	281	7100	14.20	2.146	3.99	0.089	0.4450	0.3589	101
2	29	10.4	302	7317	14.63	2.312	3.99	0.089	0.3895	0.4079	123
3	200	10.4	2080	7050	14.10	2.109	3.99	0.089	0.4581	0.3483	724
4	200	10.4	2080	7756	15.51	2.681	3.99	0.089	0.2811	0.5235	1089
5	200	10.4	2080	7800	15.60	2.721	3.99	0.089	0.2705	0.5364	1116
6	178	10.4	1851	8032	16.06	2.937	3.99	0.089	0.2156	0.6087	1127
7	200	10.4	2080	7548	15.10	2.501	3.99	0.089	0.3318	0.4658	969
8	200	10.4	2080	7838	15.68	2.755	3.99	0.089	0.2614	0.5477	1139
9	200	10.4	2080	7557	15.11	2.509	3.99	0.089	0.3296	0.4682	974
10	200	10.4	2080	7444	14.89	2.415	3.99	0.089	0.3576	0.4390	913
sum	1634									Total ESAL =	8275

Load Data to 1.0 in displacement- Section No. 5' @ 60 mph
Displacement during seating load (25 cycles) = 0.08 in

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	L_x (kips)	β_x	β_{18}	$-G_t$	Log $[W_{tx}/W_{t18}]$	EALF	W_{18}
1	2	10.4	21	7100	14.20	2.146	3.99	0.089	0.4450	0.3589	7
2	29	10.4	302	7317	14.63	2.312	3.99	0.089	0.3895	0.4079	123
3	200	10.4	2080	7050	14.10	2.109	3.99	0.089	0.4581	0.3483	724
4	200	10.4	2080	7756	15.51	2.681	3.99	0.089	0.2811	0.5235	1089
5	200	10.4	2080	7800	15.60	2.721	3.99	0.089	0.2705	0.5364	1116
6	178	10.4	1851	8032	16.06	2.937	3.99	0.089	0.2156	0.6087	1127
7	200	10.4	2080	7548	15.10	2.501	3.99	0.089	0.3318	0.4658	969
8	200	10.4	2080	7838	15.68	2.755	3.99	0.089	0.2614	0.5477	1139
9	200	10.4	2080	7557	15.11	2.509	3.99	0.089	0.3296	0.4682	974
10	1516	10.4	15766	7444	14.89	2.415	3.99	0.089	0.3576	0.4390	6921
sum	2925									Total ESAL =	14189

Conversion from Dual Tire Loads to ESAL - Section No. 6 @ 40 mph
Complete load data
HMA M_R = 250 ksi

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	L_x (kips)	β_x	β_{18}	$-G_t$	Log $[W_{tx}/W_{t18}]$	EALF	W_{18}
1	21	12.4	260	8049	16.10	4.048	5.529	089	0.2135	0.6116	159
2	200	12.4	2480	9000	18.00	5.529	5.529	0.089	0.0000	1.0000	2480
3	200	12.4	2480	9277	18.55	6.028	5.529	0.089	-0.0585	1.1441	2837
4	200	12.4	2480	9142	18.28	5.781	5.529	0.089	-0.0302	1.0719	2658
5	200	12.4	2480	9188	18.38	5.865	5.529	0.089	-0.0398	1.0961	2718
sum	821									Total ESAL =	10853

Load Data to 1.0 in displacement- Section No. 6 @ 40 mph
Displacement during seating load (25 cycles) = 0.55 in

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	L_x (kips)	β_x	β_{18}	$-G_t$	Log $[W_{tx}/W_{t18}]$	EALF	W_{18}
1	0	12.4	0	8049	16.10	4.048	5.529	0.089	0.2135	0.6116	0
2	196	12.4	2430	9000	18.00	5.529	5.529	0.089	0.0000	1.0000	2430
3	200	12.4	2480	9277	18.55	6.028	5.529	0.089	-0.0585	1.1441	2837
4	200	12.4	2480	9142	18.28	5.781	5.529	0.089	-0.0302	1.0719	2658
5	203	12.4	2517	9188	18.38	5.865	5.529	0.089	-0.0398	1.0961	2759
sum	799									Total ESAL =	10685

Conversion from Dual Tire Loads to ESAL - Section No. 6 @ 60 mph
Complete load data
HMA M_R = 250 ksi

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	L_x (kips)	β_x	β_{18}	$-G_t$	Log $[W_{tx}/W_{t18}]$	EALF	W_{18}
1	21	16.8	353	8049	16.10	4.048	5.529	0.089	0.2135	0.6116	216
2	200	16.8	3360	9000	18.00	5.529	5.529	0.089	0.0000	1.0000	3360
3	200	16.8	3360	9277	18.55	6.028	5.529	0.089	-0.0585	1.1441	3844
4	200	16.8	3360	9142	18.28	5.781	5.529	0.089	-0.0302	1.0719	3602
5	200	16.8	3360	9188	18.38	5.865	5.529	0.089	-0.0398	1.0961	3683
sum	821									Total ESAL =	14704

Load Data to 1.0 in displacement- Section No. 6 @ 60 mph
Displacement during seating load (25 cycles) = 0.55 in

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	L_x (kips)	β_x	β_{18}	$-G_t$	Log $[W_{tx}/W_{t18}]$	EALF	W_{18}
1	0	16.8	0	8049	16.10	4.048	5.529	0.089	0.2135	0.6116	0
2	196	16.8	3293	9000	18.00	5.529	5.529	0.089	0.0000	1.0000	3293
3	200	16.8	3360	9277	18.55	6.028	5.529	0.089	-0.0585	1.1441	3844
4	200	16.8	3360	9142	18.28	5.781	5.529	0.089	-0.0302	1.0719	3602
5	204	16.8	3427	9188	18.38	5.865	5.529	0.089	-0.0398	1.0961	3757
sum	800									Total ESAL =	14495

Conversion from Dual Tire Loads to ESAL - Section No. 6' @ 40 mph
Complete load data
HMA M_R = 370 ksi

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	L_x (kips)	β_x	β_{18}	$-G_t$	Log $[W_{tx}/W_{t18}]$	EALF	W_{18}
1	21	8.5	179	8049	16.10	2.910	3.929	0.089	0.2115	0.6145	110
2	200	8.5	1700	9000	18.00	3.929	3.929	0.089	0.0000	1.0000	1700
3	200	8.5	1700	9277	18.55	4.272	3.929	0.089	-0.0580	1.1428	1943
4	200	8.5	1700	9142	18.28	4.102	3.929	0.089	-0.0299	1.0713	1821
5	200	8.5	1700	9188	18.38	4.159	3.929	0.089	-0.0395	1.0952	1862
sum	821									Total ESAL =	7436

Load Data to 1.0 in displacement- Section No. 6' @ 40 mph
Displacement during seating load (25 cycles) = 0.55 in

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	L_x (kips)	β_x	β_{18}	$-G_t$	Log $[W_{tx}/W_{t18}]$	EALF	W_{18}
1	0	8.5	0	8049	16.10	2.910	3.929	0.089	0.2115	0.6145	0
2	196	8.5	1666	9000	18.00	3.929	3.929	0.089	0.0000	1.0000	1666
3	200	8.5	1700	9277	18.55	4.272	3.929	0.089	-0.0580	1.1428	1943
4	200	8.5	1700	9142	18.28	4.102	3.929	0.089	-0.0299	1.0713	1821
5	203	8.5	1726	9188	18.38	4.159	3.929	0.089	-0.0395	1.0952	1890
sum	799									Total ESAL =	7320

Conversion from Dual Tire Loads to ESAL - Section No. 6' @ 60 mph
Complete load data
HMA M_R = 370 ksi

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	L_x (kips)	β_x	β_{18}	$-G_t$	Log $[W_{tx}/W_{t18}]$	EALF	W_{18}
1	21	9.4	197	8049	16.10	2.910	3.929	0.089	0.2115	0.6145	121
2	200	9.4	1880	9000	18.00	3.929	3.929	0.089	0.0000	1.0000	1880
3	200	9.4	1880	9277	18.55	4.272	3.929	0.089	-0.0580	1.1428	2148
4	200	9.4	1880	9142	18.28	4.102	3.929	0.089	-0.0299	1.0713	2014
5	200	9.4	1880	9188	18.38	4.159	3.929	0.089	-0.0395	1.0952	2059
sum	821									Total ESAL =	8223

Load Data to 1.0 in displacement- Section No. 6' @ 60 mph
Displacement during seating load (25 cycles) = 0.55 in

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	L_x (kips)	β_x	β_{18}	$-G_t$	Log $[W_{tx}/W_{t18}]$	EALF	W_{18}
1	0	9.4	0	8049	16.10	2.910	3.929	0.089	0.2115	0.6145	0
2	196	9.4	1842	9000	18.00	3.929	3.929	0.089	0.0000	1.0000	1842
3	200	9.4	1880	9277	18.55	4.272	3.929	0.089	-0.0580	1.1428	2148
4	200	9.4	1880	9142	18.28	4.102	3.929	0.089	-0.0299	1.0713	2014
5	204	9.4	1918	9188	18.38	4.159	3.929	0.089	-0.0395	1.0952	2100
sum	800									Total ESAL =	8105

Conversion from Dual Tire Loads to ESAL - Section No. 7 @ 40 mph
Complete load data
HMA M_R = 250 ksi

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	L_x (kips)	β_x	β_{18}	$-G_t$	Log $[W_{tx}/W_{t18}]$	EALF	W_{18}
1	200	12.4	2480	8620	17.24	5.429	6.137	0.089	0.0830	0.8260	2048
2	200	12.4	2480	9159	18.32	6.453	6.137	0.089	-0.0338	1.0810	2681
3	200	12.4	2480	9046	18.09	6.228	6.137	0.089	-0.0098	1.0229	2537
4	200	12.4	2480	9053	18.11	6.242	6.137	0.089	-0.0113	1.0264	2546
5	200	12.4	2480	9088	18.18	6.311	6.137	0.089	-0.0188	1.0442	2590
6	200	12.4	2480	9093	18.19	6.321	6.137	0.089	-0.0198	1.0468	2596
7	200	12.4	2480	9069	18.14	6.273	6.137	0.089	-0.0147	1.0345	2566
8	200	12.4	2480	9076	18.15	6.287	6.137	0.089	-0.0162	1.0381	2574
sum	1600									Total ESAL =	20137

Load Data to 1.0 in displacement- Section No. 7 @ 40 mph
Displacement during seating load (25 cycles) = 0.14 in

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	L_x (kips)	β_x	β_{18}	$-G_t$	Log $[W_{tx}/W_{t18}]$	EALF	W_{18}
1	175	12.4	2170	8620	17.24	5.429	6.137	0.089	0.0830	0.8260	1792
2	200	12.4	2480	9159	18.32	6.453	6.137	0.089	-0.0338	1.0810	2681
3	200	12.4	2480	9046	18.09	6.228	6.137	0.089	-0.0098	1.0229	2537
4	200	12.4	2480	9053	18.11	6.242	6.137	0.089	-0.0113	1.0264	2546
5	200	12.4	2480	9088	18.18	6.311	6.137	0.089	-0.0188	1.0442	2590
6	200	12.4	2480	9093	18.19	6.321	6.137	0.089	-0.0198	1.0468	2596
7	200	12.4	2480	9069	18.14	6.273	6.137	0.089	-0.0147	1.0345	2566
8	415	12.4	5146	9076	18.15	6.287	6.137	0.089	-0.0162	1.0381	5342
sum	1790									Total ESAL =	22649

Conversion from Dual Tire Loads to ESAL - Section No. 7 @ 60 mph
Complete load data
HMA M_R = 250 ksi

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	L_x (kips)	β_x	β_{18}	$-G_t$	Log $[W_{tx}/W_{t18}]$	EALF	W_{18}
1	200	16.5	3300	8620	17.24	5.429	6.137	0.089	0.0830	0.8260	2726
2	200	16.5	3300	9159	18.32	6.453	6.137	0.089	-0.0338	1.0810	3567
3	200	16.5	3300	9046	18.09	6.228	6.137	0.089	-0.0098	1.0229	3376
4	200	16.5	3300	9053	18.11	6.242	6.137	0.089	-0.0113	1.0264	3387
5	200	16.5	3300	9088	18.18	6.311	6.137	0.089	-0.0188	1.0442	3446
6	200	16.5	3300	9093	18.19	6.321	6.137	0.089	-0.0198	1.0468	3454
7	200	16.5	3300	9069	18.14	6.273	6.137	0.089	-0.0147	1.0345	3414
8	200	16.5	3300	9076	18.15	6.287	6.137	0.089	-0.0162	1.0381	3426
sum	1600									Total ESAL =	26796

Load Data to 1.0 in displacement- Section No. 7 @ 60 mph
Displacement during seating load (25 cycles) = 0.14 in

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	L_x (kips)	β_x	β_{18}	$-G_t$	Log $[W_{tx}/W_{t18}]$	EALF	W_{18}
1	175	16.5	2888	8620	17.24	5.429	6.137	0.089	0.0830	0.8260	2385
2	200	16.5	3300	9159	18.32	6.453	6.137	0.089	-0.0338	1.0810	3567
3	200	16.5	3300	9046	18.09	6.228	6.137	0.089	-0.0098	1.0229	3376
4	200	16.5	3300	9053	18.11	6.242	6.137	0.089	-0.0113	1.0264	3387
5	200	16.5	3300	9088	18.18	6.311	6.137	0.089	-0.0188	1.0442	3446
6	200	16.5	3300	9093	18.19	6.321	6.137	0.089	-0.0198	1.0468	3454
7	200	16.5	3300	9069	18.14	6.273	6.137	0.089	-0.0147	1.0345	3414
8	415	16.5	6848	9076	18.15	6.287	6.137	0.089	-0.0162	1.0381	7108
sum	1790									Total ESAL =	30137

Conversion from Dual Tire Loads to ESAL - Section No. 7' @ 40 mph
Complete load data
HMA M_R = 370 ksi

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	L_x (kips)	β_x	β_{18}	$-G_t$	Log $[W_{tx}/W_{t18}]$	EALF	W_{18}
1	200	8.4	1680	8620	17.24	3.955	4.456	0.089	0.0824	0.8272	1390
2	200	8.4	1680	9159	18.32	4.680	4.456	0.089	-0.0336	1.0804	1815
3	200	8.4	1680	9046	18.09	4.520	4.456	0.089	-0.0098	1.0227	1718
4	200	8.4	1680	9053	18.11	4.530	4.456	0.089	-0.0112	1.0262	1724
5	200	8.4	1680	9088	18.18	4.579	4.456	0.089	-0.0186	1.0439	1754
6	200	8.4	1680	9093	18.19	4.586	4.456	0.089	-0.0197	1.0464	1758
7	200	8.4	1680	9069	18.14	4.552	4.456	0.089	-0.0146	1.0343	1738
8	200	8.4	1680	9076	18.15	4.562	4.456	0.089	-0.0161	1.0378	1744
sum	1600									Total ESAL =	13640

Load Data to 1.0 in displacement- Section No. 7' @ 40 mph
Displacement during seating load (25 cycles) = 0.14 in

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	L_x (kips)	β_x	β_{18}	$-G_t$	Log $[W_{tx}/W_{t18}]$	EALF	W_{18}
1	175	8.4	1470	8620	17.24	3.955	4.456	0.089	0.0824	0.8272	1216
2	200	8.4	1680	9159	18.32	4.680	4.456	0.089	-0.0336	1.0804	1815
3	200	8.4	1680	9046	18.09	4.520	4.456	0.089	-0.0098	1.0227	1718
4	200	8.4	1680	9053	18.11	4.530	4.456	0.089	-0.0112	1.0262	1724
5	200	8.4	1680	9088	18.18	4.579	4.456	0.089	-0.0186	1.0439	1754
6	200	8.4	1680	9093	18.19	4.586	4.456	0.089	-0.0197	1.0464	1758
7	200	8.4	1680	9069	18.14	4.552	4.456	0.089	-0.0146	1.0343	1738
8	415	8.4	3486	9076	18.15	4.562	4.456	0.089	-0.0161	1.0378	3618
sum	1790									Total ESAL =	15340

Conversion from Dual Tire Loads to ESAL - Section No. 7' @ 60 mph
Complete load data
HMA M_R = 370 ksi

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	L_x (kips)	β_x	β_{18}	$-G_t$	Log $[W_{tx}/W_{t18}]$	EALF	W_{18}
1	200	9.2	1840	8620	17.24	3.955	4.456	0.089	0.0824	0.8272	1522
2	200	9.2	1840	9159	18.32	4.680	4.456	0.089	-0.0336	1.0804	1988
3	200	9.2	1840	9046	18.09	4.520	4.456	0.089	-0.0098	1.0227	1882
4	200	9.2	1840	9053	18.11	4.530	4.456	0.089	-0.0112	1.0262	1888
5	200	9.2	1840	9088	18.18	4.579	4.456	0.089	-0.0186	1.0439	1921
6	200	9.2	1840	9093	18.19	4.586	4.456	0.089	-0.0197	1.0464	1925
7	200	9.2	1840	9069	18.14	4.552	4.456	0.089	-0.0146	1.0343	1903
8	200	9.2	1840	9076	18.15	4.562	4.456	0.089	-0.0161	1.0378	1910
sum	1600									Total ESAL =	14939

Load Data to 1.0 in displacement- Section No. 7' @ 60 mph
Displacement during seating load (25 cycles) = 0.14 in

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	L_x (kips)	β_x	β_{18}	$-G_t$	Log $[W_{tx}/W_{t18}]$	EALF	W_{18}
1	175	9.2	1610	8620	17.24	3.955	4.456	0.089	0.0824	0.8272	1332
2	200	9.2	1840	9159	18.32	4.680	4.456	0.089	-0.0336	1.0804	1988
3	200	9.2	1840	9046	18.09	4.520	4.456	0.089	-0.0098	1.0227	1882
4	200	9.2	1840	9053	18.11	4.530	4.456	0.089	-0.0112	1.0262	1888
5	200	9.2	1840	9088	18.18	4.579	4.456	0.089	-0.0186	1.0439	1921
6	200	9.2	1840	9093	18.19	4.586	4.456	0.089	-0.0197	1.0464	1925
7	200	9.2	1840	9069	18.14	4.552	4.456	0.089	-0.0146	1.0343	1903
8	415	9.2	3818	9076	18.15	4.562	4.456	0.089	-0.0161	1.0378	3962
sum	1790									Total ESAL =	16801

