

POST-INJECTION WELDED JOINT FATIGUE TESTS OF SANDWICH PLATE SYSTEM PANELS

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(ABSTRACT)

The Sandwich Plate System (SPS) is created by bonding two steel plates together with an elastomer core that is injected into a cavity formed by the steel plates and perimeter bars. The result is a stiffer and lighter panel that can be used for plate-like structures such as bridge decks, stadium risers or ship decks. For more versatility, the effects of welding post-injection to the SPS panels were investigated.

Three post-injection welded joints were tested to determine fatigue resistance and the effects of cyclic loading on the localized debonding of the heat affected zone at the post-injection welded joint of a SPS bridge deck. Seven panels containing one of three post-injection weld configurations were investigated. Each panel was fatigue tested to ten million cycles or until failure, by applying remote bending to the post-injection welded joint.

Experimental deflections and strains were compared to finite element analyses. Fatigue-life predictions were made using code based S-N curves, and a relatively new mesh-insensitive structural stress method with a master S-N curve approach.

The post-injection welded joint demonstrated good fatigue resistance to recommended AASHTO loading when shims were used under the middle support to offset the camber in the SPS panels. It was also found that stresses caused by draw down of the camber had an adverse affect on the post-injection welded joint and greatly reduced its fatigue resistance.

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CHAPTER 1 INTRODUCTION

1.1 INTRODUCTION AND BACKGROUND

The Sandwich Plate System (SPS) consists of two steel plates bonded together by a polyurethane elastomer core as shown in Figure 1.1. The system utilizes two relatively thin steel face plates separated by the inner core of a much less dense material to create a stiffer and stronger section than that of a single stiffened plate. It is assumed that the elastomer core contributes very little to the flexural rigidity but does transfer the shear from one steel plate to the other. Analogously, the faceplates act as flanges and the elastomer core as the web of a beam in flexure. The thickness of the steel faceplates and the elastomer core can be customized to meet particular strength and stiffness requirements. The purpose of this study is to determine the fatigue resistance of a welded joint used in SPS bridge deck.

SPS has many advantages over traditional stiffened steel plates as outlined by Kennedy et al (2002). Those that relate directly to the design and construction of bridge decks include the elimination of intermediate stiffeners due to increased stiffness and the prevention of local buckling of the steel plate because of continuous support from the elastomer core. This in return decreases the amount of fatigue prone welding details, thereby increasing fatigue resistance. The system also reduces susceptibility to corrosion. Both of these advantages lead to less maintenance and longer and safer service lives. Also, a SPS bridge deck, equivalent in strength, to a concrete bridge deck is much lighter.

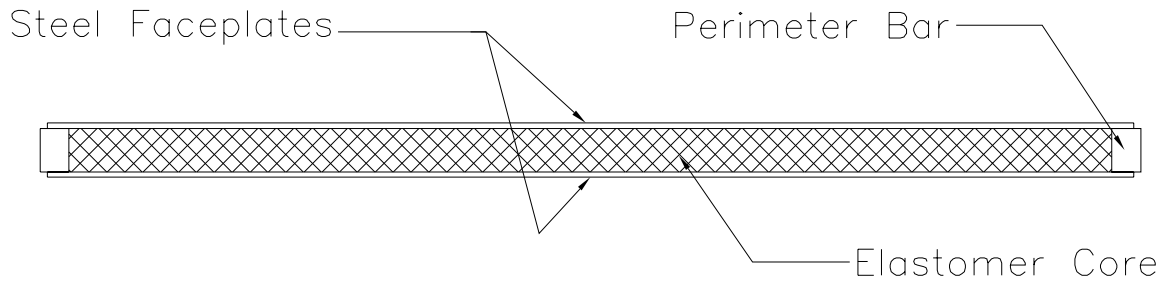


Figure 1.1 SPS Panel

Cost savings come from an increase in stiffness, less weight, ease of erection, and fewer repair costs over the life time of the structure. Disadvantages of the Sandwich Plate System include initial costs and the limited amount of fatigue data due to its composite nature.

The SPS was developed by Intelligent Engineering Limited (IE) of Ottawa, Ontario, Canada in conjunction with Elastogran GmbH, a member of the BASF Group of Lemförde, Lower Saxony, Germany (Kennedy et al 2002). The SPS panels are manufactured by injecting a two-part liquid polyurethane into the hollow space formed by the two faceplates and the perimeter bars which are welded together prior to injection. The polyurethane then hardens, bonding the faceplates together, and creating a composite section. An ultimate bond strength of 6 MPa (0.87 ksi) or greater between the elastomer core and steel plate is obtained when the surfaces are properly prepared (Kennedy and Kennedy 2004).

Research and development of the SPS panels for marine and civil applications have been on going for the last decade. Until recently the system has been successfully applied mostly to rehabilitation of ship hulls and decks. Its use has now been expanded to civil applications, particularly bridge decks. To date, SPS panels have been used to



Figure 1.2 Shenley Bridge, St-Martin, Quebec, Canada

rehabilitate an orthotropic bridge deck in Germany and for prototype bridge deck panels for the Austria Military. Also, there have been three SPS panel bridges constructed in Canada, the first of which is the Shenley Bridge at St-Martin, Quebec (Figure 1.2), a two lane, three girder bridge using eight SPS panels for the deck (Intelligent Engineering, 2004). The other two are the Port Britain Bridge, Port Hope, Ontario and the Lennoxville Bridge, Lennoxville, Quebec. At the time of this writing, three more bridges with SPS decks are in preliminary design and planning stages in Oklahoma, Texas, and Virginia.

The construction of a SPS bridge is simple and quick. After longitudinal steel girders are set in place at the site, the prefabricated SPS panels are placed transversely on the girders. To achieve continuity between panels, the webs of cold-formed edge angles are connected using slip critical bolts. Longitudinal groove welds are used to connect the top face plates. The panels are made to act compositely with the longitudinal girders by connecting them with slip critical bolts. Typical panel-to-panel and panel-to-girder connections are seen in Figure 1.3.

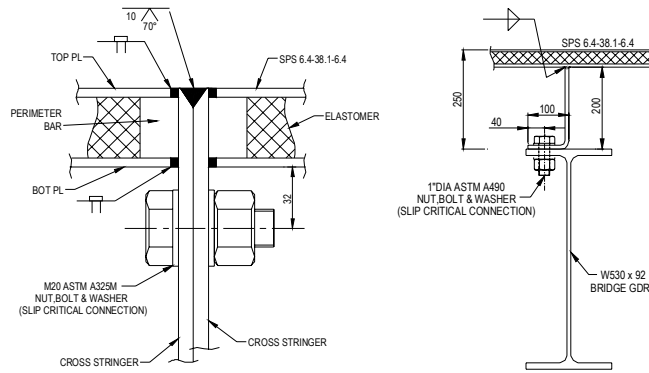


Figure 1.3 Typical Panel-to-Panel and Panel-to-Girder Connections
(Courtesy of Intelligent Engineering)

With ongoing research and development of the SPS bridge deck system, different connections have been developed. It is sometimes necessary to weld joints to the SPS panels post-injection or to do field welds directly to the SPS panel. One application is welding transverse and longitudinal support structures to SPS bridge deck panels for the purpose of connecting to the steel girders as shown in Figure 1.4. A post-injection weld may cause localized debonding of the steel-elastomer interface due to heating of the plate and destroying the bond, as indicated in Figure 1.5. The localized debonding may propagate to a global delamination due to repetitive loading causing a fatigue failure. An aspect of the development of these connections is the effect of fatigue and fatigue category classification, which is based on joint geometry and applied stress ranges.

A testing program was developed by Virginia Polytechnic Institute and State University in conjunction with Intelligent Engineering Ltd. to study post-injection welded joints. This research was conducted because the geometry and the nature of the post-injection welded joint does not match any known published connections in fatigue category classification literature. It was necessary to examine the behavior of the localized debonding under cyclic loading to determine the weld group's fatigue category.



Figure 1.4 Transverse support welded to SPS deck and steel girder.

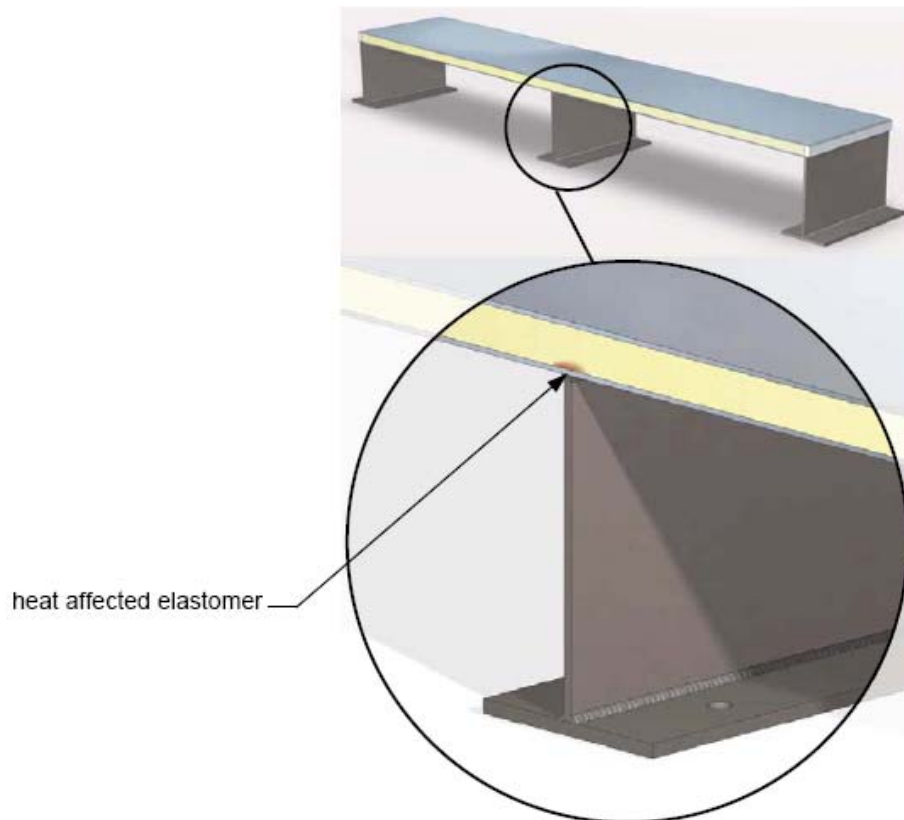


Figure 1.5 Heat affected area due to post-injection welded joint.
(Courtesy of Intelligent Engineering)

1.2 LITERATURE REVIEW

Until recently there has been little research done on SPS bridge deck systems, hence little is found in the literature. There was also difficulty in finding an orthotropic steel deck with which to compare the system because of its unique elastomer core. However, Intelligent Engineering Ltd. has published several papers outlining the concept of SPS system for civil applications, including technical papers on its strength and performance. The most extensive experimental research on the SPS bridge deck has been performed at Virginia Polytechnic Institute and State University in conjunction with Intelligent Engineering Ltd.

Kennedy et al. (2002) make a design comparison between a modern steel orthotropic deck box girder and two different SPS panel box girders for use on a suspension bridge. Ultimate, fatigue, and serviceability limit states were checked under the effects of live load for each of the three bridges. All three bridges weighed nearly the same. It was stated that the chief advantages of the SPS panel bridges were greatly reduced welding, improved fatigue resistance, and construction. In addition, the SPS bridges had greater flexural stiffness to reduce deck curvature, which may extend wearing surface life. It was stated that the SPS bridges have inherent damping qualities because of the elastomer core, which may reduce vibration. Kennedy et al. state that the SPS panel bridges are an attractive alternative to the conventional orthotropic deck box girder.

Lloyd's Register (2000) published a technical paper which discusses several possible advantages of SPS panels over stiffened steel plates for maritime applications: Fatigue cracks are less likely to occur due to the reduced amount of welds. Stress is

distributed over a much larger area using SPS panels in a double-hull oil tanker design as compared to stiffened steel plates. Further, it is easier to maintain the SPS structure. Other advantages include increased impact resistance and integrated acoustic and thermal insulation.

Intelligent Engineering (2002) prepared a technical report for the Austrian Military. Three static tests were performed in Ludwigshafen, Germany on the SPS bridge deck panel and it was found that the panels carried 1.29 times the design load applied at maximum eccentricity. A fatigue test, with an asphalt wearing surface in place, was performed with a cycle count of 5 million. No fatigue cracks were found and there was no evidence of debonding of the elastomer core from the steel plates. A finite element analysis was also conducted using ANSYS. The experimental strains were found to be in reasonable agreement with model values and there was only a 7% discrepancy between experimental and predicted deflections. Intelligent Engineering found the SPS bridge deck panel to be adequate and to perform better than a stiffened steel deck.

Another analytical study was performed by Intelligent Engineering (2003) using a 6-40-6 (6 mm plate + 44 mm elastic core + 6 mm plate) SPS panel for a top flange of a box girder for the proposed Mexico City Elevated Ring Road. A lightweight and cost efficient alternative solution was needed in place of a traditional reinforced concrete deck because of the soil conditions in Mexico City. It was reported that the SPS bridge deck panel design met all code requirements using the Canadian Highway Bridge Code and was 50% lighter than a reinforced concrete deck resulting in a reduced load transferred to

the foundation and reduced applied earthquake load. A finite element model was created using ANSYS to analyze SPS panel, the longitudinal welds and the guard rail.

Static and dynamic tests were performed by Intelligent Engineering (2004) on the Shenley Bridge in the Saint Martin, Ontario, Canada, shown in Figure 1.3. A test truck weighing 519 kN (117 kips) was used in five different loading configurations. Strains were measured in 20 locations. Twelve strain gages were located on the flanges of the girder to measure longitudinal strain. Four strain gages were located on the transverse angles and underside of the deck to measure transverse strains. Four strain gages were located centrally on the underside on two panels to measure transverse and longitudinal strains. The maximum bending moment was 1398 kN-m (95.8 kip-ft), or approximately 20% of the maximum moment that could be applied to the deck. A finite element analysis was conducted with ANSYS and the experimental strains and deflections were in good agreement with the predicted values. A dynamic test, as required by the Canadian Highway Bridge Design Code, was also performed. It was determined that the first mode was due to bending at a frequency of 5.8 Hz with a damping ratio of 0.8% and the second mode was torsional at 6.0 Hz.

Martin (2005) performed a series of tests on a SPS Bridge deck system to determine the deck's behavior, the longitudinal weld fatigue resistance, and to examine the effects of shear lag. Three static tests, with different loading configurations, were performed on a 3 m (9.84 ft) by 9 m (29.5 ft) SPS bridge panel to measure strains and deflections. The experimental values closely corresponded with predicted values determined from a finite element model using ANSYS. Four elastic tests were performed on a half scale, single span, bridge consisting of eight panels. The eight panels were

connected to two steel girders using slip critical bolted connections. Composite action was found in the steel girder-SPS panel assemblage, although the composite action decreased as the loading configurations were changed and some slip did occur between the bent plate and the girder. The effective width for the half scale SPS bridge panels was found to be the full physical width 2250 mm (88.9 in.) as confirmed by the experimental data. Fatigue tests were conducted on panel-to-panel connection between panels to determine the S-N curve for the transverse weld group. The connection can be seen in Figure 1.3. The bent side plates of the SPS Panel are bolted together using slip critical bolts and the top SPS plates are welded together using a partial penetration groove weld. Square butt welds are required between the bent plates, perimeter bars and top and bottom steel plates for the core injection. Three tests were performed to ten million cycles, five million cycles, and one hundred thousand cycles. It was determined that the transverse weld group was a least a fatigue category E.

Harris et al. (2006) performed live load tests on the Shenley Bridge in Quebec, Canada to determine the lateral load distribution factors and the dynamic load allowance. Using a three-axle dump truck, tests were performed by driving the truck across the bridge at eight kilometers per hour (5 mph) at four lane locations. It was found that the current AASHTO specifications for determining the lateral load distribution factors were adequate for a SPS bridge deck. The dynamic allowance tests were performed at a speed of 80 kilometers per hour (50 mph) for three lane locations. It was determined that AASTHO provisions were not adequate to calculate dynamic allowance for a SPS bridge deck and that additional study is required to predict the dynamic response.

Wolchuk (1990) reviews three steel orthotropic bridge decks in Europe and the lessons learned from weld cracks. Two of the bridges, the Haseltal and Sinntal bridges in West Germany, had cracks in the welds joining the ribs between the floor beams and the floor-beam webs. These cracks were attributed to shrinkage due to cooling immediately after welding. The cracks then widened to a visible state because of the applied stresses. It was concluded that this particular detail was the cause and even the best quality welding could not have prevented the shrinkage cracking. The third bridge, the Severn Crossing Bridge in the United Kingdom, had three details prone to fatigue. Attachments welded to the underside of the deck for erection purposes were one cause and it was recommended that such attachments not be allowed. The other two weld details used fillet welds, which caused eccentric loading. It was recommended that an 80% partial penetration weld be used for the weld details.

In Summary, research on SPS bridge decks is progressing. The general behavior of the individual SPS panel and the elastomer core properties are well researched. More analytical than experimental research has been done on SPS bridge deck systems and most of the experimental research was done in a laboratory. However, fatigue testing is needed on full scale SPS panels and the fatigue resistance of SPS bridge deck connections should be determined, which include the post injection welded joint. The SPS Panel connection tested by Martin was not a post-injection weld and did not include delamination of the elastomer core from the steel plates. Also the connection tested by Martin was located at the edge of a SPS panel, whereas the post-injection weld is located away from the panel edge. The loading mode used by Martin was similar to that of a post-injection welded joint on a SPS bridge deck, therefore similar procedures can be use.

Also the built SPS bridges should be monitored more to determine the dynamic response and the effects of repeated loading.

1.3 OBJECTIVE AND SCOPE

The objective of this study was to determine the effect of cyclic loading on a post-injection welded joint for transverse and longitudinal support structures of a SPS bridge deck. The localized debonding of the heat affected zone due to the post-injection weld was studied to determine the joints fatigue resistance. Seven panels containing one of three post-injection weld configurations were investigated. Each panel was fatigue tested to ten million cycles or until failure by applying remote bending to the post-injection welded joint.

Experimental results were compared to finite element analyses. Fatigue-life predictions were made using code based S-N curves, and a relatively new mesh-insensitive structural stress method with a master S-N curve approach.

Chapter 2 defines structure stress and reviews the master S-N curve method. This chapter also discusses code based detail categories used for predicting fatigue life from the American Association of State Highway and Transportation Officials Specifications (AASHTO 2004) and the Canadian Standards Association Standard (CSA 2001) specifications. The effects of cumulative damage due to varying stress ranges and use of the Palmgren-Miner summation for fatigue life predictions when this condition exists are discussed. Chapter 3 contains the test setup, instrumentation, testing procedures, and the determination of loads used for each test series. Chapter 4 contains the general information about the panels with shear stud connections in Test Series 1, their results,

and a comparison between experimental and predicted values. Chapter 5 contains the general information about the panels with insert bar connections in Test Series 2 through 5, their results, and a comparison between experimental and predicted values. Chapters 4 and 5 also contain the fatigue life predictions using both the code based approach and the master S-N method. Finally Chapter 6 presents conclusions and suggestions for future research.

1.4 TEST SPECIMENS

All the panels were provided by Intelligent Engineering Ltd., Ottawa, Ontario, Canada, and were fabricated by the SOLICOR a division of CANAM, Quebec, Canada. Seven SPS 4.8-38.1-4.8 (3/16 in.-1 1/2 in.-3/16in.) panels were tested. The panels are designated by listing the thicknesses of the steel-elastomer-steel sandwich plate layers (steel-elastomer-steel) in millimeters (inches). Each panel had three supports welded to the bottom steel plate with the post-injection welded joint of interest at mid span and the two others at the ends as shown in Figure 1.6. Larger 2781 mm by 2235 mm (109 in. by

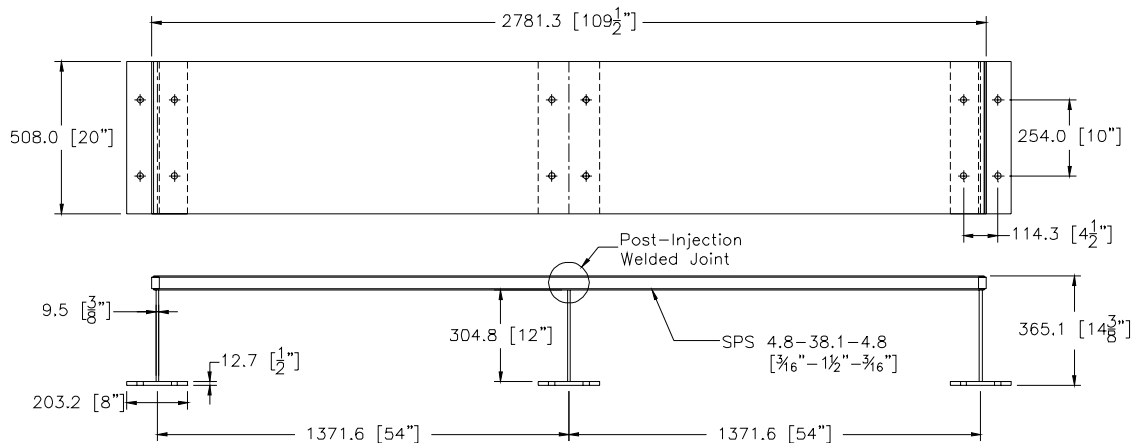


Figure 1.6 Panel Dimensions

88 in.) panels were first fabricated than cut into four 508 mm (20 in.) wide panels for testing. All panels were made using ASTM A452 grade 50W steel.

The three post-injection welded joints are defined in Figure 1.7. Three of the panels had no additional material in the cavity over the position of the post-injection welded support, allowing the bond to be destroyed during welding, Figure 1.7(a), which is referred to as the Basic Connection. Two panels had two shear studs welded before injection to the bottom faceplate in the cavity over the position of the post-injection welded support, Figure 1.7(b), the Shear Stud Connection. The purpose of the shear studs is to prevent local debonding caused by the post injection welded joint to propagate to global delamination. Two panels had a 50.8 mm by 6.35 mm (2 in. by 1/4 in.) insert bar glued across the bottom faceplate in the cavity over the position of the post-injection welded support before injection, Figure 1.7(c), the Insert Bar Connection. The insert bar creates a thermal break and provides a heat sink for the post-injection weld, thereby protecting the steel-elastomer bond. Finite element analyses by Intelligent Engineering Ltd. were made to determine strains and deflections for comparison with measured values. Stresses at the post-injection welded joint from finite element analyses were used for the fatigue life predictions.

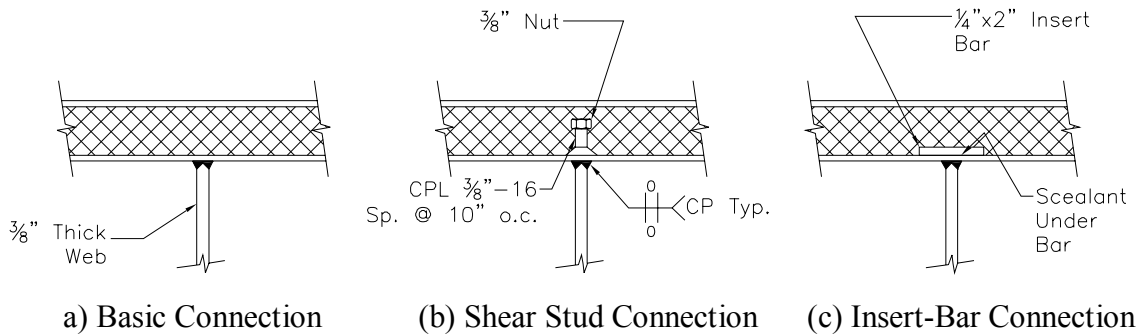


Figure 1.7 Post-injection welded joints.

CHAPTER 2

FATIGUE LIFE PREDICTION METHODS

2.1 FATIGUE DESIGN

One approach to fatigue design for welded members is the application of component S-N curves, which show the relationship between the fatigue life, N and the applied stress range, S. Welded joints have complex geometry and metallurgy, along with possible defects and porosity that make it difficult to use traditional fracture mechanics to determine stress concentration factors to be used in fatigue life prediction (Dowling 1999). To simplify the design process, most design codes such as the American Association of State Highway and Transportation Officials Specifications (2004) or the Canadian Standards Association Standard (2001) use component S-N curves based on a large number of tests of a particular welded detail (Dowling, 1999). Extensive testing has been completed on a wide-range of details, resulting in a family of S-N curves. Non-tested details can be related to a member of the family of curves that has similar fatigue resistance.

The family of AASTHO S-N Curves is shown in Figure 2.1 (AASHTO 2004). It groups details with similar fatigue resistance into eight so-called Detail Categories, A through E'. The equation for the S-N curves is as followed

$$\left(\frac{A}{N}\right)^{\frac{1}{3}} \geq \frac{1}{2}(\Delta F)_{TH} \quad (2.1)$$

where A is a fitting constant and varies for each Detail Category, N is the number of cycles at failure for the stress range, the super script is the slope, and $(\Delta F)_{TH}$ is the

constant-amplitude fatigue threshold. The constant-amplitude fatigue threshold is represented by the horizontal dotted line connected to each curve and represent the long-life region or the portion of the curve where the component is unaffected by fatigue. the constant-amplitude fatigue threshold is reduced by one-half to account for trucks heavier than the design fatigue truck and for the bulk of the traffic which are trucks lighter than the design truck. The number and magnitude of the stress ranges produced by lighter trucks are difficult to asses and are generally unknown (CSA 2001).

The configuration of the SPS post-injection welded joints and loading mode do not match any of the weld connections in AASTHO Section 6.6, and a Detail Category for design use cannot be assigned. In this study an attempt was made to match the fatigue resistance of the SPS post-injection welded joint with one of the AASTHO Detail Categories through fatigue testing. With the determined Detail Category curve, the fatigue life was then estimated and compared with the experimental fatigue life.

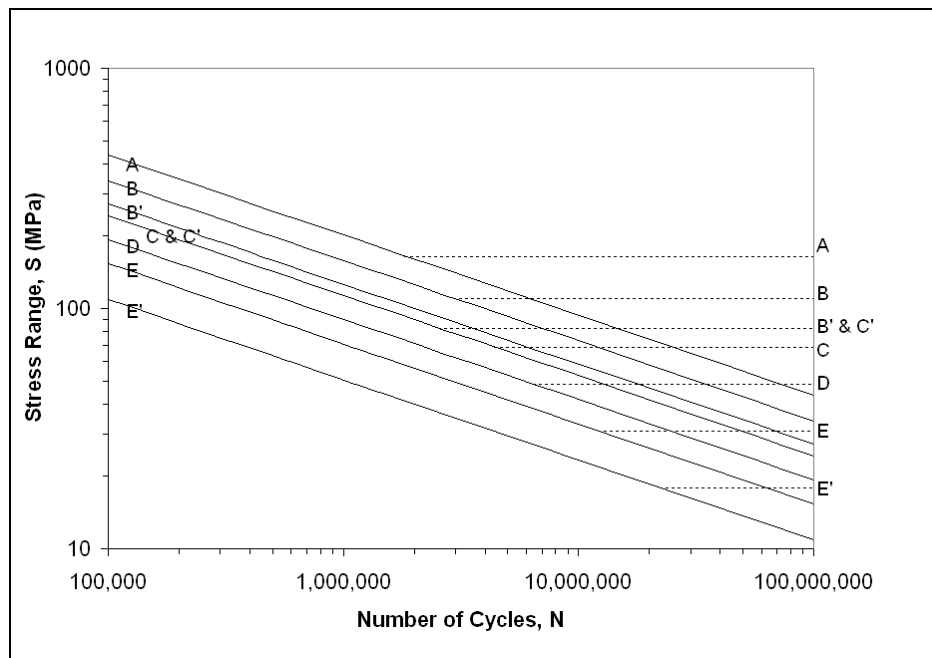


Figure 2.1 AASTHO S-N Curves (AASTHO 2004)

2.2 FATIGUE BEHAVIOR IN LONG-LIFE REGION

To determine the fatigue life of the post-injection welded joint using the S-N curves in the long-life region, a method from CSA Limit State Design of Steel Structures was employed to calculate the cumulative fatigue damage (CSA 2001) for two different stress ranges. The method uses the Palmgren-Miner Rule for cumulative fatigue damage, which is simply the summation of the ratios of the number of applied stress range cycles N_i to the number of predicted cycles to failure N_{fi} at that stress range (Dowling 1999) that is,

$$\frac{N_1}{N_{f1}} + \frac{N_2}{N_{f2}} + \dots = \Sigma \frac{N_i}{N_{fi}} \leq 1.0 \quad (2.2)$$

Fatigue failure is expected to occur when the rule sums to unity. The method from CSA also includes behavior in the long life region using a S-N Curve with a slope of 1/5 instead of 1/3. The S-N curves with slopes of 1/5 in the long life region are shown in Figure 2.2. This S-N curve in the CSA Limit State Design of Steel Structures is directed to fatigue in buildings rather than bridges. The 1/5 slope is justified since the variation in load is much less in buildings, for instance the passage of a crane in an industrial building, as compared to vehicle traffic on a bridge. For experimental purposes the 1/5 slope was used in this research for the long-life region. Both the Palmgren-Miner Rule and the CSA 1/5 slope were needed to calculate fatigue life since all the panels in Test Series 2 through 5 entered the long-life region and were tested at two different stress ranges. (See Section 5.6.1)

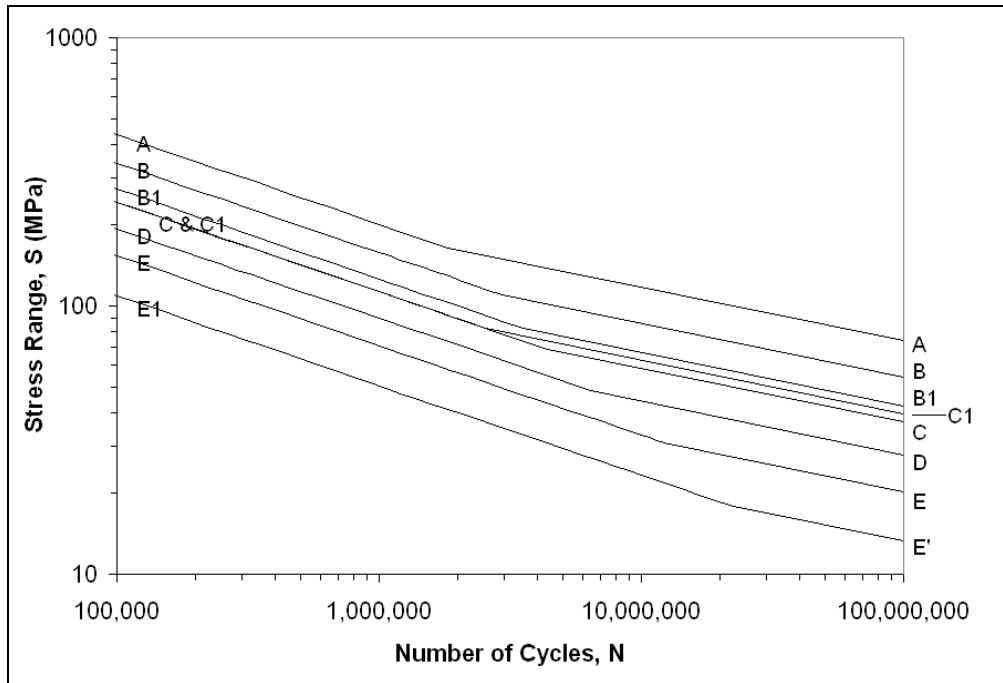


Figure 2.2 S-N curves, 1/5 slope (CSA 2001)

2.3 MASTER S-N CURVE METHOD

A relatively new method for fatigue evaluation of welded components developed by Dong et al. (2002) called the master S-N curve method was also used to determine the fatigue life of the SPS post-injection welded joint. Before the development of this method, there was not an effective finite element method available to determine the stress concentration at the toe of the weld. The reason is that the finite element solution at the weld toe is greatly influenced by element size and type, which is due to notch stress singularity. The method uses a finite element solution to define a mesh-insensitive structural stress based on elementary structural mechanics theory. A master S-N curve used in the method was developed by Dong et al. (2002) by re-evaluating data from previously tested welded connections using what is termed “mesh-insensitive structural stress”.