Conversion from Dual Tire Loads to ESAL - Section No. 9 @ 40 mph
Complete load data
HMA M_R = 250 ksi

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	L_x (kips)	β_x	β_{18}	$-G_t$	Log $[W_{tx}/W_{t18}]$	EALF	W_{18}
1	200	7.6	1520	7745	15.49	1.486	2.116	0.089	0.2769	0.5285	803
2	200	7.6	1520	8903	17.81	2.060	2.116	0.089	0.0202	0.9545	1451
3	200	7.6	1520	8892	17.78	2.054	2.116	0.089	0.0225	0.9495	1443
4	200	7.6	1520	8918	17.84	2.069	2.116	0.089	0.0171	0.9615	1461
5	200	7.6	1520	8873	17.75	2.043	2.116	0.089	0.0265	0.9408	1430
6	200	7.6	1520	8884	17.77	2.049	2.116	0.089	0.0242	0.9458	1438
7	200	7.6	1520	8861	17.72	2.036	2.116	0.089	0.0290	0.9354	1422
8	200	7.6	1520	8865	17.73	2.039	2.116	0.089	0.0282	0.9372	1425
9	59	7.6	448	8854	17.71	2.032	2.116	0.089	0.0305	0.9322	418
10	200	7.6	1520	8917	17.83	2.068	2.116	0.089	0.0173	0.9610	1461
11	200	7.6	1520	8945	17.89	2.084	2.116	0.089	0.0114	0.9740	1480
12	200	7.6	1520	8909	17.82	2.064	2.116	0.089	0.0190	0.9573	1455
13	200	7.6	1520	8873	17.75	2.043	2.116	0.089	0.0265	0.9408	1430
14	200	7.6	1520	8516	17.03	1.849	2.116	0.089	0.1027	0.7894	1200
15	200	7.6	1520	8887	17.77	2.051	2.116	0.089	0.0236	0.9472	1440
16	200	7.6	1520	8892	17.78	2.054	2.116	0.089	0.0225	0.9495	1443
17	200	7.6	1520	8907	17.81	2.062	2.116	0.089	0.0194	0.9564	1454
18	200	7.6	1520	8954	17.91	2.089	2.116	0.089	0.0096	0.9782	1487
19	200	7.6	1520	8897	17.79	2.057	2.116	0.089	0.0215	0.9518	1447
20	110	7.6	836	8830	17.66	2.019	2.116	0.089	0.0355	0.9214	770
21	200	7.6	1520	8885	17.77	2.050	2.116	0.089	0.0240	0.9463	1438
22	200	7.6	1520	8917	17.83	2.068	2.116	0.089	0.0173	0.9610	1461
23	200	7.6	1520	8878	17.76	2.046	2.116	0.089	0.0254	0.9431	1433

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	L_x (kips)	β_x	β_{18}	$-G_t$	Log $[W_{tx}/W_{t18}]$	EALF	W_{18}
24	200	7.6	1520	8936	17.87	2.079	2.116	0.089	0.0133	0.9698	1474
25	200	7.6	1520	8980	17.96	2.104	2.116	0.089	0.0042	0.9905	1506
26	200	7.6	1520	8881	17.76	2.048	2.116	0.089	0.0248	0.9445	1436
27	200	7.6	1520	8897	17.79	2.057	2.116	0.089	0.0215	0.9518	1447
28	200	7.6	1520	8944	17.89	2.084	2.116	0.089	0.0116	0.9735	1480
29	200	7.6	1520	8904	17.81	2.061	2.116	0.089	0.0200	0.9550	1452
30	200	7.6	1520	8905	17.81	2.061	2.116	0.089	0.0198	0.9555	1452
31	30	7.6	228	8900	17.80	2.058	2.116	0.089	0.0208	0.9532	217
32	120	7.6	912	8900	17.80	2.058	2.116	0.089	0.0208	0.9532	869
33	200	7.6	1520	8896	17.79	2.056	2.116	0.089	0.0217	0.9513	1446
34	200	7.6	1520	8925	17.85	2.073	2.116	0.089	0.0156	0.9647	1466
35	200	7.6	1520	8931	17.86	2.076	2.116	0.089	0.0144	0.9675	1471
sum	6519									Total ESAL =	46405

Load Data to 1.0 in displacement- Section No. 9 @ 40 mph
Displacement during seating load (25 cycles) = 0.15 in

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	L_x (kips)	β_x	β_{18}	$-G_t$	Log $[W_{tx}/W_{t18}]$	EALF	W_{18}
1	175	7.6	1330	7745	15.49	1.486	2.116	0.089	0.2769	0.5285	703
2	200	7.6	1520	8903	17.81	2.060	2.116	0.089	0.0202	0.9545	1451
3	200	7.6	1520	8892	17.78	2.054	2.116	0.089	0.0225	0.9495	1443
4	200	7.6	1520	8918	17.84	2.069	2.116	0.089	0.0171	0.9615	1461
5	200	7.6	1520	8873	17.75	2.043	2.116	0.089	0.0265	0.9408	1430
6	200	7.6	1520	8884	17.77	2.049	2.116	0.089	0.0242	0.9458	1438
7	200	7.6	1520	8861	17.72	2.036	2.116	0.089	0.0290	0.9354	1422
8	200	7.6	1520	8865	17.73	2.039	2.116	0.089	0.0282	0.9372	1425
9	59	7.6	448	8854	17.71	2.032	2.116	0.089	0.0305	0.9322	418
10	200	7.6	1520	8917	17.83	2.068	2.116	0.089	0.0173	0.9610	1461
11	200	7.6	1520	8945	17.89	2.084	2.116	0.089	0.0114	0.9740	1480
12	200	7.6	1520	8909	17.82	2.064	2.116	0.089	0.0190	0.9573	1455
13	200	7.6	1520	8873	17.75	2.043	2.116	0.089	0.0265	0.9408	1430
14	200	7.6	1520	8516	17.03	1.849	2.116	0.089	0.1027	0.7894	1200
15	200	7.6	1520	8887	17.77	2.051	2.116	0.089	0.0236	0.9472	1440
16	200	7.6	1520	8892	17.78	2.054	2.116	0.089	0.0225	0.9495	1443
17	200	7.6	1520	8907	17.81	2.062	2.116	0.089	0.0194	0.9564	1454
18	200	7.6	1520	8954	17.91	2.089	2.116	0.089	0.0096	0.9782	1487
19	200	7.6	1520	8897	17.79	2.057	2.116	0.089	0.0215	0.9518	1447
20	110	7.6	836	8830	17.66	2.019	2.116	0.089	0.0355	0.9214	770
21	200	7.6	1520	8885	17.77	2.050	2.116	0.089	0.0240	0.9463	1438
22	200	7.6	1520	8917	17.83	2.068	2.116	0.089	0.0173	0.9610	1461
23	200	7.6	1520	8878	17.76	2.046	2.116	0.089	0.0254	0.9431	1433
24	200	7.6	1520	8936	17.87	2.079	2.116	0.089	0.0133	0.9698	1474

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	L_x (kips)	β_x	β_{18}	$-G_t$	Log $[W_{tx}/W_{t18}]$	EALF	W_{18}
25	200	7.6	1520	8980	17.96	2.104	2.116	0.089	0.0042	0.9905	1506
26	200	7.6	1520	8881	17.76	2.048	2.116	0.089	0.0248	0.9445	1436
27	200	7.6	1520	8897	17.79	2.057	2.116	0.089	0.0215	0.9518	1447
28	200	7.6	1520	8944	17.89	2.084	2.116	0.089	0.0116	0.9735	1480
29	200	7.6	1520	8904	17.81	2.061	2.116	0.089	0.0200	0.9550	1452
30	200	7.6	1520	8905	17.81	2.061	2.116	0.089	0.0198	0.9555	1452
31	30	7.6	228	8900	17.80	2.058	2.116	0.089	0.0208	0.9532	217
32	120	7.6	912	8900	17.80	2.058	2.116	0.089	0.0208	0.9532	869
33	200	7.6	1520	8896	17.79	2.056	2.116	0.089	0.0217	0.9513	1446
34	200	7.6	1520	8925	17.85	2.073	2.116	0.089	0.0156	0.9647	1466
35	1981	7.6	15056	8931	17.86	2.076	2.116	0.089	0.0144	0.9675	14566
sum	8275									Total ESAL =	59400

Conversion from Dual Tire Loads to ESAL - Section No. 9 @ 60 mph
Complete load data
HMA MR = 250 ksi

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	Lx (kips)	bx	b18	-Gt	Log [Wtx/Wt18]	EALF	W18
1	200	9.7	1940	7745	15.49	1.486	2.116	0.089	0.2769	0.5285	1025
2	200	9.7	1940	8903	17.81	2.060	2.116	0.089	0.0202	0.9545	1852
3	200	9.7	1940	8892	17.78	2.054	2.116	0.089	0.0225	0.9495	1842
4	200	9.7	1940	8918	17.84	2.069	2.116	0.089	0.0171	0.9615	1865
5	200	9.7	1940	8873	17.75	2.043	2.116	0.089	0.0265	0.9408	1825
6	200	9.7	1940	8884	17.77	2.049	2.116	0.089	0.0242	0.9458	1835
7	200	9.7	1940	8861	17.72	2.036	2.116	0.089	0.0290	0.9354	1815
8	200	9.7	1940	8865	17.73	2.039	2.116	0.089	0.0282	0.9372	1818
9	59	9.7	572	8854	17.71	2.032	2.116	0.089	0.0305	0.9322	534
10	200	9.7	1940	8917	17.83	2.068	2.116	0.089	0.0173	0.9610	1864
11	200	9.7	1940	8945	17.89	2.084	2.116	0.089	0.0114	0.9740	1890
12	200	9.7	1940	8909	17.82	2.064	2.116	0.089	0.0190	0.9573	1857
13	200	9.7	1940	8873	17.75	2.043	2.116	0.089	0.0265	0.9408	1825
14	200	9.7	1940	8516	17.03	1.849	2.116	0.089	0.1027	0.7894	1531
15	200	9.7	1940	8887	17.77	2.051	2.116	0.089	0.0236	0.9472	1838
16	200	9.7	1940	8892	17.78	2.054	2.116	0.089	0.0225	0.9495	1842
17	200	9.7	1940	8907	17.81	2.062	2.116	0.089	0.0194	0.9564	1855
18	200	9.7	1940	8954	17.91	2.089	2.116	0.089	0.0096	0.9782	1898
19	200	9.7	1940	8897	17.79	2.057	2.116	0.089	0.0215	0.9518	1846
20	110	9.7	1067	8830	17.66	2.019	2.116	0.089	0.0355	0.9214	983
21	200	9.7	1940	8885	17.77	2.050	2.116	0.089	0.0240	0.9463	1836
Test No.	Plate Cycles	Conv. Factor	Repetition of Axle	Avg. Load	L_x (kips)	β_x	β_{18}	$-G_t$	Log $[W_{tx}/W_{t18}]$	EALF	W_{18}

	Applied		Loads	(lb)								
22	200	9.7	1940	8917	17.83	2.068	2.116	0.089	0.0173	0.9610	1864
23	200	9.7	1940	8878	17.76	2.046	2.116	0.089	0.0254	0.9431	1830
24	200	9.7	1940	8936	17.87	2.079	2.116	0.089	0.0133	0.9698	1881
25	200	9.7	1940	8980	17.96	2.104	2.116	0.089	0.0042	0.9905	1922
26	200	9.7	1940	8881	17.76	2.048	2.116	0.089	0.0248	0.9445	1832
27	200	9.7	1940	8897	17.79	2.057	2.116	0.089	0.0215	0.9518	1846
28	200	9.7	1940	8944	17.89	2.084	2.116	0.089	0.0116	0.9735	1889
29	200	9.7	1940	8904	17.81	2.061	2.116	0.089	0.0200	0.9550	1853
30	200	9.7	1940	8905	17.81	2.061	2.116	0.089	0.0198	0.9555	1854
31	30	9.7	291	8900	17.80	2.058	2.116	0.089	0.0208	0.9532	277
32	120	9.7	1164	8900	17.80	2.058	2.116	0.089	0.0208	0.9532	1109
33	200	9.7	1940	8896	17.79	2.056	2.116	0.089	0.0217	0.9513	1846
34	200	9.7	1940	8925	17.85	2.073	2.116	0.089	0.0156	0.9647	1872
35	200	9.7	1940	8931	17.86	2.076	2.116	0.089	0.0144	0.9675	1877
sum	6519									Total ESAL =	59228

Load Data to 1.0 in displacement - Section No. 9 @ 60 mph
Displacement during seating load (25 cycles) = 0.15 in

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	Lx (kips)	bx	b18	-Gt	Log [Wtx/Wt18]	EALF	W18
1	175	9.7	1698	7745	15.49	1.486	2.116	0.089	0.2769	0.5285	897
2	200	9.7	1940	8903	17.81	2.060	2.116	0.089	0.0202	0.9545	1852
3	200	9.7	1940	8892	17.78	2.054	2.116	0.089	0.0225	0.9495	1842
4	200	9.7	1940	8918	17.84	2.069	2.116	0.089	0.0171	0.9615	1865
5	200	9.7	1940	8873	17.75	2.043	2.116	0.089	0.0265	0.9408	1825
6	200	9.7	1940	8884	17.77	2.049	2.116	0.089	0.0242	0.9458	1835
7	200	9.7	1940	8861	17.72	2.036	2.116	0.089	0.0290	0.9354	1815
8	200	9.7	1940	8865	17.73	2.039	2.116	0.089	0.0282	0.9372	1818
9	59	9.7	572	8854	17.71	2.032	2.116	0.089	0.0305	0.9322	534
10	200	9.7	1940	8917	17.83	2.068	2.116	0.089	0.0173	0.9610	1864
11	200	9.7	1940	8945	17.89	2.084	2.116	0.089	0.0114	0.9740	1890
12	200	9.7	1940	8909	17.82	2.064	2.116	0.089	0.0190	0.9573	1857
13	200	9.7	1940	8873	17.75	2.043	2.116	0.089	0.0265	0.9408	1825
14	200	9.7	1940	8516	17.03	1.849	2.116	0.089	0.1027	0.7894	1531
15	200	9.7	1940	8887	17.77	2.051	2.116	0.089	0.0236	0.9472	1838
16	200	9.7	1940	8892	17.78	2.054	2.116	0.089	0.0225	0.9495	1842
17	200	9.7	1940	8907	17.81	2.062	2.116	0.089	0.0194	0.9564	1855
18	200	9.7	1940	8954	17.91	2.089	2.116	0.089	0.0096	0.9782	1898
19	200	9.7	1940	8897	17.79	2.057	2.116	0.089	0.0215	0.9518	1846
20	110	9.7	1067	8830	17.66	2.019	2.116	0.089	0.0355	0.9214	983
21	200	9.7	1940	8885	17.77	2.050	2.116	0.089	0.0240	0.9463	1836
22	200	9.7	1940	8917	17.83	2.068	2.116	0.089	0.0173	0.9610	1864
23	200	9.7	1940	8878	17.76	2.046	2.116	0.089	0.0254	0.9431	1830
24	200	9.7	1940	8936	17.87	2.079	2.116	0.089	0.0133	0.9698	1881

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	L_x (kips)	β_x	β_{18}	$-G_t$	Log $[W_{tx}/W_{t18}]$	EALF	W_{18}
25	200	9.7	1940	8980	17.96	2.104	2.116	0.089	0.0042	0.9905	1922
26	200	9.7	1940	8881	17.76	2.048	2.116	0.089	0.0248	0.9445	1832
27	200	9.7	1940	8897	17.79	2.057	2.116	0.089	0.0215	0.9518	1846
28	200	9.7	1940	8944	17.89	2.084	2.116	0.089	0.0116	0.9735	1889
29	200	9.7	1940	8904	17.81	2.061	2.116	0.089	0.0200	0.9550	1853
30	200	9.7	1940	8905	17.81	2.061	2.116	0.089	0.0198	0.9555	1854
31	30	9.7	291	8900	17.80	2.058	2.116	0.089	0.0208	0.9532	277
32	120	9.7	1164	8900	17.80	2.058	2.116	0.089	0.0208	0.9532	1109
33	200	9.7	1940	8896	17.79	2.056	2.116	0.089	0.0217	0.9513	1846
34	200	9.7	1940	8925	17.85	2.073	2.116	0.089	0.0156	0.9647	1872
35	1981	9.7	19216	8931	17.86	2.076	2.116	0.089	0.0144	0.9675	18591
sum	8275									Total ESAL =	75814

Conversion from Dual Tire Loads to ESAL - Section No. 9' @ 40 mph
Complete load data
HMA MR = 370 ksi

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	Lx (kips)	□x	□18	-Gt	Log [Wtx/Wt18]	EALF	W18
1	200	5.6	1120	7745	15.49	1.178	1.63	0.089	0.2738	0.5323	596
2	200	5.6	1120	8903	17.81	1.590	1.63	0.089	0.0200	0.9551	1070
3	200	5.6	1120	8892	17.78	1.585	1.63	0.089	0.0222	0.9501	1064
4	200	5.6	1120	8918	17.84	1.596	1.63	0.089	0.0169	0.9619	1077
5	200	5.6	1120	8873	17.75	1.578	1.63	0.089	0.0262	0.9415	1054
6	200	5.6	1120	8884	17.77	1.582	1.63	0.089	0.0239	0.9464	1060
7	200	5.6	1120	8861	17.72	1.573	1.63	0.089	0.0287	0.9361	1048
8	200	5.6	1120	8865	17.73	1.574	1.63	0.089	0.0278	0.9379	1050
9	59	5.6	330	8854	17.71	1.570	1.63	0.089	0.0301	0.9330	308
10	200	5.6	1120	8917	17.83	1.596	1.63	0.089	0.0171	0.9614	1077
11	200	5.6	1120	8945	17.89	1.607	1.63	0.089	0.0113	0.9743	1091
12	200	5.6	1120	8909	17.82	1.592	1.63	0.089	0.0187	0.9578	1073
13	200	5.6	1120	8873	17.75	1.578	1.63	0.089	0.0262	0.9415	1054
14	200	5.6	1120	8516	17.03	1.439	1.63	0.089	0.1015	0.7915	887
15	200	5.6	1120	8887	17.77	1.583	1.63	0.089	0.0233	0.9478	1062
16	200	5.6	1120	8892	17.78	1.585	1.63	0.089	0.0222	0.9501	1064
17	200	5.6	1120	8907	17.81	1.591	1.63	0.089	0.0191	0.9569	1072
18	200	5.6	1120	8954	17.91	1.611	1.63	0.089	0.0094	0.9785	1096
19	200	5.6	1120	8897	17.79	1.587	1.63	0.089	0.0212	0.9523	1067
20	110	5.6	616	8830	17.66	1.560	1.63	0.089	0.0351	0.9223	568
21	200	5.6	1120	8885	17.77	1.583	1.63	0.089	0.0237	0.9469	1061
22	200	5.6	1120	8917	17.83	1.596	1.63	0.089	0.0171	0.9614	1077
23	200	5.6	1120	8878	17.76	1.580	1.63	0.089	0.0252	0.9437	1057