2.3.1 Structural Stress Definition

Dong et al. (2002) define the structural stress (σ_s) as simply the membrane stress (σ_m), plus the bending stress (σ_b) at a point element.

$$\sigma_s = \sigma_m + \sigma_b \quad (2.3)$$

The structural stress is equilibrium-equivalent to the finite element solution through thickness stress distribution and satisfies elementary structural mechanics theory. The membrane and bending stresses are calculated using all the element nodal forces from the finite element solution along a section at the weld toe by employing the following equations:

$$\sigma_m = \frac{f_i}{t} \quad (2.4)$$

$$\sigma_b = \frac{6 \cdot m_i}{t^2} \quad (2.5)$$

where f_i and m_i are forces and moments per element width along the weld. These are calculated from the element nodal forces in a work equivalent manner located at the mid-thickness of the plate. The thickness of the steel plate is t .

Dong et al (2002) developed an equivalent structural stress parameter, S_s , for the development of the master S-N curve. The parameter is based on the structural stress as previously defined, a modified Paris Law, and a fracture mechanics based prediction of fatigue life. The range of structural stress parameter, ΔS_s , is as follows:

$$\Delta S_s = \frac{\Delta \sigma_s}{(t \cdot C_{ul})^{(2-m)/2m} \cdot I(r)^{1/m}} \quad (2.6)$$

and

$$I(r) = 0.294(r)^2 + 0.846(r) + 25.815 \quad (2.7)$$

where $r = \sigma_b/\sigma_s$, σ_s is the structural stress from Equation 2.3, m is the conventional Paris Law exponent equal to 3.6, C_{ul} is 1.0 for t in mm (25.4 for t in inches), and Δ denotes a range in stress.

2.3.2 Master S-N Curve

The master S-N curve used in this study was developed by Dong et al. (2002) using existing weld fatigue data of joints with varying material properties, joint configurations, plate thicknesses, and loading conditions. For example material yield strengths varied from 180 MPa (26 ksi) to 600MPa (87 ksi), plate thicknesses varied from 2 mm (1/16 in) to 100 mm (4 in), and both T- fillet and cruciform joints were tested. To develop the master S-N curve Dong et al. re-evaluated each of the welded joints using the mesh-insensitive structural stress to calculate the equivalent structural stress parameter. The S-N data for all the different components were compiled and then represented by one master S-N curve rather than a family of curves. The master S-N curve developed by Dong et al. for fatigue life prediction was used for the SPS post-injection welded joint. This was justified since its material properties, configuration, and loading conditions fit well within the attributes of the tests used for the development of the master S-N curve.

2.3.3 Procedure

The following is the procedure outlined by Dong et al. (2002) with a few modifications made to fit the finite element model used in this study. The SPS post-injection welded joint was modeled using ANSYS as seen in Figure 2.3(a). It was required to model the weld to determine the structural stress along the plane A-A at the weld toe, Figure 2.3(b). The model of the weld did not need to be detailed, it was only

important to distinguish the weld toe for the structural stress method (Kyuba and Dong, 2003). The element nodal forces were determined from the finite element analysis along the plane A-A at the toe of the weld as seen in Figure 2.3(b). An 8-node solid brick element was used and only the four nodal forces normal to plane A-A for each element were needed. The structural stress was calculated for each width of element along the weld toe.

The structural stress from Equation 2.3, was determined by first calculating the line forces, f_i , and moments, m_i , as follows:

$$f_i = \frac{2(F_1 + F_2)}{w} \quad (2.8)$$

$$m_i = \frac{2(M_1 + M_2)}{w} \quad (2.9)$$

where F_1 and F_2 are the summation of the element nodal forces at the two edges of the stack of elements, shown in Figure 2.3(c). The moments, M_1 and M_2 , are the summation of the nodal moments, with respect to the mid-thickness along the weld toe, at the two edges of the stack of elements and

$$M_j = \sum F_{jk} \cdot s_k \quad (2.10)$$

where s_k is the distance from the mid thickness of the plate to the element nodal forces, ($j = 1, 2$ and $k = 1, n + 1$, where n is the number of elements in through thickness direction) also shown in Figure 2.3(c). Using the line forces, the membrane stress and bending stress were computed using Equations 2.4 and 2.5, respectively, and then summed for the structural stress. The structural stress parameter was then calculated using Equation 2.6.

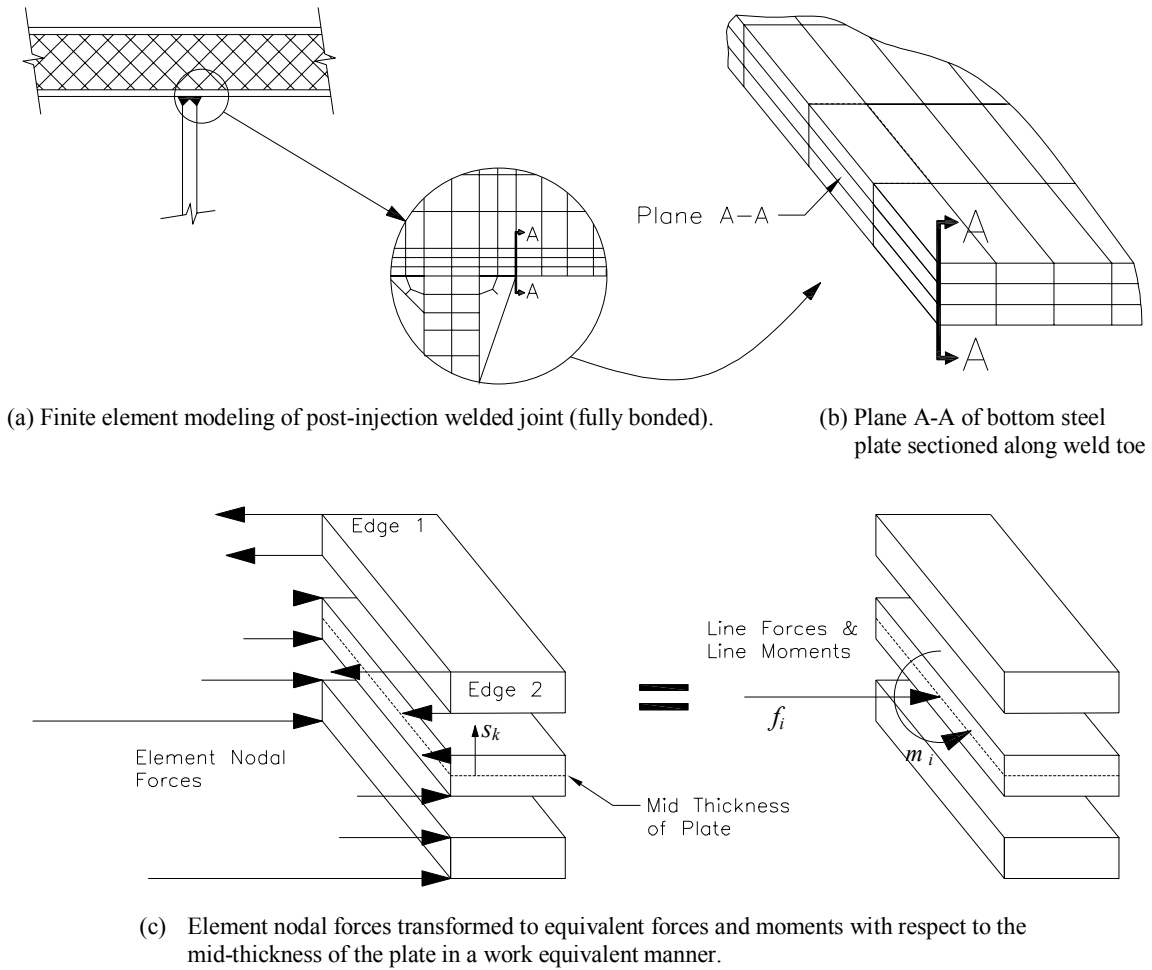


Figure 2.3 Development of line and moment forces from finite element model

With the structural stress parameter and the master S-N curve, the number of cycles was determined from the equation of the master S-N curve.

$$\log N = B \cdot \log \Delta S_s + A \quad (2.11)$$

Where A is 12.185 for SI units (9.623 for USC units) and B is -3.056 for the mean curve. The value A equals 12.929 and 11.442 for the upper and lower 95% prediction interval, respectively. Cumulative fatigue damage was determined using the Palmgren-Miner Rule.

CHAPTER 3

POST-INJECTION WELDED JOINT FATIGUE TESTING

3.1 TEST SETUP

Each test setup was configured similarly with the exception of testing one panel versus two panels. A two panel test set-up is shown in Figure 3.1, where the panels were placed side-by-side in the testing frame with each support bolted to separate transverse W250x73 (W10x49) floor beams, which in turn were bolted to the laboratory reaction floor beams. Stiffeners were added to the middle floor beam under each panel support. Neoprene pads measuring 63.5 mm by 226.6 mm by 457.2 mm (2 1/2 in. by 9 in. by 18 in.) were placed on each panel at the position indicated in Figure 3.2. A 25.4 mm (1 in.) steel plate was placed on top of each pad. A W250x149 (W10x100) spread beam carried the load from a MTS actuator to the neoprene pads. The actuator was supported by a loading frame and braced just above the piston. The setup could also accommodate one panel centered under the actuator.

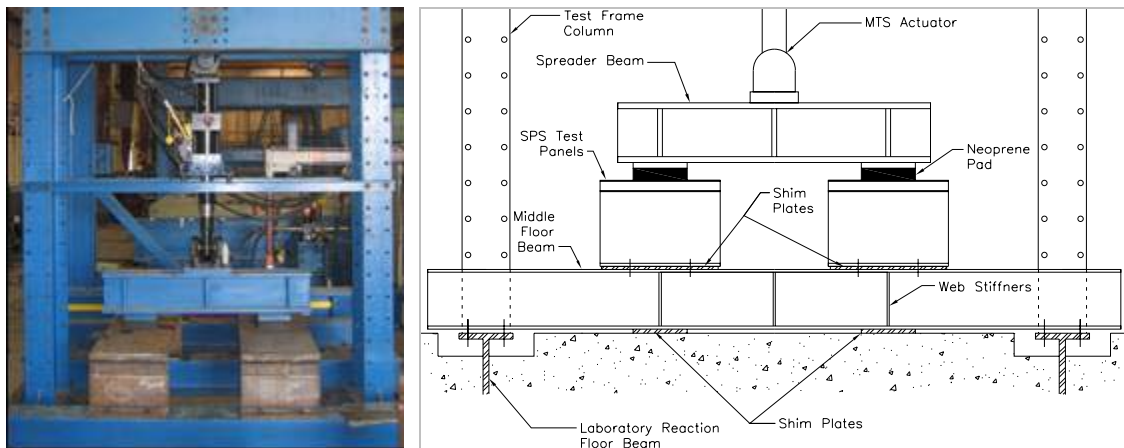


Figure 3.1 Test set-up

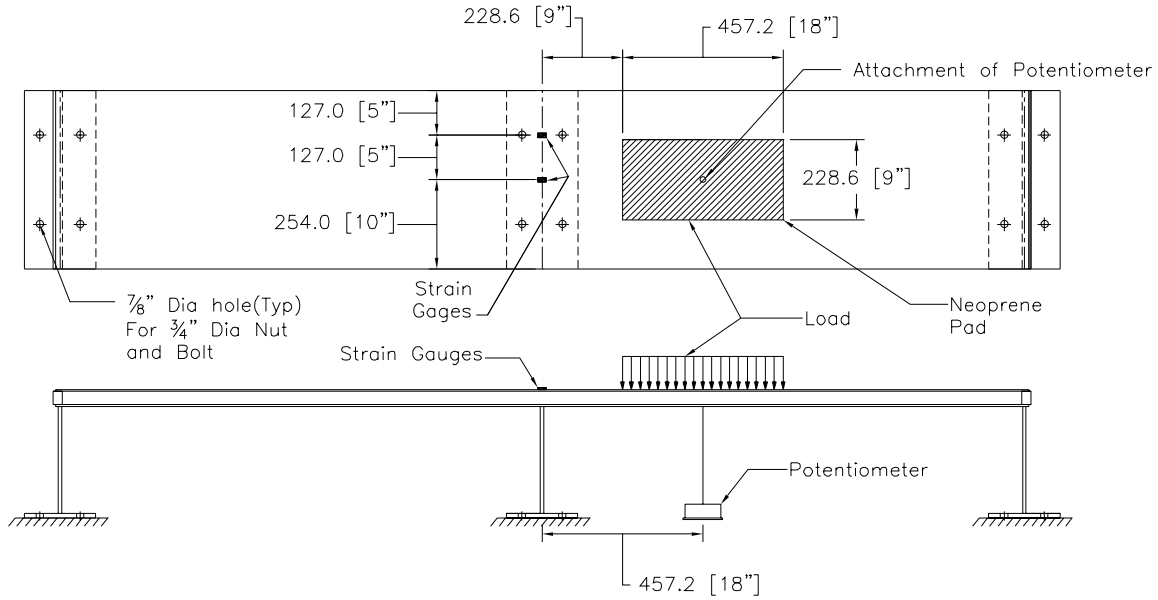


Figure 3.2 Load, potentiometer and strain gage locations

3.2 INSTRUMENTATION

An MTS actuator, equipped with a displacement transducer (LVDT) and a load cell to measure deflection and load, respectively was used to apply the desired cyclic loading. An MTS 407 controller was used to set the cyclic loading sequence, and view load range, position of the actuator, and cycle count. Two quarter bridge strain gages with a resistance of 120 Ohms were used to measure strains on the top steel plate. A potentiometer, positioned directly under the center of loading, was used to measure deflection during periodic stiffness tests. Location of the strain gages and the potentiometer are shown in Figure 3.2. A PC based data acquisition system was used to record and view all of these measurements during cyclic fatigue tests and static stiffness tests.

3.3 TEST PROCEDURE

Each panel was loaded cyclically using displacement control following a sine function. The sine function amplitude, set point (approximately one-half of the displacement range), and frequency were controlled using the MTS 407 Controller. Displacements were set to match the maximum and minimum loads for each test series of Table 3.1. The minimum load is ten percent of the maximum and this offset from zero was to prevent bouncing of the spreader beam. If the maximum or minimum loads drifted, the displacements were readjusted. Frequencies were 0.5 to 1.0 Hz for the first 1000 cycles and 2.0 to 4.0 Hz thereafter. A stiffness test was performed at 1, 10, 100, 1000, 10000, 100,000 cycles and then daily until 10,000,000 cycles or failure. For each stiffness test, cyclic loading was stopped and the load was removed. Instrumentation was zeroed on the data acquisition system. Each panel was loaded incremental by 2224 kN (500 lbs) until the specified maximum load of Table 3.1 was reached; strain, panel deflection, and load were recorded at each increment using the data acquisition system. Displacement was then returned to the set point and cyclic loading was resumed. Adjustments were made to the sine function amplitude and set point to match the maximum and minimum loads.

Before each stiffness test, the panels were checked for delamination during the previous cycles. Delamination was detected by transverse shearing between steel-elastomer interface by sight and/or feel. Also shrinking of the elastomer core was checked as detected by an under bite of the steel plate which is also a sign of delamination, since delamination releases residual stresses from the curing process thereby causing the elastomer core to recoil or shrink. The toe of the weld along the

bottom steel plate on the side of the load was also inspected for fatigue cracks. The strains and deflections were compared to previous stiffness tests to observe changes in stiffness as a change may indicate delamination.

Table 3.1
Load ranges for Test Series 2 through 5

Test Series	Panel	Post-Injection Welded Joint Type	Max. Load, kN (kips)	Min. Load 10% Offset, kN (kips)
1	1P	Basic	45.2 (10.2)	4.52 (1.02)
	3	Shear Stud	45.2 (10.2)	4.52 (1.02)
	4	Shear Stud	45.2 (10.2)	4.52 (1.02)
2	A	Basic	45.2 (10.2)	4.52 (1.02)
	C	Insert Bar	45.2 (10.2)	4.52 (1.02)
3	B	Basic	65 (14.6)	6.5 (1.46)
	D	Insert Bar	65 (14.6)	6.5 (1.46)
4	B	Basic	97.5 (21.9)	9.75 (2.19)
	D	Insert Bar	97.5 (21.9)	9.75 (2.19)
5	A	Basic	110.1 (24.75)	11.01 (2.475)
	C	Insert Bar	110.1 (24.75)	11.01 (2.475)

3.4 SUPPLEMENTARY TESTING

Strains during cyclic loading were checked each time the frequency was increased above a previously used frequency to determine if the dynamic loading and speed of loading affected the strains at the maximum and minimum loads. This was done by zeroing the instrumentation before starting the sinusoidal cyclic loading program. After the program was adjusted, strain, deflection, and load were recorded during several cycles at 1/100 second time intervals. The data was then compared to strains from the most recently performed static stiffness test and the theoretical strains of the finite element analyses.

Tensile tests were performed for the top and bottom steel plates of the SPS panels from Test Series 1. Coupons for the test were machined from steel plates cut from the SPS panels after the panels were tested. The coupons were prepared in accordance with ASTM A370-05 “Standard Test Methods and Definitions for Mechanical Test of Steel Products”. Each test determined yield strength, ultimate strength and the percent elongation after rupture.

3.5 DETERMINATION OF SPECIMEN LOADING

Four different loads were used for Test Series 1-5 as listed in Table 3.1. The first load of 45.2 kN (10.2 kips) used for Test Series 1 and 2 was determined from AASTHO fatigue loading requirements. The design truck for fatigue loading in Section 3.6.1.4 of the AASTHO LRFD Bridge Design Specification (2004) is shown in Figure 3.3. It has axle spacings of 4300 mm (14 ft) and 9000 mm (30 ft) and wheel spacing of 1800 mm (6 ft). The weight is distributed with 35 kN (8 kips) on the front axle and 145 kN (32 kip) on the back two axles. These fatigue loadings were multiplied by the load factor of 0.75 and the dynamic load allowance factor of 1.15 as specified in Sections 3.4.1 and 3.6.2.1 of the AASHTO Specification, respectively.

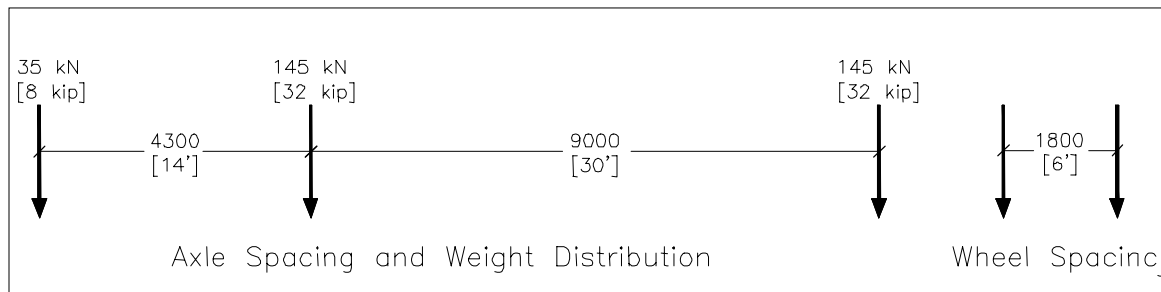


Figure 3.3 AASTHO Fatigue Design Truck Loads and Spacings

A global analytical model of a bridge using finite elements was used to determine the 45.2 kN (10.2 kips) load for the test specimen. The global model was for a bridge deck replacement scenario. Intelligent Engineering Ltd. provided the following description of the bridge:

A bridge deck replacement scenario was investigated whereby six 33 ft-9 in long prefabricated SPS panels would be constructed to span between existing floor beams of a through-truss steel bridge. The panel widths ranged in size from 8 ft to 10 ft. The SPS deck plate consists of two 3/16 in. steel faceplates separated by a 1½ in. elastomer core. Two stringers, tees built from a coped W21 section, are welded to the underside of SPS plate to complete the panel. The new stringers are positioned transversely, typically every 4 ft-6 in., at the location of existing stringers to replicate the load distribution of the existing deck to the existing floor beams.

The load on the test specimen was scaled to match interface shear stresses at the heat affected zone from the welding of the tee stringers to the underside of the SPS panels from the global analytical model. This was done by scaling the load on an analytical model of the test specimen to match the rotations of a post-injection welded joint on the global analytical model with the design truck at the position that produced the largest rotation at that joint.

After Test Series 2 completed ten million cycles without failure, the load for the two new panels of Test Series 3 was set at 65 kN (14.6 kips). This was determined by taking the heaviest AASHTO fatigue design truck axle load divided by two, or in other

words the heaviest wheel load of the design truck. A load factor of 0.75 and dynamic allowance factor of 1.15 were again used and the load was rounded up to 65 kN (14.6 kips). After ten million cycles without failure, the load from Test Series 3 was then increased by 150% to 97.5 kN (21.9 kips) and testing continued as Test Series 4 on the Test Series 3 test panels until failure. Next, Panels from Test Series 2 were tested again at a higher load. The load from Test Series 2 was increased by 243% to 110.1 kN (24.75 kip) and testing continued until failure. (The load for the two panels was near the highest calibrated value for the actuator, hence, a 243% increase rather than 250% increase.) The specifics for each test and the results are found in the following chapters.

CHAPTER 4

SHEAR STUD CONNECTION-TEST SERIES 1

4.1 GENERAL

Panels 1P, 3 and 4 were tested in Series 1. Panel 1P was a basic connection without shear studs. Panels 3 and 4 contained the shear stud connection with two shear studs centered over the middle support spaced at 169.3 mm (6.67 in) as shown in Figure 4.1. Submerged arc welding (SAW) was used to weld the post-injection joint. The polarity was direct current (DC) using 475 amps. The welding speed was 305 to 356 mm/min (12 to 14 in/min) using 2.4 mm (3/32 in) wire. All three panels were cambered upward due to residual stresses caused by the post-injection weld. The camber measured 7.9 to 9.5 mm (5/16 to 3/8 in) at the middle support. Each panel was loaded into the testing frame and the bolts of the middle support were tightened first, drawing down the camber. The bolts were tightened by a quarter turn until the middle support was flush with the floor beam. A 3.2 mm (1/8 in) shim was used to account for the unevenness of the middle support with the floor beam. The end supports were then bolted. Before testing began an initial destruction of the steel-elastomer bond could be seen at the cut edges of each panel over the post-injection welded joint, varying in length from about 40 to 50 mm (1 1/2 to 2 in). A typical destruction of the bond is shown in Figure 4.2. Strain gage locations and designations for each panel are shown in Figure 4.1.

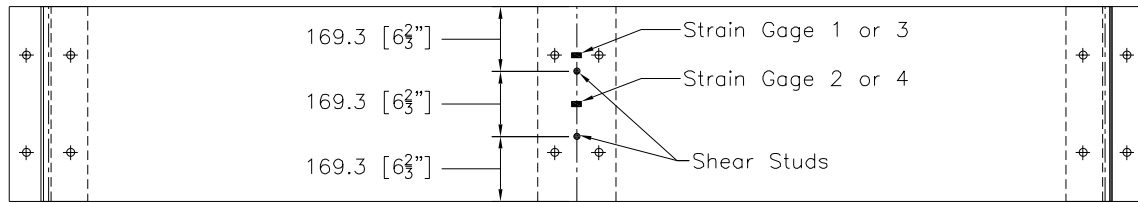


Figure 4.1 Location of shear studs and strain gage designations

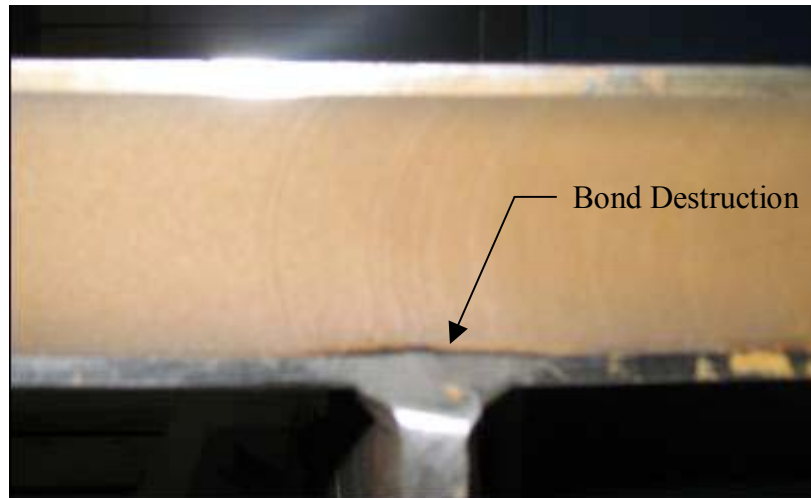


Figure 4.2 Typical destruction of bond at steel-elastomer interface.

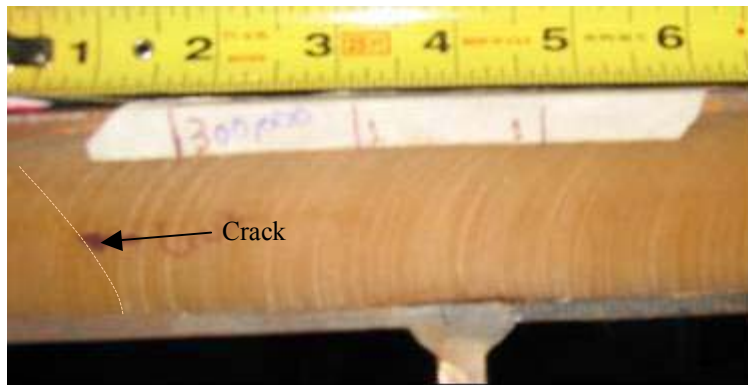
Testing began with Panels 1P and 3 side-by-side. Testing continued until Panel 3 failed by cracking of the elastomer core at 410,000 cycles. Panel 3 was then replaced with Panel 4 and testing continued until Panel 4 failed by cracking of the elastomer core at 1,416,337 cycles. Panel 4 was then removed and Panel 1P was placed in the middle directly under the actuator to be tested alone. The bottom steel plate of Panel 1P fractured along the weld toe at 2,639,016 cycles, concluding Test Series 1.

4.2 FATIGUE TEST OBSERVATIONS

4.2.1 Panel 3

In the first 300,000 cycles of testing Panel 3, the delamination of the steel-elastomer interface propagated 38 to 50 mm (1 1/2 to 2 in) towards the load location.

During the next 100,000 cycles, the delamination propagated to 180 mm (7 in) on the right side, whereupon, the elastomer core cracked at 410,000 cycles. The total delamination length from center support towards the load location was 240 mm (9 1/2 in) on the right side and 100 mm (4 in) on the left side. (Left and right sides are designated by looking at the end of the panel opposite the load location and facing the panel.) The crack originated on the right side at about 178 mm (7 in) from the center support and propagated through the panel to the other side and then curved back toward the center support. The path of the crack between the two cut edges is unconfirmed; however, Panel 4 had a similar failure and its confirmed path was as such. Figure 4.3 shows the cracked elastomer core of Panel 3 on both sides.



(a) Left cut edge (*Crack Highlighted*)



(b) Right cut edge

Figure 4.3 Panel 3 failure, elastomer core crack

4.2.2 Panel 4

Panel 4 replaced Panel 3 along side Panel 1P. During initial testing Panel 4 was accidentally overloaded to 122.3 kN (27.5 kips). At about 1,300,000 cycles, the delamination on the right cut edge propagated to about 200 mm (8 in). There was only slight delamination before this. The panel failed at 1,416,337 cycles with a crack in the elastomer core, as seen in Figure 4.4. There was a total delamination length from center support out towards the load location of 240 mm (9 1/2 in) on the left cut edge and 60 mm (2 3/8 in) on the right cut edge. The crack originated from the left edge at about 184 mm (7 1/4 in) from the center support and propagated through the panel curving back towards the center support to the other side. The crack only propagated 350 mm (14 in) across the panel width, not reaching the other side. The path of the crack was confirmed by cutting sections out of the panel. Cutting Panel 4 into sections also revealed the shear studs shown in Figure 4.5. The failure of Panel 4 was nearly the same as Panel 3 with respect to the position of the crack and the delamination lengths at the cut edges.



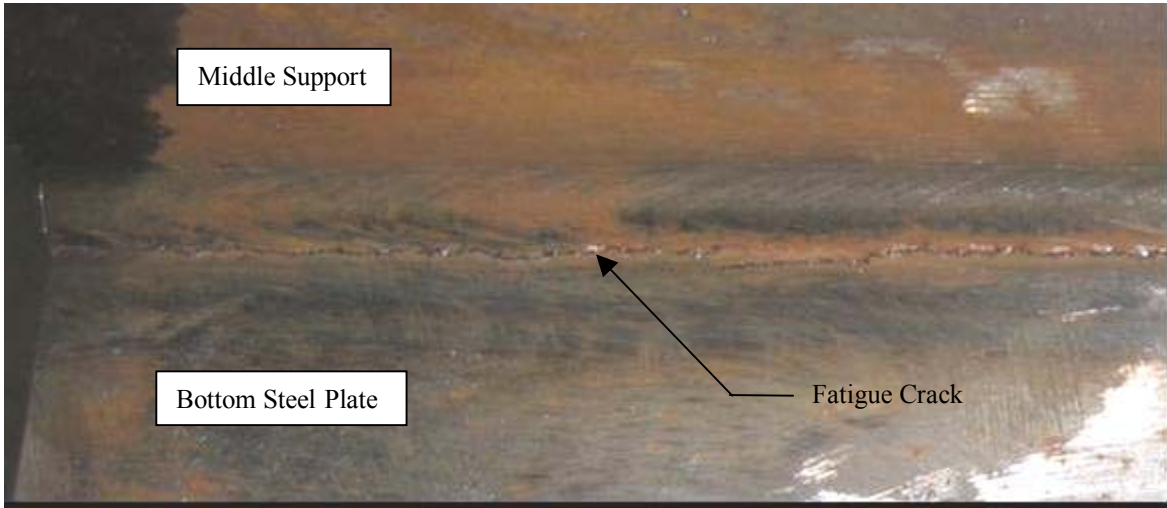
Figure 4.4 Cracked core of Panel 4 on the left cut edge



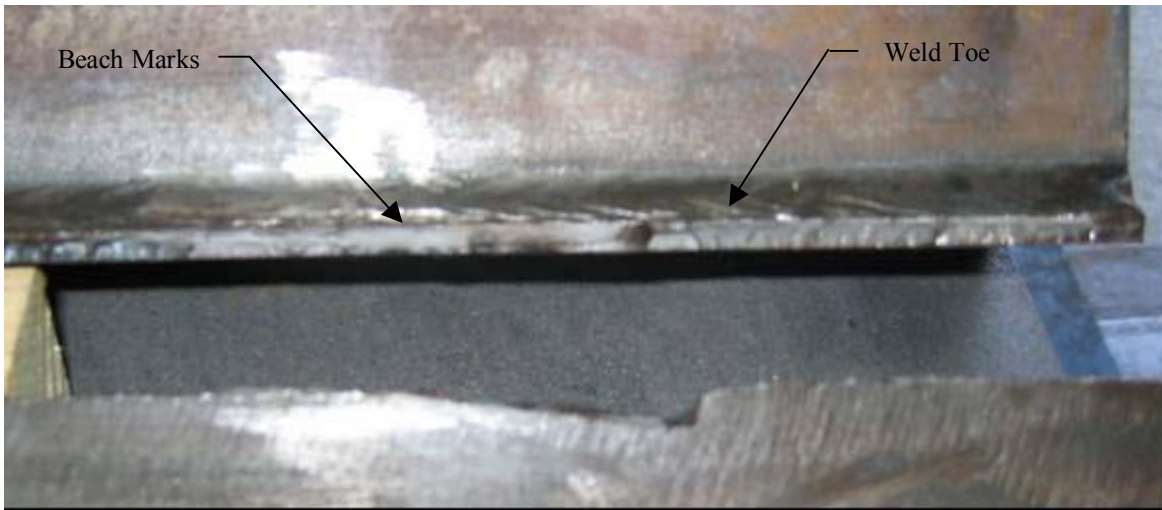
Figure 4.5 Shear studs in Panel 4

4.2.3 Panel 1P

Panel 1P was tested along side either Panel 3 or Panel 4 up until 1,826,337 cycles at which point it was placed in the middle of the test setup to be tested alone. While being testing alongside the other panels, the initial delamination propagated about 75 mm (3 in) towards the load on both of the cut edges in the first 600,000 cycles, but did not grow after that. Panel 1P was overloaded to 122.3 kN (27.5 kips) during initial testing of Panel 4, at which point an increase in strains was noticed. On the side opposite the load, the delamination grew to about 64 mm (2 1/2 in) at failure. During testing a black oily substance secreted out of the destroyed bond area from the right cut edge. The amount of secretion decreased after 1,200,000 cycles. A fatigue fracture in the bottom steel plate along the weld toe on the side of the load was discovered at 2,639,016 cycles. Beach marks, curved lines or surface concentric about the crack origin, were found 114 mm (4 1/2 in) from the left cut edge. Figure 4.6 shows the fatigue crack and the beach marks, which originated from the weld toe side.