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	L_x (kips)	β_x	β_{18}	$-G_t$	Log $[W_{tx}/W_{t18}]$	EALF	W_{18}
24	200	5.6	1120	8936	17.87	1.603	1.63	0.089	0.0132	0.9702	1087
25	200	5.6	1120	8980	17.96	1.622	1.63	0.089	0.0041	0.9906	1109
26	200	5.6	1120	8881	17.76	1.581	1.63	0.089	0.0245	0.9451	1058
27	200	5.6	1120	8897	17.79	1.587	1.63	0.089	0.0212	0.9523	1067
28	200	5.6	1120	8944	17.89	1.607	1.63	0.089	0.0115	0.9738	1091
29	200	5.6	1120	8904	17.81	1.590	1.63	0.089	0.0198	0.9555	1070
30	200	5.6	1120	8905	17.81	1.591	1.63	0.089	0.0196	0.9560	1071
31	30	5.6	168	8900	17.80	1.589	1.63	0.089	0.0206	0.9537	160
32	120	5.6	672	8900	17.80	1.589	1.63	0.089	0.0206	0.9537	641
33	200	5.6	1120	8896	17.79	1.587	1.63	0.089	0.0214	0.9519	1066
34	200	5.6	1120	8925	17.85	1.599	1.63	0.089	0.0154	0.9651	1081
35	200	5.6	1120	8931	17.86	1.601	1.63	0.089	0.0142	0.9679	1084
sum	6519									Total ESAL =	34218

Load Data to 1.0 in displacement - Section No. 9' @ 40 mph
Displacement during seating load (25 cycles) = 0.15 in

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	L_x (kips)	β_x	β_{18}	$-G_t$	Log $[W_{tx}/W_{t18}]$	EALF	W_{18}
1	175	5.6	980	7745	15.49	1.178	1.63	0.089	0.2738	0.5323	522
2	200	5.6	1120	8903	17.81	1.590	1.63	0.089	0.0200	0.9551	1070
3	200	5.6	1120	8892	17.78	1.585	1.63	0.089	0.0222	0.9501	1064
4	200	5.6	1120	8918	17.84	1.596	1.63	0.089	0.0169	0.9619	1077
5	200	5.6	1120	8873	17.75	1.578	1.63	0.089	0.0262	0.9415	1054
6	200	5.6	1120	8884	17.77	1.582	1.63	0.089	0.0239	0.9464	1060
7	200	5.6	1120	8861	17.72	1.573	1.63	0.089	0.0287	0.9361	1048
8	200	5.6	1120	8865	17.73	1.574	1.63	0.089	0.0278	0.9379	1050
9	59	5.6	330	8854	17.71	1.570	1.63	0.089	0.0301	0.9330	308
10	200	5.6	1120	8917	17.83	1.596	1.63	0.089	0.0171	0.9614	1077
11	200	5.6	1120	8945	17.89	1.607	1.63	0.089	0.0113	0.9743	1091
12	200	5.6	1120	8909	17.82	1.592	1.63	0.089	0.0187	0.9578	1073
13	200	5.6	1120	8873	17.75	1.578	1.63	0.089	0.0262	0.9415	1054
14	200	5.6	1120	8516	17.03	1.439	1.63	0.089	0.1015	0.7915	887
15	200	5.6	1120	8887	17.77	1.583	1.63	0.089	0.0233	0.9478	1062
16	200	5.6	1120	8892	17.78	1.585	1.63	0.089	0.0222	0.9501	1064
17	200	5.6	1120	8907	17.81	1.591	1.63	0.089	0.0191	0.9569	1072
18	200	5.6	1120	8954	17.91	1.611	1.63	0.089	0.0094	0.9785	1096
19	200	5.6	1120	8897	17.79	1.587	1.63	0.089	0.0212	0.9523	1067
20	110	5.6	616	8830	17.66	1.560	1.63	0.089	0.0351	0.9223	568
21	200	5.6	1120	8885	17.77	1.583	1.63	0.089	0.0237	0.9469	1061
22	200	5.6	1120	8917	17.83	1.596	1.63	0.089	0.0171	0.9614	1077
23	200	5.6	1120	8878	17.76	1.580	1.63	0.089	0.0252	0.9437	1057
24	200	5.6	1120	8936	17.87	1.603	1.63	0.089	0.0132	0.9702	1087

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	L_x (kips)	β_x	β_{18}	$-G_t$	Log $[W_{tx}/W_{t18}]$	EALF	W_{18}
25	200	5.6	1120	8980	17.96	1.622	1.63	0.089	0.0041	0.9906	1109
26	200	5.6	1120	8881	17.76	1.581	1.63	0.089	0.0245	0.9451	1058
27	200	5.6	1120	8897	17.79	1.587	1.63	0.089	0.0212	0.9523	1067
28	200	5.6	1120	8944	17.89	1.607	1.63	0.089	0.0115	0.9738	1091
29	200	5.6	1120	8904	17.81	1.590	1.63	0.089	0.0198	0.9555	1070
30	200	5.6	1120	8905	17.81	1.591	1.63	0.089	0.0196	0.9560	1071
31	30	5.6	168	8900	17.80	1.589	1.63	0.089	0.0206	0.9537	160
32	120	5.6	672	8900	17.80	1.589	1.63	0.089	0.0206	0.9537	641
33	200	5.6	1120	8896	17.79	1.587	1.63	0.089	0.0214	0.9519	1066
34	200	5.6	1120	8925	17.85	1.599	1.63	0.089	0.0154	0.9651	1081
35	1981	5.6	11094	8931	17.86	1.601	1.63	0.089	0.0142	0.9679	10737
sum	8275									Total ESAL =	43796

Conversion from Dual Tire Loads to ESAL - Section No. 9' @ 60 mph
omplete load data
HMA M_R = 370 ksi

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	L_x (kips)	β_x	β_{18}	$-G_t$	Log $[W_{tx}/W_{t18}]$	EALF	W_{18}
1	200	6	1200	7745	15.49	1.178	1.63	0.089	0.2738	0.5323	639
2	200	6	1200	8903	17.81	1.590	1.63	0.089	0.0200	0.9551	1146
3	200	6	1200	8892	17.78	1.585	1.63	0.089	0.0222	0.9501	1140
4	200	6	1200	8918	17.84	1.596	1.63	0.089	0.0169	0.9619	1154
5	200	6	1200	8873	17.75	1.578	1.63	0.089	0.0262	0.9415	1130
6	200	6	1200	8884	17.77	1.582	1.63	0.089	0.0239	0.9464	1136
7	200	6	1200	8861	17.72	1.573	1.63	0.089	0.0287	0.9361	1123
8	200	6	1200	8865	17.73	1.574	1.63	0.089	0.0278	0.9379	1125
9	59	6	354	8854	17.71	1.570	1.63	0.089	0.0301	0.9330	330
10	200	6	1200	8917	17.83	1.596	1.63	0.089	0.0171	0.9614	1154
11	200	6	1200	8945	17.89	1.607	1.63	0.089	0.0113	0.9743	1169
12	200	6	1200	8909	17.82	1.592	1.63	0.089	0.0187	0.9578	1149
13	200	6	1200	8873	17.75	1.578	1.63	0.089	0.0262	0.9415	1130
14	200	6	1200	8516	17.03	1.439	1.63	0.089	0.1015	0.7915	950
15	200	6	1200	8887	17.77	1.583	1.63	0.089	0.0233	0.9478	1137
16	200	6	1200	8892	17.78	1.585	1.63	0.089	0.0222	0.9501	1140
17	200	6	1200	8907	17.81	1.591	1.63	0.089	0.0191	0.9569	1148
18	200	6	1200	8954	17.91	1.611	1.63	0.089	0.0094	0.9785	1174
19	200	6	1200	8897	17.79	1.587	1.63	0.089	0.0212	0.9523	1143
20	110	6	660	8830	17.66	1.560	1.63	0.089	0.0351	0.9223	609
21	200	6	1200	8885	17.77	1.583	1.63	0.089	0.0237	0.9469	1136
22	200	6	1200	8917	17.83	1.596	1.63	0.089	0.0171	0.9614	1154
23	200	6	1200	8878	17.76	1.580	1.63	0.089	0.0252	0.9437	1132

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	L_x (kips)	β_x	β_{18}	$-G_t$	Log $[W_{tx}/W_{t18}]$	EALF	W_{18}
24	200	6	1200	8936	17.87	1.603	1.63	0.089	0.0132	0.9702	1164
25	200	6	1200	8980	17.96	1.622	1.63	0.089	0.0041	0.9906	1189
26	200	6	1200	8881	17.76	1.581	1.63	0.089	0.0245	0.9451	1134
27	200	6	1200	8897	17.79	1.587	1.63	0.089	0.0212	0.9523	1143
28	200	6	1200	8944	17.89	1.607	1.63	0.089	0.0115	0.9738	1169
29	200	6	1200	8904	17.81	1.590	1.63	0.089	0.0198	0.9555	1147
30	200	6	1200	8905	17.81	1.591	1.63	0.089	0.0196	0.9560	1147
31	30	6	180	8900	17.80	1.589	1.63	0.089	0.0206	0.9537	172
32	120	6	720	8900	17.80	1.589	1.63	0.089	0.0206	0.9537	687
33	200	6	1200	8896	17.79	1.587	1.63	0.089	0.0214	0.9519	1142
34	200	6	1200	8925	17.85	1.599	1.63	0.089	0.0154	0.9651	1158
35	200	6	1200	8931	17.86	1.601	1.63	0.089	0.0142	0.9679	1161
sum	6519									Total ESAL =	36662

Load Data to 1.0 in displacement- Section No. 9' @ 60 mph
Displacement during seating load (25 cycles) = 0.15 in

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	L_x (kips)	β_x	β_{18}	$-G_t$	Log $[W_{tx}/W_{t18}]$	EALF	W_{18}
1	175	6	1050	7745	15.49	1.178	1.63	0.089	0.2738	0.5323	559
2	200	6	1200	8903	17.81	1.590	1.63	0.089	0.0200	0.9551	1146
3	200	6	1200	8892	17.78	1.585	1.63	0.089	0.0222	0.9501	1140
4	200	6	1200	8918	17.84	1.596	1.63	0.089	0.0169	0.9619	1154
5	200	6	1200	8873	17.75	1.578	1.63	0.089	0.0262	0.9415	1130
6	200	6	1200	8884	17.77	1.582	1.63	0.089	0.0239	0.9464	1136
7	200	6	1200	8861	17.72	1.573	1.63	0.089	0.0287	0.9361	1123
8	200	6	1200	8865	17.73	1.574	1.63	0.089	0.0278	0.9379	1125
9	59	6	354	8854	17.71	1.570	1.63	0.089	0.0301	0.9330	330
10	200	6	1200	8917	17.83	1.596	1.63	0.089	0.0171	0.9614	1154
11	200	6	1200	8945	17.89	1.607	1.63	0.089	0.0113	0.9743	1169
12	200	6	1200	8909	17.82	1.592	1.63	0.089	0.0187	0.9578	1149
13	200	6	1200	8873	17.75	1.578	1.63	0.089	0.0262	0.9415	1130
14	200	6	1200	8516	17.03	1.439	1.63	0.089	0.1015	0.7915	950
15	200	6	1200	8887	17.77	1.583	1.63	0.089	0.0233	0.9478	1137
16	200	6	1200	8892	17.78	1.585	1.63	0.089	0.0222	0.9501	1140
17	200	6	1200	8907	17.81	1.591	1.63	0.089	0.0191	0.9569	1148
18	200	6	1200	8954	17.91	1.611	1.63	0.089	0.0094	0.9785	1174
19	200	6	1200	8897	17.79	1.587	1.63	0.089	0.0212	0.9523	1143
20	110	6	660	8830	17.66	1.560	1.63	0.089	0.0351	0.9223	609
21	200	6	1200	8885	17.77	1.583	1.63	0.089	0.0237	0.9469	1136
22	200	6	1200	8917	17.83	1.596	1.63	0.089	0.0171	0.9614	1154
23	200	6	1200	8878	17.76	1.580	1.63	0.089	0.0252	0.9437	1132
24	200	6	1200	8936	17.87	1.603	1.63	0.089	0.0132	0.9702	1164

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	L_x (kips)	β_x	β_{18}	$-G_t$	Log $[W_{tx}/W_{t18}]$	EALF	W_{18}
25	200	6	1200	8980	17.96	1.622	1.63	0.089	0.0041	0.9906	1189
26	200	6	1200	8881	17.76	1.581	1.63	0.089	0.0245	0.9451	1134
27	200	6	1200	8897	17.79	1.587	1.63	0.089	0.0212	0.9523	1143
28	200	6	1200	8944	17.89	1.607	1.63	0.089	0.0115	0.9738	1169
29	200	6	1200	8904	17.81	1.590	1.63	0.089	0.0198	0.9555	1147
30	200	6	1200	8905	17.81	1.591	1.63	0.089	0.0196	0.9560	1147
31	30	6	180	8900	17.80	1.589	1.63	0.089	0.0206	0.9537	172
32	120	6	720	8900	17.80	1.589	1.63	0.089	0.0206	0.9537	687
33	200	6	1200	8896	17.79	1.587	1.63	0.089	0.0214	0.9519	1142
34	200	6	1200	8925	17.85	1.599	1.63	0.089	0.0154	0.9651	1158
35	1981	6	11886	8931	17.86	1.601	1.63	0.089	0.0142	0.9679	11504
sum	8275									Total ESAL =	46924

Conversion from Dual Tire Loads to ESAL - Section No. 10 @ 40 mph
Complete load data
HMA M_R = 250 ksi

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	L_x (kips)	β_x	β_{18}	$-G_t$	Log $[W_{tx}/W_{t18}]$	EALF	W_{18}
1	100	13.2	1320	7510	15.02	3.901	6.474	0.089	0.3458	0.4510	595
2	59	13.2	779	7795	15.59	4.319	6.474	0.089	0.2753	0.5305	413
3	200	13.2	2640	8040	16.08	4.705	6.474	0.089	0.2164	0.6075	1604
4	200	13.2	2640	8550	17.10	5.592	6.474	0.089	0.0988	0.7966	2103
5	200	13.2	2640	8705	17.41	5.885	6.474	0.089	0.0642	0.8625	2277
6	200	13.2	2640	8764	17.53	6.000	6.474	0.089	0.0512	0.8887	2346
sum	959									Total ESAL =	9338

Load Data to 1.0 in displacement- Section No. 10 @ 40 mph
Displacement during seating load (25 cycles) = 0.08 in

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	L_x (kips)	β_x	β_{18}	$-G_t$	Log $[W_{tx}/W_{t18}]$	EALF	W_{18}
1	75	13.2	990	7510	15.02	3.901	6.474	0.089	0.3458	0.4510	446
2	59	13.2	779	7795	15.59	4.319	6.474	0.089	0.2753	0.5305	413
3	200	13.2	2640	8040	16.08	4.705	6.474	0.089	0.2164	0.6075	1604
4	200	13.2	2640	8550	17.10	5.592	6.474	0.089	0.0988	0.7966	2103
5	200	13.2	2640	8705	17.41	5.885	6.474	0.089	0.0642	0.8625	2277
6	126	13.2	1663	8764	17.53	6.000	6.474	0.089	0.0512	0.8887	1478
sum	860									Total ESAL =	8321

Conversion from Dual Tire Loads to ESAL - Section No. 10 @ 60 mph
Complete load data
HMA MR = 250 ksi

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	Lx (kips)	bx	b18	-Gt	Log [Wtx/Wt18]	EALF	W18
1	100	17.7	1770	7510	15.02	3.901	6.474	0.089	0.3458	0.4510	798
2	59	17.7	1044	7795	15.59	4.319	6.474	0.089	0.2753	0.5305	554
3	200	17.7	3540	8040	16.08	4.705	6.474	0.089	0.2164	0.6075	2151
4	200	17.7	3540	8550	17.10	5.592	6.474	0.089	0.0988	0.7966	2820
5	200	17.7	3540	8705	17.41	5.885	6.474	0.089	0.0642	0.8625	3053
6	200	17.7	3540	8764	17.53	6.000	6.474	0.089	0.0512	0.8887	3146
sum	959									Total ESAL =	12522

Load Data to 1.0 in displacement- Section No. 10 @ 60 mph
Displacement during seating load (25 cycles) = 0.08 in

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	Lx (kips)	bx	b18	-Gt	Log [Wtx/Wt18]	EALF	W18
1	75	17.7	1328	7510	15.02	3.901	6.474	0.089	0.3458	0.4510	599
2	59	17.7	1044	7795	15.59	4.319	6.474	0.089	0.2753	0.5305	554
3	200	17.7	3540	8040	16.08	4.705	6.474	0.089	0.2164	0.6075	2151
4	200	17.7	3540	8550	17.10	5.592	6.474	0.089	0.0988	0.7966	2820
5	200	17.7	3540	8705	17.41	5.885	6.474	0.089	0.0642	0.8625	3053
6	126	17.7	2230	8764	17.53	6.000	6.474	0.089	0.0512	0.8887	1982
sum	860									Total ESAL =	11158

Conversion from Dual Tire Loads to ESAL - Section No. 10' @ 40 mph
Complete load data
HMA M_R = 370 ksi

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	L_x (kips)	β_x	β_{18}	$-G_t$	Log $[W_{tx}/W_{t18}]$	EALF	W_{18}
1	100	8.6	860	7510	15.02	2.822	4.603	0.089	0.3427	0.4542	391
2	59	8.6	507	7795	15.59	3.112	4.603	0.089	0.2729	0.5334	271
3	200	8.6	1720	8040	16.08	3.379	4.603	0.089	0.2146	0.6101	1049
4	200	8.6	1720	8550	17.10	3.993	4.603	0.089	0.0980	0.7980	1373
5	200	8.6	1720	8705	17.41	4.196	4.603	0.089	0.0637	0.8635	1485
6	200	8.6	1720	8764	17.53	4.275	4.603	0.089	0.0508	0.8895	1530
sum	959									Total ESAL =	6098