(a) Fatigue crack at toe of weld



(b) Fracture surface and beach marks

Figure 4.6 Failure of Panel 1P

4.3 SUMMARY OF TEST RESULTS

The testing sequence, completed cycles, loads, life predictions, and mode of failure for Test Series 1 are listed in Table 4.1. Stiffness test data is summarized in Tables 4.2, 4.3, and 4.4.

The strains and deflections at the maximum-recorded load for each stiffness test versus the number of cycles are plotted together using the corresponding data shown in Tables 4.2, 4.3, and 4.4. Strains were measured on the top steel plate directly over the middle support and deflections were measured from bottom steel plate centered under the load. Figures 4.7 and 4.8 are the strains versus number of cycles with logarithmic and linear scales, respectively. Logarithmic scale was used to capture the behavior of the strains in the beginning. There was a definite trend of increasing strain in the top steel plate above the post-injection weld prior to failure. The onset of rapid increase in strain for Panel 4 corresponds with the delamination of 200 mm (8 in.) at 1,300,000 cycles. It is theorized for Panel 1P that the fatigue crack began at about 1,200,000 cycles, that is, the start of the increase of strain, and completely cracked through the width of the panel at 2,500,000 cycles at which point the strain leveled out. However, this cannot be confirmed since the crack was only discovered at 2,639,016 cycles. The increase in strain at 410,000 cycles in Panel 1P's curves was due to the replacement of Panel 3 with 4 and then the accidental overload. The small spike at 1,826,337 cycles was caused by moving Panel 1P to the middle test location after the Panel 4 failure.

Table 4.1
Testing Matrix for Test Series 1

Test Series	Panel	Post- Injection Welded Joint Type	Middle Support Shimmed	Max. Load, kN (kips)	Min. Load 10% Offset, kN (kips)	Start Date	End Date	Cycles Completed	Fatigue Life Prediction		Failure Mode
									AASTHO S-N Curve	Master S-N Curve	
1	1P	Basic	No	45.2 (10.2)	4.52 (1.02)	6/28/2005	7/30/2005	2,639,016	2,273,329	1,567,180	Fatigue Crack Bottom Steel Plate
	3	Shear Stud	No	45.2 (10.2)	4.52 (1.02)	6/28/2005	7/8/2005	410,000	NA	NA	Elastomer Core Crack
	4	Shear Stud	No	45.2 (10.2)	4.52 (1.02)	7/11/2005	7/22/2005	1,416,337	NA	NA	Elastomer Core Crack

Table 4.2
Stiffness Test Results for Panel 3

Panel 3				
# of Cycles	Load Cell (lbs)	Deflection @ #2 (mm)	SG #3 (µε)	SG #4 (µε)
1	20399	-5.48	361	290
10	20396	-5.31	375	303
100	20394	-5.31	374	301
1000	20403	-5.30	369	298
10000	20388	-5.49	375	299
63173	20396	-5.64	397	312
100000	20393	-5.47	413	328
184161	20400	-5.41	428	346
200000	20397	-5.59	432	368
300000	20399	-5.82	473	408
400541	20397	-6.17	530	460

Table 4.3
Stiffness Test Results for Panel 4

Panel 4				
# of Cycles	Load Cell (lbs)	Deflection @ #2 (mm)	SG #3 (µε)	SG #4 (µε)
1	20391	-5.6388	404	325
1	20391	-5.6388	404	325
10	20399	-5.2832	414	329
1000	20406	-5.0546	414	330
10000	20402	-5.3848	410	335
90000	20403	-5.2324	407	340
100000	20403	-5.2324	405	341
190000	20402	-5.334	405	347
271064	20407	-5.2324	404	346
290000	20402	-4.9784	402	344
390000	20400	-5.1054	402	347
586196	20400	-5.2324	389	342
633200	20402	-5.1054	388	344
826201	20399	-5.0546	397	345
1027015	20402	-5.0546	402	349
1213200	20402	-5.2324	405	360
1269550	20393	-5.2832	406	371
1388000	20399	-5.5626	448	428
1416337	20396	-6.6294	526	488

**Table 4.4
Stiffness Test Results for Panel 1P**

Panel 1P				
# of Cycles	Load Cell (lbs)	Deflection @ #1 (mm)	SG #1 ($\mu\epsilon$)	SG #2 ($\mu\epsilon$)
1	20399	-5.570	244	271
10	20396	-5.258	249	272
100	20394	-5.232	247	271
1000	20403	-5.161	241	268
10000	20388	-5.182	239	263
63173	20396	-5.118	239	259
100000	20393	-4.991	247	268
184161	20400	-5.055	247	261
200000	20397	-5.258	254	280
300000	20399	-5.088	254	272
400541	20397	-4.958	252	265
410001	20391	-5.309	264	279
410001	20391	-5.309	264	279
410010	20399	-5.055	287	316
411000	20406	-5.029	296	316
420000	20402	-5.105	286	322
500000	20403	-5.105	286	317
510000	20403	-5.080	284	316
600000	20402	-5.105	289	322
681064	20407	-5.029	282	313
700000	20402	-4.775	279	310
800000	20400	-4.775	286	311
996196	20400	-4.851	291	314
1043200	20402	-4.851	286	316
1236201	20399	-4.826	292	314
1437015	20402	-4.928	300	340
1623200	20402	-4.801	310	368
1679550	20393	-4.902	319	379
1798000	20399	-4.851	334	392
1826337	20396	-5.029	348	417
1826337	10196	-5.232	343	397
1958400	10199	-4.902	352	400
2132100	10203	-4.953	357	435
2208618	10206	-5.029	361	444
2390808	10200	-4.928	368	466
2522065	10206	-5.334	398	521
2639065	10203	-5.436	393	526

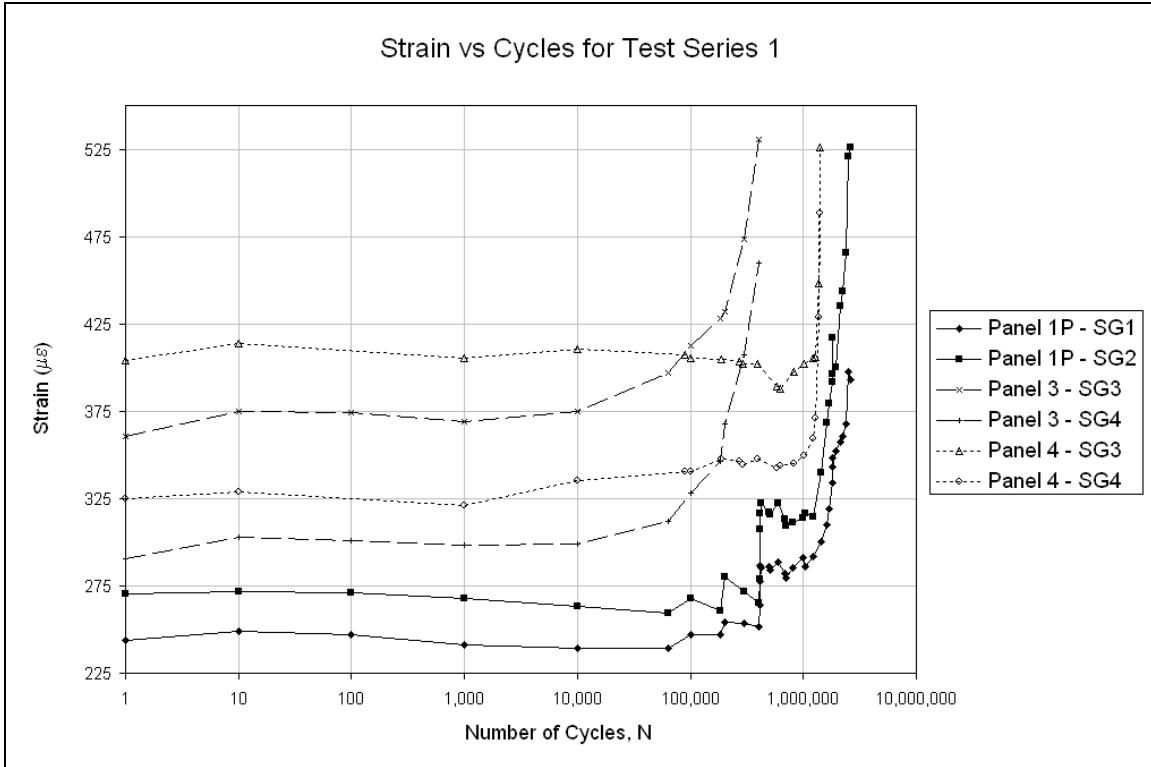


Figure 4.7 Strain versus number of cycles for panels 1P, 3 and 4, semi-log scale.

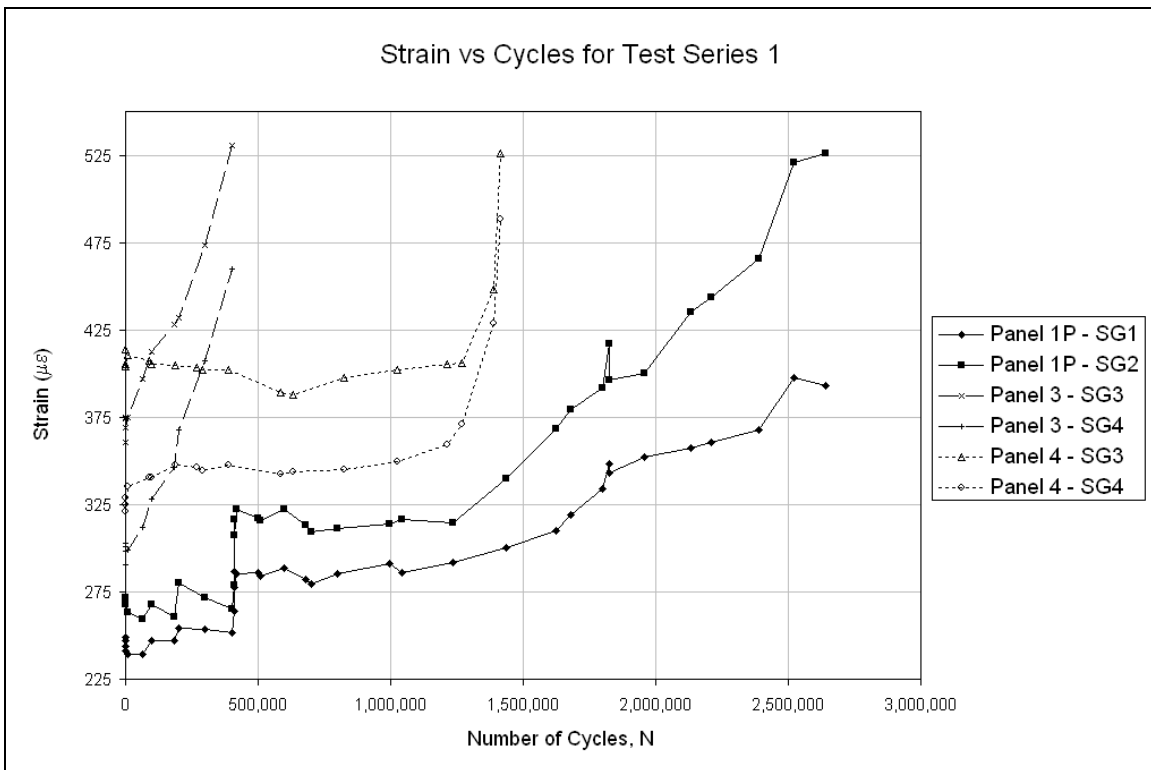


Figure 4.8 Strain versus number of cycles for panels 1P, 3 and 4, linear scale.

Similar trends can be seen in Figures 4.9 and 4.10, where deflections versus number of cycles are plotted in logarithmic and linear scales, respectively. There was a noticeable increase in deflection in Panels 3 and 4 before their elastomer cores cracked. However, for panel 1P, only a slight increase in deflection occurred before the crack was discovered.

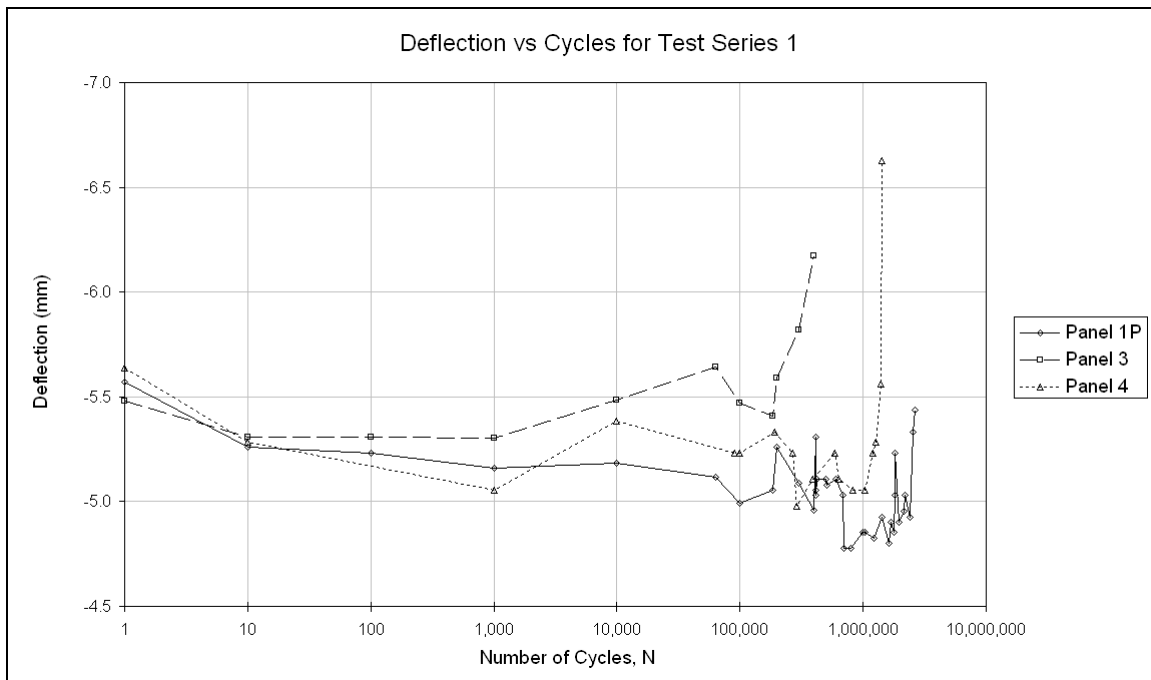


Figure 4.9 Deflection versus number of cycles for Test Series 1, semi-log scale.

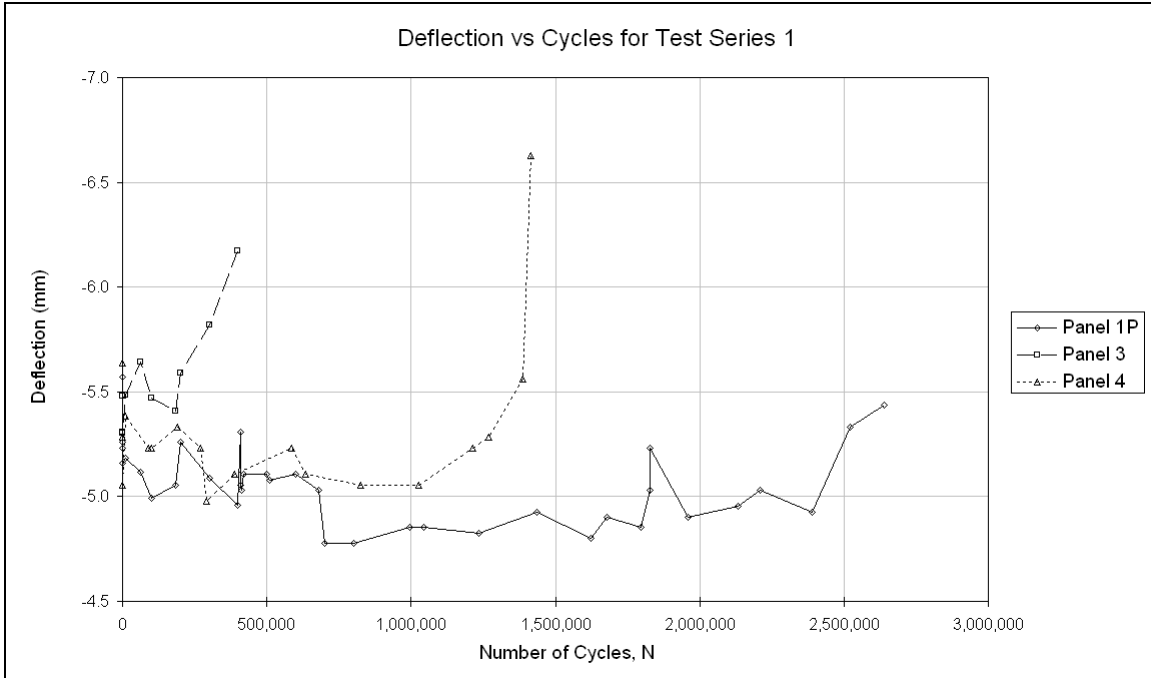


Figure 4.10 Deflection versus number of cycles for Test Series 1, linear scale.

4.4 SUPPLEMENTARY TEST RESULTS

The results for the coupon tests are shown in Table 4.5. The coupons were cut from the top and bottom steel plates of Panel 1P on the side opposite the load. The stress-strain curve was characteristic of high-strength low-alloy steel, with a 0.2 % offset used to determine the yield strength. The elongation was based on an initial 229 mm (9 in gage length).

Table 4.5
Coupon test results for top and bottom steel plates, Test Series 1

Coupon	Yield Stress MPa (ksi)	Ultimate Stress (ksi)	% Elongation
Top 1	466 (67.6)	634 (91.9)	8.7
Top 2	483 (70.1)	648 (94.0)	10.8
Bottom 3	478 (69.3)	645 (93.6)	10.2
Bottom 4	483 (70.1)	654 (94.9)	9.4
Average	478 (69.3)	645 (93.6)	9.8

A dynamic stiffness test for Panel 1P was performed during cyclic loading at a frequency of 2.1 Hz to determine if dynamic loading and the speed of the test affected the strains at the maximum and minimum loads. Strains recorded during the dynamic stiffness test were plotted along with the strains from the static stiffness test previous to the dynamic test in Figure 4.11. The strains at the maximum cyclic load corresponded very well, however the strains at the minimum cyclic load did not. The minimum recorded strains during the dynamic stiffness test were the expected ten percent of the maximum strain which corresponds with the ten percent offset for the minimum load. The strains for the static stiffness test at ten percent of the maximum load were higher than expected. The difference occurs because the neoprene pads in static stiffness test started at zero load and as the load was applied the neoprene pads became stiffer. During the dynamic stiffness test, the pads, were not able to recover and remained stiff. Because the neoprene pads remained stiff during cyclic testing the measured strains correspond better with the theoretical strains.

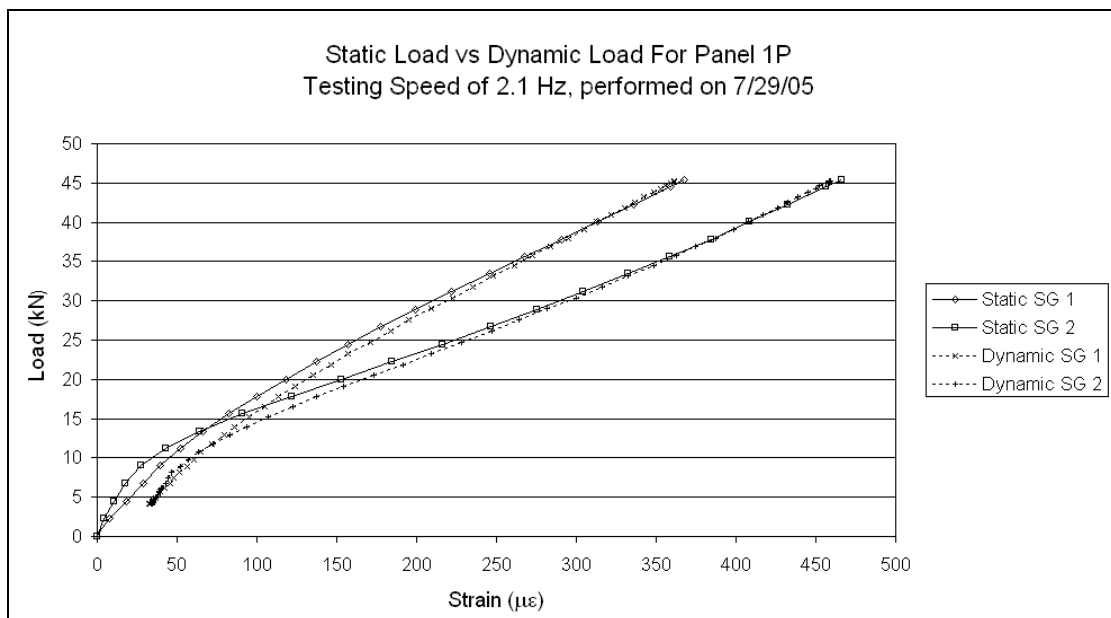


Figure 4.11 Dynamic versus static stiffness test at 2.1 Hz

4.5 DELAMINATION AND CAMBER DRAW DOWN ANALYSIS

Finite element analyses were performed by Intelligent Engineering Ltd. to investigate the effects of delamination. The steel-elastomer interface at the SPS post-injection weld was modeled with three different scenarios. First, with a fully bonded steel-elastomer interface, then with a delamination of 25 mm (1 in) and finally with a delamination of 75 mm (3 in). The stress at the top of the bottom plate normal to the plain along the weld toe for the fully bonded model was 135 MPa (19.5 ksi). With the 25 mm delamination the stress increased 123% to 166 MPa (24.1 ksi), and with the 75 mm delamination the stress increased 219% to 296 MPa (42.9 ksi). However, deflections increased only slightly, with less than a 1% increase from the fully bonded model to the 25 mm delamination model, and only a 3.6% increase in deflection for the 75 mm delamination model.

Intelligent Engineering Ltd. provided results of a finite element analysis modeling the draw down of the camber from the post-injection weld. The normal stress and the shear stress of the steel-elastomer core interface are plotted along with a failure envelope of the normal stress and shear stress interaction in Figure 4.12. The failure envelope was provided by Intelligent Engineering Ltd. based on tests conducted at the Technical University of Hamburg-Hamburg. The basic post-injection welded joint was modeled with a 30 mm (1 3/16 in.) delamination and the draw down of 15 mm (9/32 in.) camber. The predicted normal stress was 2.72 MPa (0.395 ksi) and the predicted shear stress was 0.44 MPa (0.0064 ksi). These stresses are well within the failure envelope, therefore the bond between the steel-elastomer core interface under static loading should hold; however this does not include effects from fatigue.

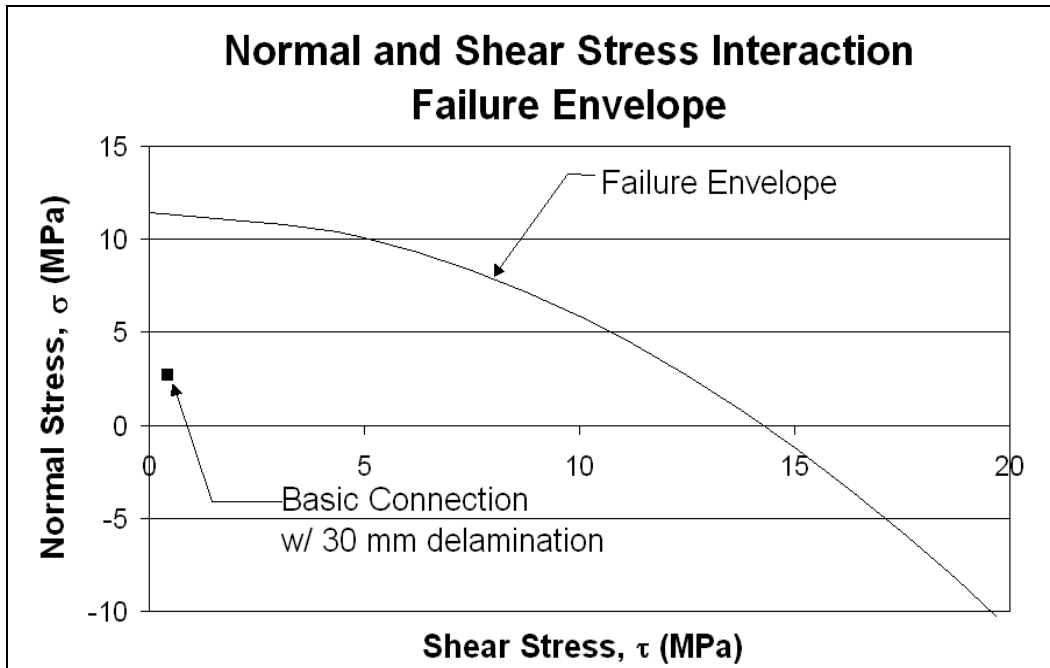


Figure 4.12 Failure envelope for normal and shear stress interaction

4.6 COMPARISON OF EXPERIMENTAL AND PREDICTED RESULTS

To determine theoretical values for stress, strain and deflection, finite element analyses were performed by Intelligent Engineering Ltd using ANSYS. The steel elements were modeled using SOLID45 brick elements and were assigned a modulus of elasticity of 206 GPa (30,000 ksi) and Poisson's ratio of 0.287. The elastomer core elements were modeled using HYPER58 brick elements and were assigned a modulus of elasticity of 750 MPa (109 ksi) and a Poisson's ratio of 0.36.

Load versus experimental and theoretical deflections are shown in Figure 4.13. The experimental load increments were approximately 4.45 kN (1.0 kip) and the maximum load was 45.2 kN (10.2 kips). Experimental deflections for each panel were taken from the stiffness test performed at 10,000 cycles. The predicted deflection of the bottom steel plate centered under the load was 4.04 mm (0.159 in) at the maximum load. The experimental deflections exceeded the predicted values by 28 to 35 percent. The

large difference between the experimental and predicted deflections was caused by deflections in the floor beam that were not accounted for in the predicted deflections. The problem was helped in the next series of test by adding stiffeners to the web of the middle floor beam under each test specimen and providing better shims between the floor beam and the reaction floor. The difference was reduced to 3 to 12 percent in Test Series 2 to 5.

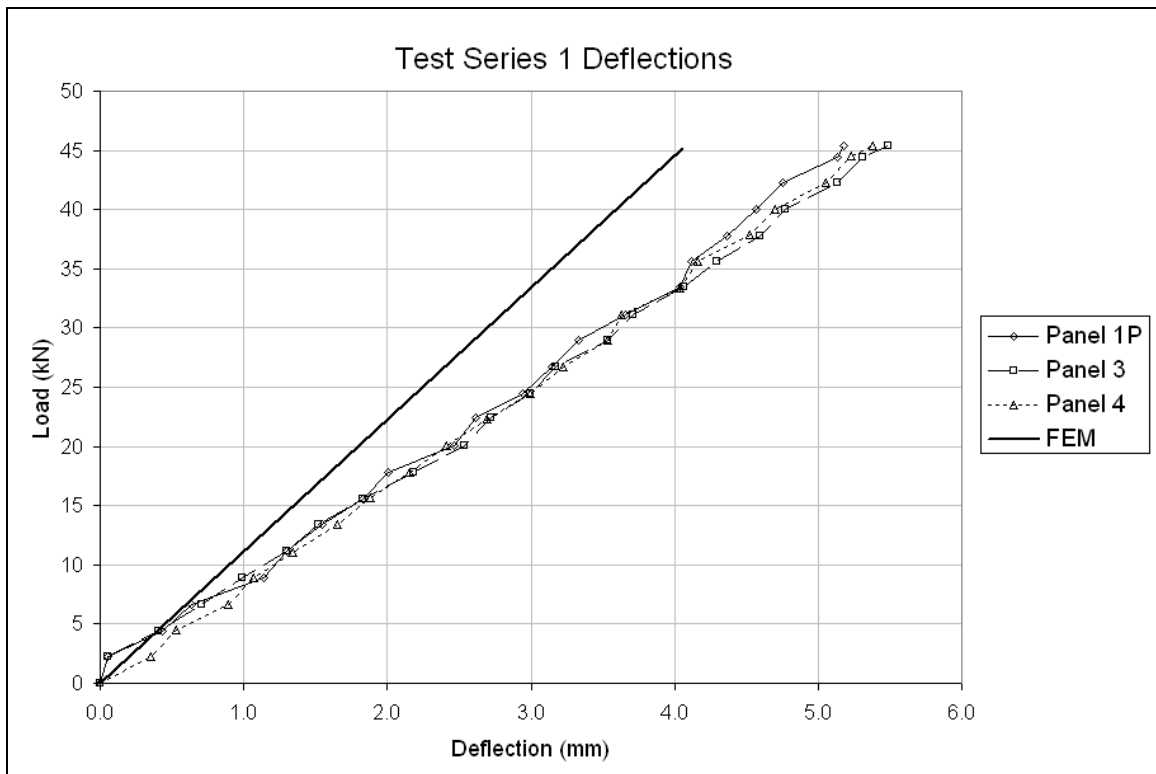


Figure 4.13 Predicted versus Experimental Deflections, Test Series 1

Load versus strain for the theoretical and experimental strains for the interior strain gages (2 and 4) and the exterior strain gages (1 and 3) are shown in Figures 4.14 and 4.15, respectively. The maximum predicted strain from the finite element solution for gages 1 and 3 was $380 \mu\epsilon$ and for gages 2 and 4 it was $369 \mu\epsilon$. Strains in Panel 1P were much lower than the predicted strains. Panel 1P's strains and deflections were less than

Panels 3 and 4 indicating some unanticipated eccentricity in the setup. Another indication of eccentricity is that the values from strain gage 4 on Panels 3 and 4 were 12-21% lower than predicted value and the values from strain gage 3 on Panel 4 were up to 11% higher than predicted. After the completion of Panel 1P testing, it was discovered that the neoprene pad was damaged and was a possible cause of the eccentricity. The pad was replaced for the next series of testing.