Load Data to 1.0 in displacement- Section No. 10' @ 40 mph
Displacement during seating load (25 cycles) = 0.08 in

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	L_x (kips)	β_x	β_{18}	$-G_t$	Log $[W_{tx}/W_{t18}]$	EALF	W_{18}
1	75	8.6	645	7510	15.02	2.822	4.603	0.089	0.3427	0.4542	293
2	59	8.6	507	7795	15.59	3.112	4.603	0.089	0.2729	0.5334	271
3	200	8.6	1720	8040	16.08	3.379	4.603	0.089	0.2146	0.6101	1049
4	200	8.6	1720	8550	17.10	3.993	4.603	0.089	0.0980	0.7980	1373
5	200	8.6	1720	8705	17.41	4.196	4.603	0.089	0.0637	0.8635	1485
6	126	8.6	1084	8764	17.53	4.275	4.603	0.089	0.0508	0.8895	964
sum	860									Total ESAL =	5435

Conversion from Dual Tire Loads to ESAL - Section No. 10' @ 60 mph
Complete load data
HMA M_R = 370 ksi

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	L_x (kips)	β_x	β_{18}	$-G_t$	Log $[W_{tx}/W_{t18}]$	EALF	W_{18}
1	100	9.5	950	7510	15.02	2.822	4.603	0.089	0.3427	0.4542	432
2	59	9.5	561	7795	15.59	3.112	4.603	0.089	0.2729	0.5334	299
3	200	9.5	1900	8040	16.08	3.379	4.603	0.089	0.2146	0.6101	1159
4	200	9.5	1900	8550	17.10	3.993	4.603	0.089	0.0980	0.7980	1516
5	200	9.5	1900	8705	17.41	4.196	4.603	0.089	0.0637	0.8635	1641
6	200	9.5	1900	8764	17.53	4.275	4.603	0.089	0.0508	0.8895	1690
sum	959									Total ESAL =	6737

Load Data to 1.0 in displacement- Section No. 10' @ 60 mph
Displacement during seating load (25 cycles) = 0.08 in

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	L_x (kips)	β_x	β_{18}	$-G_t$	Log $[W_{tx}/W_{t18}]$	EALF	W_{18}
1	75	9.5	713	7510	15.02	2.822	4.603	0.089	0.3427	0.4542	324
2	59	9.5	561	7795	15.59	3.112	4.603	0.089	0.2729	0.5334	299
3	200	9.5	1900	8040	16.08	3.379	4.603	0.089	0.2146	0.6101	1159
4	200	9.5	1900	8550	17.10	3.993	4.603	0.089	0.0980	0.7980	1516
5	200	9.5	1900	8705	17.41	4.196	4.603	0.089	0.0637	0.8635	1641
6	126	9.5	1197	8764	17.53	4.275	4.603	0.089	0.0508	0.8895	1065
sum	860									Total ESAL =	6003

Conversion from Dual Tire Loads to ESAL - Section No. 11 @ 40 mph
Complete load data
HMA M_R = 250 ksi

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	L_x (kips)	β_x	β_{18}	$-G_t$	Log $[W_{tx}/W_{t18}]$	EALF	W_{18}
1	51	12.2	622	7991	15.98	4.036	5.625	0.089	0.2274	0.5924	369
2	200	12.2	2440	8877	17.75	5.410	5.625	0.089	0.0265	0.9408	2296
3	200	12.2	2440	8955	17.91	5.546	5.625	0.089	0.0097	0.9780	2386
4	200	12.2	2440	8964	17.93	5.562	5.625	0.089	0.0077	0.9824	2397
5	200	12.2	2440	9029	18.06	5.677	5.625	0.089	-0.0062	1.0144	2475
6	200	12.2	2440	8906	17.81	5.460	5.625	0.089	0.0202	0.9545	2329
7	200	12.2	2440	8972	17.94	5.576	5.625	0.089	0.0060	0.9863	2407
8	200	12.2	2440	8985	17.97	5.599	5.625	0.089	0.0032	0.9926	2422
9	200	12.2	2440	8962	17.92	5.558	5.625	0.089	0.0081	0.9814	2395
10	200	12.2	2440	8966	17.93	5.565	5.625	0.089	0.0073	0.9834	2399
11	200	12.2	2440	8974	17.95	5.579	5.625	0.089	0.0056	0.9873	2409
12	200	12.2	2440	8970	17.94	5.572	5.625	0.089	0.0064	0.9853	2404
13	200	12.2	2440	8984	17.97	5.597	5.625	0.089	0.0034	0.9921	2421
sum	2451									Total ESAL =	29108

Load Data to 1.0 in displacement- Section No. 11 @ 40 mph
Displacement during seating load (25 cycles) = 0.15 in

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	L_x (kips)	β_x	β_{18}	$-G_t$	Log $[W_{tx}/W_{t18}]$	EALF	W_{18}
1	26	12.2	317	7991	15.98	4.036	5.625	0.089	0.2274	0.5924	188
2	200	12.2	2440	8877	17.75	5.410	5.625	0.089	0.0265	0.9408	2296
3	200	12.2	2440	8955	17.91	5.546	5.625	0.089	0.0097	0.9780	2386
4	200	12.2	2440	8964	17.93	5.562	5.625	0.089	0.0077	0.9824	2397
5	200	12.2	2440	9029	18.06	5.677	5.625	0.089	-0.0062	1.0144	2475
6	200	12.2	2440	8906	17.81	5.460	5.625	0.089	0.0202	0.9545	2329
7	200	12.2	2440	8972	17.94	5.576	5.625	0.089	0.0060	0.9863	2407
8	200	12.2	2440	8985	17.97	5.599	5.625	0.089	0.0032	0.9926	2422
9	200	12.2	2440	8962	17.92	5.558	5.625	0.089	0.0081	0.9814	2395
10	200	12.2	2440	8966	17.93	5.565	5.625	0.089	0.0073	0.9834	2399
11	200	12.2	2440	8974	17.95	5.579	5.625	0.089	0.0056	0.9873	2409
12	200	12.2	2440	8970	17.94	5.572	5.625	0.089	0.0064	0.9853	2404
13	1274	12.2	15543	8984	17.97	5.597	5.625	0.089	0.0034	0.9921	15421
										Total ESAL =	41927

Conversion from Dual Tire Loads to ESAL - Section No. 11 @ 60 mph
Complete load data
HMA M_R = 250 ksi

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	L_x (kips)	β_x	β_{18}	$-G_t$	Log $[W_{tx}/W_{t18}]$	EALF	W_{18}
1	51	16.3	831	7991	15.98	4.036	5.625	0.089	0.2274	0.5924	492
2	200	16.3	3260	8877	17.75	5.410	5.625	0.089	0.0265	0.9408	3067
3	200	16.3	3260	8955	17.91	5.546	5.625	0.089	0.0097	0.9780	3188
4	200	16.3	3260	8964	17.93	5.562	5.625	0.089	0.0077	0.9824	3203
5	200	16.3	3260	9029	18.06	5.677	5.625	0.089	-0.0062	1.0144	3307
6	200	16.3	3260	8906	17.81	5.460	5.625	0.089	0.0202	0.9545	3112
7	200	16.3	3260	8972	17.94	5.576	5.625	0.089	0.0060	0.9863	3215
8	200	16.3	3260	8985	17.97	5.599	5.625	0.089	0.0032	0.9926	3236
9	200	16.3	3260	8962	17.92	5.558	5.625	0.089	0.0081	0.9814	3199
10	200	16.3	3260	8966	17.93	5.565	5.625	0.089	0.0073	0.9834	3206
11	200	16.3	3260	8974	17.95	5.579	5.625	0.089	0.0056	0.9873	3218
12	200	16.3	3260	8970	17.94	5.572	5.625	0.089	0.0064	0.9853	3212
13	200	16.3	3260	8984	17.97	5.597	5.625	0.089	0.0034	0.9921	3234
sum	2451									Total ESAL =	38891

Load Data to 1.0 in displacement- Section No. 11 @ 60 mph
Displacement during seating load (25 cycles) = 0.15 in

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	L_x (kips)	β_x	β_{18}	$-G_t$	Log $[W_{tx}/W_{t18}]$	EALF	W_{18}
1	26	16.3	424	7991	15.98	4.036	5.625	0.089	0.2274	0.5924	251
2	200	16.3	3260	8877	17.75	5.410	5.625	0.089	0.0265	0.9408	3067
3	200	16.3	3260	8955	17.91	5.546	5.625	0.089	0.0097	0.9780	3188
4	200	16.3	3260	8964	17.93	5.562	5.625	0.089	0.0077	0.9824	3203
5	200	16.3	3260	9029	18.06	5.677	5.625	0.089	-0.0062	1.0144	3307
6	200	16.3	3260	8906	17.81	5.460	5.625	0.089	0.0202	0.9545	3112
7	200	16.3	3260	8972	17.94	5.576	5.625	0.089	0.0060	0.9863	3215
8	200	16.3	3260	8985	17.97	5.599	5.625	0.089	0.0032	0.9926	3236
9	200	16.3	3260	8962	17.92	5.558	5.625	0.089	0.0081	0.9814	3199
10	200	16.3	3260	8966	17.93	5.565	5.625	0.089	0.0073	0.9834	3206
11	200	16.3	3260	8974	17.95	5.579	5.625	0.089	0.0056	0.9873	3218
12	200	16.3	3260	8970	17.94	5.572	5.625	0.089	0.0064	0.9853	3212
13	1274	16.3	20766	8984	17.97	5.597	5.625	0.089	0.0034	0.9921	20603
										Total ESAL =	56018

Conversion from Dual Tire Loads to ESAL - Section No. 11' @ 40 mph
Complete load data
HMA M_R = 370 ksi

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	L_x (kips)	β_x	β_{18}	$-G_t$	Log $[W_{tx}/W_{t18}]$	EALF	W_{18}
1	51	8.4	428	7991	15.98	2.941	4.053	0.089	0.2253	0.5953	255
2	200	8.4	1680	8877	17.75	3.902	4.053	0.089	0.0263	0.9413	1581
3	200	8.4	1680	8955	17.91	3.997	4.053	0.089	0.0096	0.9782	1643
4	200	8.4	1680	8964	17.93	4.008	4.053	0.089	0.0077	0.9825	1651
5	200	8.4	1680	9029	18.06	4.089	4.053	0.089	-0.0061	1.0143	1704
6	200	8.4	1680	8906	17.81	3.937	4.053	0.089	0.0200	0.9549	1604
7	200	8.4	1680	8972	17.94	4.018	4.053	0.089	0.0060	0.9864	1657
8	200	8.4	1680	8985	17.97	4.034	4.053	0.089	0.0032	0.9927	1668
9	200	8.4	1680	8962	17.92	4.006	4.053	0.089	0.0081	0.9816	1649
10	200	8.4	1680	8966	17.93	4.011	4.053	0.089	0.0072	0.9835	1652
11	200	8.4	1680	8974	17.95	4.020	4.053	0.089	0.0055	0.9874	1659
12	200	8.4	1680	8970	17.94	4.015	4.053	0.089	0.0064	0.9854	1656
13	200	8.4	1680	8984	17.97	4.033	4.053	0.089	0.0034	0.9922	1667
sum	2451									Total ESAL =	20046

Load Data to 1.0 in displacement- Section No. 11' @ 40 mph
Displacement during seating load (25 cycles) = 0.15 in

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	L_x (kips)	β_x	β_{18}	$-G_t$	Log $[W_{tx}/W_{t18}]$	EALF	W_{18}
1	26	8.4	218	7991	15.98	2.941	4.053	0.089	0.2253	0.5953	130
2	200	8.4	1680	8877	17.75	3.902	4.053	0.089	0.0263	0.9413	1581
3	200	8.4	1680	8955	17.91	3.997	4.053	0.089	0.0096	0.9782	1643
4	200	8.4	1680	8964	17.93	4.008	4.053	0.089	0.0077	0.9825	1651
5	200	8.4	1680	9029	18.06	4.089	4.053	0.089	-0.0061	1.0143	1704
6	200	8.4	1680	8906	17.81	3.937	4.053	0.089	0.0200	0.9549	1604
7	200	8.4	1680	8972	17.94	4.018	4.053	0.089	0.0060	0.9864	1657
8	200	8.4	1680	8985	17.97	4.034	4.053	0.089	0.0032	0.9927	1668
9	200	8.4	1680	8962	17.92	4.006	4.053	0.089	0.0081	0.9816	1649
10	200	8.4	1680	8966	17.93	4.011	4.053	0.089	0.0072	0.9835	1652
11	200	8.4	1680	8974	17.95	4.020	4.053	0.089	0.0055	0.9874	1659
12	200	8.4	1680	8970	17.94	4.015	4.053	0.089	0.0064	0.9854	1656
13	1274	8.4	10702	8984	17.97	4.033	4.053	0.089	0.0034	0.9922	10618
										Total ESAL =	28872

Conversion from Dual Tire Loads to ESAL - Section No. 11' @ 60 mph
Complete load data
HMA M_R = 370 ksi

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	L_x (kips)	β_x	β_{18}	$-G_t$	Log $[W_{tx}/W_{t18}]$	EALF	W_{18}
1	51	9.2	469	7991	15.98	2.941	4.053	0.089	0.2253	0.5953	279
2	200	9.2	1840	8877	17.75	3.902	4.053	0.089	0.0263	0.9413	1732
3	200	9.2	1840	8955	17.91	3.997	4.053	0.089	0.0096	0.9782	1800
4	200	9.2	1840	8964	17.93	4.008	4.053	0.089	0.0077	0.9825	1808
5	200	9.2	1840	9029	18.06	4.089	4.053	0.089	-0.0061	1.0143	1866
6	200	9.2	1840	8906	17.81	3.937	4.053	0.089	0.0200	0.9549	1757
7	200	9.2	1840	8972	17.94	4.018	4.053	0.089	0.0060	0.9864	1815
8	200	9.2	1840	8985	17.97	4.034	4.053	0.089	0.0032	0.9927	1827
9	200	9.2	1840	8962	17.92	4.006	4.053	0.089	0.0081	0.9816	1806
10	200	9.2	1840	8966	17.93	4.011	4.053	0.089	0.0072	0.9835	1810
11	200	9.2	1840	8974	17.95	4.020	4.053	0.089	0.0055	0.9874	1817
12	200	9.2	1840	8970	17.94	4.015	4.053	0.089	0.0064	0.9854	1813
13	200	9.2	1840	8984	17.97	4.033	4.053	0.089	0.0034	0.9922	1826
sum	2451									Total ESAL =	21955

Load Data to 1.0 in displacement- Section No. 11' @ 60 mph
Displacement during seating load (25 cycles) = 0.15 in

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	L_x (kips)	β_x	β_{18}	$-G_t$	Log $[W_{tx}/W_{t18}]$	EALF	W_{18}
1	26	9.2	239	7991	15.98	2.941	4.053	0.089	0.2253	0.5953	142
2	200	9.2	1840	8877	17.75	3.902	4.053	0.089	0.0263	0.9413	1732
3	200	9.2	1840	8955	17.91	3.997	4.053	0.089	0.0096	0.9782	1800
4	200	9.2	1840	8964	17.93	4.008	4.053	0.089	0.0077	0.9825	1808
5	200	9.2	1840	9029	18.06	4.089	4.053	0.089	-0.0061	1.0143	1866
6	200	9.2	1840	8906	17.81	3.937	4.053	0.089	0.0200	0.9549	1757
7	200	9.2	1840	8972	17.94	4.018	4.053	0.089	0.0060	0.9864	1815
8	200	9.2	1840	8985	17.97	4.034	4.053	0.089	0.0032	0.9927	1827
9	200	9.2	1840	8962	17.92	4.006	4.053	0.089	0.0081	0.9816	1806
10	200	9.2	1840	8966	17.93	4.011	4.053	0.089	0.0072	0.9835	1810
11	200	9.2	1840	8974	17.95	4.020	4.053	0.089	0.0055	0.9874	1817
12	200	9.2	1840	8970	17.94	4.015	4.053	0.089	0.0064	0.9854	1813
13	1274	9.2	11721	8984	17.97	4.033	4.053	0.089	0.0034	0.9922	11629
										Total ESAL =	31622

Conversion from Dual Tire Loads to ESAL - Section No. 12 @ 40 mph
Complete load data
HMA M_R = 250 ksi

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	L_x (kips)	β_x	β_{18}	$-G_t$	Log $[W_{tx}/W_{t18}]$	EALF	W_{18}
1	75	13.3	998	7812	15.62	3.671	5.436	0.089	0.2700	0.5370	536
2	200	13.3	2660	8749	17.50	5.019	5.436	0.089	0.0543	0.8824	2347
3	200	13.3	2660	8878	17.76	5.230	5.436	0.089	0.0262	0.9414	2504
4	200	13.3	2660	8834	17.67	5.157	5.436	0.089	0.0358	0.9209	2450
5	200	13.3	2660	8923	17.85	5.305	5.436	0.089	0.0165	0.9627	2561
6	200	13.3	2660	8915	17.83	5.292	5.436	0.089	0.0183	0.9588	2551
7	200	13.3	2660	8883	17.77	5.238	5.436	0.089	0.0252	0.9437	2510
8	200	13.3	2660	8907	17.81	5.278	5.436	0.089	0.0200	0.9550	2540
sum	1475									Total ESAL =	17998

Load Data to 1.0 in displacement- Section No. 12 @ 40 mph
Displacement during seating load (25 cycles) = 0.19 in

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	L_x (kips)	β_x	β_{18}	$-G_t$	Log $[W_{tx}/W_{t18}]$	EALF	W_{18}
1	50	13.3	665	7812	15.62	3.671	5.436	0.089	0.2700	0.5370	357
2	200	13.3	2660	8749	17.50	5.019	5.436	0.089	0.0543	0.8824	2347
3	200	13.3	2660	8878	17.76	5.230	5.436	0.089	0.0262	0.9414	2504
4	200	13.3	2660	8834	17.67	5.157	5.436	0.089	0.0358	0.9209	2450
5	200	13.3	2660	8923	17.85	5.305	5.436	0.089	0.0165	0.9627	2561
6	200	13.3	2660	8915	17.83	5.292	5.436	0.089	0.0183	0.9588	2551
7	200	13.3	2660	8883	17.77	5.238	5.436	0.089	0.0252	0.9437	2510
8	200	13.3	2660	8907	17.81	5.278	5.436	0.089	0.0200	0.9550	2540
sum	1450									Total ESAL =	17820