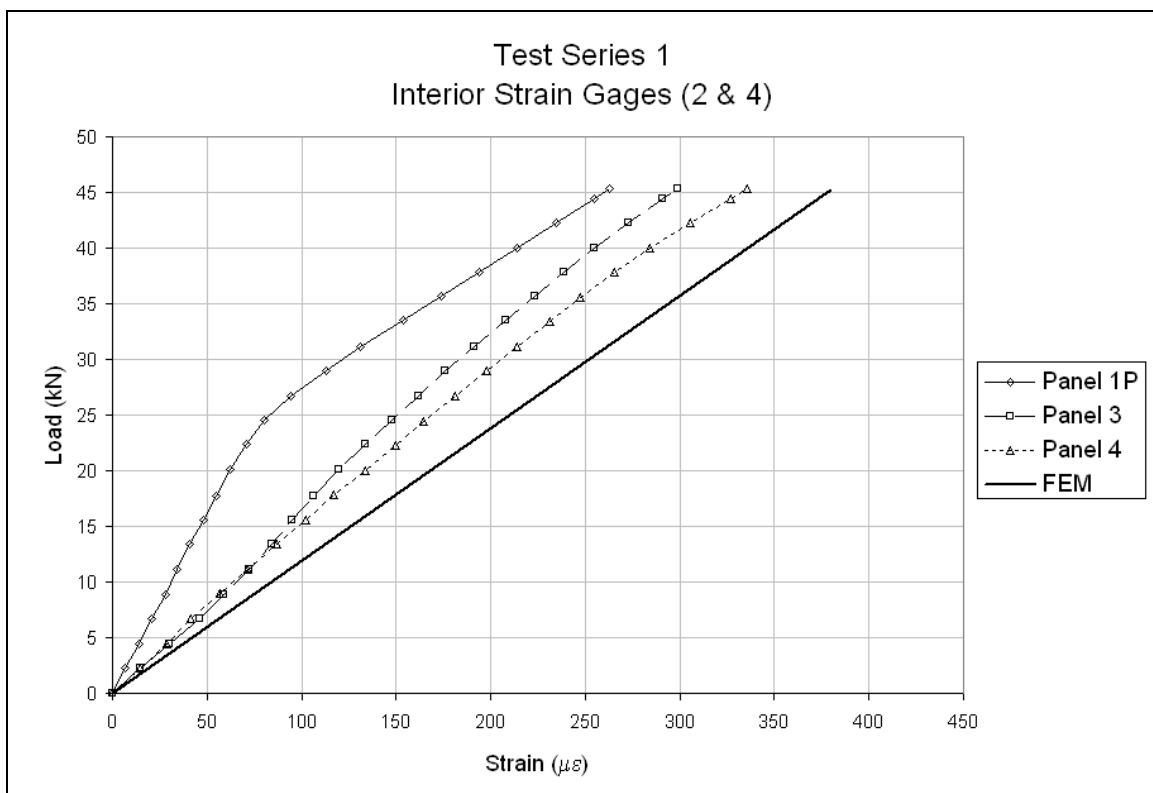


Figure 4.14 Predicted versus experimental strains of interior strain gages, Test Series 1

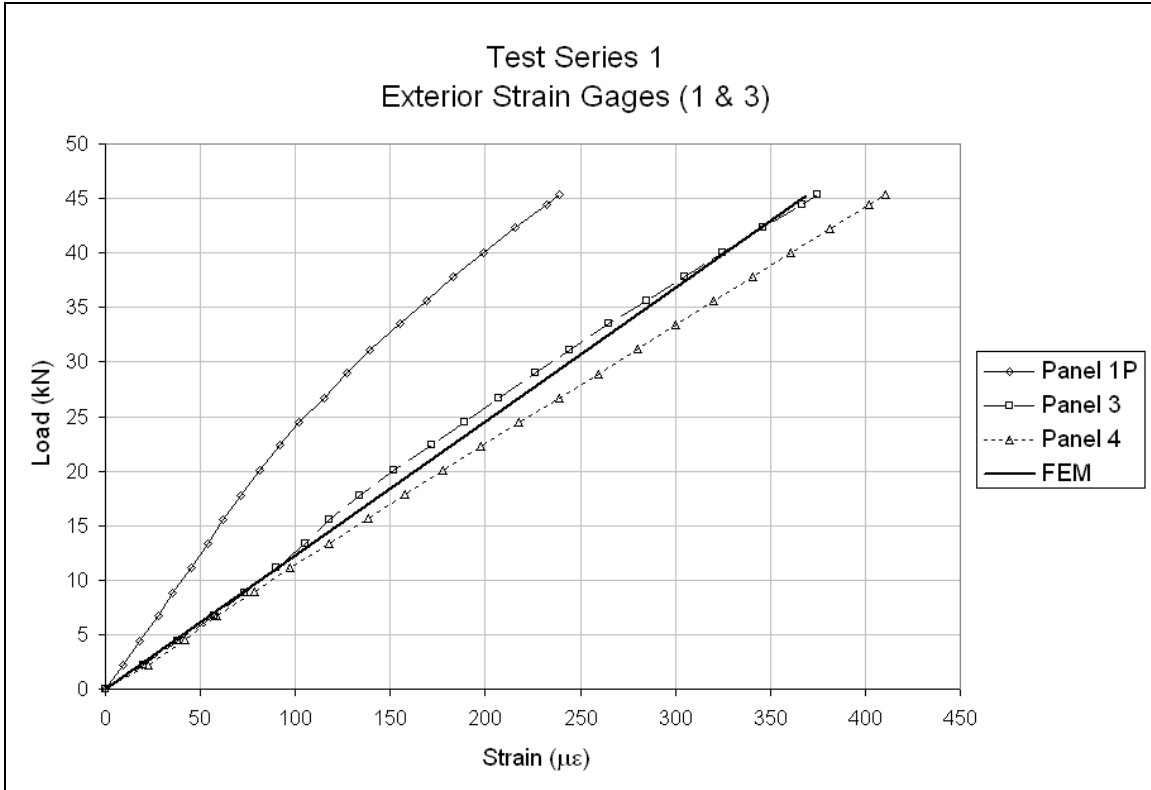


Figure 4.15 Predicted versus experimental strains of exterior strain gages, Test Series 1

4.7 FATIGUE LIFE PREDICTIONS

4.7.1 S-N Curves

The section of interest that was most susceptible to fatigue cracking is along the weld toe in the bottom steel plate of the SPS panel on the side of the load location. The AASTHO S-N curves were developed for fatigue resistance in steel welded details, therefore, no attempt was made to predict the fatigue resistance of the elastomer core. AASHTO specifies that fatigue provisions are only to be used on “details subjected to a net applied tensile stress” (AASTHO 2004). The applied load only produced a net compressive stress in the underside steel plate of the SPS panel at the weld toe, and a net tensile force at the top of the underside steel plate. The top of the underside steel plate on the side of the steel-elastomer interface are classified as Detail Category A, plain

member, from Table 6.6.1.2.3-1 of AASTHO (2004). The shear studs are considered Detail Category C. The draw down of the camber at the middle support was also considered, which produces tensile stresses at the weld toe of the bottom steel plate before load was applied. Stresses at the weld toe began in tension and reverse to compression as the load was applied. The welded detail under this state of stress was classified as Detail Category C at the weld toe.

The finite element model was used to analyze the panel with a draw down of 7.9 mm (5/16 in.) at the middle support with and without the applied load. The resulting analyses, including the net applied stress at the bottom and top of the underside steel plate, and the ten percent offset for the testing range are listed in Table 4.6. To predict the fatigue life at the weld, Detail Category C was used for the tensile stresses along the weld toe at the bottom of the underside steel plate. Although the experimental strains were less than the values predicted from the finite element analysis, the tensile stress on the bottom steel plate along the weld toe remained the same, since the applied net compressive stress was larger than the tensile draw down stress. Therefore, the tensile stress with the ten percent offset of 85.5 MPa (12.4 ksi) was used for the stress range for the fatigue life prediction.

Table 4.6
Stresses from Finite Element Analyses, Test Series 1

Stress	Location of Bottom Steel Plate at Weld Toe	
	Bottom MPa (ksi)	Top MPa (ksi)
7.9 mm Draw Down	110.2 (16.0)	10.29 (1.5)
10% offset	85.5 (12.4)	22.6 (3.3)
Applied	-137.2 (-19.9)	133.4 (19.3)
Net Applied	-247.4 (-35.9)	123.1 (17.9)

The stress range was set equal to Equation 2.1 with the constant A equal to 1.44×10^{12} MPa (4.4×10^9 ksi). The Palmgren-Miner summation was not needed to account for cumulative damage since only one stress range was used for all three panels in Test Series 1. It was found that the predicted fatigue life for the Detail Category C for the post-injection welded joint with stresses from the draw down was 2,273,329 cycles. This is compared 2,639,016 cycles or approximately 96.4 cycles per day for 75 years from Panel 1P with the fatigue crack in the steel plate, which is a short fatigue life for a bridge. The Panel 1P S-N data is plotted along with the Detail Category C in Figure 4.15.

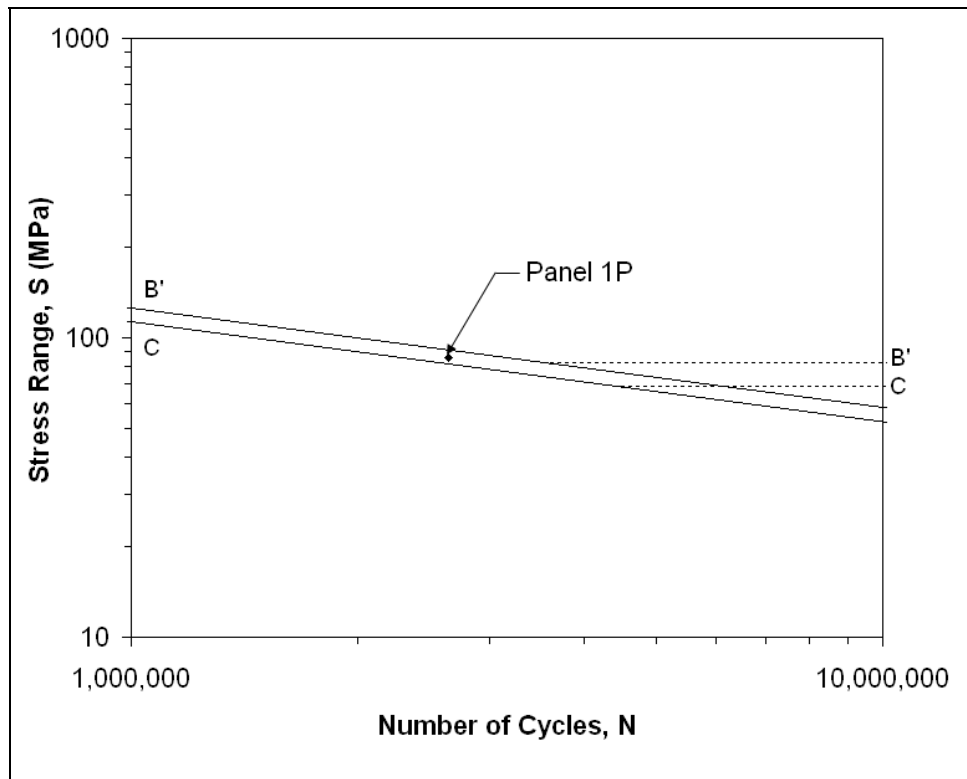


Figure 4.16 Panel 1P S-N data bounded by Detail Categories C

4.7.2 Structural Stress Method

Element nodal forces used to determine the structural stress for the master S-N curve method were taken from finite element analyses. The finite element model was a

modification of the model provided by Intelligent Engineering Ltd. It was modified to represent the section at the weld toe. SOLID45 brick elements were also used for the elastomer core elements instead of the HYPER58 elements, but the same material properties were used.

The structural stress for the master S-N curve method was calculated in accordance with the procedure outlined in Chapter 2. The structural stress at the bottom of the underside steel plate along the weld toe is plotted in Figure 4.17. The plot contains structural stress from the draw down, applied load, and the ten-percent offset. The structural stress parameter, ΔS_s , was calculated to be 91.236 MPa (13.3 ksi) with Equation 2.6 using 160 MPa (23.6) as the tensile portion of the structural stress range. The r value was based on the structural stress for the draw down stresses. Using Equation 2.11 the fatigue life was calculated to be 1,567,180 cycles for the mean master S-N curve. The fatigue life calculated using the upper 95% prediction interval, was 8,674,770 cycles. Figure 4.18 is the plot of Panel 1P and the master S-N curve.

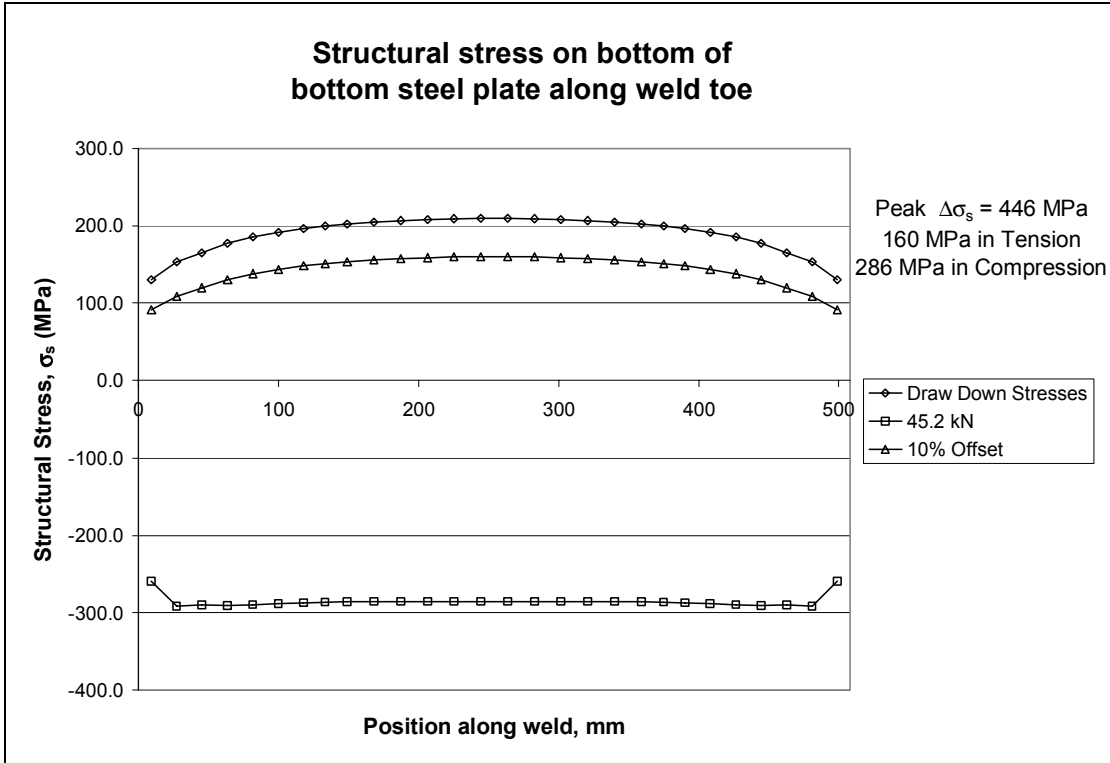


Figure 4.17 Predicted structural stress at the bottom of bottom steel plate, Panel 1P

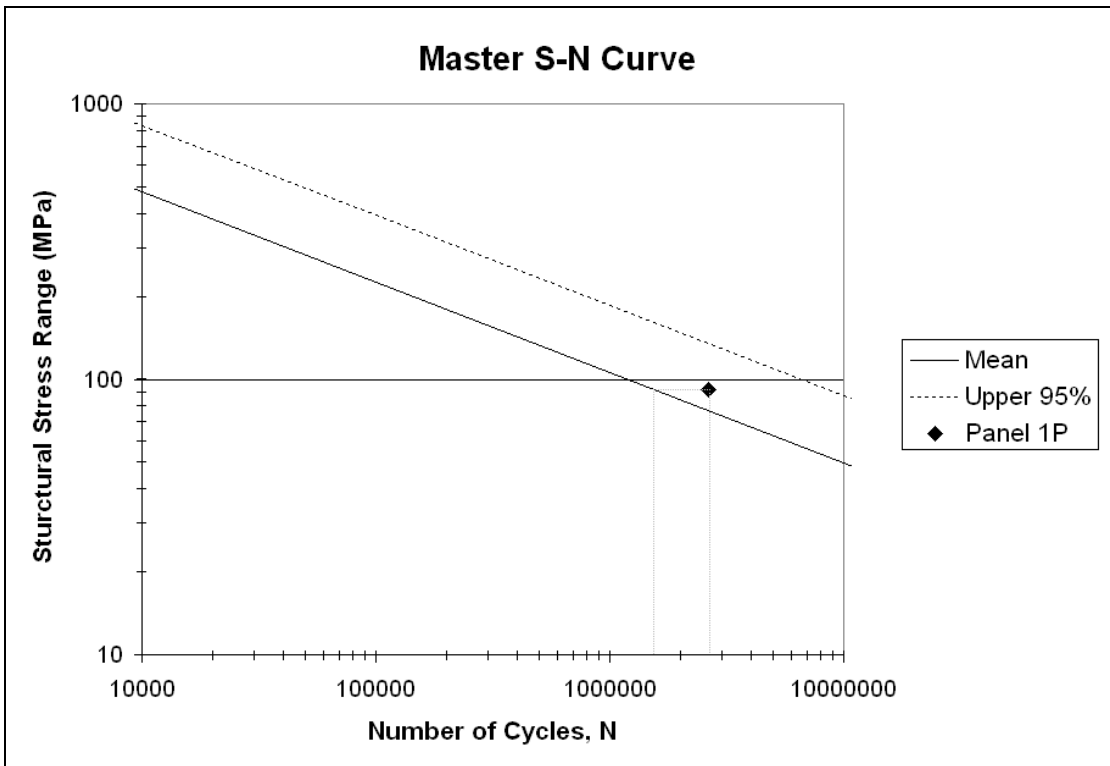


Figure 4.18 Panel 1P with master S-N Curve

4.8 DISCUSSION OF RESULTS

From the experimental results it could be seen that a sharp increase in the strains of the top plate was an indication of delamination and a gradual increase was a possible indication of crack growth of the steel plate at the weld toe. Similar trends in the deflections indicated loss in stiffness. Changes in deflections were not as indicative as the strains, which was also confirmed with the finite element analyses of the varying delamination lengths. From the experimental observations it was seen that the delamination grew as the fatigue testing progressed, indicating delamination was affected by fatigue. This was supported by the normal stress and shear stress interaction analysis of static loading. Panels 3 and 4 delaminated much more than Panel 1P, leading to the possible conclusion that the shear studs may have contributed to the delamination. But, the large delamination only occurred on one side, contradicting this conclusion since the shear studs were on both sides. The stress from the draw down in addition to the stress from the applied load may have contributed to the fatigue delamination.

The SPS post-injection welded joint with tensile stress from the draw down of the camber was classified as the AASTHO Detail Category C. This was confirmed with the experimental data. The AASTHO S-N curve was able to predict the fatigue life within 366,000 cycles, or factor of 1.16. Again the stresses from the draw down of the camber were used to calculate the structural stress for the master S-N curve method. The mean master S-N curve predicted a fatigue life within a million cycles, a factor of 1.68, much lower than the actual, but the S-N data of Panel 1P fell between the mean curve and the upper 95% prediction interval of the master S-N curve.

CHAPTER 5

INSERT BAR CONNECTION-TEST SERIES 2-5

5.1 GENERAL

Panels A and C were tested in Series 2 and 5, and Panels B and D were tested in Series 3 and 4. Panels A and B were the basic connection without insert bars, and Panels C and D contained the insert bars over the post injection welded joint. Figure 5.1 shows the position of the insert bars. Submerged arc welding was used to weld the post-injection joint with alternating current (AC) and 460 amps. The welding speed was 508 to 559 mm/min (20 to 22 in/min) using 2.4 mm (3/32 in) wire. All four panels were cambered due to residual stresses caused by the post-injection weld. The camber was concave downward measuring 13 to 19 mm (1/2 to 3/4 in.) under the middle support. Shims were used under the middle support rather than drawing down the middle support and creating tensile stresses in the bottom plate. An initial destruction of the steel-elastomer bond could be seen at the cut edges of Panels A and B over the post-injection welded joint and varied in length from 35 to 44 mm (1 3/8 in. to 1 3/4 in.), slightly less than the delamination of the panels of Test Series 1. Insert bars were imbedded into Panels C and D, to prevent the destruction of the bond between the steel-elastomer interface over the middle support. The two strain gages and their designation for each panel are also shown in Figure 5.1. The joint between the top steel plate and the end perimeter bars of each panel was not welded when received from fabricator as seen in Figure 5.2. To remain consistent with Test Series 1, laboratory personnel welded these joints on all four panels after Panels A and C had been subjected to 550,000 cycles.

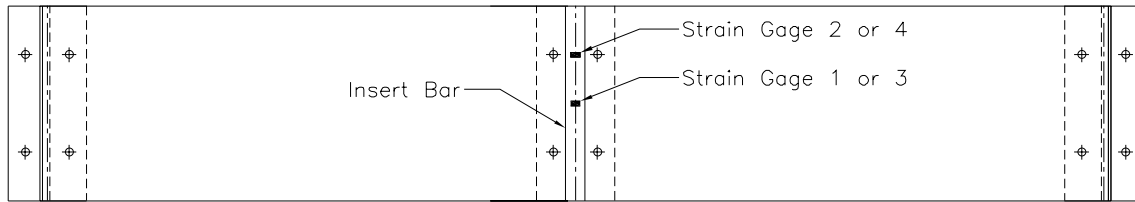


Figure 5.1 Location of insert bar and strain gages in Panels C and D.



Figure 5.2 Top Steel Plate and perimeter bars not welded

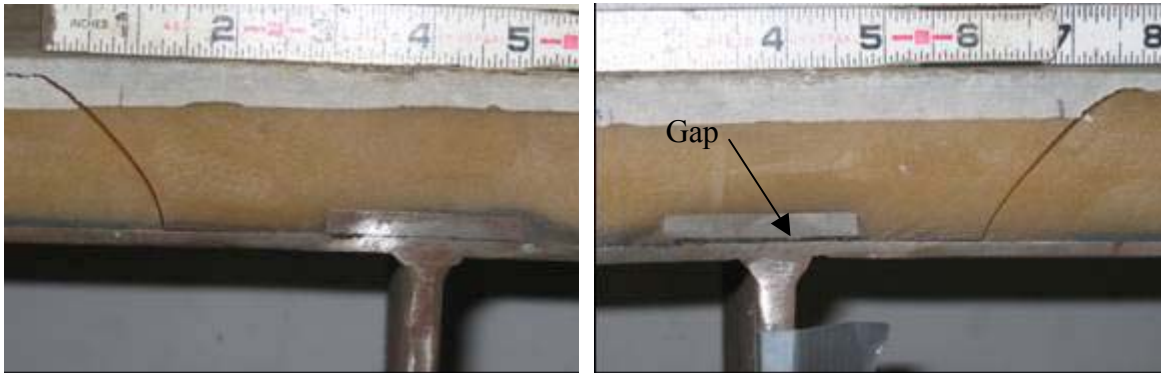
Panels A and C were tested together in Test Series 2 and completed 10,000,000 cycles without failure. Panels B and D of Test Series 3 also completed 10,000,000 cycles at a higher load without failure. Test Series 4 was a continuation of Test Series 3 at a higher load. Panel D failed first at less than 100,000 cycles with a shear failure in the elastomer core near the middle support and Panel B failed at about 390,000 cycles with a similar failure of the core and a partial crack in the bottom steel plate. Panels A and C were then again tested at a higher load and Panel C failed at 2027 cycles with a failure in the core like Panels B and D. Panel A failed at 85,714 cycles with the same type of elastomer core failure.

5.2 FATIGUE TEST OBSERVATIONS

5.2.1 Test Series 2 and 5

Panel C was tested at 45.2 kN (10.2 kips) in Test Series 2. On the right edge there was a 1.6 mm (1/16 in) gap between the insert bar and the bottom steel plate as seen in Figure 5.3. On left edge the gap was less than 1 mm (1/32 in). During testing the gap would close with loading. A hairline crack formed at the top corners of the insert bar on both sides of the panel after 125,000 cycles. Underbites, or retraction of the elastomer core, formed on Panel C propagating from the bond destruction of the bottom steel-elastomer interface towards the load location from the face of the middle support 73 mm (2 7/8 in) on right edge and 86 mm (3 3/8 in) on left edge. On the side away from load location, underbites propagated 73 mm (2 7/8 in.) on the right edge and 70 mm (2 3/4 in.) on the left edge. No shearing was found between the steel-elastomer interface during cyclic loading

In Test Series 5, the load was increased by 243% to 110.1kN (24.75 kips). Panel C failed at 2027 cycles with an abrupt cracking of the elastomer core. It was not known where the crack originated; however it most likely started from the bottom steel elastomer interface. On the left edge at the bottom interface, the crack was at a distance of 67 mm (2 5/8 in.) from the face of the middle support and on the right edge it was 51 mm (2 in.). The crack curved up to a near 45 degree angle as seen in Figure 5.3.



(b) Left cut edge

(b) Right cut edge

Figure 5.3 Panel C failure, elastomer core crack

Panel A also reached 10,000,000 cycles without failure in Test Series 2. After 10,000,000 cycles there was an underbite of the bottom steel plate on the side of the load location measuring from face of the middle support 73 mm (2 7/8 in.) on right cut edge and 60 mm (2 3/8 in.) on the left cut edge. On the side opposite the load location, the underbite propagated 47 mm (1 7/8 in.) on the right cut edge and 29 mm (1 1/4 in.) on the left cut edge from face of the middle support. No shearing was found between the steel-elastomer interface during cyclic testing.

In Test Series 5, Panel A failed at 85,840 cycles with a crack in the elastomer core originating from the left edge 54 mm (2 1/8 in.) from the face of the middle support at the steel-elastomer interface. The crack propagated through the panel to the other edge curving up to a near 45 degree angle as seen in Figure 5.4

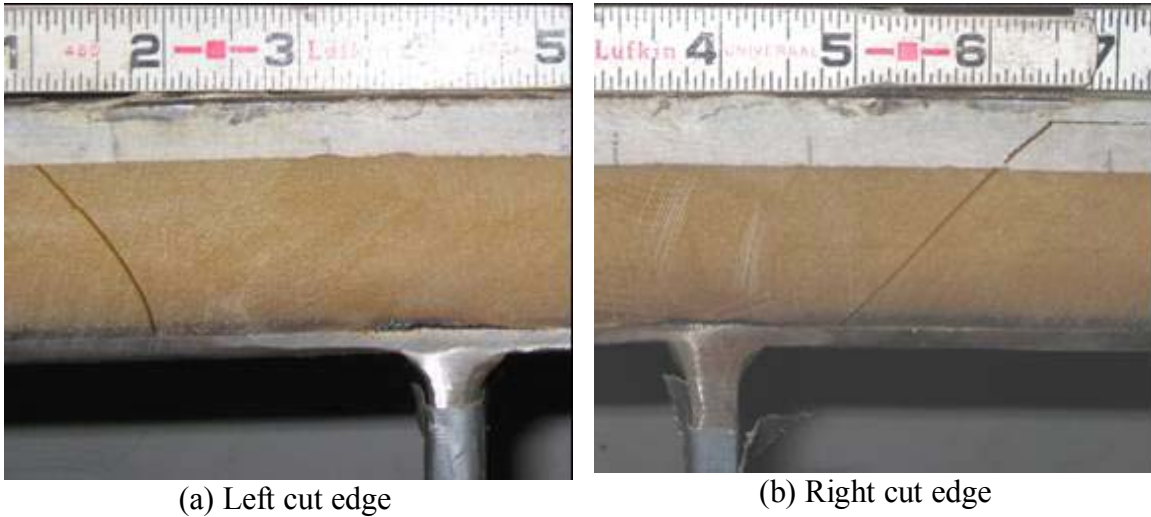


Figure 5.4 Panel A failure, elastomer core crack

5.2.2 Test Series 3 and 4

Panel D reached 10,000,000 cycles in Test Series 3 without failure with a load of 65kN (14.6 kips). Strain levels increased slightly near the end of the test series with a sharp increase in strains for the last stiffness test after 10,000,000 cycles. There existed a gap of less than 1 mm (1/32 in.) between the insert bar and the bottom steel plate, and during testing the gap would close and open with loading and unloading. A hairline crack formed at the top corners of the insert bar on the side of the load after 2,300,000cycles. No underbite formed during the 10 million cycles

In Test Series 4, the load was increased by 150% to 97.5 kN (21.9 kips). Panel D failed first by the elastomer core cracking between 30,000 and 100,000 cycles. The cycle at failure is unknown since the test continued after failure to the predetermined shut-off cycle of 100,000. The crack in the elastomer core of Panel D shown in Figure 5.5 originated 60 mm (2 3/8 in.) from the face of the center support. It propagated through the width of the panel curving up to a 45 degree angle.

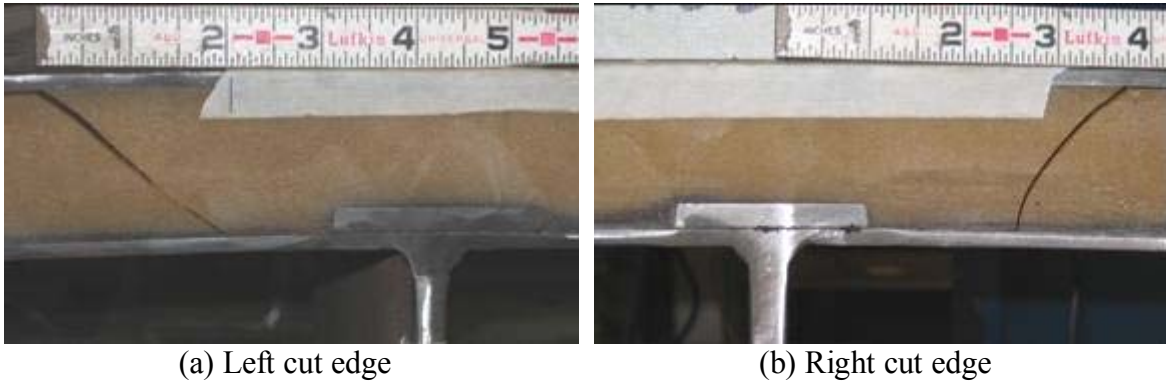


Figure 5.5 Panel D failure, elastomer core crack

Panel B also reached 10,000,000 cycles without failure in Test Series 3; however, strain levels decreased slightly through the 10,000,000 cycles. At end of Test Series 3 the underbite of the bottom steel plate propagated 73 mm (2 7/8 in.) on right cut edge from the face of the middle support towards the load location and 48 mm (1 7/8 in.) on the left cut edge. On the side opposite the load location, the underbite extended from the face of the middle support 76 mm (3 in.) on the right cut edge and 60 mm (2 3/8 in.) on the left cut edge. No shearing was found between the steel-elastomer interface during cyclic testing.

In Test Series 4, Panel B was tested alone from 100,000 to failure at 390,000 cycles. Since panel D failed at an unknown cycle count between 30,000 and 100,000 cycles, the amount of load applied to Panel B between the Panel D failure cycle and 100,000 cycles was negligible, therefore the end cycle is estimated to be between 320,000 and 390,000 cycles. The panel failed with a crack in elastomer core originating 60 mm (2 3/8 in.) from the face of the middle support and curving up to a near 45 degree angle as shown in Figure 5.6. A crack was also found in the bottom steel plate along the weld toe. The crack was through the thickness of the plate but only spanned the inner 240 mm (9

1/2 in.) of the width of the plate as illustrated in Figure 5.7. It is not known when the crack was formed as it was discovered after the panel was removed and sectioned to reveal the elastomer core fracture surface. The fracture surface had two distinct regions as seen in Figure 5.8, a smoother region extending a quarter of the thickness from the weld toe, and a rough region extending the rest of the thickness. It is possible that the crack enlarged after it was removed from the testing frame.



Figure 5.6 Panel B failure, elastomer core crack

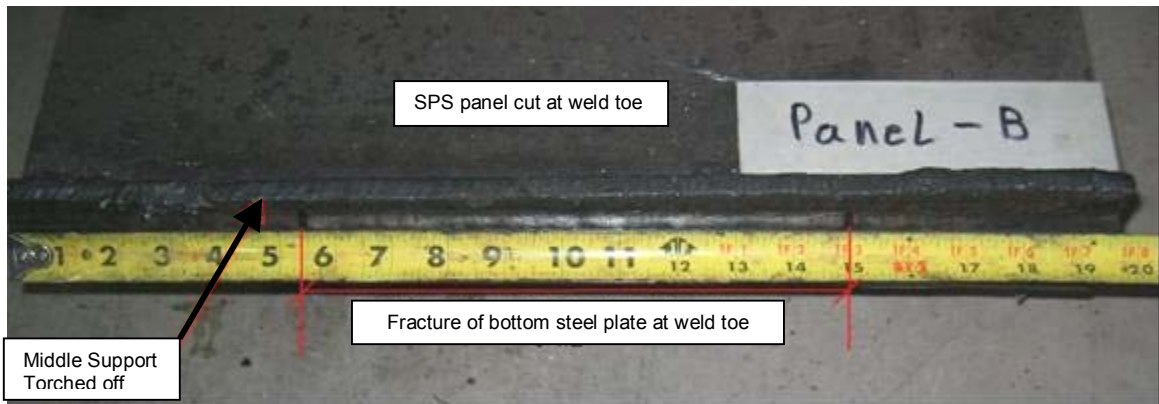


Figure 5.7 Panel B bottom steel plate fracture

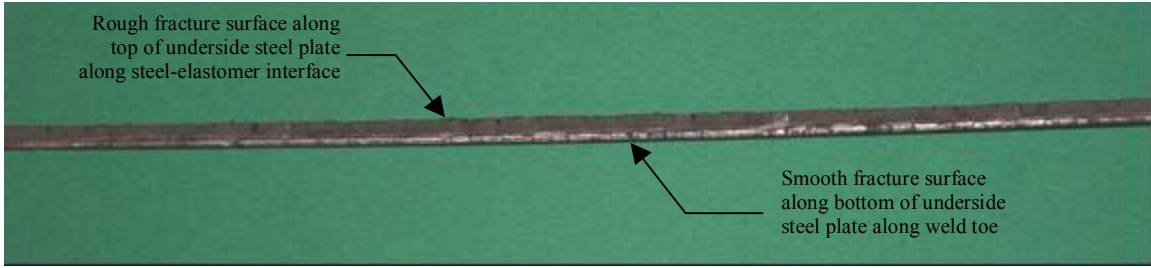


Figure 5.8 Failure plane of fracture in Panel B

The failures in the elastomer core of panels A, B, C, and D were very similar with the delaminations starting 54 to 67 mm (2 1/8 to 2 5/8 in.) from the face of the middle support. The cracks also curved up to a near 45 degree angle. A comparison of the fracture surfaces and their points of origin for Panels B and D is shown in Figure 5.9

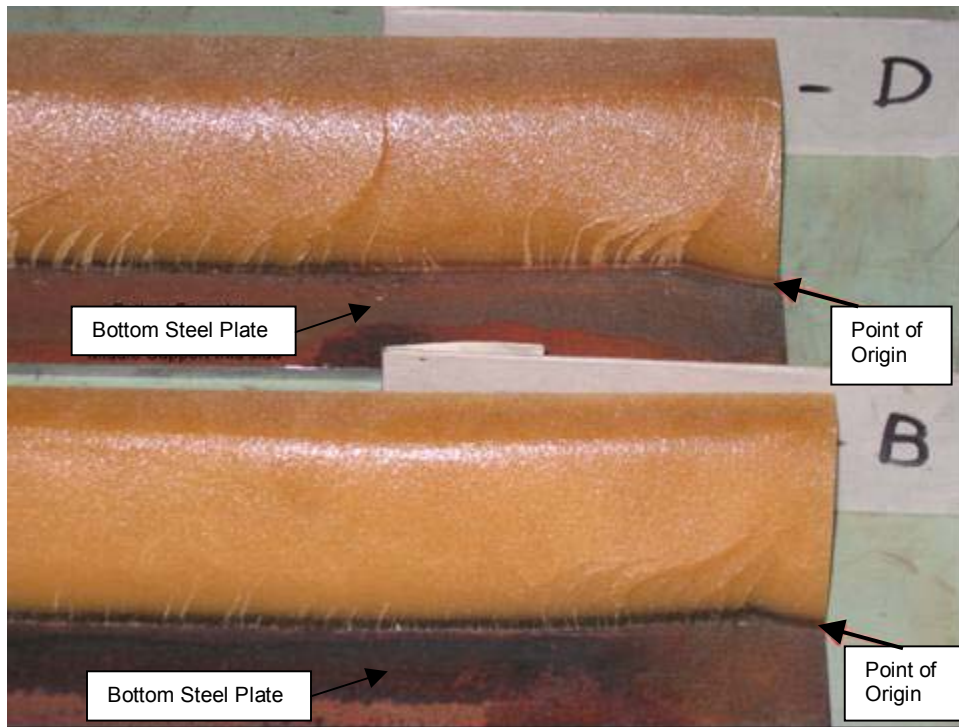


Figure 5.9 Comparison of elastomer core fracture surfaced in Panels B and D

5.3 TEST RESULTS

5.3.1 Summary

The testing sequence, completed cycles, loads, life predictions, and mode of failure are listed in Table 5.1.

The strains and deflections at the maximum-recorded load for each stiffness test are plotted together versus the number of cycles in Figure 5.11 through 5.21. Strains were measured on the top steel plate directly over the middle support and deflections were measured from the bottom steel plate centered under the load location.

5.3.2 Test Series 2 and 5

Figures 5.10 and 5.11 are the strains versus number of cycles for Test Series 2 with semi-logarithmic and linear scales, respectively. Strain levels stayed fairly constant for Panel A through the ten million cycles, while there was a slight decrease in strain for Panel C, which was most likely due to softening of the neoprene pads over the life of the test. For both panels, the interior strains (gages 1 and 3) were less than the exterior strains (gages 2 and 4). On average, Panel C had a $28 \mu\epsilon$ difference between interior and exterior strains and Panel A had a $19 \mu\epsilon$ difference. The interior strain on Panel A was larger than Panel C interior strain.

Table 5.1
Testing Matrix for Test Series 2-5

Test Series	Panel	Post- Injection Welded Joint Type	Middle Support Shimmed	Max. Load, kN (kips)	Min. Load 10% Offset, kN (kips)	Start Date	End Date	Cycles Completed	Fatigue Life Prediction			Failure Mode
									AASTHO S-N Curve	Master S-N Curve	Stress Reduction	
2	A	Basic	Yes	45.2 (10.2)	4.52 (1.02)	9/12/2005	11/9/2005	10,000,000				13,359,864
	C	Insert Bar	Yes	45.2 (10.2)	4.52 (1.02)	9/12/2005	11/9/2005	10,000,000	13,359,864	79,489,882	16,117	No Failure
3	B	Basic	Yes	65 (14.6)	6.5 (1.46)	11/16/2005	12/22/2005	10,000,000	2,172,338	12,925,199	NA	No Failure
	D	Insert Bar	Yes	65 (14.6)	6.5 (1.46)	11/16/2005	12/22/2005	10,000,000	2,172,338	12,925,199	NA	No Failure
Additional Cycles at Increased Load												
4	B	Basic	Yes	97.5 (21.9)	9.75 (2.19)	1/11/2006	1/21/2006	320,000- 390,000	6,000,456	395,920	NA	Elastomer Core Crack & Fracture of Bottom Steel Plate
	D	Insert Bar	Yes	97.5 (21.9)	9.75 (2.19)	1/11/2006	1/12/2006	30,000- 100,000	6,000,456	395,920	NA	Elastomer Core Crack
5	A	Basic	Yes	110.1 (24.75)	11.01 (2.475)	3/1/2006	3/4/2006	85,840	105,556	1,069,742	NA	Elastomer Core Crack
	C	Insert Bar	Yes	110.1 (24.75)	11.01 (2.475)	3/1/2006	3/1/2006	2027	105,556	1,069,742	NA	Elastomer Core Crack

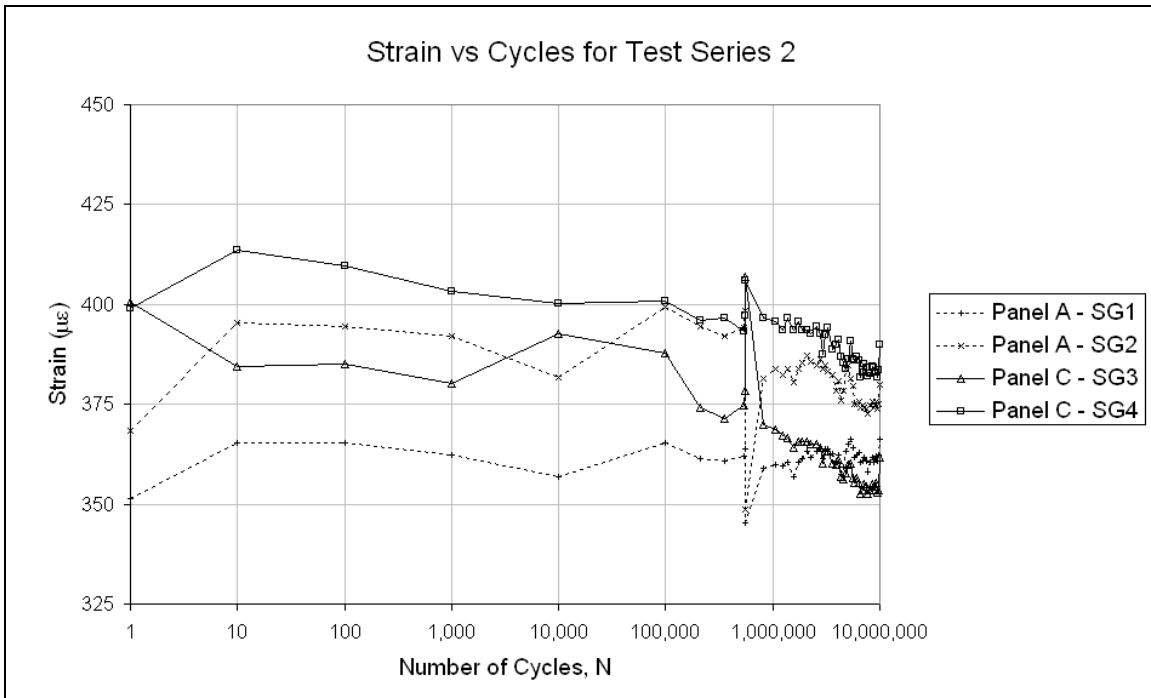


Figure 5.10 Strain versus number of cycles for Test Series 2, semi-log scale

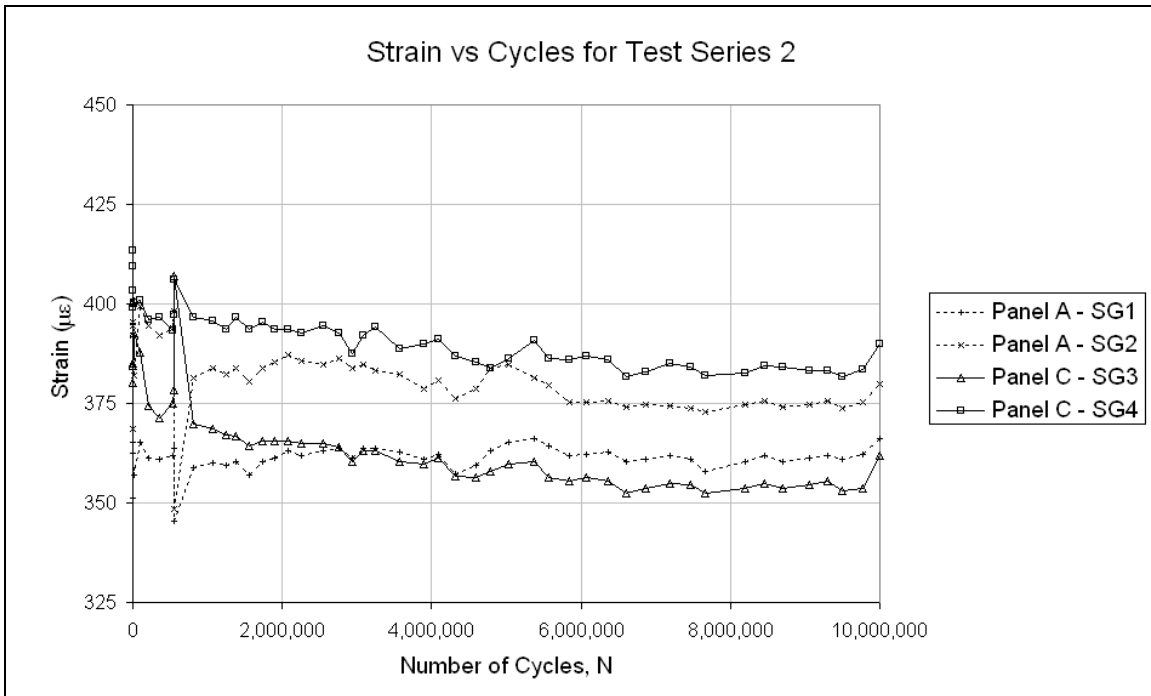


Figure 5.11 Strain versus number of cycles for Test Series 2, linear scale

Figure 5.12 is the strain versus the number of cycles for Test Series 5 with a semi-logarithmic scale. Strains increased in Test Series 5 due to the increased applied load. Panel C failed abruptly at 2027 cycles but no increase in strain before failure was captured. Panel A showed a sharp increase in strain prior to failure. The Panel A interior strains were larger than the exterior strains, this being opposite from Test Series 2. Also interior strains on Panel A were smaller than the Panel C interior strains, also opposite of Test Series 2.

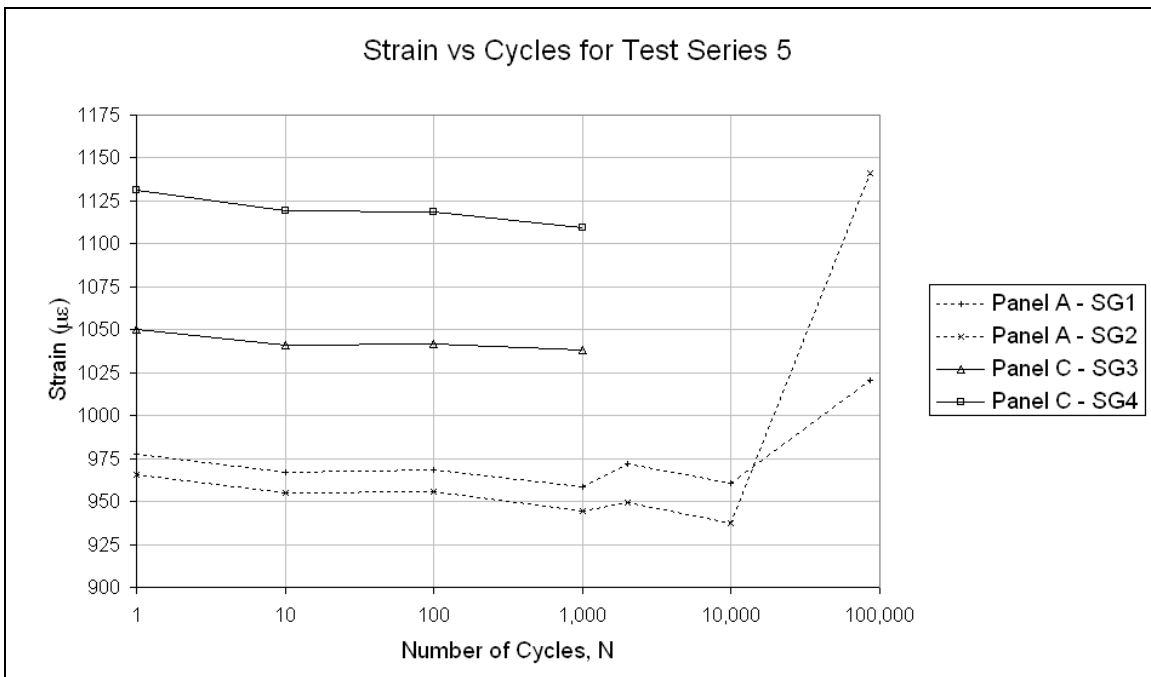


Figure 5.12 Strain versus number of cycles for Test Series 5, semi-log scale

Figures 5.13, 5.14, and 5.15 show the deflections versus number of cycles for Test Series 2 and 5. Deflections remained fairly constant through Test Series 2. On average, Panel A was 0.33 mm (0.013 in.) greater than Panel C. In Test Series 5, Panel A deflections were on average 0.7 mm (0.028 in.) less, thus following the same trend as for the strains. There was a slight increase in Panel A deflections before failure. Tables 5.2 and 5.3 contain the data for the last six figures.

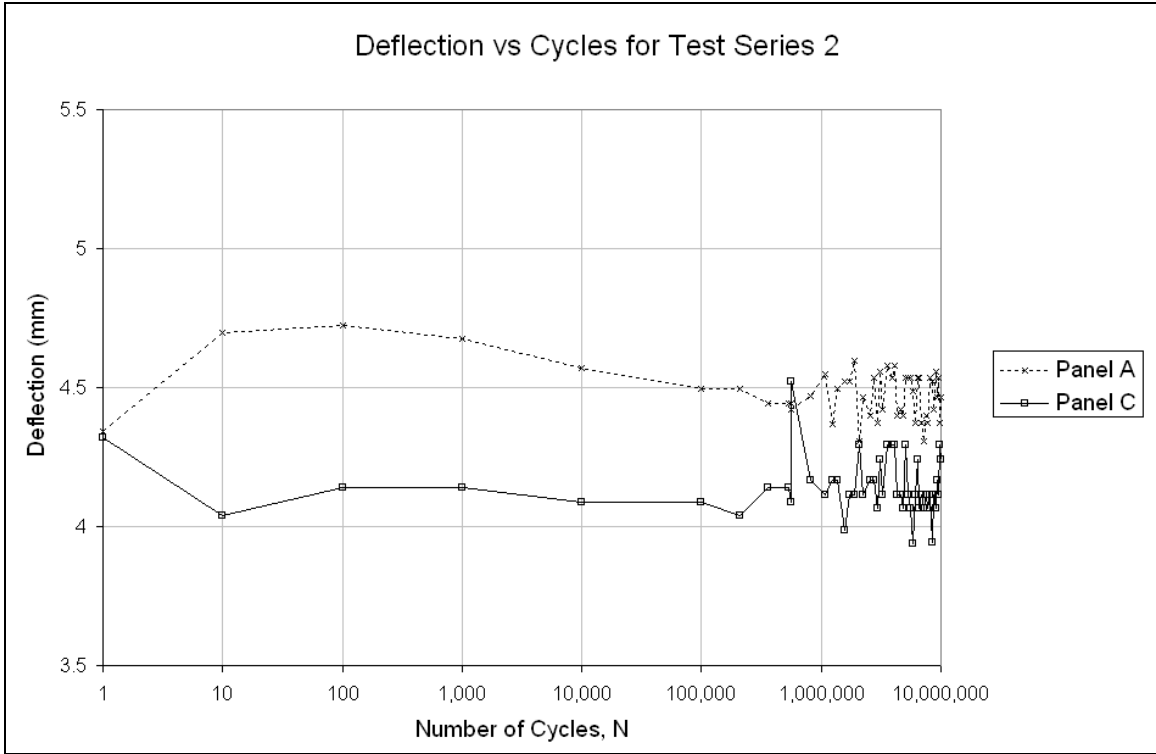


Figure 5.13 Deflection versus number of cycles for Test Series 2, semi-log scale

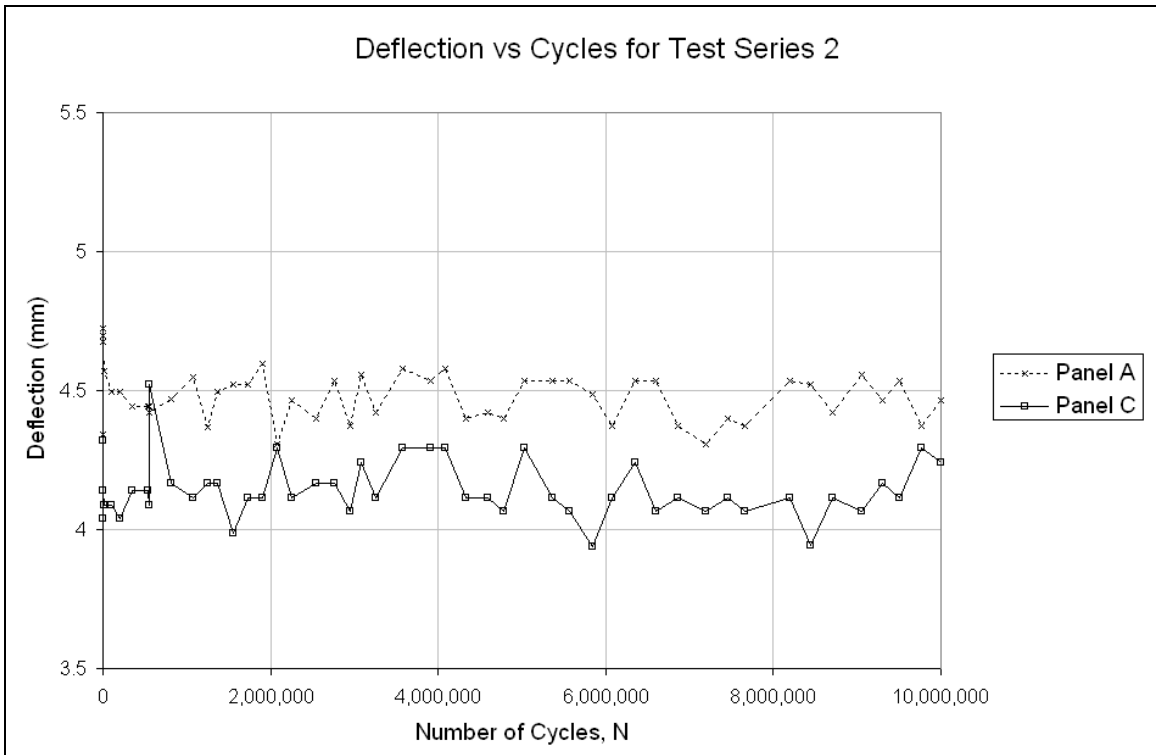


Figure 5.14 Deflection versus number of cycles for Test Series 2, linear scale

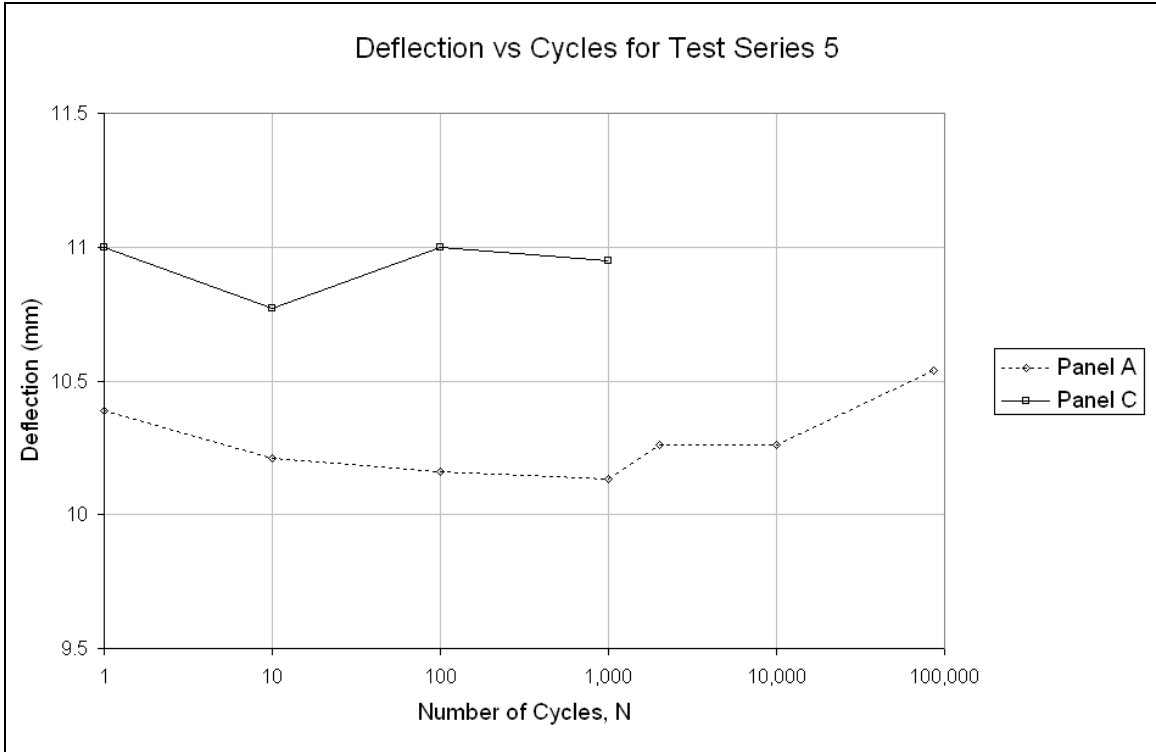


Figure 5.15 Deflection versus number of cycles for Test Series 5, semi-log scale

Table 5.2
Stiffness Test Results for Test Series 2

Test Series 2		Panel A			Panel C		
Cycle	Load (kN)	Deflection (mm)	Stain Gage 1 (µε)	Stain Gage 2 (µε)	Deflection (mm)	Stain Gage 3 (µε)	Stain Gage 4 (µε)
1	45.3	4.34	351	368	4.32	400	399
10	45.4	4.70	365	395	4.04	384	413
100	45.4	4.72	365	394	4.14	385	410
1000	45.4	4.67	362	392	4.14	380	403
10000	45.4	4.57	357	382	4.09	393	400
100000	45.4	4.50	365	399	4.09	388	401
208899	45.4	4.50	361	394	4.04	374	396
355555	45.4	4.45	361	392	4.14	371	397
538300	45.4	4.45	362	394	4.14	375	393
559475	45.4	4.45	364	398	4.09	378	397
559475	45.4	4.42	345	349	4.52	407	406
816900	45.4	4.47	359	381	4.17	370	397
1068555	45.4	4.55	360	384	4.11	369	396
1252100	45.4	4.37	359	382	4.17	367	394
1372156	45.4	4.50	360	384	4.17	367	397
1554010	45.4	4.52	357	380	3.99	364	394
1736600	45.4	4.52	360	384	4.11	366	396
1899000	45.4	4.60	361	385	4.11	366	394
2076200	45.4	4.31	363	387	4.29	366	394
2255720	45.4	4.47	362	386	4.11	365	393
2546800	45.4	4.40	363	385	4.17	365	395
2764900	45.4	4.53	364	386	4.17	364	393
2943700	45.4	4.37	361	384	4.06	360	387
3079735	45.4	4.56	364	385	4.24	363	392
3249000	45.4	4.42	364	383	4.11	363	394
3570500	45.4	4.58	363	382	4.29	360	389
3903201	45.4	4.53	361	379	4.29	360	390
4084000	45.4	4.58	362	381	4.29	361	391
4326200	45.4	4.40	357	376	4.11	357	387
4591099	45.4	4.42	359	379	4.11	356	385
4781000	45.4	4.40	363	384	4.06	358	384
5031500	45.4	4.53	365	385	4.29	360	386
5368700	45.4	4.53	366	381	4.11	360	391
5561000	45.4	4.53	364	380	4.06	356	386
5844400	45.4	4.49	362	375	3.94	355	386
6074000	45.4	4.37	362	375	4.11	356	387
6356199	45.4	4.53	363	376	4.24	355	386
6601300	45.4	4.53	360	374	4.06	353	382
6861000	45.4	4.37	361	375	4.11	354	383
7191000	45.4	4.31	362	374	4.06	355	385
7463100	45.4	4.40	361	374	4.11	355	384
7660000	45.4	4.37	358	373	4.06	353	382
8194001	45.4	4.53	360	375	4.11	354	383
8450001	45.4	4.52	362	376	3.94	355	385
8704000	45.4	4.42	360	374	4.11	354	384
9052500	45.4	4.56	361	375	4.06	355	383
9306500	45.4	4.47	362	376	4.17	355	383
9500001	45.4	4.53	361	374	4.11	353	382
9771201	45.4	4.37	362	375	4.29	354	384
10000000	45.4	4.47	366	380	4.24	362	390

Table 5.3
Stiffness Test Results for Test Series 5

Test Series 5		Panel A			Panel C		
Cycle	Load (kN)	Deflection (mm)	Stain Gage 1 ($\mu\epsilon$)	Stain Gage 2 ($\mu\epsilon$)	Deflection (mm)	Stain Gage 3 ($\mu\epsilon$)	Stain Gage 4 ($\mu\epsilon$)
1	110.1	10.39	977	966	11.00	1050	1131
10	110.1	10.21	967	955	10.77	1041	1119
100	110.1	10.16	968	956	11.00	1042	1119
1000	110.1	10.13	958	945	10.95	1038	1109
2027	110.1	10.26	972	949			
10000	110.1	10.26	961	937			
85840	110.1	10.54	1021	1141			

5.3.3 Test Series 3 and 4

Figures 5.16 and 5.17 show the strain versus the number of cycles for Test Series 3, in semi-logarithmic and linear scale, respectively. Panel D strains remained fairly constant through the entire test with the exception of a slight decrease in the beginning. Panel B strains decreased about 25 $\mu\epsilon$ from beginning to end with an average 12 $\mu\epsilon$ difference from the interior to the larger exterior strains. Panel D had an average 45 $\mu\epsilon$ difference from the interior to the larger exterior strains. At the beginning of the test the interior strains were approximately the same for each panel but the strains decreased for Panel B while remaining constant for Panel D.