Conversion from Dual Tire Loads to ESAL - Section No. 12 @ 60 mph
Complete load data
HMA M_R = 250 ksi

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	L_x (kips)	β_x	β_{18}	$-G_t$	Log $[W_{tx}/W_{t18}]$	EALF	W_{18}
1	75	18.2	1365	7812	15.62	3.671	5.436	0.089	0.2700	0.5370	733
2	200	18.2	3640	8749	17.50	5.019	5.436	0.089	0.0543	0.8824	3212
3	200	18.2	3640	8878	17.76	5.230	5.436	0.089	0.0262	0.9414	3427
4	200	18.2	3640	8834	17.67	5.157	5.436	0.089	0.0358	0.9209	3352
5	200	18.2	3640	8923	17.85	5.305	5.436	0.089	0.0165	0.9627	3504
6	200	18.2	3640	8915	17.83	5.292	5.436	0.089	0.0183	0.9588	3490
7	200	18.2	3640	8883	17.77	5.238	5.436	0.089	0.0252	0.9437	3435
8	200	18.2	3640	8907	17.81	5.278	5.436	0.089	0.0200	0.9550	3476
sum	1475									Total ESAL =	24629

Load Data to 1.0 in displacement- Section No. 12 @ 60 mph
Displacement during seating load (25 cycles) = 0.19 in

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	L_x (kips)	β_x	β_{18}	$-G_t$	Log $[W_{tx}/W_{t18}]$	EALF	W_{18}
1	50	18.2	910	7812	15.62	3.671	5.436	0.089	0.2700	0.5370	489
2	200	18.2	3640	8749	17.50	5.019	5.436	0.089	0.0543	0.8824	3212
3	200	18.2	3640	8878	17.76	5.230	5.436	0.089	0.0262	0.9414	3427
4	200	18.2	3640	8834	17.67	5.157	5.436	0.089	0.0358	0.9209	3352
5	200	18.2	3640	8923	17.85	5.305	5.436	0.089	0.0165	0.9627	3504
6	200	18.2	3640	8915	17.83	5.292	5.436	0.089	0.0183	0.9588	3490
7	200	18.2	3640	8883	17.77	5.238	5.436	0.089	0.0252	0.9437	3435
8	200	18.2	3640	8907	17.81	5.278	5.436	0.089	0.0200	0.9550	3476
sum	1450									Total ESAL =	24385

Conversion from Dual Tire Loads to ESAL - Section No. 12' @ 40 mph
Complete load data
HMA M_R = 370 ksi

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	L_x (kips)	β_x	β_{18}	$-G_t$	Log $[W_{tx}/W_{t18}]$	EALF	W_{18}
1	75	8.7	653	7812	15.62	2.615	3.81	0.089	0.2672	0.5405	353
2	200	8.7	1740	8749	17.50	3.527	3.81	0.089	0.0538	0.8834	1537
3	200	8.7	1740	8878	17.76	3.670	3.81	0.089	0.0260	0.9419	1639
4	200	8.7	1740	8834	17.67	3.621	3.81	0.089	0.0355	0.9216	1604
5	200	8.7	1740	8923	17.85	3.721	3.81	0.089	0.0164	0.9630	1676
6	200	8.7	1740	8915	17.83	3.712	3.81	0.089	0.0181	0.9592	1669
7	200	8.7	1740	8883	17.77	3.676	3.81	0.089	0.0249	0.9442	1643
8	200	8.7	1740	8907	17.81	3.703	3.81	0.089	0.0198	0.9554	1662
sum	1475									Total ESAL =	11782

Load Data to 1.0 in displacement- Section No. 12' @ 40 mph
Displacement during seating load (25 cycles) = 0.19 in

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	L_x (kips)	β_x	β_{18}	$-G_t$	Log $[W_{tx}/W_{t18}]$	EALF	W_{18}
1	50	8.7	435	7812	15.62	2.615	3.81	0.089	0.2672	0.5405	235
2	200	8.7	1740	8749	17.50	3.527	3.81	0.089	0.0538	0.8834	1537
3	200	8.7	1740	8878	17.76	3.670	3.81	0.089	0.0260	0.9419	1639
4	200	8.7	1740	8834	17.67	3.621	3.81	0.089	0.0355	0.9216	1604
5	200	8.7	1740	8923	17.85	3.721	3.81	0.089	0.0164	0.9630	1676
6	200	8.7	1740	8915	17.83	3.712	3.81	0.089	0.0181	0.9592	1669
7	200	8.7	1740	8883	17.77	3.676	3.81	0.089	0.0249	0.9442	1643
8	200	8.7	1740	8907	17.81	3.703	3.81	0.089	0.0198	0.9554	1662
sum	1450									Total ESAL =	11665

Conversion from Dual Tire Loads to ESAL - Section No. 12' @ 60 mph
Complete load data
HMA M_R = 370 ksi

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	L_x (kips)	β_x	β_{18}	$-G_t$	Log $[W_{tx}/W_{t18}]$	EALF	W_{18}
1	75	9.8	735	7812	15.62	2.615	3.81	0.089	0.2672	0.5405	397
2	200	9.8	1960	8749	17.50	3.527	3.81	0.089	0.0538	0.8834	1732
3	200	9.8	1960	8878	17.76	3.670	3.81	0.089	0.0260	0.9419	1846
4	200	9.8	1960	8834	17.67	3.621	3.81	0.089	0.0355	0.9216	1806
5	200	9.8	1960	8923	17.85	3.721	3.81	0.089	0.0164	0.9630	1887
6	200	9.8	1960	8915	17.83	3.712	3.81	0.089	0.0181	0.9592	1880
7	200	9.8	1960	8883	17.77	3.676	3.81	0.089	0.0249	0.9442	1851
8	200	9.8	1960	8907	17.81	3.703	3.81	0.089	0.0198	0.9554	1873
sum	1475									Total ESAL =	13272

Load Data to 1.0 in displacement- Section No. 12' @ 60 mph
Displacement during seating load (25 cycles) = 0.19 in

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	L_x (kips)	β_x	β_{18}	$-G_t$	Log $[W_{tx}/W_{t18}]$	EALF	W_{18}
1	50	9.8	490	7812	15.62	2.615	3.81	0.089	0.2672	0.5405	265
2	200	9.8	1960	8749	17.50	3.527	3.81	0.089	0.0538	0.8834	1732
3	200	9.8	1960	8878	17.76	3.670	3.81	0.089	0.0260	0.9419	1846
4	200	9.8	1960	8834	17.67	3.621	3.81	0.089	0.0355	0.9216	1806
5	200	9.8	1960	8923	17.85	3.721	3.81	0.089	0.0164	0.9630	1887
6	200	9.8	1960	8915	17.83	3.712	3.81	0.089	0.0181	0.9592	1880
7	200	9.8	1960	8883	17.77	3.676	3.81	0.089	0.0249	0.9442	1851
8	200	9.8	1960	8907	17.81	3.703	3.81	0.089	0.0198	0.9554	1873
sum	1450									Total ESAL =	13140

Conversion from Dual Tire Loads to ESAL - Section No. 13 @ 40 mph
Complete load data
HMA M_R = 250 ksi

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	L_x (kips)	β_x	β_{18}	$-G_t$	Log $[W_{tx}/W_{t18}]$	EALF	W_{18}
1	50	8.2	410	7516	15.03	2.916	4.755	0.089	0.3415	0.4555	187
2	200	8.2	1640	8582	17.16	4.755	5.436	0.089	0.0913	0.8105	1329
3	200	8.2	1640	8844	17.69	5.174	5.436	0.089	0.0336	0.9255	1518
4	200	8.2	1640	8868	17.74	5.213	5.436	0.089	0.0284	0.9367	1536
5	200	8.2	1640	8861	17.72	5.202	5.436	0.089	0.0299	0.9334	1531
6	200	8.2	1640	8908	17.82	5.280	5.436	0.089	0.0198	0.9555	1567
sum	1050									Total ESAL =	7668

Load Data to 1.0 in displacement- Section No. 13 @ 40 mph
Displacement during seating load (25 cycles) = 0.19 in

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	L_x (kips)	β_x	β_{18}	$-G_t$	Log $[W_{tx}/W_{t18}]$	EALF	W_{18}
1	25	8.2	205	7516	15.03	2.916	4.755	0.089	0.3415	0.4555	93
2	200	8.2	1640	8582	17.16	4.755	5.436	0.089	0.0913	0.8105	1329
3	200	8.2	1640	8844	17.69	5.174	5.436	0.089	0.0336	0.9255	1518
4	200	8.2	1640	8868	17.74	5.213	5.436	0.089	0.0284	0.9367	1536
5	200	8.2	1640	8861	17.72	5.202	5.436	0.089	0.0299	0.9334	1531
6	875	8.2	7175	8908	17.82	5.280	5.436	0.089	0.0198	0.9555	6856
sum	1700									Total ESAL =	12863

Conversion from Dual Tire Loads to ESAL - Section No. 13 @ 60 mph
Complete load data
HMA M_R = 250 ksi

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	L_x (kips)	β_x	β_{18}	$-G_t$	Log $[W_{tx}/W_{t18}]$	EALF	W_{18}
1	50	9.8	490	7516	15.03	2.916	4.755	0.089	0.3415	0.4555	223
2	200	9.8	1960	8582	17.16	4.755	5.436	0.089	0.0913	0.8105	1589
3	200	9.8	1960	8844	17.69	5.174	5.436	0.089	0.0336	0.9255	1814
4	200	9.8	1960	8868	17.74	5.213	5.436	0.089	0.0284	0.9367	1836
5	200	9.8	1960	8861	17.72	5.202	5.436	0.089	0.0299	0.9334	1829
6	200	9.8	1960	8908	17.82	5.280	5.436	0.089	0.0198	0.9555	1873
sum	1050									Total ESAL =	9164

Load Data to 1.0 in displacement- Section No. 13 @ 60 mph
Displacement during seating load (25 cycles) = 0.19 in

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	L_x (kips)	β_x	β_{18}	$-G_t$	Log $[W_{tx}/W_{t18}]$	EALF	W_{18}
1	25	9.8	245	7516	15.03	2.916	4.755	0.089	0.3415	0.4555	112
2	200	9.8	1960	8582	17.16	4.755	5.436	0.089	0.0913	0.8105	1589
3	200	9.8	1960	8844	17.69	5.174	5.436	0.089	0.0336	0.9255	1814
4	200	9.8	1960	8868	17.74	5.213	5.436	0.089	0.0284	0.9367	1836
5	200	9.8	1960	8861	17.72	5.202	5.436	0.089	0.0299	0.9334	1829
6	875	9.8	8575	8908	17.82	5.280	5.436	0.089	0.0198	0.9555	8194
sum	1700									Total ESAL =	15373

Conversion from Dual Tire Loads to ESAL - Section No. 13' @ 40 mph
Complete load data
HMA M_R = 370 ksi

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	L_x (kips)	β_x	β_{18}	$-G_t$	Log $[W_{tx}/W_{t18}]$	EALF	W_{18}
1	50	6.7	335	7516	15.03	2.272	3.64	0.089	0.3386	0.4585	154
2	200	6.7	1340	8582	17.16	3.202	3.64	0.089	0.0903	0.8123	1089
3	200	6.7	1340	8844	17.69	3.472	3.64	0.089	0.0333	0.9263	1241
4	200	6.7	1340	8868	17.74	3.497	3.64	0.089	0.0281	0.9373	1256
5	200	6.7	1340	8861	17.72	3.490	3.64	0.089	0.0296	0.9341	1252
6	200	6.7	1340	8908	17.82	3.540	3.64	0.089	0.0196	0.9560	1281
sum	1050									Total ESAL =	6272

Load Data to 1.0 in displacement- Section No. 13' @ 40 mph
Displacement during seating load (25 cycles) = 0.19 in

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	L_x (kips)	β_x	β_{18}	$-G_t$	Log $[W_{tx}/W_{t18}]$	EALF	W_{18}
1	25	6.7	168	7516	15.03	2.272	3.64	0.089	0.3386	0.4585	77
2	200	6.7	1340	8582	17.16	3.202	3.64	0.089	0.0903	0.8123	1089
3	200	6.7	1340	8844	17.69	3.472	3.64	0.089	0.0333	0.9263	1241
4	200	6.7	1340	8868	17.74	3.497	3.64	0.089	0.0281	0.9373	1256
5	200	6.7	1340	8861	17.72	3.490	3.64	0.089	0.0296	0.9341	1252
6	875	6.7	5863	8908	17.82	3.540	3.64	0.089	0.0196	0.9560	5604
sum	1700									Total ESAL =	10519

Conversion from Dual Tire Loads to ESAL - Section No. 13' @ 60 mph
Complete load data
HMA M_R = 370 ksi

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	L_x (kips)	β_x	β_{18}	$-G_t$	Log $[W_{tx}/W_{t18}]$	EALF	W_{18}
1	50	6.7	335	7516	15.03	2.272	3.64	0.089	0.3386	0.4585	154
2	200	6.7	1340	8582	17.16	3.202	3.64	0.089	0.0903	0.8123	1089
3	200	6.7	1340	8844	17.69	3.472	3.64	0.089	0.0333	0.9263	1241
4	200	6.7	1340	8868	17.74	3.497	3.64	0.089	0.0281	0.9373	1256
5	200	6.7	1340	8861	17.72	3.490	3.64	0.089	0.0296	0.9341	1252
6	200	6.7	1340	8908	17.82	3.540	3.64	0.089	0.0196	0.9560	1281
sum	1050									Total ESAL =	6272

Load Data to 1.0 in displacement- Section No. 13' @ 60 mph
Displacement during seating load (25 cycles) = 0.19 in

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	L_x (kips)	β_x	β_{18}	$-G_t$	Log $[W_{tx}/W_{t18}]$	EALF	W_{18}
1	25	6.7	168	7516	15.03	2.272	3.64	0.089	0.3386	0.4585	77
2	200	6.7	1340	8582	17.16	3.202	3.64	0.089	0.0903	0.8123	1089
3	200	6.7	1340	8844	17.69	3.472	3.64	0.089	0.0333	0.9263	1241
4	200	6.7	1340	8868	17.74	3.497	3.64	0.089	0.0281	0.9373	1256
5	200	6.7	1340	8861	17.72	3.490	3.64	0.089	0.0296	0.9341	1252
6	875	6.7	5863	8908	17.82	3.540	3.64	0.089	0.0196	0.9560	5604
sum	1700									Total ESAL =	10519

Conversion from Dual Tire Loads to ESAL - Section No. 14 @ 40 mph
Complete load data
HMA M_R = 250 ksi

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	L_x (kips)	β_x	β_{18}	$-G_t$	Log $[W_{tx}/W_{t18}]$	EALF	W_{18}
1	50	6.9	345	9000	18.00	2.699	2.699	0.089	0.0000	1.0000	345
2	200	6.9	1380	9000	18.00	2.699	2.699	0.089	0.0000	1.0000	1380
3	200	6.9	1380	9059	18.12	2.745	2.699	0.089	-0.0123	1.0288	1420
4	200	6.9	1380	8910	17.82	2.629	2.699	0.089	0.0189	0.9573	1321
5	200	6.9	1380	8921	17.84	2.637	2.699	0.089	0.0166	0.9625	1328
6	200	6.9	1380	8843	17.69	2.578	2.699	0.089	0.0331	0.9266	1279
7	200	6.9	1380	8890	17.78	2.614	2.699	0.089	0.0232	0.9481	1308
8	200	6.9	1380	8898	17.80	2.620	2.699	0.089	0.0215	0.9518	1313
9	200	6.9	1380	8899	17.80	2.621	2.699	0.089	0.0213	0.9522	1314
10	200	6.9	1380	8972	17.94	2.677	2.699	0.089	0.0059	0.9866	1361
11	200	6.9	1380	8894	17.79	2.617	2.699	0.089	0.0223	0.9499	1311
12	200	6.9	1380	8947	17.89	2.657	2.699	0.089	0.0111	0.9747	1345
13	200	6.9	1380	8910	17.82	2.629	2.699	0.089	0.0189	0.9573	1321
14	200	6.9	1380	8910	17.82	2.629	2.699	0.089	0.0189	0.9573	1321
15	200	6.9	1380	8930	17.86	2.644	2.699	0.089	0.0147	0.9667	1334
16	200	6.9	1380	8952	17.90	2.661	2.699	0.089	0.0101	0.9771	1348
17	200	6.9	1380	8918	17.84	2.635	2.699	0.089	0.0172	0.9611	1326
18	200	6.9	1380	8986	17.97	2.688	2.699	0.089	0.0029	0.9933	1371
19	200	6.9	1380	8942	17.88	2.654	2.699	0.089	0.0122	0.9723	1342
20	200	6.9	1380	8985	17.97	2.687	2.699	0.089	0.0031	0.9928	1370
21	200	6.9	1380	8957	17.91	2.665	2.699	0.089	0.0090	0.9794	1352
22	200	6.9	1380	8963	17.93	2.670	2.699	0.089	0.0078	0.9823	1356
23	200	6.9	1380	8948	17.90	2.658	2.699	0.089	0.0109	0.9752	1346

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	L_x (kips)	β_x	β_{18}	$-G_t$	Log $[W_{tx}/W_{t18}]$	EALF	W_{18}
24	200	6.9	1380	8943	17.89	2.654	2.699	0.089	0.0120	0.9728	1342
25	200	6.9	1380	8916	17.83	2.634	2.699	0.089	0.0177	0.9601	1325
26	200	6.9	1380	8931	17.86	2.645	2.699	0.089	0.0145	0.9672	1335
27	200	6.9	1380	8817	17.63	2.559	2.699	0.089	0.0387	0.9148	1262
28	200	6.9	1380	8938	17.88	2.651	2.699	0.089	0.0130	0.9705	1339
29	200	6.9	1380	8919	17.84	2.636	2.699	0.089	0.0170	0.9615	1327
30	200	6.9	1380	8928	17.86	2.643	2.699	0.089	0.0151	0.9658	1333
31	200	6.9	1380	8930	17.86	2.644	2.699	0.089	0.0147	0.9667	1334
32	200	6.9	1380	8920	17.84	2.637	2.699	0.089	0.0168	0.9620	1328
33	200	6.9	1380	8950	17.90	2.660	2.699	0.089	0.0105	0.9761	1347
34	200	6.9	1380	8931	17.86	2.645	2.699	0.089	0.0145	0.9672	1335
sum	6650									Total ESAL =	44419

Load Data to 1.0 in displacement- Section No. 14 @ 40 mph
Displacement during seating load (25 cycles) = 0.19 in

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	L_x (kips)	β_x	β_{18}	$-G_t$	Log $[W_{tx}/W_{t18}]$	EALF	W_{18}
1	25	6.9	173	9000	18.00	2.699	2.699	0.089	0.0000	1.0000	173
2	200	6.9	1380	9000	18.00	2.699	2.699	0.089	0.0000	1.0000	1380
3	200	6.9	1380	9059	18.12	2.745	2.699	0.089	-0.0123	1.0288	1420
4	200	6.9	1380	8910	17.82	2.629	2.699	0.089	0.0189	0.9573	1321
5	200	6.9	1380	8921	17.84	2.637	2.699	0.089	0.0166	0.9625	1328
6	200	6.9	1380	8843	17.69	2.578	2.699	0.089	0.0331	0.9266	1279
7	200	6.9	1380	8890	17.78	2.614	2.699	0.089	0.0232	0.9481	1308
8	200	6.9	1380	8898	17.80	2.620	2.699	0.089	0.0215	0.9518	1313
9	200	6.9	1380	8899	17.80	2.621	2.699	0.089	0.0213	0.9522	1314
10	200	6.9	1380	8972	17.94	2.677	2.699	0.089	0.0059	0.9866	1361
11	200	6.9	1380	8894	17.79	2.617	2.699	0.089	0.0223	0.9499	1311
12	200	6.9	1380	8947	17.89	2.657	2.699	0.089	0.0111	0.9747	1345
13	200	6.9	1380	8910	17.82	2.629	2.699	0.089	0.0189	0.9573	1321
14	200	6.9	1380	8910	17.82	2.629	2.699	0.089	0.0189	0.9573	1321
15	200	6.9	1380	8930	17.86	2.644	2.699	0.089	0.0147	0.9667	1334
16	200	6.9	1380	8952	17.90	2.661	2.699	0.089	0.0101	0.9771	1348
17	200	6.9	1380	8918	17.84	2.635	2.699	0.089	0.0172	0.9611	1326
18	200	6.9	1380	8986	17.97	2.688	2.699	0.089	0.0029	0.9933	1371
19	200	6.9	1380	8942	17.88	2.654	2.699	0.089	0.0122	0.9723	1342
20	200	6.9	1380	8985	17.97	2.687	2.699	0.089	0.0031	0.9928	1370
21	200	6.9	1380	8957	17.91	2.665	2.699	0.089	0.0090	0.9794	1352
22	200	6.9	1380	8963	17.93	2.670	2.699	0.089	0.0078	0.9823	1356
23	200	6.9	1380	8948	17.90	2.658	2.699	0.089	0.0109	0.9752	1346
24	200	6.9	1380	8943	17.89	2.654	2.699	0.089	0.0120	0.9728	1342

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	L_x (kips)	β_x	β_{18}	$-G_t$	Log $[W_{tx}/W_{t18}]$	EALF	W_{18}
25	200	6.9	1380	8916	17.83	2.634	2.699	0.089	0.0177	0.9601	1325
26	200	6.9	1380	8931	17.86	2.645	2.699	0.089	0.0145	0.9672	1335
27	200	6.9	1380	8817	17.63	2.559	2.699	0.089	0.0387	0.9148	1262
28	200	6.9	1380	8938	17.88	2.651	2.699	0.089	0.0130	0.9705	1339
29	200	6.9	1380	8919	17.84	2.636	2.699	0.089	0.0170	0.9615	1327
30	200	6.9	1380	8928	17.86	2.643	2.699	0.089	0.0151	0.9658	1333
31	200	6.9	1380	8930	17.86	2.644	2.699	0.089	0.0147	0.9667	1334
32	200	6.9	1380	8920	17.84	2.637	2.699	0.089	0.0168	0.9620	1328
33	200	6.9	1380	8950	17.90	2.660	2.699	0.089	0.0105	0.9761	1347
34	5825	6.9	40193	8931	17.86	2.645	2.699	0.089	0.0145	0.9672	38873
sum	12250									Total ESAL =	81785

Conversion from Dual Tire Loads to ESAL - Section No. 14 @ 60 mph
Complete load data
HMA M_R = 250 ksi

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	L_x (kips)	β_x	β_{18}	$-G_t$	Log $[W_{tx}/W_{t18}]$	EALF	W_{18}
1	50	8.8	440	9000	18.00	2.699	2.699	0.089	0.0000	1.0000	440
2	200	8.8	1760	9000	18.00	2.699	2.699	0.089	0.0000	1.0000	1760
3	200	8.8	1760	9059	18.12	2.745	2.699	0.089	-0.0123	1.0288	1811
4	200	8.8	1760	8910	17.82	2.629	2.699	0.089	0.0189	0.9573	1685
5	200	8.8	1760	8921	17.84	2.637	2.699	0.089	0.0166	0.9625	1694
6	200	8.8	1760	8843	17.69	2.578	2.699	0.089	0.0331	0.9266	1631
7	200	8.8	1760	8890	17.78	2.614	2.699	0.089	0.0232	0.9481	1669
8	200	8.8	1760	8898	17.80	2.620	2.699	0.089	0.0215	0.9518	1675
9	200	8.8	1760	8899	17.80	2.621	2.699	0.089	0.0213	0.9522	1676
10	200	8.8	1760	8972	17.94	2.677	2.699	0.089	0.0059	0.9866	1736
11	200	8.8	1760	8894	17.79	2.617	2.699	0.089	0.0223	0.9499	1672
12	200	8.8	1760	8947	17.89	2.657	2.699	0.089	0.0111	0.9747	1715
13	200	8.8	1760	8910	17.82	2.629	2.699	0.089	0.0189	0.9573	1685
14	200	8.8	1760	8910	17.82	2.629	2.699	0.089	0.0189	0.9573	1685
15	200	8.8	1760	8930	17.86	2.644	2.699	0.089	0.0147	0.9667	1701
16	200	8.8	1760	8952	17.90	2.661	2.699	0.089	0.0101	0.9771	1720
17	200	8.8	1760	8918	17.84	2.635	2.699	0.089	0.0172	0.9611	1692
18	200	8.8	1760	8986	17.97	2.688	2.699	0.089	0.0029	0.9933	1748
19	200	8.8	1760	8942	17.88	2.654	2.699	0.089	0.0122	0.9723	1711
20	200	8.8	1760	8985	17.97	2.687	2.699	0.089	0.0031	0.9928	1747
21	200	8.8	1760	8957	17.91	2.665	2.699	0.089	0.0090	0.9794	1724
22	200	8.8	1760	8963	17.93	2.670	2.699	0.089	0.0078	0.9823	1729
23	200	8.8	1760	8948	17.90	2.658	2.699	0.089	0.0109	0.9752	1716

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	L_x (kips)	β_x	β_{18}	$-G_t$	Log $[W_{tx}/W_{t18}]$	EALF	W_{18}
24	200	8.8	1760	8943	17.89	2.654	2.699	0.089	0.0120	0.9728	1712
25	200	8.8	1760	8916	17.83	2.634	2.699	0.089	0.0177	0.9601	1690
26	200	8.8	1760	8931	17.86	2.645	2.699	0.089	0.0145	0.9672	1702
27	200	8.8	1760	8817	17.63	2.559	2.699	0.089	0.0387	0.9148	1610
28	200	8.8	1760	8938	17.88	2.651	2.699	0.089	0.0130	0.9705	1708
29	200	8.8	1760	8919	17.84	2.636	2.699	0.089	0.0170	0.9615	1692
30	200	8.8	1760	8928	17.86	2.643	2.699	0.089	0.0151	0.9658	1700
31	200	8.8	1760	8930	17.86	2.644	2.699	0.089	0.0147	0.9667	1701
32	200	8.8	1760	8920	17.84	2.637	2.699	0.089	0.0168	0.9620	1693
33	200	8.8	1760	8950	17.90	2.660	2.699	0.089	0.0105	0.9761	1718
34	200	8.8	1760	8931	17.86	2.645	2.699	0.089	0.0145	0.9672	1702
sum	6650									Total ESAL =	56651

Load Data to 1.0 in displacement - Section No. 14 @ 60 mph
Displacement during seating load (25 cycles) = 0.19 in

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	L_x (kips)	β_x	β_{18}	$-G_t$	Log $[W_{tx}/W_{t18}]$	EALF	W_{18}
1	25	8.8	220	9000	18.00	2.699	2.699	0.089	0.0000	1.0000	220
2	200	8.8	1760	9000	18.00	2.699	2.699	0.089	0.0000	1.0000	1760
3	200	8.8	1760	9059	18.12	2.745	2.699	0.089	-0.0123	1.0288	1811
4	200	8.8	1760	8910	17.82	2.629	2.699	0.089	0.0189	0.9573	1685
5	200	8.8	1760	8921	17.84	2.637	2.699	0.089	0.0166	0.9625	1694
6	200	8.8	1760	8843	17.69	2.578	2.699	0.089	0.0331	0.9266	1631
7	200	8.8	1760	8890	17.78	2.614	2.699	0.089	0.0232	0.9481	1669
8	200	8.8	1760	8898	17.80	2.620	2.699	0.089	0.0215	0.9518	1675
9	200	8.8	1760	8899	17.80	2.621	2.699	0.089	0.0213	0.9522	1676
10	200	8.8	1760	8972	17.94	2.677	2.699	0.089	0.0059	0.9866	1736
11	200	8.8	1760	8894	17.79	2.617	2.699	0.089	0.0223	0.9499	1672
12	200	8.8	1760	8947	17.89	2.657	2.699	0.089	0.0111	0.9747	1715
13	200	8.8	1760	8910	17.82	2.629	2.699	0.089	0.0189	0.9573	1685
14	200	8.8	1760	8910	17.82	2.629	2.699	0.089	0.0189	0.9573	1685
15	200	8.8	1760	8930	17.86	2.644	2.699	0.089	0.0147	0.9667	1701
16	200	8.8	1760	8952	17.90	2.661	2.699	0.089	0.0101	0.9771	1720
17	200	8.8	1760	8918	17.84	2.635	2.699	0.089	0.0172	0.9611	1692
18	200	8.8	1760	8986	17.97	2.688	2.699	0.089	0.0029	0.9933	1748
19	200	8.8	1760	8942	17.88	2.654	2.699	0.089	0.0122	0.9723	1711
20	200	8.8	1760	8985	17.97	2.687	2.699	0.089	0.0031	0.9928	1747
21	200	8.8	1760	8957	17.91	2.665	2.699	0.089	0.0090	0.9794	1724
22	200	8.8	1760	8963	17.93	2.670	2.699	0.089	0.0078	0.9823	1729
23	200	8.8	1760	8948	17.90	2.658	2.699	0.089	0.0109	0.9752	1716
24	200	8.8	1760	8943	17.89	2.654	2.699	0.089	0.0120	0.9728	1712

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	L_x (kips)	β_x	β_{18}	$-G_t$	Log $[W_{tx}/W_{t18}]$	EALF	W_{18}
25	200	8.8	1760	8916	17.83	2.634	2.699	0.089	0.0177	0.9601	1690
26	200	8.8	1760	8931	17.86	2.645	2.699	0.089	0.0145	0.9672	1702
27	200	8.8	1760	8817	17.63	2.559	2.699	0.089	0.0387	0.9148	1610
28	200	8.8	1760	8938	17.88	2.651	2.699	0.089	0.0130	0.9705	1708
29	200	8.8	1760	8919	17.84	2.636	2.699	0.089	0.0170	0.9615	1692
30	200	8.8	1760	8928	17.86	2.643	2.699	0.089	0.0151	0.9658	1700
31	200	8.8	1760	8930	17.86	2.644	2.699	0.089	0.0147	0.9667	1701
32	200	8.8	1760	8920	17.84	2.637	2.699	0.089	0.0168	0.9620	1693
33	200	8.8	1760	8950	17.90	2.660	2.699	0.089	0.0105	0.9761	1718
34	5825	8.8	51260	8931	17.86	2.645	2.699	0.089	0.0145	0.9672	49577
sum	12250									Total ESAL =	104306

Conversion from Dual Tire Loads to ESAL - Section No. 14' @ 40 mph
Complete load data
HMA M_R = 370 ksi

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	L_x (kips)	β_x	β_{18}	$-G_t$	Log $[W_{tx}/W_{t18}]$	EALF	W_{18}
1	50	5.3	265	9000	18.00	2.066	2.066	0.089	0.0000	1.0000	265
2	200	5.3	1060	9000	18.00	2.066	2.066	0.089	0.0000	1.0000	1060
3	200	5.3	1060	9059	18.12	2.099	2.066	0.089	-0.0122	1.0285	1090
4	200	5.3	1060	8910	17.82	2.015	2.066	0.089	0.0187	0.9578	1015
5	200	5.3	1060	8921	17.84	2.021	2.066	0.089	0.0164	0.9629	1021
6	200	5.3	1060	8843	17.69	1.978	2.066	0.089	0.0328	0.9273	983
7	200	5.3	1060	8890	17.78	2.004	2.066	0.089	0.0229	0.9486	1006
8	200	5.3	1060	8898	17.80	2.009	2.066	0.089	0.0212	0.9523	1009
9	200	5.3	1060	8899	17.80	2.009	2.066	0.089	0.0210	0.9527	1010
10	200	5.3	1060	8972	17.94	2.050	2.066	0.089	0.0058	0.9867	1046
11	200	5.3	1060	8894	17.79	2.006	2.066	0.089	0.0221	0.9505	1007
12	200	5.3	1060	8947	17.89	2.036	2.066	0.089	0.0110	0.9750	1033
13	200	5.3	1060	8910	17.82	2.015	2.066	0.089	0.0187	0.9578	1015
14	200	5.3	1060	8910	17.82	2.015	2.066	0.089	0.0187	0.9578	1015
15	200	5.3	1060	8930	17.86	2.026	2.066	0.089	0.0145	0.9671	1025
16	200	5.3	1060	8952	17.90	2.039	2.066	0.089	0.0100	0.9773	1036
17	200	5.3	1060	8918	17.84	2.020	2.066	0.089	0.0171	0.9615	1019
18	200	5.3	1060	8986	17.97	2.058	2.066	0.089	0.0029	0.9933	1053
19	200	5.3	1060	8942	17.88	2.033	2.066	0.089	0.0120	0.9726	1031
20	200	5.3	1060	8985	17.97	2.057	2.066	0.089	0.0031	0.9929	1052
21	200	5.3	1060	8957	17.91	2.041	2.066	0.089	0.0089	0.9797	1038
22	200	5.3	1060	8963	17.93	2.045	2.066	0.089	0.0077	0.9825	1041
23	200	5.3	1060	8948	17.90	2.036	2.066	0.089	0.0108	0.9754	1034

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	L_x (kips)	β_x	β_{18}	$-G_t$	Log $[W_{tx}/W_{t18}]$	EALF	W_{18}
24	200	5.3	1060	8943	17.89	2.034	2.066	0.089	0.0118	0.9731	1031
25	200	5.3	1060	8916	17.83	2.019	2.066	0.089	0.0175	0.9606	1018
26	200	5.3	1060	8931	17.86	2.027	2.066	0.089	0.0143	0.9675	1026
27	200	5.3	1060	8817	17.63	1.964	2.066	0.089	0.0382	0.9157	971
28	200	5.3	1060	8938	17.88	2.031	2.066	0.089	0.0129	0.9708	1029
29	200	5.3	1060	8919	17.84	2.020	2.066	0.089	0.0168	0.9620	1020
30	200	5.3	1060	8928	17.86	2.025	2.066	0.089	0.0150	0.9661	1024
31	200	5.3	1060	8930	17.86	2.026	2.066	0.089	0.0145	0.9671	1025
32	200	5.3	1060	8920	17.84	2.021	2.066	0.089	0.0166	0.9624	1020
33	200	5.3	1060	8950	17.90	2.038	2.066	0.089	0.0104	0.9764	1035
34	200	5.3	1060	8931	17.86	2.027	2.066	0.089	0.0143	0.9675	1026
sum	6650									Total ESAL =	34131

Load Data to 1.0 in displacement - Section No. 14' @ 40 mph
Displacement during seating load (25 cycles) = 0.19 in

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	L_x (kips)	β_x	β_{18}	$-G_t$	Log $[W_{tx}/W_{t18}]$	EALF	W_{18}
1	25	5.3	133	9000	18.00	2.066	2.066	0.089	0.0000	1.0000	133
2	200	5.3	1060	9000	18.00	2.066	2.066	0.089	0.0000	1.0000	1060
3	200	5.3	1060	9059	18.12	2.099	2.066	0.089	-0.0122	1.0285	1090
4	200	5.3	1060	8910	17.82	2.015	2.066	0.089	0.0187	0.9578	1015
5	200	5.3	1060	8921	17.84	2.021	2.066	0.089	0.0164	0.9629	1021
6	200	5.3	1060	8843	17.69	1.978	2.066	0.089	0.0328	0.9273	983
7	200	5.3	1060	8890	17.78	2.004	2.066	0.089	0.0229	0.9486	1006
8	200	5.3	1060	8898	17.80	2.009	2.066	0.089	0.0212	0.9523	1009
9	200	5.3	1060	8899	17.80	2.009	2.066	0.089	0.0210	0.9527	1010
10	200	5.3	1060	8972	17.94	2.050	2.066	0.089	0.0058	0.9867	1046
11	200	5.3	1060	8894	17.79	2.006	2.066	0.089	0.0221	0.9505	1007
12	200	5.3	1060	8947	17.89	2.036	2.066	0.089	0.0110	0.9750	1033
13	200	5.3	1060	8910	17.82	2.015	2.066	0.089	0.0187	0.9578	1015
14	200	5.3	1060	8910	17.82	2.015	2.066	0.089	0.0187	0.9578	1015
15	200	5.3	1060	8930	17.86	2.026	2.066	0.089	0.0145	0.9671	1025
16	200	5.3	1060	8952	17.90	2.039	2.066	0.089	0.0100	0.9773	1036
17	200	5.3	1060	8918	17.84	2.020	2.066	0.089	0.0171	0.9615	1019
18	200	5.3	1060	8986	17.97	2.058	2.066	0.089	0.0029	0.9933	1053
19	200	5.3	1060	8942	17.88	2.033	2.066	0.089	0.0120	0.9726	1031
20	200	5.3	1060	8985	17.97	2.057	2.066	0.089	0.0031	0.9929	1052
21	200	5.3	1060	8957	17.91	2.041	2.066	0.089	0.0089	0.9797	1038
22	200	5.3	1060	8963	17.93	2.045	2.066	0.089	0.0077	0.9825	1041
23	200	5.3	1060	8948	17.90	2.036	2.066	0.089	0.0108	0.9754	1034
24	200	5.3	1060	8943	17.89	2.034	2.066	0.089	0.0118	0.9731	1031