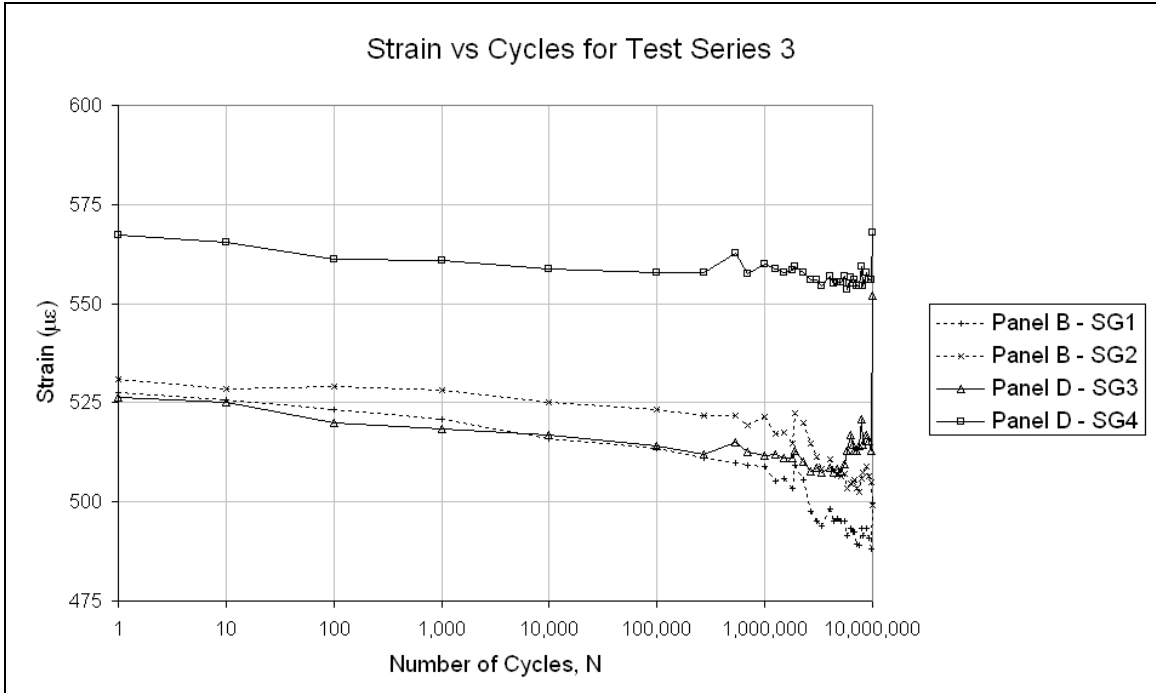


Figure 5.16 Strain versus number of cycles for Test Series 3, semi-log scale

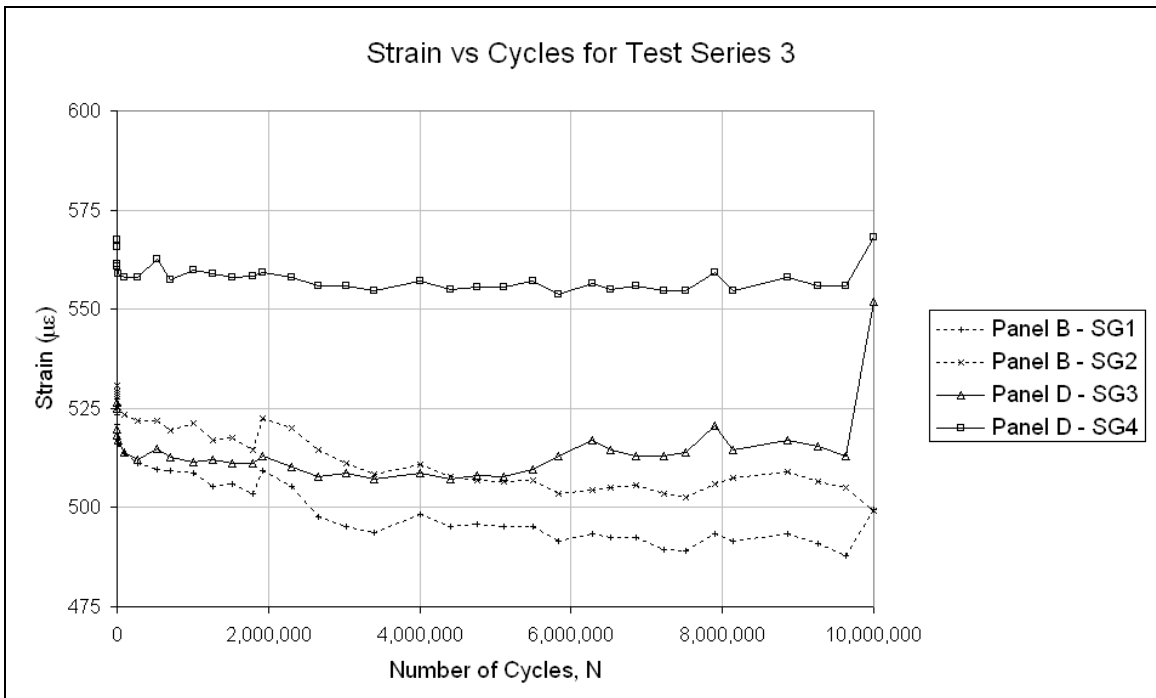


Figure 5.17 Strain versus number of cycles for Test Series 3, linear scale

Figure 5.18 shows the strain versus the number of cycles for Test Series 4 in semi-logarithmic scale. The difference between the interior and exterior strains narrowed from the previous test series. The interior strain for Panel B was larger than the exterior strain, being opposite from Test Series 3. This is the same trend as seen in Test Series 2 and 5. Immediately before the failure of Panel B there was a sharp increase in strain

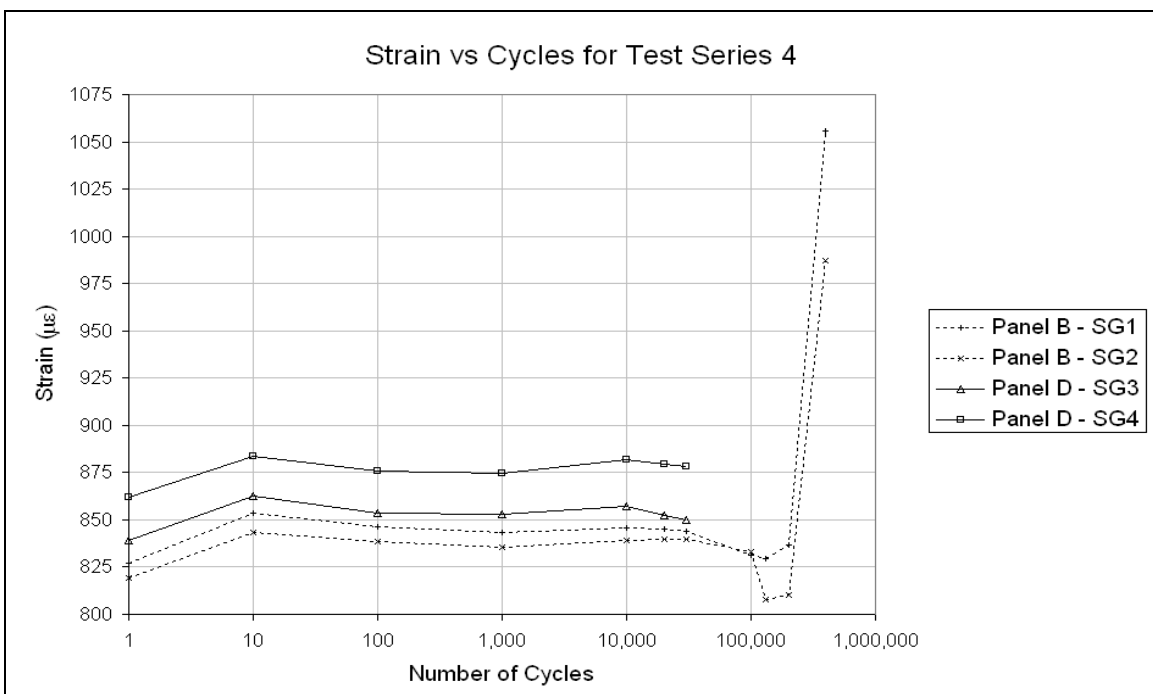


Figure 5.18 Strain versus number of cycles for Test Series 4, semi-log scale

Figures 5.19, 5.20, and 5.21 are the deflections versus number of cycles for Test Series 3 and 4. Deflections for Panel D increased 0.3 mm (0.012 in.) from beginning to end, and deflections for Panel B remained fairly constant throughout. Panel D deflections were less than Panel B deflections in the beginning but were larger than the Panel B deflection in the end. The trend of increasing deflection is again seen in Panel D prior to failure in Test Series 4, as seen in Figure 5.21.

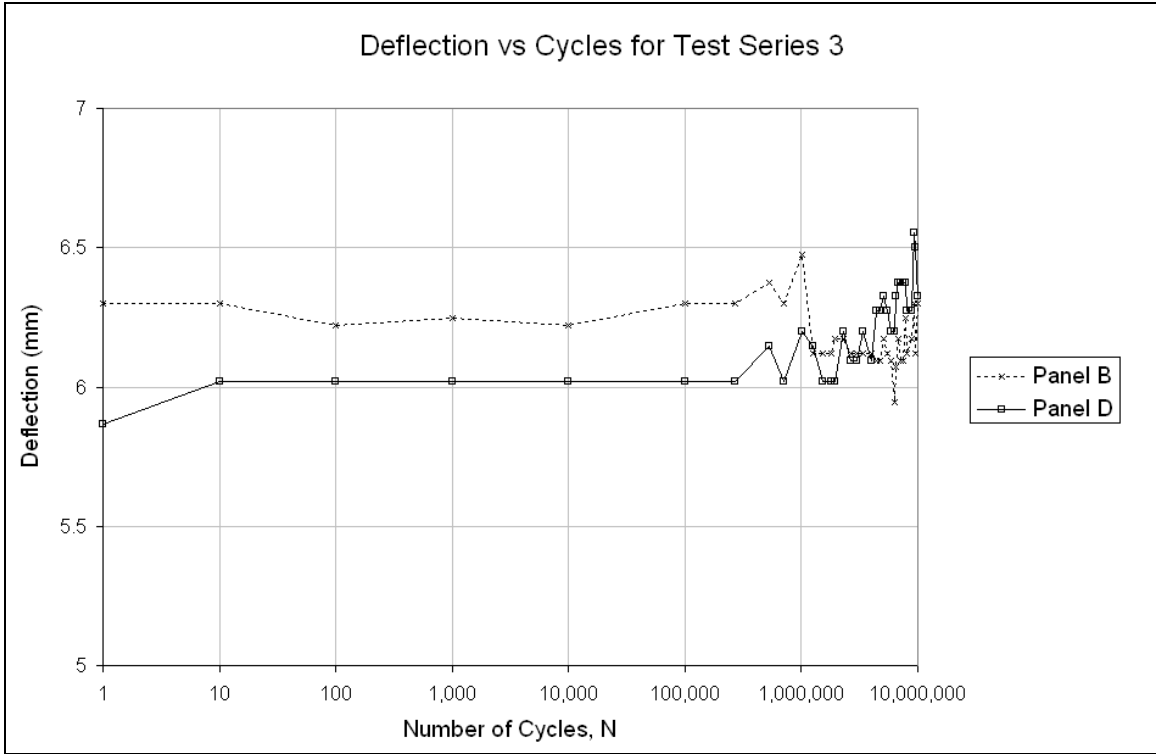


Figure 5.19 Deflections versus number of cycles for Test Series 3, semi-log scale

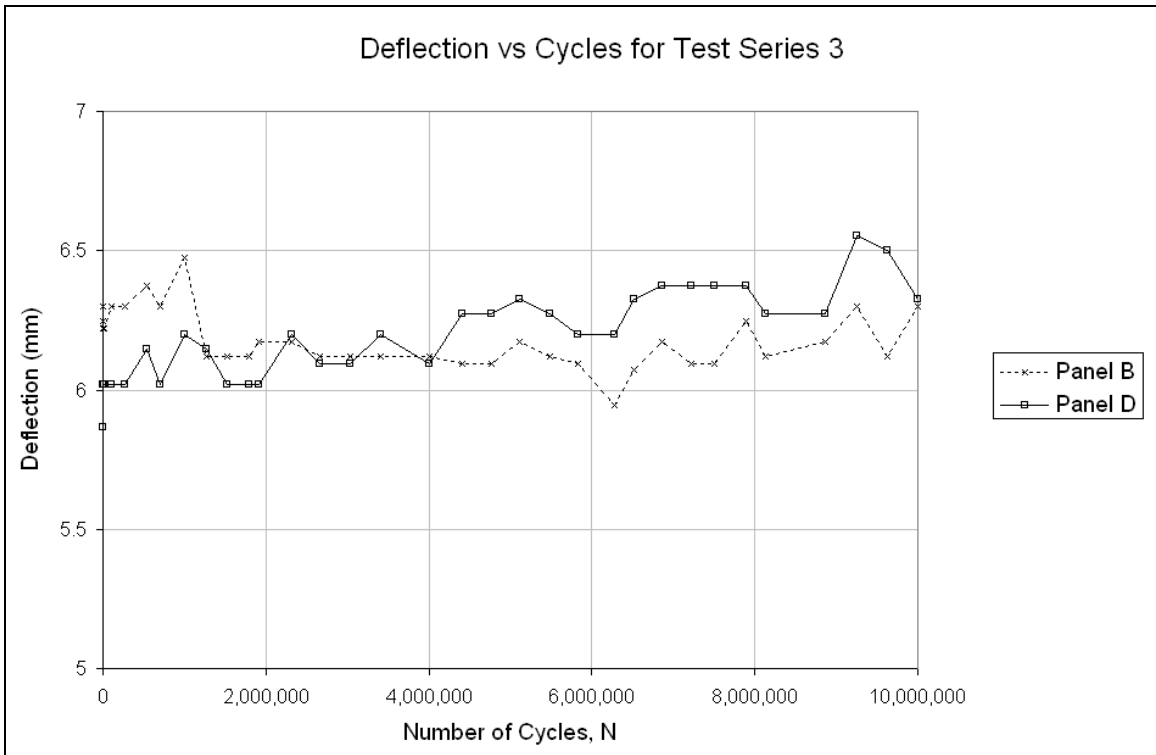


Figure 5.20 Deflections versus number of cycles for Test Series 3, linear scale

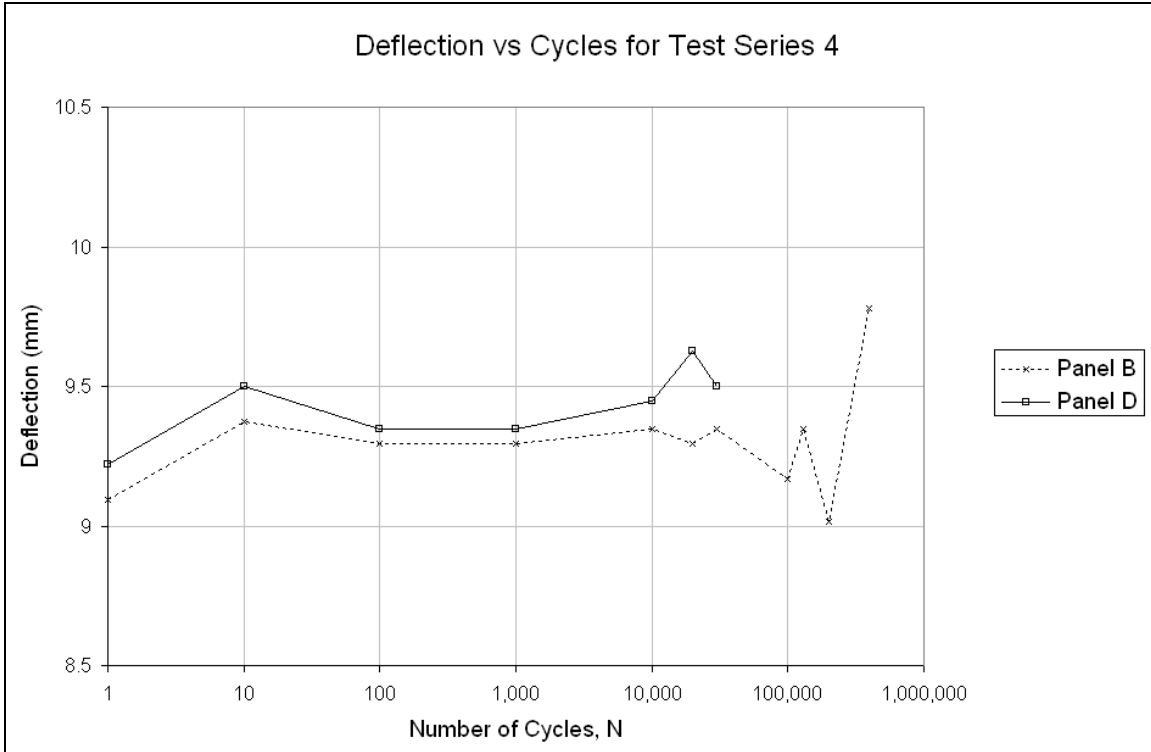


Figure 5.21 Deflections versus number of cycles for Test Series 4, semi-log scale

Data from the last six figures is in Tables 5.4 and 5.5. Similar trends are seen for Test Series 2 through 5. Strains and deflections remained fairly constant with the AASTHO loadings of 45.2 kN (10.2kips) and 65kN for all panels in Test Series 2 and 3. Also there was a sharp increase in strains and slight increase deflections for Panels A and B in Test Series 4 and 5 prior to failure in the elastomer core. The panels with the insert bar (Panels C and D) failed first before the panels without insert bars in both Test Series 4 and 5.

Table 5.4
Stiffness Test Results for Test Series 3

Test Series 3		Panel B			Panel D		
Cycle	Load (kN)	Deflection (mm)	Stain Gage 1 (µε)	Stain Gage 2 (µε)	Deflection (mm)	Stain Gage 3 (µε)	Stain Gage 4 (µε)
1	65.0	6.30	527	531	5.87	526	567
10	65.0	6.30	526	529	6.02	525	566
100	65.0	6.22	523	529	6.02	520	561
1000	65.0	6.25	521	528	6.02	518	561
10000	65.0	6.22	516	525	6.02	517	559
100000	65.0	6.30	514	523	6.02	514	558
270000	65.0	6.30	511	522	6.02	512	558
533400	65.0	6.38	510	522	6.15	515	563
698750	65.0	6.30	509	519	6.02	513	557
1008582	65.0	6.48	509	521	6.20	512	560
1271443	65.0	6.12	505	517	6.15	512	559
1519652	65.0	6.12	506	518	6.02	511	558
1795560	65.0	6.12	503	515	6.02	511	558
1920100	65.0	6.17	509	522	6.02	513	559
2311000	65.0	6.17	505	520	6.20	510	558
2653740	65.0	6.12	498	515	6.10	508	556
3027001	65.0	6.12	495	511	6.10	509	556
3404200	65.0	6.12	494	508	6.20	507	555
4002999	65.0	6.12	498	511	6.10	509	557
4403299	65.0	6.10	495	508	6.27	507	555
4763000	65.0	6.10	496	507	6.27	508	556
5114300	65.0	6.17	495	506	6.32	508	556
5493000	65.0	6.12	495	507	6.27	510	557
5830000	65.0	6.10	491	504	6.20	513	554
6280200	65.0	5.94	493	505	6.20	517	556
6522001	65.0	6.07	492	505	6.32	514	555
6862000	65.0	6.17	492	505	6.38	513	556
7222222	65.0	6.10	490	504	6.38	513	555
7510000	65.0	6.10	489	503	6.38	514	555
7895800	65.0	6.25	493	506	6.38	521	559
8135000	65.0	6.12	491	507	6.27	514	555
8866201	65.0	6.17	493	509	6.27	517	558
9257301	65.0	6.30	491	507	6.55	515	556
9628801	65.0	6.12	488	505	6.50	513	556
10000000	65.0	6.30	500	499	6.32	552	568

Table 5.5
Stiffness Test Results for Test Series 4

Test Series 4		Panel B			Panel D		
Cycle	Load (kN)	Deflection (mm)	Stain Gage 1 ($\mu\epsilon$)	Stain Gage 2 ($\mu\epsilon$)	Deflection (mm)	Stain Gage 3 ($\mu\epsilon$)	Stain Gage 4 ($\mu\epsilon$)
1	95.7	9.09	827	819	9.22	839	862
10	97.5	9.37	853	843	9.50	862	884
100	97.5	9.30	847	838	9.35	854	876
1000	97.5	9.30	843	836	9.35	853	875
10000	97.5	9.35	846	839	9.45	857	882
20000	97.5	9.30	845	840	9.63	852	879
30000	97.5	9.35	844	839	9.50	850	878
100000	97.5	9.17	832	833	0.00		
130000	97.5	9.35	829	808	0.00		
200000	97.5	9.02	837	810	0.00		
393647	97.5	9.78	1056	987	0.00		

5.4 SUPPLEMENTARY TEST RESULTS

A dynamic stiffness test for Test Series 3 was performed during cyclic loading at a frequency of 4 Hz to determine if dynamic loading and the speed of the test affected the strains at the maximum and minimum loads. Strains recorded during the dynamic stiffness test are plotted along with the strains from static stiffness test prior to the dynamic stiffness testing in Figure 5.22. The strains at the maximum load corresponded very well, however the strains at the minimum cyclic load did not correspond as well. The minimum recorded strains during the dynamic stiffness test were the expected ten percent of the maximum strain which corresponds with the ten percent offset for the minimum load. The strains for the static stiffness test at ten percent of the maximum load were higher than expected. The difference occurs because the neoprene pads in static stiffness test started at zero load and as the load was applied the neoprene pads became stiffer. During the dynamic stiffness test the pads were not able to recover and remained stiff. Because the neoprene pads remained stiff during cyclic testing the measured strains correspond better with the theoretical strains.

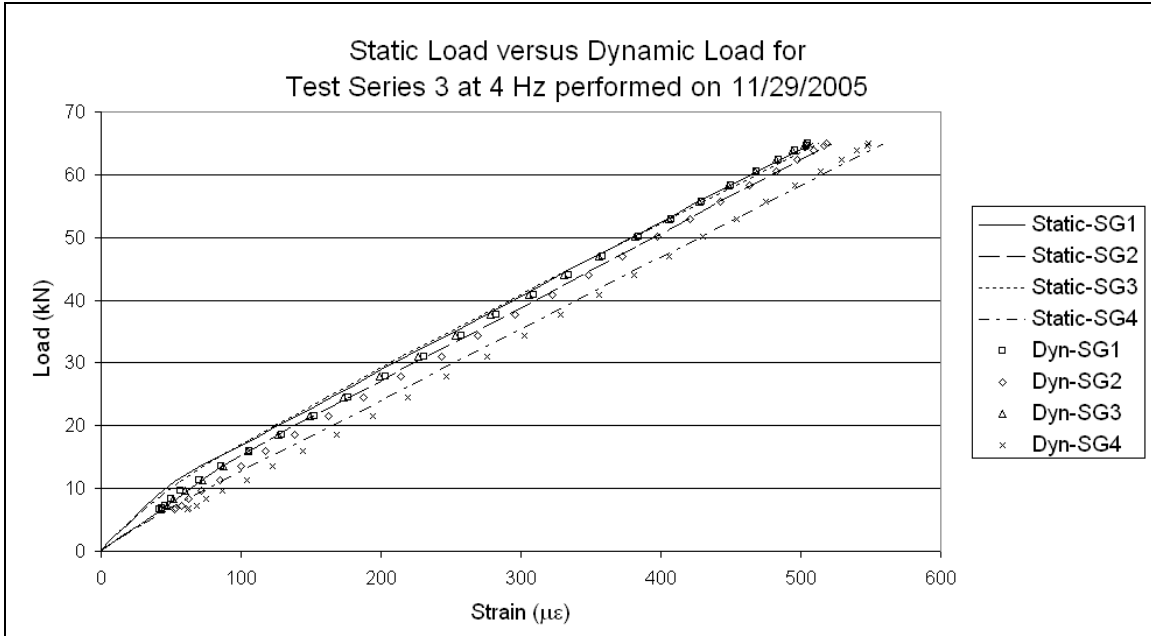


Figure 5.22 Dynamic versus static stiffness test at 4 Hz for Panels B and D

5.5 COMPARISON OF EXPERIMENTAL AND PREDICTED RESULTS

5.5.1 Finite Element Analysis

To determine theoretical values for stress, strain and deflection, Intelligent Engineering Ltd performed finite element analyses using the commercial software ANSYS. The theoretical stresses, strains, and deflections used to compare to the experimental values were determined from analyses.

The steel elements were modeled using SOLID45 brick elements and were given a modulus of elasticity of 206 GPa (30,000 ksi), and Poisson's ratio of 0.287. The elastomer core elements were modeled using HYPER58 brick elements and were given a modulus of elasticity of 750 MPa (109 ksi), and a Poisson's ratio of 0.36.

Load versus the experimental and theoretical deflections and strains were plotted. Experimental deflection and strain values of each panel were taken from the stiffness test performed at increments of 10,000 cycles for each panel. The experimental load

increments were approximately 4.45 kN (1.0 kip) and the maximum load was 45.2 kN (10.2 kips)

5.5.2 Test Series 2 and 5

There was a 2-14 percent increase in the experimental deflections from the predicted values of Test Series 2 and 5 as shown in Figure 5.23. The predicted deflections at the maximum loads of Test Series 2 and 5 were 4.03 mm (0.159 in.) and 9.82 mm (0.386 in.), respectively. The correlation was much better than for Test Series 1 due to the added stiffeners to the web of the middle floor beam under each test specimen.

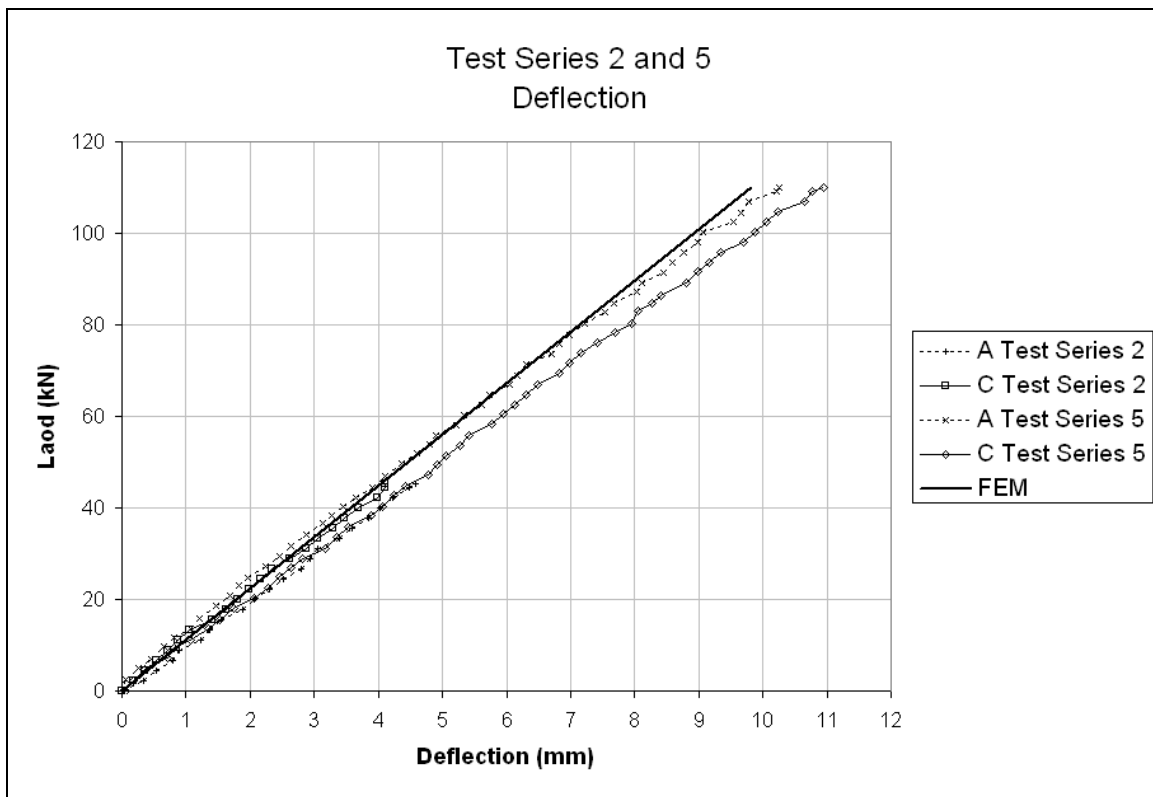


Figure 5.23 Experimental and theoretical deflections for Test Series 2 and 5.

Load versus strain for the theoretical and experimental strains for the interior strain gages (1 and 3) and the exterior strain gages (2 and 4) are plotted in Figures 5.24 and 5.25, respectively. The maximum predicted strains for Test Series 2 from the finite element solution were $380 \mu\epsilon$ for gage locations 1 and 3 and $369 \mu\epsilon$ for gage locations 2 and 4. For Test Series 5, the predicted strains for gage locations 1 and 3 were $923 \mu\epsilon$ and $897 \mu\epsilon$ for gage locations 2 and 4. The experimental values for Test Series 2 correlated well with the theoretical values with only a 3-8.5 percent difference. For Panel C in Test Series 5, the experimental strains were 12.5 percent greater at strain gage 3 and 24 percent greater at strain gage 4. There was a 4 percent greater strain in Panel A at both gages compared to the predicted strain. Panel A of Test Series 5.