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	L_x (kips)	β_x	β_{18}	$-G_t$	Log $[W_{tx}/W_{t18}]$	EALF	W_{18}
25	200	5.3	1060	8916	17.83	2.019	2.066	0.089	0.0175	0.9606	1018
26	200	5.3	1060	8931	17.86	2.027	2.066	0.089	0.0143	0.9675	1026
27	200	5.3	1060	8817	17.63	1.964	2.066	0.089	0.0382	0.9157	971
28	200	5.3	1060	8938	17.88	2.031	2.066	0.089	0.0129	0.9708	1029
29	200	5.3	1060	8919	17.84	2.020	2.066	0.089	0.0168	0.9620	1020
30	200	5.3	1060	8928	17.86	2.025	2.066	0.089	0.0150	0.9661	1024
31	200	5.3	1060	8930	17.86	2.026	2.066	0.089	0.0145	0.9671	1025
32	200	5.3	1060	8920	17.84	2.021	2.066	0.089	0.0166	0.9624	1020
33	200	5.3	1060	8950	17.90	2.038	2.066	0.089	0.0104	0.9764	1035
34	5825	5.3	30873	8931	17.86	2.027	2.066	0.089	0.0143	0.9675	29870
sum	12250									Total ESAL =	62843

Conversion from Dual Tire Loads to ESAL - Section No. 14' @ 60 mph
Complete load data
HMA M_R = 370 ksi

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	L_x (kips)	β_x	β_{18}	$-G_t$	Log $[W_{tx}/W_{t18}]$	EALF	W_{18}
1	50	8.8	440	9000	18.00	2.699	2.699	0.089	0.0000	1.0000	440
2	200	8.8	1760	9000	18.00	2.699	2.699	0.089	0.0000	1.0000	1760
3	200	8.8	1760	9059	18.12	2.745	2.699	0.089	-0.0123	1.0288	1811
4	200	8.8	1760	8910	17.82	2.629	2.699	0.089	0.0189	0.9573	1685
5	200	8.8	1760	8921	17.84	2.637	2.699	0.089	0.0166	0.9625	1694
6	200	8.8	1760	8843	17.69	2.578	2.699	0.089	0.0331	0.9266	1631
7	200	8.8	1760	8890	17.78	2.614	2.699	0.089	0.0232	0.9481	1669
8	200	8.8	1760	8898	17.80	2.620	2.699	0.089	0.0215	0.9518	1675
9	200	8.8	1760	8899	17.80	2.621	2.699	0.089	0.0213	0.9522	1676
10	200	8.8	1760	8972	17.94	2.677	2.699	0.089	0.0059	0.9866	1736
11	200	8.8	1760	8894	17.79	2.617	2.699	0.089	0.0223	0.9499	1672
12	200	8.8	1760	8947	17.89	2.657	2.699	0.089	0.0111	0.9747	1715
13	200	8.8	1760	8910	17.82	2.629	2.699	0.089	0.0189	0.9573	1685
14	200	8.8	1760	8910	17.82	2.629	2.699	0.089	0.0189	0.9573	1685
15	200	8.8	1760	8930	17.86	2.644	2.699	0.089	0.0147	0.9667	1701
16	200	8.8	1760	8952	17.90	2.661	2.699	0.089	0.0101	0.9771	1720
17	200	8.8	1760	8918	17.84	2.635	2.699	0.089	0.0172	0.9611	1692
18	200	8.8	1760	8986	17.97	2.688	2.699	0.089	0.0029	0.9933	1748
19	200	8.8	1760	8942	17.88	2.654	2.699	0.089	0.0122	0.9723	1711
20	200	8.8	1760	8985	17.97	2.687	2.699	0.089	0.0031	0.9928	1747
21	200	8.8	1760	8957	17.91	2.665	2.699	0.089	0.0090	0.9794	1724
22	200	8.8	1760	8963	17.93	2.670	2.699	0.089	0.0078	0.9823	1729
23	200	8.8	1760	8948	17.90	2.658	2.699	0.089	0.0109	0.9752	1716

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	L_x (kips)	β_x	β_{18}	$-G_t$	Log $[W_{tx}/W_{t18}]$	EALF	W_{18}
24	200	8.8	1760	8943	17.89	2.654	2.699	0.089	0.0120	0.9728	1712
25	200	8.8	1760	8916	17.83	2.634	2.699	0.089	0.0177	0.9601	1690
26	200	8.8	1760	8931	17.86	2.645	2.699	0.089	0.0145	0.9672	1702
27	200	8.8	1760	8817	17.63	2.559	2.699	0.089	0.0387	0.9148	1610
28	200	8.8	1760	8938	17.88	2.651	2.699	0.089	0.0130	0.9705	1708
29	200	8.8	1760	8919	17.84	2.636	2.699	0.089	0.0170	0.9615	1692
30	200	8.8	1760	8928	17.86	2.643	2.699	0.089	0.0151	0.9658	1700
31	200	8.8	1760	8930	17.86	2.644	2.699	0.089	0.0147	0.9667	1701
32	200	8.8	1760	8920	17.84	2.637	2.699	0.089	0.0168	0.9620	1693
33	200	8.8	1760	8950	17.90	2.660	2.699	0.089	0.0105	0.9761	1718
34	200	8.8	1760	8931	17.86	2.645	2.699	0.089	0.0145	0.9672	1702
sum	6650									Total ESAL =	56651

Load Data to 1.0 in displacement - Section No. 14' @ 60 mph
Displacement during seating load (25 cycles) = 0.19 in

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	L_x (kips)	β_x	β_{18}	$-G_t$	Log $[W_{tx}/W_{t18}]$	EALF	W_{18}
1	25	8.8	220	9000	18.00	2.699	2.699	0.089	0.0000	1.0000	220
2	200	8.8	1760	9000	18.00	2.699	2.699	0.089	0.0000	1.0000	1760
3	200	8.8	1760	9059	18.12	2.745	2.699	0.089	-0.0123	1.0288	1811
4	200	8.8	1760	8910	17.82	2.629	2.699	0.089	0.0189	0.9573	1685
5	200	8.8	1760	8921	17.84	2.637	2.699	0.089	0.0166	0.9625	1694
6	200	8.8	1760	8843	17.69	2.578	2.699	0.089	0.0331	0.9266	1631
7	200	8.8	1760	8890	17.78	2.614	2.699	0.089	0.0232	0.9481	1669
8	200	8.8	1760	8898	17.80	2.620	2.699	0.089	0.0215	0.9518	1675
9	200	8.8	1760	8899	17.80	2.621	2.699	0.089	0.0213	0.9522	1676
10	200	8.8	1760	8972	17.94	2.677	2.699	0.089	0.0059	0.9866	1736
11	200	8.8	1760	8894	17.79	2.617	2.699	0.089	0.0223	0.9499	1672
12	200	8.8	1760	8947	17.89	2.657	2.699	0.089	0.0111	0.9747	1715
13	200	8.8	1760	8910	17.82	2.629	2.699	0.089	0.0189	0.9573	1685
14	200	8.8	1760	8910	17.82	2.629	2.699	0.089	0.0189	0.9573	1685
15	200	8.8	1760	8930	17.86	2.644	2.699	0.089	0.0147	0.9667	1701
16	200	8.8	1760	8952	17.90	2.661	2.699	0.089	0.0101	0.9771	1720
17	200	8.8	1760	8918	17.84	2.635	2.699	0.089	0.0172	0.9611	1692
18	200	8.8	1760	8986	17.97	2.688	2.699	0.089	0.0029	0.9933	1748
19	200	8.8	1760	8942	17.88	2.654	2.699	0.089	0.0122	0.9723	1711
20	200	8.8	1760	8985	17.97	2.687	2.699	0.089	0.0031	0.9928	1747
21	200	8.8	1760	8957	17.91	2.665	2.699	0.089	0.0090	0.9794	1724
22	200	8.8	1760	8963	17.93	2.670	2.699	0.089	0.0078	0.9823	1729
23	200	8.8	1760	8948	17.90	2.658	2.699	0.089	0.0109	0.9752	1716
24	200	8.8	1760	8943	17.89	2.654	2.699	0.089	0.0120	0.9728	1712

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	L_x (kips)	β_x	β_{18}	$-G_t$	Log $[W_{tx}/W_{t18}]$	EALF	W_{18}
25	200	8.8	1760	8916	17.83	2.634	2.699	0.089	0.0177	0.9601	1690
26	200	8.8	1760	8931	17.86	2.645	2.699	0.089	0.0145	0.9672	1702
27	200	8.8	1760	8817	17.63	2.559	2.699	0.089	0.0387	0.9148	1610
28	200	8.8	1760	8938	17.88	2.651	2.699	0.089	0.0130	0.9705	1708
29	200	8.8	1760	8919	17.84	2.636	2.699	0.089	0.0170	0.9615	1692
30	200	8.8	1760	8928	17.86	2.643	2.699	0.089	0.0151	0.9658	1700
31	200	8.8	1760	8930	17.86	2.644	2.699	0.089	0.0147	0.9667	1701
32	200	8.8	1760	8920	17.84	2.637	2.699	0.089	0.0168	0.9620	1693
33	200	8.8	1760	8950	17.90	2.660	2.699	0.089	0.0105	0.9761	1718
34	5825	8.8	51260	8931	17.86	2.645	2.699	0.089	0.0145	0.9672	49577
sum	12250									Total ESAL =	104306

Conversion from Dual Tire Loads to ESAL - Section No. 15 @ 40 mph
Complete load data
HMA M_R = 250 ksi

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	L_x (kips)	β_x	β_{18}	$-G_t$	Log $[W_{tx}/W_{t18}]$	EALF	W_{18}
1	25	11.8	295	5824	11.65	2.305	7.491	0.089	0.8198	0.1514	45
2	50	11.8	590	7057	14.11	3.787	7.491	0.089	0.4644	0.3433	203
3	100	11.8	1180	7161	14.32	3.939	7.491	0.089	0.4369	0.3657	432
4	200	11.8	2360	7201	14.40	3.999	7.491	0.089	0.4264	0.3747	884
sum	375									Total ESAL =	1563

Load Data to 1.0 in displacement - Section No. 15 @ 40 mph
Displacement during seating load (25 cycles) = 0.48 in

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	L_x (kips)	β_x	β_{18}	$-G_t$	Log $[W_{tx}/W_{t18}]$	EALF	W_{18}
1	0	11.8	0	5824	11.65	2.305	7.491	0.089	0.8198	0.1514	0
2	50	11.8	590	7057	14.11	3.787	7.491	0.089	0.4644	0.3433	203
3	100	11.8	1180	7161	14.32	3.939	7.491	0.089	0.4369	0.3657	432
4	170	11.8	2006	7201	14.40	3.999	7.491	0.089	0.4264	0.3747	752
sum	320									Total ESAL =	1386

Conversion from Dual Tire Loads to ESAL - Section No. 15 @ 60 mph
Complete load data
HMA M_R = 250 ksi

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	L_x (kips)	β_x	β_{18}	$-G_t$	Log [W_{tx}/W_{t18}]	EALF	W_{18}
1	25	16.8	420	5824	11.65	2.305	7.491	0.089	0.8198	0.1514	64
2	50	16.8	840	7057	14.11	3.787	7.491	0.089	0.4644	0.3433	288
3	100	16.8	1680	7161	14.32	3.939	7.491	0.089	0.4369	0.3657	614
4	200	16.8	3360	7201	14.40	3.999	7.491	0.089	0.4264	0.3747	1259
sum	375									Total ESAL =	2225

Load Data to 1.0 in displacement - Section No. 15 @ 60 mph
Displacement during seating load (25 cycles) = 0.48 in

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	L_x (kips)	β_x	β_{18}	$-G_t$	Log [W_{tx}/W_{t18}]	EALF	W_{18}
1	0	16.8	0	5824	11.65	2.305	7.491	0.089	0.8198	0.1514	0
2	50	16.8	840	7057	14.11	3.787	7.491	0.089	0.4644	0.3433	288
3	100	16.8	1680	7161	14.32	3.939	7.491	0.089	0.4369	0.3657	614
4	170	16.8	2856	7201	14.40	3.999	7.491	0.089	0.4264	0.3747	1070
sum	320									Total ESAL =	1973

Conversion from Dual Tire Loads to ESAL - Section No. 15' @ 40 mph
Complete load data
HMA M_R = 370 ksi

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	L_x (kips)	β_x	β_{18}	$-G_t$	Log $[W_{tx}/W_{t18}]$	EALF	W_{18}
1	25	7.4	185	5824	11.65	1.680	5.167	0.089	0.8108	0.1546	29
2	50	7.4	370	7057	14.11	2.676	5.167	0.089	0.4600	0.3467	128
3	100	7.4	740	7161	14.32	2.779	5.167	0.089	0.4328	0.3692	273
4	200	7.4	1480	7201	14.40	2.819	5.167	0.089	0.4224	0.3781	560
sum	375									Total ESAL =	990

Load Data to 1.0 in displacement - Section No. 15' @ 40 mph
Displacement during seating load (25 cycles) = 0.48 in

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	L_x (kips)	β_x	β_{18}	$-G_t$	Log $[W_{tx}/W_{t18}]$	EALF	W_{18}
1	0	7.4	0	5824	11.65	1.680	5.167	0.089	0.8108	0.1546	0
2	50	7.4	370	7057	14.11	2.676	5.167	0.089	0.4600	0.3467	128
3	100	7.4	740	7161	14.32	2.779	5.167	0.089	0.4328	0.3692	273
4	170	7.4	1258	7201	14.40	2.819	5.167	0.089	0.4224	0.3781	476
sum	320									Total ESAL =	877

Conversion from Dual Tire Loads to ESAL - Section No. 15' @ 60 mph
Complete load data
HMA M_R = 370 ksi

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	L_x (kips)	β_x	β_{18}	$-G_t$	Log $[W_{tx}/W_{t18}]$	EALF	W_{18}
1	25	8.2	205	5824	11.65	1.680	5.167	0.089	0.8108	0.1546	32
2	50	8.2	410	7057	14.11	2.676	5.167	0.089	0.4600	0.3467	142
3	100	8.2	820	7161	14.32	2.779	5.167	0.089	0.4328	0.3692	303
4	200	8.2	1640	7201	14.40	2.819	5.167	0.089	0.4224	0.3781	620
sum	375									Total ESAL =	1097

Load Data to 1.0 in displacement - Section No. 15' @ 60 mph
Displacement during seating load (25 cycles) = 0.48 in

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	L_x (kips)	β_x	β_{18}	$-G_t$	Log $[W_{tx}/W_{t18}]$	EALF	W_{18}
1	0	8.2	0	5824	11.65	1.680	5.167	0.089	0.8108	0.1546	0
2	50	8.2	410	7057	14.11	2.676	5.167	0.089	0.4600	0.3467	142
3	100	8.2	820	7161	14.32	2.779	5.167	0.089	0.4328	0.3692	303
4	170	8.2	1394	7201	14.40	2.819	5.167	0.089	0.4224	0.3781	527
sum	320									Total ESAL =	972

Conversion from Dual Tire Loads to ESAL - Section No. 16 @ 40 mph
Complete load data
HMA M_R = 250 ksi

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	L_x (kips)	β_x	β_{18}	$-G_t$	Log $[W_{tx}/W_{t18}]$	EALF	W_{18}
1	25	13.0	325	6505	13.01	2.215	5.254	0.089	0.6106	0.2452	80
2	50	13.0	650	7080	14.16	2.741	5.254	0.089	0.4542	0.3514	228
3	100	13.0	1300	7180	14.36	2.842	5.254	0.089	0.4281	0.3732	485
4	200	13.0	2600	7319	14.64	2.988	5.254	0.089	0.3923	0.4053	1054
5	200	13.0	2600	7676	15.35	3.389	5.254	0.089	0.3029	0.4978	1294
6	200	13.0	2600	7863	15.73	3.616	5.254	0.089	0.2575	0.5527	1437
sum	775									Total ESAL =	4578

Load Data to 1.0 in displacement - Section No. 16 @ 40 mph
Displacement during seating load (25 cycles) = 0.36 in

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	L_x (kips)	β_x	β_{18}	$-G_t$	Log $[W_{tx}/W_{t18}]$	EALF	W_{18}
1	0	13.0	0	6505	13.01	2.215	5.254	0.089	0.6106	0.2452	0
2	50	13.0	650	7080	14.16	2.741	5.254	0.089	0.4542	0.3514	228
3	100	13.0	1300	7180	14.36	2.842	5.254	0.089	0.4281	0.3732	485
4	200	13.0	2600	7319	14.64	2.988	5.254	0.089	0.3923	0.4053	1054
5	200	13.0	2600	7676	15.35	3.389	5.254	0.089	0.3029	0.4978	1294
6	60	13.0	780	7863	15.73	3.616	5.254	0.089	0.2575	0.5527	431
sum	610									Total ESAL =	3493

Conversion from Dual Tire Loads to ESAL - Section No. 16 @ 60 mph
Complete load data
HMA M_R = 250 ksi

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	L_x (kips)	β_x	β_{18}	$-G_t$	Log $[W_{tx}/W_{t18}]$	EALF	W_{18}
1	25	20.1	503	6505	13.01	2.215	5.254	0.089	0.6106	0.2452	123
2	50	20.1	1005	7080	14.16	2.741	5.254	0.089	0.4542	0.3514	353
3	100	20.1	2010	7180	14.36	2.842	5.254	0.089	0.4281	0.3732	750
4	200	20.1	4020	7319	14.64	2.988	5.254	0.089	0.3923	0.4053	1629
5	200	20.1	4020	7676	15.35	3.389	5.254	0.089	0.3029	0.4978	2001
6	200	20.1	4020	7863	15.73	3.616	5.254	0.089	0.2575	0.5527	2222
sum	775									Total ESAL =	7079

Load Data to 1.0 in displacement - Section No. 16 @ 60 mph
Displacement during seating load (25 cycles) = 0.36 in