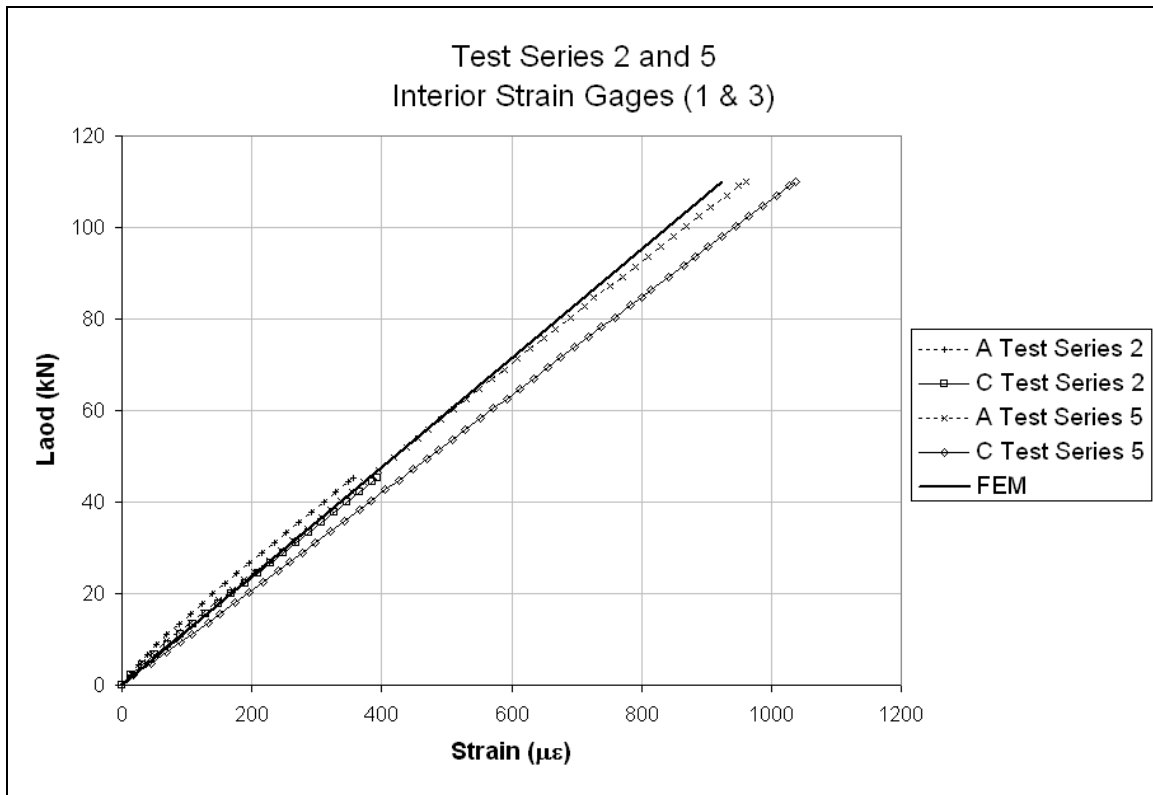


Figure 5.24 Experimental and theoretical interior strains for Test Series 2 and 5

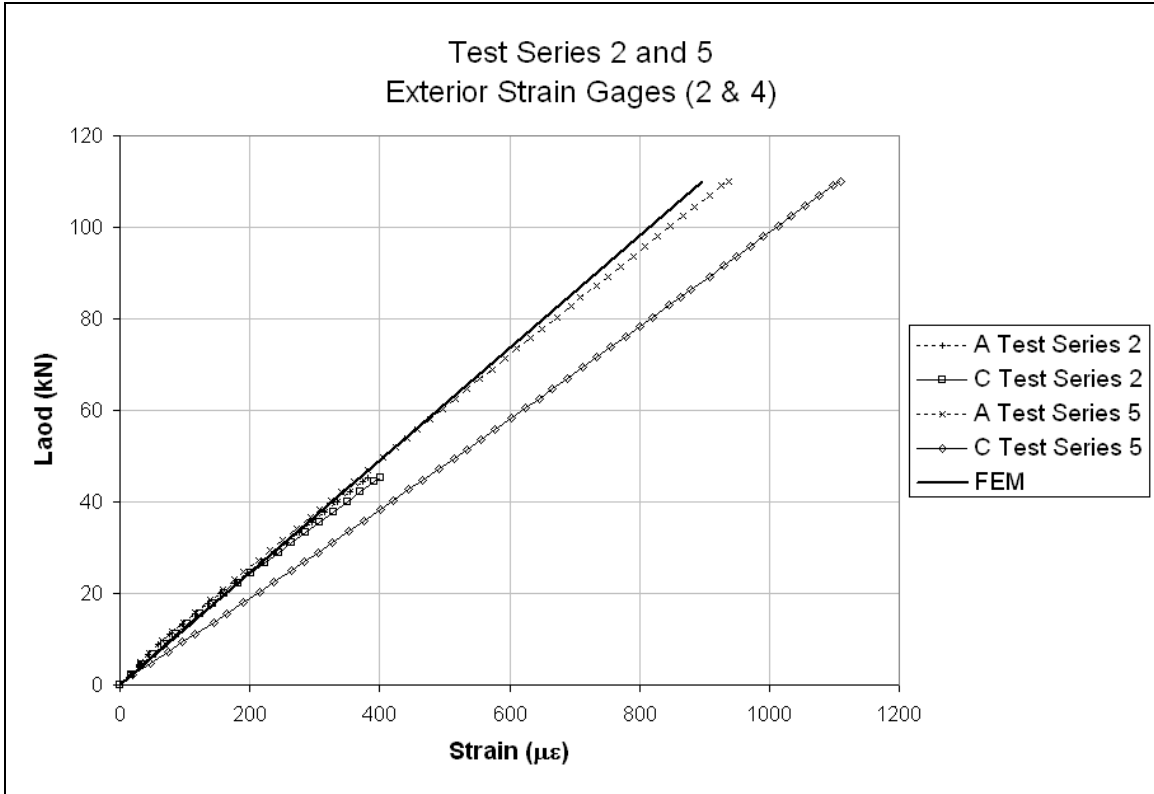


Figure 5.25 Experimental and theoretical exterior strains for Test Series 2 and 5

5.5.3 Test Series 3 and 4

Experimental deflections in Test Series 3 and 4 corresponded well with theoretical values. The experimental deflections were 4-9 percent greater than the predicted values in Figure 5.26. The predicted deflection of the bottom steel plate centered under the load for Test Series 3 and 4 were 5.79 mm (0.228 in.) and 8.69 mm (0.342 in.), respectively, at the maximum loads.

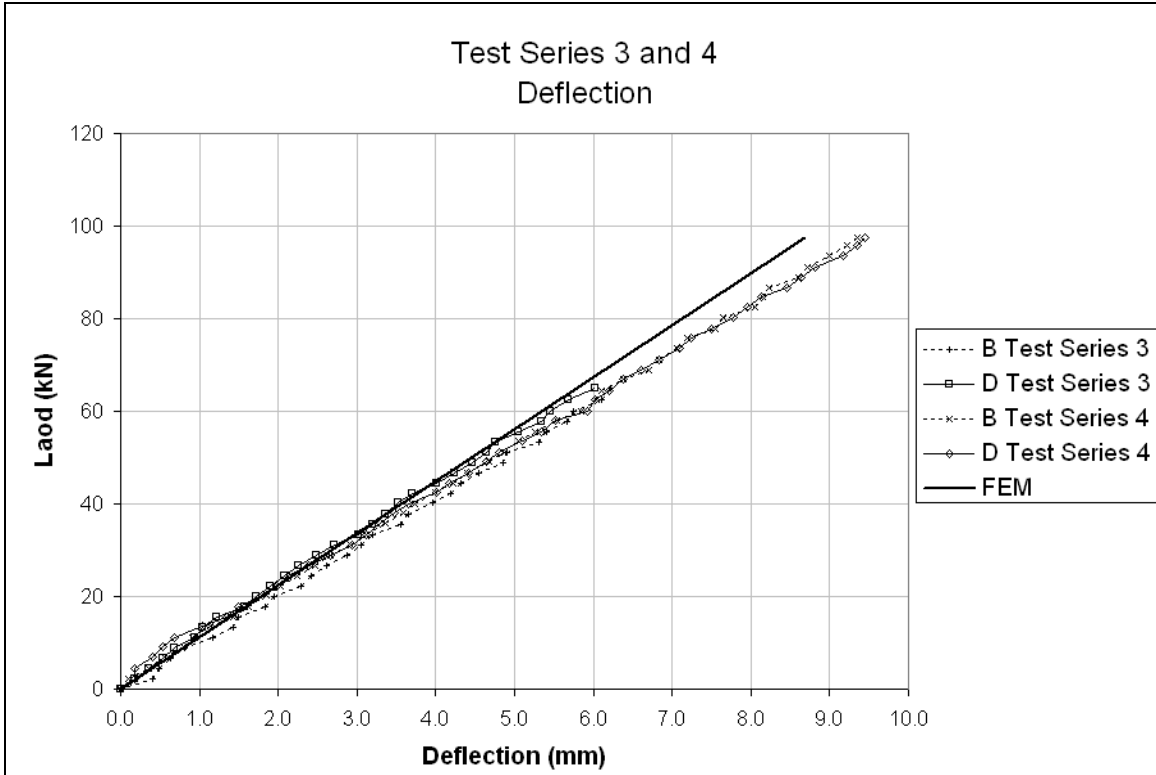


Figure 5.26 Experimental and theoretical deflection for Test Series 3 and 4

Load versus strain for the theoretical and experimental strains for the interior strain gages (1 and 3) and the exterior strain gages (2 and 4) are plotted in Figure 5.27 and 5.28, respectively. The maximum predicted interior strains for Test Series 3 and 4 from the finite element solution were $546 \mu\epsilon$ and $820 \mu\epsilon$, respectively, and $529 \mu\epsilon$ and $794 \mu\epsilon$ for the exterior strains. The experimental values for Test Series 3 correlated well with the theoretical values with only a 1-5.5 percent difference. For Test Series 4 there was a 3.5-11 percent increase in experimental strains.

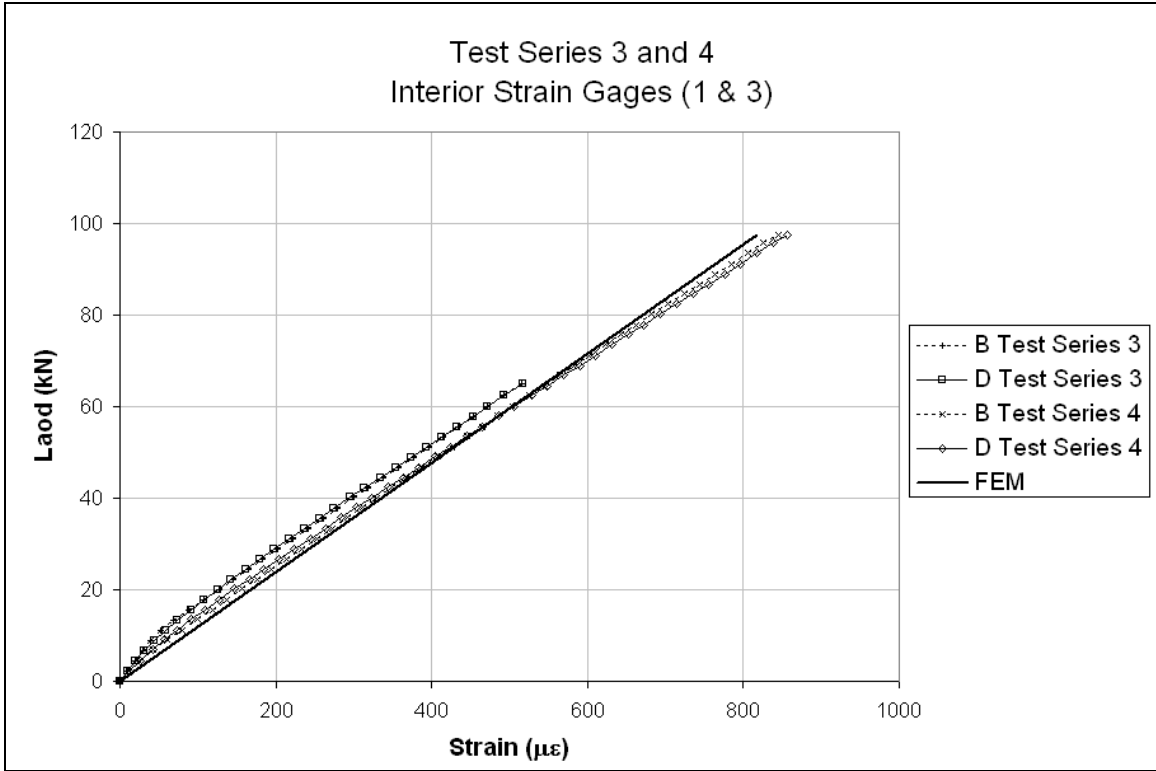


Figure 5.27 Experimental and theoretical interior strains for Test Series 3 and 4

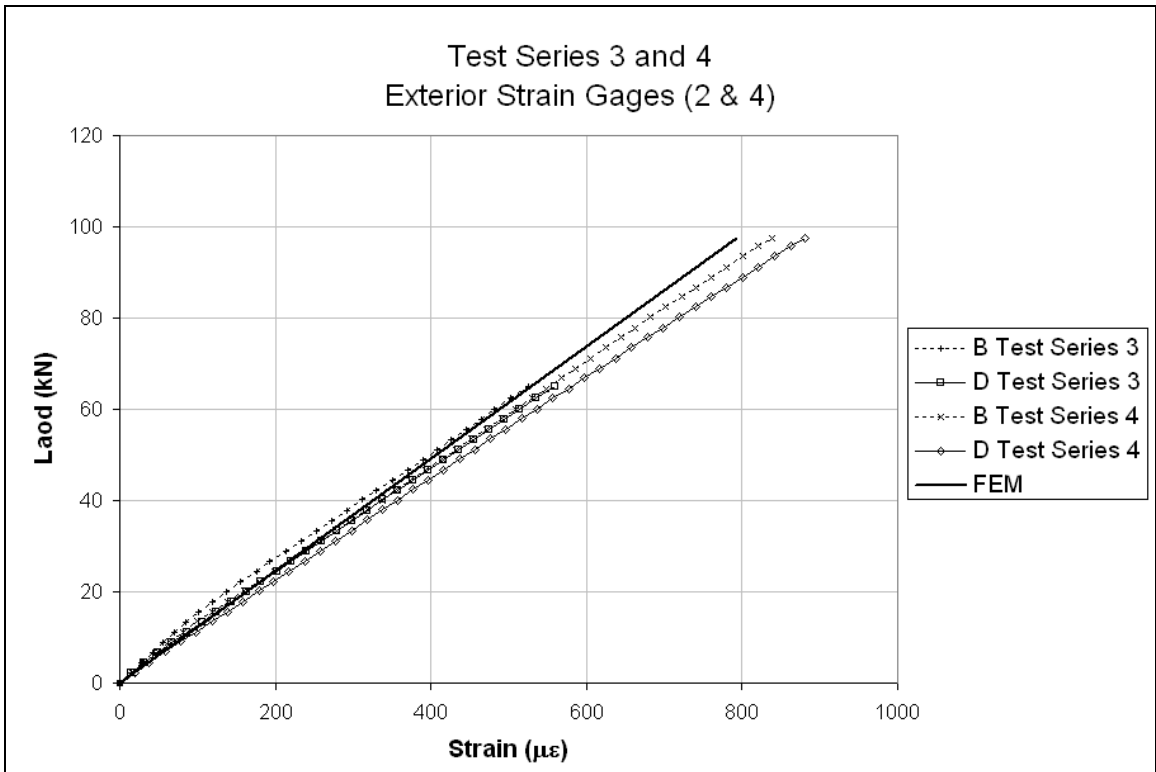


Figure 5.28 Experimental and theoretical exterior strains for Test Series 3 and 4

5.6 FATIGUE LIFE PREDICTION

5.6.1 *S-N Curves with Palmgren-Miner Summation*

The section of interest that was most susceptible to fatigue cracking was along the weld toe of the underside steel plate of the SPS panel on the side of the load. AASHTO specifies that fatigue provisions are only to be used on “details subjected to a net applied tensile stress” (AASHTO 2004). The applied load produced a net compressive stress on the bottom of the underside steel plate of the SPS panel at the weld toe, and a net tensile stress at the top of the underside steel plate. The top of the underside steel plate on the side of the elastomer-steel interface is classified as Detail Category A, plain member, from Table 6.6.1.2.3-1 of AASHTO (2004). There was no draw down forces since shims were used in Test Series 2 through 5; therefore there was not a net tensile stress at the weld toe of the underside steel plate.

The finite element analyses from Intelligent Engineering were used to determine the stresses on the underside steel plate of the SPS panel at the weld toe and the steel-elastomer interface. The tensile stresses of the top of the underside steel plate were used for the fatigue life prediction. Ninety percent of the net applied stress was used in the calculations to account for the experimental ten percent offset. Since the stresses on the bottom of the underside steel plate along the weld toe were only compressive they were not used for the fatigue life prediction. To predict the fatigue life at the connection, Detail Category A was used for the tensile stresses. Finite element analysis was only performed for the Test Series 2, the 45.2 kN (10.2 kip) load. The stresses for Test Series 3, 4, and 5 were obtained assuming the principal of superposition. The stresses used for the fatigue life predictions are listed in Table 5.6. The table also contains the predicted and

experimental stress of the top steel plate and their ratio to make a comparison of how well the finite element analyses predicted the stresses.

Table 5.6
Stresses used for fatigue life predictions, Test Series 2 through 5

Test Series	Load (kN)	Predicted Stresses and Strains			Experimental Stress and Strain		Stress Ratio Exp/Pred of Top Faceplate
		Top of Underside Faceplate (Used for Fatigue Life Prediction)	Top Faceplate	Top Faceplate	Top Faceplate	Top Faceplate	
		MPa (ksi)	MPa (ksi)	$\mu\epsilon$	$\mu\epsilon$	MPa	
2	45.2	123.1 (17.9)	78.3 (11.4)	380	377	77.7	0.99
3	65	177.0 (25.7)	112.6 (16.3)	546	517	106.5	0.95
4	97.5	265.5 (38.5)	168.9 (24.5)	820	850	175.1	1.04
5	109.8	299.1 (43.4)	190.1 (27.6)	923	968	199.4	1.05

Fatigue life predictions are in Table 5.7. The stresses included a ten percent offset, e.g. $123.1 - 12.3 = 110.8$ MPa (16.1). The N_{fi}' for Test Series 2 and 3 is the predicted number of cycles needed for failure using the 1/5 slope of Detail Category A curve, where A' is equal to 223×10^{15} MPa (32.34×10^{15} ksi). The N_{fi} for Test Series 4 and 5 is the predicted number of cycles needed for failure using the 1/3 slope of Detail Category A curve, where A is equal to 8190×10^9 MPa (25×10^9 ksi). The N_i for Test Series 4 and 5 are the predicted fatigue lives using the Palmgren-Miner summation.

Table 5.7
Fatigue life predictions using S-N curves and Palmgren-Miner summation

Test Series	N_i	Stress F, MPa (ksi)	$N_{fi} = A/F^3$ $N'_{fi} = A'/F^5$	N_i/N_{fi}
2	10,000,000	110.8 (16.1)	13,359,864	0.75
5	105,556	269.2 (39.0)	419,724	0.25
			$\Sigma =$	1.00
3	10,000,000	159.3 (23.1)	2,172,338	4.60
4	0	239.0 (34.7)	600,045	0.00
			$\Sigma =$	1.00

The predicted fatigue lives and the actual fatigue lives are compared with the Detail Category A curve as shown in Figure 5.29. Even though the panels in Test Series

2 and 3 did not fail, their stresses at ten million cycles were plotted to illustrate their proximity to the predicted number of cycles for failure. The ten million cycles for Panel D in Test Series 3 was greater than the predicted number of cycles, therefore the fatigue life of Panel D in Test Series 4 was calculated without the Palmgren-Miner summation. The Palmgren-Miner summation was used in the prediction of fatigue life for Test Series 5. It can be seen from Figure 5.27 that panels A and C of Test Series 2 were near the predicted fatigue life represented by the 1/5 slope line, and that Panels B and D in Test Series 3 were past the predicted life. In Test Series 4, the experimental fatigue lives were relatively close to the predicted life of 600,045 cycles. Panel D failed first at 30,000 cycles, and then Panel B failed at 320,000 cycles. Panels C failed first in Test Series 5 at 2027 cycles, and Panel A failed at 85,840 with in 20,000 cycles of the predicted cycle of 105,556.

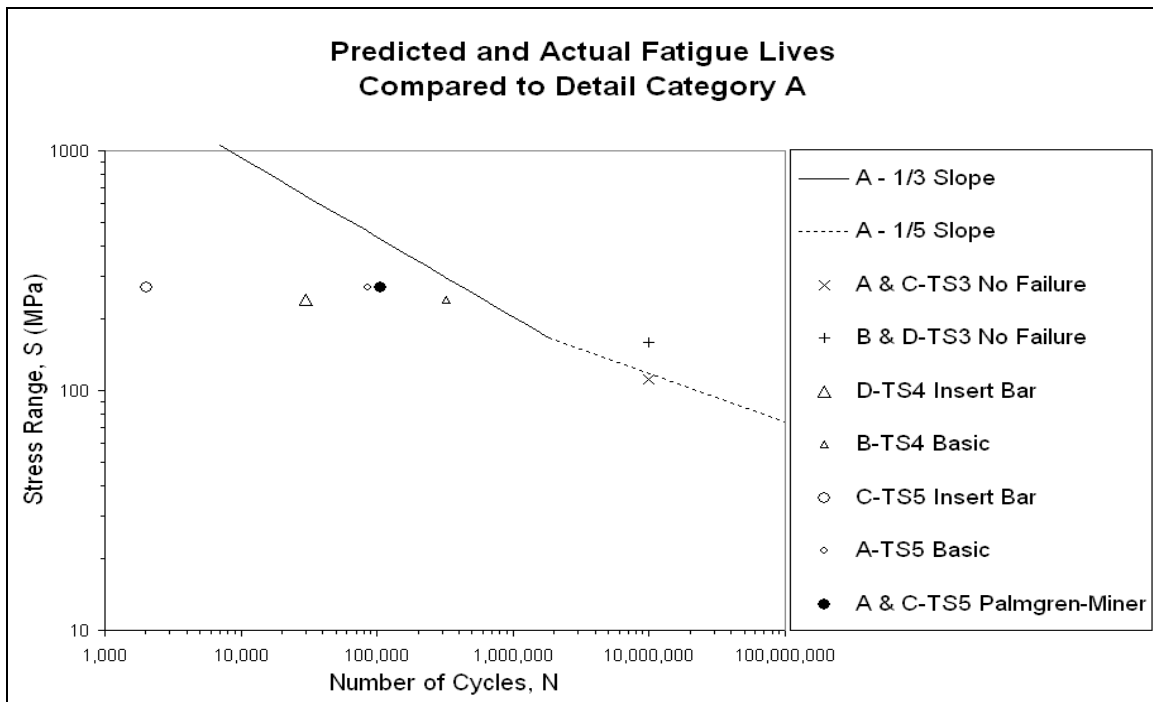


Figure 5.29 Predicted and actual fatigue lives compared to Detail Category A

It is important to note that all four panels failed before their predicted fatigue life with a crack in the core. A fatigue crack was discovered in the bottom steel plate along the weld toe in Panel D after the core cracked. It was not certain when this crack occurred. Since the S-N curves were developed for determining fatigue resistance in welded metal connections the failures in the elastomer cores cannot be compared to the predicted fatigue lives using the S-N curves. The only data that can be compared to the S-N curves is the crack in the bottom steel plate of Panel D. Not knowing exactly when it occurred, limits the comparison. Using Detail Category A, it should have failed at approximately 2,175,000 cycles in Test Series 3. This indicates that a fatigue crack in the steel plate in Panels B and D was much more probable.

To account for a probable reduction in stresses of the bottom steel plate, Intelligent Engineering Ltd. suggested taking a stress reduction of 31 percent, which in essence raises the S-N curve by two standard deviations. The experimental strains were measured on the top steel plate to be able to verify the finite element analyses, however they were not measured at the weld of interest on the bottom steel plate since it was not feasible to attach strain gages at that location. The experimental strains of the top steel plate correlated well with the finite element analyses, but it was not certain that the stresses of the bottom steel plate were as accurate, therefore the stresses were multiplied by a reduction factor. Table 5.8 contains the reduced stresses and their correlating predicted fatigue lives. With the reduction, the Palmgren-Miner summation was used for both Test Series 4 and 5.

Table 5.8
Fatigue life predictions using S-N curves and Palmgren-Miner summation with a stress reduction of two standard deviations

Test Series	N_i	Stress F, MPa (ksi)	$N_{fi} = A/F^3$ $N'_{fi} = A'/F^5$	N_i/N_{fi}
2	10,000,000	77.6 (13.3)	79,489,882	0.13
5	1,069,742	188.5 (27.3)	1,223,684	0.87
			$\Sigma =$	1.00
3	10,000,000	111.5 (16.2)	12,925,199	0.77
4	395,920	167.3 (24.3)	1,749,402	0.23
			$\Sigma =$	1.00

Figure 5.30 contains the comparison of the actual and predicted fatigue lives using the reduced stresses with the Detail Category A. It can be seen that only Panels B and D of Test Series 3 and 4 are near the predicted fatigue lives. This matches well with the fatigue crack that was found in Panel B.

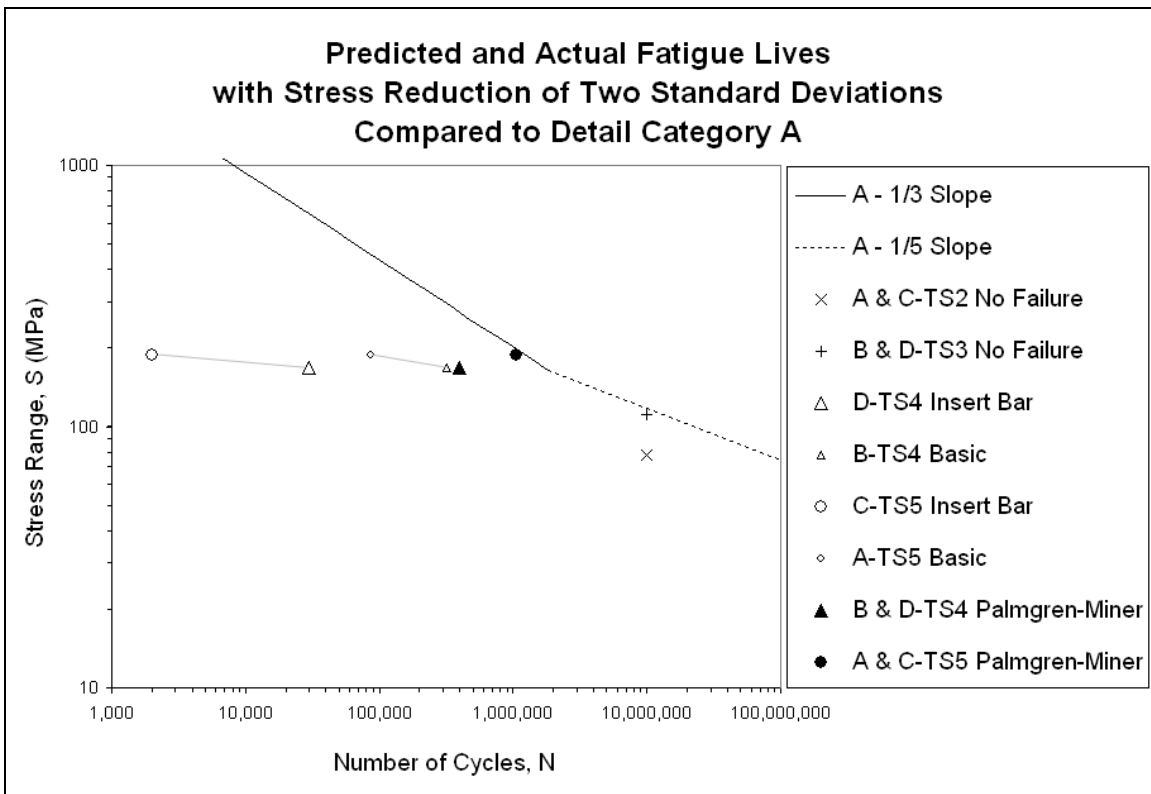


Figure 5.30 Predicted and actual fatigue lives with reduced stresses

A line drawn between the two basic connection data points and between the two insert bar connection data points of Test Series 4 and 5 in Figure 5.30 shows a pattern correlating with the connection type, that is, the basic versus the insert bar connection. In both cases, as stated earlier the panels with the insert bars, C and D, failed first. It can be seen that a S-N curve could be developed with further research accounting for the failure limit state of a crack in the elastomer core due to fatigue.

5.6.2 *Structural Stress*

Element nodal forces used to determine the structural stress for the master S-N curve method were taken from finite element analyses performed by the author. The finite element model was a modification of the model provided by Intelligent Engineering Ltd. It was modified to represent the section at the weld toe. SOLID45 brick elements were used for the elastomer core elements instead of the HYPER58 elements, and the same material properties were used.

The structural stress for the master S-N curve method was calculated for Test Series 2 in accordance with the procedure outlined in Chapter 2. The structural stress at the top of the underside steel plate along the weld toe is plotted in Figure 5.31. The plot contains structural stress from applied load and the ten-percent offset. The structural stress parameter, ΔS_s , was calculated to be 167.9 MPa (24.4 ksi) with Equation 2.6 using only the peak tensile stress of the structural stress range of 291 MPa (42.2 ksi). Using Equation 2.10 the fatigue life was calculated to be 16,117 cycles for the mean master S-N curve. Using the upper 99% prediction interval, the fatigue life was calculated as 154,256 cycles. This is compared to 10,000,000 cycles that did not cause a failure.

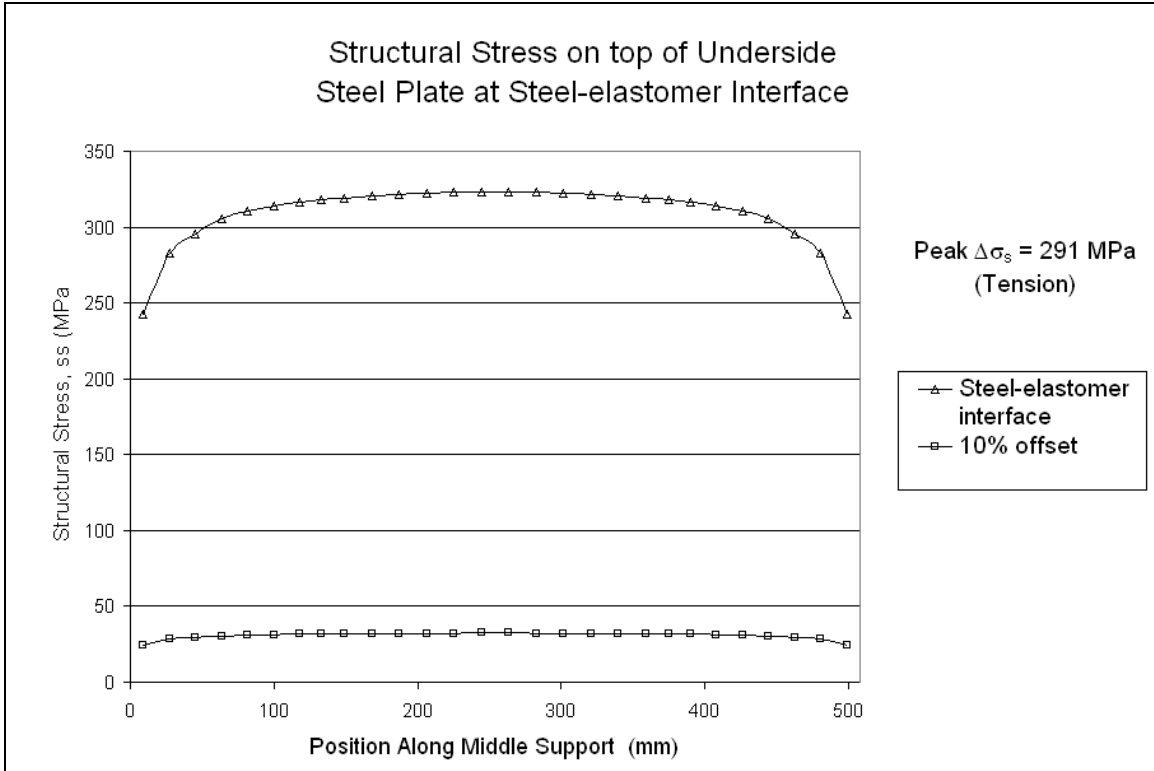


Figure 5.31 Structural stress at the top of the underside steel plate.

The structural stress method was not used for Test Series 3, 4, and 5 since it failed to predict a reasonable fatigue life for Test Series 2. All of the subsequent tests were tested at higher loads and would have caused the prediction to be even lower. It is reasoned that this method did not provide a reasonable prediction for Test Series 2 - 5 because there was no net tensile stress at the weld toe. The tensile stress only occurred in the top portion of the underside steel plate. In the research performed by Dong et al (2002) there were no connections tested where the weld toe stress was only in compression.

5.7 DISCUSSION OF RESULTS

Both the basic and the insert bar connections were able to reach 10,000,000 cycles without failure under the prescribed AASHTO loading, Test Series 2, and single AASHTO truck wheel load, Test Series 3. Failure only occurred after a significant increase of those loads, Test Series 4 and 5. There were sudden increases in measured strains and deflections directly preceding failure. Both panels with the insert bars failed before the panels with the basic connections in Test Series 4 and 5. It is theorized that the insert bar produced a stress raiser causing the elastomer core to crack sooner under the fatigue loading.

Only one of the panels had a fatigue crack in the steel plate at the weld toe, and, therefore, it was the only one that could be directly compared to a Detail Category S-N curve. With a reduction in stress, Detail Category A was able to predict the fatigue life within 80,000 cycles for Panel B. Without the reduction, Detail Category A predicted this same panel to have failed before 10,000,000 cycles in its first test.