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	L_x (kips)	β_x	β_{18}	$-G_t$	Log $[W_{tx}/W_{t18}]$	EALF	W_{18}
1	0	20.1	0	6505	13.01	2.215	5.254	0.089	0.6106	0.2452	0
2	50	20.1	1005	7080	14.16	2.741	5.254	0.089	0.4542	0.3514	353
3	100	20.1	2010	7180	14.36	2.842	5.254	0.089	0.4281	0.3732	750
4	200	20.1	4020	7319	14.64	2.988	5.254	0.089	0.3923	0.4053	1629
5	200	20.1	4020	7676	15.35	3.389	5.254	0.089	0.3029	0.4978	2001
6	60	20.1	1206	7863	15.73	3.616	5.254	0.089	0.2575	0.5527	667
sum	610									Total ESAL =	5400

Conversion from Dual Tire Loads to ESAL - Section No. 16' @ 40 mph
Complete load data
HMA M_R = 370 ksi

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	L_x (kips)	β_x	β_{18}	$-G_t$	Log $[W_{tx}/W_{t18}]$	EALF	W_{18}
1	25	7.4	185	6505	13.01	1.552	3.481	0.089	0.6020	0.2500	46
2	50	7.4	370	7080	14.16	1.886	3.481	0.089	0.4481	0.3564	132
3	100	7.4	740	7180	14.36	1.950	3.481	0.089	0.4224	0.3781	280
4	200	7.4	1480	7319	14.64	2.043	3.481	0.089	0.3871	0.4101	607
5	200	7.4	1480	7676	15.35	2.297	3.481	0.089	0.2991	0.5023	743
6	200	7.4	1480	7863	15.73	2.441	3.481	0.089	0.2543	0.5568	824
sum	775									Total ESAL =	2632

Load Data to 1.0 in displacement - Section No. 16' @ 40 mph
Displacement during seating load (25 cycles) = 0.36 in

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	L_x (kips)	β_x	β_{18}	$-G_t$	Log $[W_{tx}/W_{t18}]$	EALF	W_{18}
1	0	7.4	0	6505	13.01	1.552	3.481	0.089	0.6020	0.2500	0
2	50	7.4	370	7080	14.16	1.886	3.481	0.089	0.4481	0.3564	132
3	100	7.4	740	7180	14.36	1.950	3.481	0.089	0.4224	0.3781	280
4	200	7.4	1480	7319	14.64	2.043	3.481	0.089	0.3871	0.4101	607
5	200	7.4	1480	7676	15.35	2.297	3.481	0.089	0.2991	0.5023	743
6	60	7.4	444	7863	15.73	2.441	3.481	0.089	0.2543	0.5568	247
sum	610									Total ESAL =	2009

Conversion from Dual Tire Loads to ESAL - Section No. 16' @ 60 mph
Complete load data
HMA M_R = 370 ksi

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	L_x (kips)	β_x	β_{18}	$-G_t$	Log $[W_{tx}/W_{t18}]$	EALF	W_{18}
1	25	8.5	213	6505	13.01	1.552	3.481	0.089	0.6020	0.2500	53
2	50	8.5	425	7080	14.16	1.886	3.481	0.089	0.4481	0.3564	151
3	100	8.5	850	7180	14.36	1.950	3.481	0.089	0.4224	0.3781	321
4	200	8.5	1700	7319	14.64	2.043	3.481	0.089	0.3871	0.4101	697
5	200	8.5	1700	7676	15.35	2.297	3.481	0.089	0.2991	0.5023	854
6	200	8.5	1700	7863	15.73	2.441	3.481	0.089	0.2543	0.5568	947
sum	775									Total ESAL =	3024

Load Data to 1.0 in displacement - Section No. 16' @ 60 mph
Displacement during seating load (25 cycles) = 0.36 in

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	L_x (kips)	β_x	β_{18}	$-G_t$	Log $[W_{tx}/W_{t18}]$	EALF	W_{18}
1	0	8.5	0	6505	13.01	1.552	3.481	0.089	0.6020	0.2500	0
2	50	8.5	425	7080	14.16	1.886	3.481	0.089	0.4481	0.3564	151
3	100	8.5	850	7180	14.36	1.950	3.481	0.089	0.4224	0.3781	321
4	200	8.5	1700	7319	14.64	2.043	3.481	0.089	0.3871	0.4101	697
5	200	8.5	1700	7676	15.35	2.297	3.481	0.089	0.2991	0.5023	854
6	60	8.5	510	7863	15.73	2.441	3.481	0.089	0.2543	0.5568	284
sum	610									Total ESAL =	2308

Conversion from Dual Tire Loads to ESAL - Section No. 17 @ 40 mph
Complete load data
HMA M_R = 250 ksi

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	L_x (kips)	β_x	β_{18}	$-G_t$	Log $[W_{tx}/W_{t18}]$	EALF	W_{18}
1	25	14.6	365	7000	14.00	4.607	9.428	0.089	0.4819	0.3297	120
2	75	14.6	1095	7084	14.17	4.761	9.428	0.089	0.4593	0.3473	380
3	125	14.6	1825	6972	13.94	4.557	9.428	0.089	0.4894	0.3240	591
4	200	14.6	2920	7262	14.52	5.101	9.428	0.089	0.4123	0.3870	1130
5	200	14.6	2920	7167	14.33	4.917	9.428	0.089	0.4373	0.3654	1067
sum	625									Total ESAL =	3289

Load Data to 1.0 in displacement - Section No. 17 @ 40 mph
Displacement during seating load (25 cycles) = 0.33 in

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	L_x (kips)	β_x	β_{18}	$-G_t$	Log $[W_{tx}/W_{t18}]$	EALF	W_{18}
1	0	14.6	0	7000	14.00	4.607	9.428	0.089	0.4819	0.3297	0
2	75	14.6	1095	7084	14.17	4.761	9.428	0.089	0.4593	0.3473	380
3	125	14.6	1825	6972	13.94	4.557	9.428	0.089	0.4894	0.3240	591
4	200	14.6	2920	7262	14.52	5.101	9.428	0.089	0.4123	0.3870	1130
5	155	14.6	2263	7167	14.33	4.917	9.428	0.089	0.4373	0.3654	827
sum	555									Total ESAL =	2928

Conversion from Dual Tire Loads to ESAL - Section No. 17 @ 60 mph
Complete load data
HMA M_R = 250 ksi

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	L_x (kips)	β_x	β_{18}	$-G_t$	Log $[W_{tx}/W_{t18}]$	EALF	W_{18}
1	25	21.2	530	7000	14.00	4.607	9.428	0.089	0.4819	0.3297	175
2	75	21.2	1590	7084	14.17	4.761	9.428	0.089	0.4593	0.3473	552
3	125	21.2	2650	6972	13.94	4.557	9.428	0.089	0.4894	0.3240	859
4	200	21.2	4240	7262	14.52	5.101	9.428	0.089	0.4123	0.3870	1641
5	200	21.2	4240	7167	14.33	4.917	9.428	0.089	0.4373	0.3654	1549
sum	625									Total ESAL =	4775

Load Data to 1.0 in displacement - Section No. 17 @ 60 mph
Displacement during seating load (25 cycles) = 0.33 in

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	L_x (kips)	β_x	β_{18}	$-G_t$	Log $[W_{tx}/W_{t18}]$	EALF	W_{18}
1	0	21.2	0	7000	14.00	4.607	9.428	0.089	0.4819	0.3297	0
2	75	21.2	1590	7084	14.17	4.761	9.428	0.089	0.4593	0.3473	552
3	125	21.2	2650	6972	13.94	4.557	9.428	0.089	0.4894	0.3240	859
4	200	21.2	4240	7262	14.52	5.101	9.428	0.089	0.4123	0.3870	1641
5	155	21.2	3286	7167	14.33	4.917	9.428	0.089	0.4373	0.3654	1201
sum	555									Total ESAL =	4252

Conversion from Dual Tire Loads to ESAL - Section No. 17' @ 40 mph
Complete load data
HMA M_R = 370 ksi

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	L_x (kips)	β_x	β_{18}	$-G_t$	Log $[W_{tx}/W_{t18}]$	EALF	W_{18}
1	25	8.5	213	7000	14.00	3.230	6.474	0.089	0.4780	0.3327	71
2	75	8.5	638	7084	14.17	3.334	6.474	0.089	0.4556	0.3502	223
3	125	8.5	1063	6972	13.94	3.196	6.474	0.089	0.4854	0.3270	347
4	200	8.5	1700	7262	14.52	3.562	6.474	0.089	0.4091	0.3899	663
5	200	8.5	1700	7167	14.33	3.439	6.474	0.089	0.4338	0.3683	626
sum	625									Total ESAL =	1930

Load Data to 1.0 in displacement - Section No. 17' @ 40 mph
Displacement during seating load (25 cycles) = 0.33 in

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	L_x (kips)	β_x	β_{18}	$-G_t$	Log $[W_{tx}/W_{t18}]$	EALF	W_{18}
1	0	8.5	0	7000	14.00	3.230	6.474	0.089	0.4780	0.3327	0
2	75	8.5	638	7084	14.17	3.334	6.474	0.089	0.4556	0.3502	223
3	125	8.5	1063	6972	13.94	3.196	6.474	0.089	0.4854	0.3270	347
4	200	8.5	1700	7262	14.52	3.562	6.474	0.089	0.4091	0.3899	663
5	155	8.5	1318	7167	14.33	3.439	6.474	0.089	0.4338	0.3683	485
sum	555									Total ESAL =	1719

Conversion from Dual Tire Loads to ESAL - Section No. 17' @ 60 mph
Complete load data
HMA M_R = 370 ksi

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	L_x (kips)	β_x	β_{18}	$-G_t$	Log $[W_{tx}/W_{t18}]$	EALF	W_{18}
1	25	9.7	243	7000	14.00	3.230	6.474	0.089	0.4780	0.3327	81
2	75	9.7	728	7084	14.17	3.334	6.474	0.089	0.4556	0.3502	255
3	125	9.7	1213	6972	13.94	3.196	6.474	0.089	0.4854	0.3270	396
4	200	9.7	1940	7262	14.52	3.562	6.474	0.089	0.4091	0.3899	756
5	200	9.7	1940	7167	14.33	3.439	6.474	0.089	0.4338	0.3683	714
sum	625									Total ESAL =	2203

Load Data to 1.0 in displacement- Section No. 17' @ 60 mph
Displacement during seating load (25 cycles) = 0.33 in

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	L_x (kips)	β_x	β_{18}	$-G_t$	Log $[W_{tx}/W_{t18}]$	EALF	W_{18}
1	0	9.7	0	7000	14.00	3.230	6.474	0.089	0.4780	0.3327	0
2	75	9.7	728	7084	14.17	3.334	6.474	0.089	0.4556	0.3502	255
3	125	9.7	1213	6972	13.94	3.196	6.474	0.089	0.4854	0.3270	396
4	200	9.7	1940	7262	14.52	3.562	6.474	0.089	0.4091	0.3899	756
5	155	9.7	1504	7167	14.33	3.439	6.474	0.089	0.4338	0.3683	554
sum	555									Total ESAL =	1961

Conversion from Dual Tire Loads to ESAL - Section No. 18 @ 40 mph
Complete load data
HMA M_R = 250 ksi

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	L_x (kips)	β_x	β_{18}	$-G_t$	Log $[W_{tx}/W_{t18}]$	EALF	W_{18}
1	25	9.6	240	5683	11.37	1.730	5.723	0.089	0.8576	0.1388	33
2	50	9.6	480	6323	12.65	2.228	5.723	0.089	0.6642	0.2167	104
3	1	9.6	10	4548	9.10	1.091	5.723	0.089	1.2493	0.0563	1
4	100	9.6	960	6399	12.80	2.294	5.723	0.089	0.6423	0.2279	219
5	35	9.6	336	7507	15.01	3.464	5.723	0.089	0.3455	0.4513	152
6	150	9.6	1440	6451	12.90	2.341	5.723	0.089	0.6274	0.2358	340
sum	361									Total ESAL =	848

Load Data to 1.0 in displacement - Section No. 18 @ 40 mph
Displacement during seating load (25 cycles) = 0.41 in

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	L_x (kips)	β_x	β_{18}	$-G_t$	Log $[W_{tx}/W_{t18}]$	EALF	W_{18}
1	0	9.6	0	5683	11.37	1.730	5.723	0.089	0.8576	0.1388	0
2	50	9.6	480	6323	12.65	2.228	5.723	0.089	0.6642	0.2167	104
3	1	9.6	10	4548	9.10	1.091	5.723	0.089	1.2493	0.0563	1
4	100	9.6	960	6399	12.80	2.294	5.723	0.089	0.6423	0.2279	219
5	35	9.6	336	7507	15.01	3.464	5.723	0.089	0.3455	0.4513	152
6	104	9.6	998	6451	12.90	2.341	5.723	0.089	0.6274	0.2358	235
sum	290									Total ESAL =	710

Conversion from Dual Tire Loads to ESAL - Section No. 18 @ 60 mph
Complete load data
HMA M_R = 250 ksi

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	L_x (kips)	β_x	β_{18}	$-G_t$	Log $[W_{tx}/W_{t18}]$	EALF	W_{18}
1	25	13.5	338	5683	11.37	1.730	5.723	0.089	0.8576	0.1388	47
2	50	13.5	675	6323	12.65	2.228	5.723	0.089	0.6642	0.2167	146
3	1	13.5	14	4548	9.10	1.091	5.723	0.089	1.2493	0.0563	1
4	100	13.5	1350	6399	12.80	2.294	5.723	0.089	0.6423	0.2279	308
5	35	13.5	473	7507	15.01	3.464	5.723	0.089	0.3455	0.4513	213
6	150	13.5	2025	6451	12.90	2.341	5.723	0.089	0.6274	0.2358	478
sum	361									Total ESAL =	1192

Load Data to 1.0 in displacement - Section No. 18 @ 60 mph
Displacement during seating load (25 cycles) = 0.41 in

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	L_x (kips)	β_x	β_{18}	$-G_t$	Log $[W_{tx}/W_{t18}]$	EALF	W_{18}
1	0	13.5	0	5683	11.37	1.730	5.723	0.089	0.8576	0.1388	0
2	50	13.5	675	6323	12.65	2.228	5.723	0.089	0.6642	0.2167	146
3	1	13.5	14	4548	9.10	1.091	5.723	0.089	1.2493	0.0563	1
4	100	13.5	1350	6399	12.80	2.294	5.723	0.089	0.6423	0.2279	308
5	35	13.5	473	7507	15.01	3.464	5.723	0.089	0.3455	0.4513	213
6	104	13.5	1404	6451	12.90	2.341	5.723	0.089	0.6274	0.2358	331
sum	290									Total ESAL =	999

Conversion from Dual Tire Loads to ESAL - Section No. 18' @ 40 mph
Complete load data
HMA M_R = 370 ksi

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	L_x (kips)	β_x	β_{18}	$-G_t$	Log $[W_{tx}/W_{t18}]$	EALF	W_{18}
1	25	6.2	155	5683	11.37	1.312	4.053	0.089	0.8476	0.1420	22
2	50	6.2	310	6323	12.65	1.654	4.053	0.089	0.6567	0.2204	68
3	1	6.2	6	4548	9.10	0.874	4.053	0.089	1.2355	0.0581	0
4	100	6.2	620	6399	12.80	1.700	4.053	0.089	0.6351	0.2317	144
5	35	6.2	217	7507	15.01	2.503	4.053	0.089	0.3421	0.4549	99
6	150	6.2	930	6451	12.90	1.732	4.053	0.089	0.6205	0.2396	223
sum	361									Total ESAL =	556

Load Data to 1.0 in displacement- Section No. 18' @ 40 mph
Displacement during seating load (25 cycles) = 0.41 in

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	L_x (kips)	β_x	β_{18}	$-G_t$	Log $[W_{tx}/W_{t18}]$	EALF	W_{18}
1	0	6.2	0	5683	11.37	1.312	4.053	0.089	0.8476	0.1420	0
2	50	6.2	310	6323	12.65	1.654	4.053	0.089	0.6567	0.2204	68
3	1	6.2	6	4548	9.10	0.874	4.053	0.089	1.2355	0.0581	0
4	100	6.2	620	6399	12.80	1.700	4.053	0.089	0.6351	0.2317	144
5	35	6.2	217	7507	15.01	2.503	4.053	0.089	0.3421	0.4549	99
6	104	6.2	645	6451	12.90	1.732	4.053	0.089	0.6205	0.2396	155
sum	290									Total ESAL =	466

Conversion from Dual Tire Loads to ESAL - Section No. 18' @ 60 mph
Complete load data
HMA M_R = 370 ksi

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	L_x (kips)	β_x	β_{18}	$-G_t$	Log $[W_{tx}/W_{t18}]$	EALF	W_{18}
1	25	6.7	168	5683	11.37	1.312	4.053	0.089	0.8476	0.1420	24
2	50	6.7	335	6323	12.65	1.654	4.053	0.089	0.6567	0.2204	74
3	1	6.7	7	4548	9.10	0.874	4.053	0.089	1.2355	0.0581	0
4	100	6.7	670	6399	12.80	1.700	4.053	0.089	0.6351	0.2317	155
5	35	6.7	235	7507	15.01	2.503	4.053	0.089	0.3421	0.4549	107
6	150	6.7	1005	6451	12.90	1.732	4.053	0.089	0.6205	0.2396	241
sum	361									Total ESAL =	601

Load Data to 1.0 in displacement- Section No. 18' @ 60 mph
Displacement during seating load (25 cycles) = 0.41 in

Test No.	Plate Cycles Applied	Conv. Factor	Repetition of Axle Loads	Avg. Load (lb)	L_x (kips)	β_x	β_{18}	$-G_t$	Log $[W_{tx}/W_{t18}]$	EALF	W_{18}
1	0	6.7	0	5683	11.37	1.312	4.053	0.089	0.8476	0.1420	0
2	50	6.7	335	6323	12.65	1.654	4.053	0.089	0.6567	0.2204	74
3	1	6.7	7	4548	9.10	0.874	4.053	0.089	1.2355	0.0581	0
4	100	6.7	670	6399	12.80	1.700	4.053	0.089	0.6351	0.2317	155
5	35	6.7	235	7507	15.01	2.503	4.053	0.089	0.3421	0.4549	107
6	104	6.7	697	6451	12.90	1.732	4.053	0.089	0.6205	0.2396	167
sum	290									Total ESAL =	503