Though the S-N curve was able to make good predictions of fatigue resistance in the steel plate, the fracture of the steel plate was not the controlling failure mechanism. Cracking of the elastomer core controlled in each panel and even occurred in the panel with the cracked steel plate. It is believed that the cracked elastomer core was caused by a stress raiser at the tip of the delamination between the steel plate and the elastomer core. Further research would be needed to confirm this. A pattern was seen in the S-N data of the four panels correlating to the crack of the elastomer core. In Figures 5.29 and 5.30, a line was drawn between similar connections, and it is seen that the connecting lines of the basic connection and the connecting line between the insert bar connections

have similar slopes. It may be possible with further research, to develop a S-N curve accounting for the failure mode of a crack in the elastomer core due to fatigue. This may be the controlling failure mode at higher stress levels since the lines between the similar connections are less steep than the S-N curve for the welded connection

The structural stress method and the master S-N curve were not able to predict the fatigue life of Panels A, B, C, and D. This was most likely because the structural stress method was developed for a peak tensile stress at the weld toe, which was not the case for the tested panels.

CHAPTER 6

CONCLUSIONS AND SUGGESTED FUTURE RESEARCH

6.1 SUMMARY

Three post-injection welded joints were tested to determine the effect of cyclic loading on the localized debonding of the heat affected zone and to determine its fatigue resistance. Seven panels, each containing one of three post-injection weld configurations, were investigated. Each panel was fatigue tested to ten million cycles or until failure by applying remote bending to the post-injection welded joint.

Experimental results were compared to finite element analyses. Fatigue-life predictions were made using code based S-N curves, and a relatively new mesh-insensitive structural stress method with a master S-N curve approach.

6.2 CONCLUSION

6.2.1 Shear Studs Connection Test Series 1

The panels of Test Series 1, which included shear studs, were greatly affected by cyclic loading due to the stresses created from the draw down of the camber. It was found that a net tensile stress at the weld toe caused by the draw down significantly decreased the fatigue resistance as compared to tests where shims were used to prevent net tensile stress at the weld toe. It was shown by analysis that a static load would not affect the delamination of the steel-elastomer bond when the camber draw down was present. However, it was concluded experimentally that the bond at the heat affected zone

with the draw down of the camber was affected by cyclic loading causing global delamination and lowering the fatigue resistance. It is not certain how the shear stud connection affected the fatigue resistance, since the presence of the net tensile stress from the draw down of the camber dominated. However, it was observed that with the draw down of the camber, the basic connection had better fatigue resistance than the shear stud connection. Clearly, draw down of the camber significantly affected the fatigue resistance.

Both the AASTHO S-N curve and the master S-N curve method were able to reasonably predict the fatigue life of cracks in the bottom steel plate along the weld toe of the SPS panel when stresses from the draw down of the camber were present. The AASTHO S-N curve was able to predict the fatigue life within 366,000 cycles, a factor of 1.16. The mean master S-N curve predicted a fatigue life within a million cycles, a factor of 1.5, but much lower than the actual fatigue life. The S-N data of Panel 1P fell between the mean curve and the upper 95% prediction interval of the master S-N curve.

6.2.2 Insert Bar Connection Test Series 2 – 5

With shims under the camber, the insert bar connection and the basic connection both demonstrated good fatigue resistance. Both connections were able to reach 10,000,000 cycles without failure under the prescribed AASHTO loading, as well as an increased load equivalent to a single AASHTO truck wheel load. Both connection type panels failed only after another increase in load. No signs of delamination were detected or were minimal. The minimal delamination stopped growing after the first few hundred thousand cycles. Fatigue resistance of the basic connection was slightly better than the connection with the insert bar

Since the controlling failure mode was cracking of the elastomer core, the fatigue life prediction models were not applicable for this failure mode. However, the S-N curve using the Palmgren-Miner summation for cumulative damage was able to predict the fatigue crack that occurred in the steel plate along the weld toe of Panel B. The structural stress method with the master S-N curve were not able to predict the fatigue life of Panels A through D. This was most likely because the structural stress method was developed for a peak tensile stress at the weld toe and the panels of Test Series 2 through 5 only had net compression stresses at the weld toe.

6.3 SUGGESTIONS FOR FUTURE RESEARCH

The ultimate load of the post-injection welded joint needs to be determined, as well as its failure mode. Any analyses associated with the ultimate load should include yielding of the steel top and bottom plates, debonding at the steel-elastomer interface and yielding of the cross supports. Development of an S-N curve for cracking of the elastomer core in a post-injection welded joint is also suggested. The post-injection welded joint should be tested for the effects of differential temperature shrinkage between the elastomer core and the steel plate. Further research is required to determine the level of stress from draw down of the camber is tolerable and whether are would be unnecessary.

Fatigue testing should also be performed on a full SPS bridge deck panel containing a post-injection welded joint. Strain gages should be placed on the top steel plate above the post injection welded joint. Increased strain would indicate delamination. Deflection should also be monitored although it is not as indicative as strain data. Strain gages placed near the weld toe on the bottom side of the SPS panel are suggested. It is

possible that changes in strain may be more apparent at this location. The location of the loading patch with respect to the post-injection welded joint should also vary. A load patch closer to the post-injection welded joint could be more critical.

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APPENDIX A:
EXPERIMENTAL RESULTS FOR TEST SERIES 1
PANELS 1P, 3 AND 4

A.1 Stiffness Test for Test Series 1, Panels 1P, 3 and 4

Stiffness Test: 1		Date: 6/28/2005		Panel 1P, Cycle: 1		Panel 3, Cycle: 1	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Wire Pot 2 (in)	Strain Gage 1 ($\mu\epsilon$)	Strain Gage 2 ($\mu\epsilon$)	Strain Gage 3 ($\mu\epsilon$)	Strain Gage 4 ($\mu\epsilon$)
---	---	---	---	---	---	---	---
-998	-0.185	-0.006	-0.007	8	7	18	14
-1999	-0.254	-0.016	-0.021	17	14	33	28
-3000	-0.294	-0.029	-0.035	26	21	49	41
-3997	-0.324	-0.045	-0.044	35	28	64	54
-4998	-0.352	-0.051	-0.058	44	35	80	66
-6000	-0.377	-0.068	-0.065	55	42	94	77
-6997	-0.400	-0.073	-0.077	64	50	109	89
-8001	-0.422	-0.094	-0.093	75	57	125	101
-8998	-0.441	-0.100	-0.097	85	64	142	114
-9999	-0.459	-0.110	-0.114	96	73	159	128
-11003	-0.477	-0.123	-0.121	107	84	177	142
-11998	-0.492	-0.128	-0.135	119	97	194	156
-12997	-0.508	-0.140	-0.139	132	115	213	171
-14005	-0.523	-0.156	-0.153	146	135	231	186
-15000	-0.538	-0.162	-0.160	160	155	250	201
-15999	-0.551	-0.171	-0.174	175	177	268	217
-17000	-0.565	-0.181	-0.181	190	199	288	233
-17998	-0.578	-0.187	-0.188	205	220	307	249
-19001	-0.593	-0.205	-0.202	222	242	327	265
-19993	-0.608	-0.213	-0.209	237	261	350	283
-20399	-0.616	-0.219	-0.216	244	271	361	290

Comment:

Stiffness Test: 2		Date: 6/28/2005		Panel 1P, Cycle: 10		Panel 3, Cycle: 10	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Wire Pot 2 (in)	Strain Gage 1 ($\mu\epsilon$)	Strain Gage 2 ($\mu\epsilon$)	Strain Gage 3 ($\mu\epsilon$)	Strain Gage 4 ($\mu\epsilon$)
0	-0.025	0.000	0.000	0	0	0	0
-998	-0.346	-0.006	-0.014	9	7	20	15
-1995	-0.407	-0.016	-0.021	18	14	39	30
-2997	-0.437	-0.024	-0.035	29	21	56	45
-4000	-0.463	-0.040	-0.044	39	29	73	59
-4999	-0.485	-0.051	-0.058	49	36	89	73
-5997	-0.505	-0.057	-0.063	59	44	105	84
-6999	-0.524	-0.073	-0.077	70	51	121	97
-7998	-0.541	-0.077	-0.084	81	59	138	110
-9001	-0.557	-0.097	-0.097	91	67	156	123
-10000	-0.573	-0.103	-0.104	102	75	175	138
-10994	-0.587	-0.113	-0.118	113	85	193	152
-11999	-0.601	-0.124	-0.125	124	98	213	168
-12997	-0.614	-0.130	-0.139	137	115	231	183
-13992	-0.627	-0.140	-0.146	150	135	250	198
-14997	-0.640	-0.155	-0.160	165	156	270	213
-15995	-0.653	-0.164	-0.167	180	178	289	229
-17006	-0.666	-0.171	-0.174	195	200	308	245
-18000	-0.679	-0.181	-0.188	210	222	328	261
-18996	-0.692	-0.188	-0.195	226	243	348	278
-19993	-0.703	-0.203	-0.206	242	263	368	295
-20396	-0.709	-0.207	-0.209	249	272	375	303

Stiffness Test: 3		Date: 6/28/2005		Panel 1P, Cycle: 100		Panel 3, Cycle: 100	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Wire Pot 2 (in)	Strain Gage 1 ($\mu\epsilon$)	Strain Gage 2 ($\mu\epsilon$)	Strain Gage 3 ($\mu\epsilon$)	Strain Gage 4 ($\mu\epsilon$)
-2	-0.017	0.000	0.000	0	0	0	0
-998	-0.129	0.006	0.007	-8	-7	-19	-15
-1995	-0.189	0.016	0.019	-17	-14	-36	-30
-3003	-0.219	0.025	0.028	-28	-21	-54	-45
-3995	-0.243	0.040	0.042	-37	-29	-70	-58
-4999	-0.265	0.050	0.051	-47	-36	-86	-71
-5978	-0.284	0.057	0.065	-58	-44	-101	-83
-7002	-0.303	0.072	0.072	-68	-51	-117	-95
-8010	-0.321	0.077	0.084	-79	-59	-134	-108
-9031	-0.337	0.098	0.093	-89	-67	-152	-121
-10006	-0.351	0.102	0.104	-100	-75	-170	-136
-10979	-0.365	0.116	0.111	-111	-85	-188	-150
-11998	-0.379	0.124	0.125	-123	-99	-208	-165
-14038	-0.405	0.141	0.139	-150	-136	-247	-196
-14011	-0.408	0.146	0.146	-153	-140	-247	-196
-14998	-0.419	0.157	0.153	-165	-158	-266	-212
-16001	-0.432	0.164	0.160	-179	-180	-286	-227
-17002	-0.444	0.171	0.174	-194	-201	-306	-243
-18001	-0.457	0.182	0.186	-210	-224	-326	-260
-19003	-0.469	0.187	0.195	-225	-244	-347	-277
-19987	-0.481	0.203	0.202	-240	-263	-366	-294
-20394	-0.486	-0.206	-0.209	-247	-271	-374	-301

Stiffness Test: 4		Date: 6/28/2005		Panel 1P, Cycle: 1000		Panel 3, Cycle: 1000	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Wire Pot 2 (in)	Strain Gage 1 ($\mu\epsilon$)	Strain Gage 2 ($\mu\epsilon$)	Strain Gage 3 ($\mu\epsilon$)	Strain Gage 4 ($\mu\epsilon$)
2	0.000	0.000	0.000	0	0	0	0
-1000	-0.142	0.004	0.007	-8	-7	-19	-15
-1990	-0.200	0.015	0.021	-16	-14	-35	-30
-3009	-0.228	0.030	0.035	-26	-21	-52	-44
-4009	-0.252	0.043	0.042	-35	-28	-68	-58
-5016	-0.273	0.051	0.058	-45	-35	-84	-70
-6000	-0.293	0.066	0.065	-55	-43	-99	-82
-7014	-0.311	0.072	0.077	-65	-50	-114	-94
-8000	-0.327	0.083	0.086	-75	-58	-131	-106
-9030	-0.343	0.097	0.100	-85	-66	-149	-120
-9994	-0.357	0.102	0.104	-95	-74	-167	-134
-11006	-0.371	0.117	0.121	-107	-84	-185	-148
-11999	-0.385	0.123	0.125	-119	-98	-204	-162
-13007	-0.398	0.130	0.137	-133	-116	-223	-178
-13985	-0.411	0.144	0.146	-146	-135	-242	-193
-14998	-0.424	0.157	0.156	-160	-156	-262	-209
-15996	-0.436	0.164	0.169	-174	-178	-282	-225
-17000	-0.448	0.172	0.174	-188	-199	-302	-241
-18027	-0.461	0.180	0.188	-204	-220	-322	-257
-18993	-0.473	0.187	0.195	-218	-240	-341	-273
-20011	-0.486	0.201	0.209	-234	-260	-361	-291
-20403	-0.490	-0.203	-0.209	-241	-268	-369	-298

Stiffness Test: 5		Date: 6/28/2005		Panel 1P, Cycle: 10000		Panel 3, Cycle: 10000	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Wire Pot 2 (in)	Strain Gage 1 ($\mu\epsilon$)	Strain Gage 2 ($\mu\epsilon$)	Strain Gage 3 ($\mu\epsilon$)	Strain Gage 4 ($\mu\epsilon$)
-2	0.000	0.000	0.000	0	0	0	0
-1007	-0.194	0.002	0.002	-9	-7	-20	-15
-2002	-0.245	0.017	0.016	-18	-14	-38	-30
-3011	-0.267	0.025	0.028	-28	-21	-57	-46
-3989	-0.288	0.045	0.039	-35	-28	-73	-59
-5027	-0.306	0.051	0.051	-45	-34	-90	-72
-6022	-0.322	0.061	0.060	-54	-41	-105	-84
-7002	-0.338	0.072	0.072	-62	-48	-118	-95
-7995	-0.353	0.079	0.086	-71	-55	-134	-106
-9036	-0.368	0.097	0.100	-81	-62	-152	-120
-10080	-0.382	0.103	0.107	-92	-71	-172	-134
-11021	-0.395	0.116	0.118	-102	-80	-189	-148
-12012	-0.409	0.124	0.125	-115	-94	-207	-162
-13040	-0.422	0.131	0.139	-127	-113	-226	-176
-13991	-0.434	0.144	0.146	-139	-131	-244	-191
-15058	-0.448	0.159	0.160	-155	-154	-265	-208
-16037	-0.459	0.162	0.169	-169	-174	-285	-223
-17002	-0.470	0.172	0.181	-183	-194	-305	-239
-17992	-0.481	0.180	0.188	-199	-214	-325	-255
-19019	-0.493	0.187	0.202	-216	-235	-346	-273
-19988	-0.505	0.202	0.209	-232	-255	-367	-291
-20388	-0.509	-0.204	-0.216	-239	-263	-375	-299

Stiffness Test: 6		Date: 6/29/2005		Panel 1P, Cycle: 63173		Panel 3, Cycle: 63173	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Wire Pot 2 (in)	Strain Gage 1 ($\mu\epsilon$)	Strain Gage 2 ($\mu\epsilon$)	Strain Gage 3 ($\mu\epsilon$)	Strain Gage 4 ($\mu\epsilon$)
-2	0.000	0.000	0.000	0	0	0	0
-1006	-0.355	-0.010	-0.016	-9	-6	-24	-17
-1981	-0.391	-0.019	-0.030	-16	-13	-43	-32
-3014	-0.408	-0.025	-0.037	-25	-19	-62	-47
-4003	-0.423	-0.041	-0.051	-33	-25	-79	-61
-4989	-0.438	-0.051	-0.058	-42	-31	-96	-74
-6000	-0.452	-0.058	-0.072	-50	-38	-111	-86
-7000	-0.466	-0.071	-0.079	-60	-45	-127	-98
-7987	-0.479	-0.076	-0.093	-70	-52	-145	-111
-9028	-0.492	-0.096	-0.107	-81	-60	-166	-126
-10026	-0.504	-0.101	-0.111	-92	-68	-185	-141
-10994	-0.516	-0.111	-0.127	-103	-76	-206	-156
-12028	-0.529	-0.123	-0.141	-115	-90	-227	-172
-13020	-0.540	-0.128	-0.146	-128	-106	-247	-188
-14026	-0.552	-0.135	-0.155	-141	-126	-267	-204
-15030	-0.563	-0.149	-0.169	-156	-147	-288	-220
-16059	-0.575	-0.163	-0.176	-171	-169	-309	-237
-17037	-0.586	-0.168	-0.188	-186	-190	-329	-253
-17989	-0.596	-0.177	-0.197	-200	-209	-348	-268
-19009	-0.608	-0.184	-0.206	-216	-230	-368	-286
-20001	-0.619	-0.193	-0.215	-233	-251	-388	-304
-20396	-0.623	-0.202	-0.222	-239	-259	-397	-312

Stiffness Test: 7		Date: 6/29/2005		Panel 1P, Cycle: 100000		Panel 3, Cycle: 100000	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Wire Pot 2 (in)	Strain Gage 1 ($\mu\epsilon$)	Strain Gage 2 ($\mu\epsilon$)	Strain Gage 3 ($\mu\epsilon$)	Strain Gage 4 ($\mu\epsilon$)
0	0.000	0.000	0.000	0	0	0	0
-1001	-0.244	-0.008	-0.012	9	7	23	18
-2017	-0.283	-0.019	-0.021	17	14	43	33
-3008	-0.300	-0.026	-0.037	25	19	62	49
-3991	-0.315	-0.040	-0.044	34	26	81	64
-5007	-0.329	-0.050	-0.058	44	33	100	78
-5996	-0.343	-0.058	-0.069	53	40	116	91
-6988	-0.357	-0.069	-0.076	63	47	133	104
-8003	-0.371	-0.079	-0.090	74	55	150	117
-8995	-0.383	-0.084	-0.100	84	62	170	132
-10003	-0.396	-0.103	-0.111	95	70	190	147
-11004	-0.408	-0.109	-0.120	107	80	212	163
-12001	-0.421	-0.121	-0.134	119	93	233	180
-13008	-0.432	-0.130	-0.141	133	111	254	196
-14002	-0.444	-0.135	-0.153	148	132	277	213
-14986	-0.455	-0.148	-0.160	162	152	297	229
-16007	-0.467	-0.154	-0.174	178	175	319	246
-17014	-0.479	-0.169	-0.181	193	196	341	264
-18008	-0.490	-0.177	-0.194	208	217	362	282
-19000	-0.501	-0.185	-0.201	224	238	383	301
-19998	-0.512	-0.193	-0.215	241	260	404	320
-20393	-0.516	-0.197	-0.215	247	268	413	328

Stiffness Test: 8		Date: 6/30/2005		Panel 1P, Cycle: 184161		Panel 3, Cycle: 184161	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Wire Pot 2 (in)	Strain Gage 1 ($\mu\epsilon$)	Strain Gage 2 ($\mu\epsilon$)	Strain Gage 3 ($\mu\epsilon$)	Strain Gage 4 ($\mu\epsilon$)
-2	0.000	0.000	0.000	0	0	-1	0
-1003	-0.168	-0.009	-0.007	8	6	25	18
-2004	-0.203	-0.016	-0.019	16	13	49	37
-3020	-0.219	-0.024	-0.028	26	19	72	55
-4012	-0.233	-0.040	-0.042	34	26	92	71
-5005	-0.248	-0.050	-0.049	44	32	112	86
-5979	-0.261	-0.055	-0.063	53	40	130	101
-7017	-0.275	-0.071	-0.074	64	47	147	115
-8015	-0.288	-0.076	-0.081	74	55	165	128
-9027	-0.300	-0.091	-0.095	85	62	185	144
-10055	-0.313	-0.101	-0.102	96	71	206	160
-10998	-0.325	-0.108	-0.116	107	79	227	176
-12012	-0.338	-0.124	-0.130	120	91	249	194
-12999	-0.349	-0.128	-0.137	133	108	270	211
-14023	-0.360	-0.135	-0.144	147	129	292	227
-15001	-0.371	-0.149	-0.157	162	150	313	244
-16050	-0.382	-0.160	-0.164	177	171	335	262
-17000	-0.393	-0.168	-0.178	192	191	356	279
-17960	-0.404	-0.176	-0.185	207	210	376	297
-19010	-0.415	-0.184	-0.194	224	232	398	318
-20005	-0.426	-0.193	-0.206	240	253	419	338
-20400	-0.431	-0.199	-0.213	247	261	428	346

Stiffness Test: 9		Date: 7/5/2005		Panel 1P, Cycle: 200000		Panel 3, Cycle: 200000	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Wire Pot 2 (in)	Strain Gage 1 ($\mu\epsilon$)	Strain Gage 2 ($\mu\epsilon$)	Strain Gage 3 ($\mu\epsilon$)	Strain Gage 4 ($\mu\epsilon$)
0	0.000	0.000	0.000	0	0	0	0
-1004	-0.204	-0.006	-0.014	9	8	25	21
-2004	-0.251	-0.018	-0.021	18	15	46	39
-3002	-0.273	-0.028	-0.035	28	22	66	58
-3989	-0.293	-0.046	-0.049	38	30	87	75
-5004	-0.310	-0.055	-0.056	49	38	108	92
-6022	-0.326	-0.061	-0.069	59	45	123	106
-6999	-0.340	-0.076	-0.081	70	53	140	119
-8000	-0.354	-0.081	-0.090	80	61	157	132
-8985	-0.368	-0.099	-0.104	91	69	176	147
-9997	-0.382	-0.106	-0.116	103	78	198	165
-11014	-0.395	-0.116	-0.123	115	88	221	183
-11995	-0.408	-0.128	-0.137	127	104	243	201
-13010	-0.420	-0.133	-0.144	141	122	266	220
-13996	-0.432	-0.140	-0.157	155	143	289	239
-15021	-0.444	-0.154	-0.164	170	165	312	257
-16039	-0.455	-0.166	-0.178	185	186	335	277
-17040	-0.467	-0.173	-0.185	201	208	358	297
-18001	-0.479	-0.181	-0.199	216	228	379	317
-18983	-0.490	-0.189	-0.206	231	249	401	337
-20002	-0.502	-0.196	-0.215	248	270	423	360
-20397	-0.506	-0.207	-0.220	254	280	432	368

Stiffness Test: 10		Date: 7/6/2005		Panel 1P, Cycle: 300000		Panel 3, Cycle: 300000	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Wire Pot 2 (in)	Strain Gage 1 ($\mu\epsilon$)	Strain Gage 2 ($\mu\epsilon$)	Strain Gage 3 ($\mu\epsilon$)	Strain Gage 4 ($\mu\epsilon$)
2	-0.111	0.000	0.000	0	0	0	0
-1001	-0.230	-0.009	-0.007	10	7	27	22
-2002	-0.272	-0.019	-0.021	19	15	52	43
-2996	-0.290	-0.026	-0.035	30	21	77	64
-4001	-0.307	-0.044	-0.044	40	29	101	85
-5001	-0.323	-0.054	-0.056	50	36	123	104
-5991	-0.337	-0.059	-0.069	59	44	142	120
-6989	-0.351	-0.075	-0.083	70	51	159	135
-8004	-0.365	-0.079	-0.090	81	59	178	151
-9004	-0.379	-0.096	-0.104	92	67	199	167
-9996	-0.391	-0.104	-0.118	103	75	222	186
-10998	-0.404	-0.110	-0.123	114	84	247	206
-12003	-0.417	-0.125	-0.139	126	97	272	227
-13005	-0.430	-0.131	-0.153	139	116	297	247
-14003	-0.441	-0.138	-0.157	153	136	321	268
-15006	-0.453	-0.151	-0.171	168	157	345	288
-16001	-0.465	-0.163	-0.178	183	179	370	309
-17003	-0.476	-0.170	-0.194	199	200	394	330
-17997	-0.488	-0.178	-0.201	215	220	418	352
-19004	-0.500	-0.187	-0.215	231	242	441	376
-19996	-0.511	-0.194	-0.220	247	263	464	398
-20399	-0.516	-0.200	-0.229	254	272	473	408

Stiffness Test: 11		Date: 7/8/2005		Panel 1P, Cycle: 400541		Panel 3, Cycle: 400541	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Wire Pot 2 (in)	Strain Gage 1 ($\mu\epsilon$)	Strain Gage 2 ($\mu\epsilon$)	Strain Gage 3 ($\mu\epsilon$)	Strain Gage 4 ($\mu\epsilon$)
-2	0.000	0.001	0.000	0	0	-2	-1
-1003	-0.089	-0.006	-0.007	8	7	28	24
-2002	-0.127	-0.013	-0.021	17	14	57	48
-3011	-0.145	-0.031	-0.037	27	20	86	74
-4001	-0.161	-0.039	-0.051	36	28	113	97
-4976	-0.176	-0.046	-0.060	45	34	139	120
-6002	-0.190	-0.054	-0.072	56	42	163	140
-7005	-0.205	-0.069	-0.086	66	49	183	159
-8030	-0.219	-0.073	-0.097	77	58	203	177
-8999	-0.232	-0.090	-0.111	88	65	224	195
-10006	-0.246	-0.098	-0.125	99	74	250	217
-11015	-0.258	-0.106	-0.132	111	83	277	239
-12007	-0.271	-0.118	-0.146	123	95	305	261
-13005	-0.283	-0.124	-0.160	137	114	332	284
-13982	-0.295	-0.133	-0.167	151	134	360	306
-15016	-0.307	-0.145	-0.181	166	155	388	330
-16021	-0.319	-0.155	-0.194	181	176	416	353
-16984	-0.331	-0.163	-0.201	197	196	442	377
-18008	-0.343	-0.170	-0.215	213	216	469	402
-19003	-0.354	-0.180	-0.225	229	237	495	426
-20011	-0.366	-0.188	-0.236	245	257	521	451
-20397	-0.370	-0.195	-0.243	252	265	530	460

Comments: Specimen 3 failed around 410000 cycles, elastomer core cracked.

Stiffness Test: 12		Date: 7/11/2005		Panel 1P, Cycle: 410001		Panel 4, Cycle: 1	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Wire Pot 2 (in)	Strain Gage 1 ($\mu\epsilon$)	Strain Gage 2 ($\mu\epsilon$)	Strain Gage 3 ($\mu\epsilon$)	Strain Gage 4 ($\mu\epsilon$)
2	0.000	0.000	0.000	0	0	0	1
-1004	-0.147	-0.010	-0.009	10	8	18	15
-2004	-0.201	-0.020	-0.023	19	15	34	27
-2997	-0.229	-0.035	-0.035	29	23	51	40
-3978	-0.260	-0.049	-0.051	39	31	70	55
-4992	-0.280	-0.055	-0.065	51	39	89	70
-6005	-0.299	-0.070	-0.072	62	47	108	85
-6992	-0.316	-0.075	-0.085	73	55	127	99
-7989	-0.332	-0.080	-0.092	84	64	146	115
-8998	-0.349	-0.100	-0.106	96	73	166	131
-9991	-0.364	-0.105	-0.111	108	81	185	146
-10957	-0.379	-0.120	-0.127	119	91	204	162
-11990	-0.394	-0.126	-0.132	134	105	225	178
-12997	-0.409	-0.134	-0.145	147	122	245	195
-13982	-0.422	-0.144	-0.152	162	142	265	211
-14991	-0.442	-0.160	-0.166	178	165	285	226
-15998	-0.456	-0.168	-0.180	193	187	306	244
-16994	-0.470	-0.176	-0.187	209	208	329	262
-17997	-0.483	-0.184	-0.199	225	228	351	279
-18998	-0.495	-0.190	-0.208	241	249	373	298
-20002	-0.507	-0.206	-0.215	258	271	396	317
-20391	-0.512	-0.209	-0.222	264	279	404	325

Comments: Specimen 3 was replaced with specimen 4, continued testing as before.

Stiffness Test: 13		Date: 7/12/2005		Panel 1P, Cycle: 410001		Panel 4, Cycle: 1	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Wire Pot 2 (in)	Strain Gage 1 ($\mu\epsilon$)	Strain Gage 2 ($\mu\epsilon$)	Strain Gage 3 ($\mu\epsilon$)	Strain Gage 4 ($\mu\epsilon$)
0	0.000	0.000	0.000	0	0	0	0
-1012	-0.080	-0.010	-0.010	10	8	21	15
-2008	-0.130	-0.020	-0.020	20	16	40	30
-3000	-0.150	-0.030	-0.030	30	23	58	44
-4020	-0.160	-0.040	-0.040	41	31	78	58
-5015	-0.180	-0.050	-0.050	51	39	97	73
-6013	-0.190	-0.050	-0.060	62	47	117	89
-7002	-0.210	-0.070	-0.070	74	55	137	104
-8003	-0.220	-0.080	-0.080	86	64	157	119
-8990	-0.230	-0.090	-0.090	98	77	177	135
-10005	-0.240	-0.100	-0.100	112	94	197	151
-11035	-0.260	-0.100	-0.110	127	114	218	167
-12009	-0.270	-0.110	-0.120	142	135	238	182
-13019	-0.280	-0.130	-0.130	158	156	259	199
-14009	-0.290	-0.140	-0.140	174	178	279	215
-15004	-0.300	-0.140	-0.150	190	200	300	232
-16001	-0.320	-0.150	-0.160	207	221	321	248
-17003	-0.330	-0.160	-0.170	225	243	342	265
-18011	-0.340	-0.170	-0.180	243	266	364	283
-19004	-0.350	-0.180	-0.190	261	287	385	302
-20403	-0.370	-0.200	-0.210	288	318	414	331
-20391	-0.512	-0.209	-0.222	264	279	404	325

Comments: Stiffness test performed after overload of specimens of 55 kips

Stiffness Test: 14		Date: 7/12/2005		Panel 1P, Cycle: 410010		Panel 4, Cycle: 10	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Wire Pot 2 (in)	Strain Gage 1 ($\mu\epsilon$)	Strain Gage 2 ($\mu\epsilon$)	Strain Gage 3 ($\mu\epsilon$)	Strain Gage 4 ($\mu\epsilon$)
0	0.000	0.000	0.000	0	0	0	0
-1012	-0.049	-0.007	-0.007	10	7	22	15
-2004	-0.095	-0.021	-0.021	20	15	42	30
-2980	-0.114	-0.030	-0.028	30	22	58	43
-4010	-0.129	-0.039	-0.042	40	30	79	58
-5007	-0.143	-0.051	-0.048	51	38	99	73
-6005	-0.157	-0.055	-0.062	62	46	118	88
-7009	-0.171	-0.074	-0.067	74	54	139	104
-8010	-0.184	-0.080	-0.083	86	63	159	119
-9010	-0.197	-0.091	-0.090	98	75	179	135
-9996	-0.209	-0.100	-0.104	111	92	199	151
-10991	-0.221	-0.106	-0.111	125	112	219	166
-11999	-0.233	-0.115	-0.125	141	133	240	182
-13022	-0.245	-0.128	-0.132	157	156	260	199
-14052	-0.257	-0.139	-0.145	174	178	281	215
-15010	-0.268	-0.146	-0.152	190	200	302	231
-16010	-0.280	-0.156	-0.162	207	222	322	248
-17000	-0.291	-0.163	-0.171	224	243	343	264
-17983	-0.303	-0.173	-0.178	242	264	363	281
-19000	-0.315	-0.185	-0.192	260	286	384	300
-19998	-0.326	-0.193	-0.199	278	307	405	320
-20399	-0.332	-0.199	-0.208	287	316	414	329

Comments:

Stiffness Test: 17		Date: 7/12/2005		Panel 1P, Cycle: 420000		Panel 4, Cycle: 10000	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Wire Pot 2 (in)	Strain Gage 1 ($\mu\epsilon$)	Strain Gage 2 ($\mu\epsilon$)	Strain Gage 3 ($\mu\epsilon$)	Strain Gage 4 ($\mu\epsilon$)
0	0.000	0.000	0.000	0	0	0	0
-997	-0.059	-0.006	-0.014	9	7	22	15
-2011	-0.103	-0.024	-0.021	19	14	42	29
-3008	-0.121	-0.034	-0.035	28	21	59	42
-4018	-0.135	-0.039	-0.042	38	29	79	57
-4990	-0.149	-0.054	-0.053	49	36	97	71
-6016	-0.163	-0.059	-0.065	60	45	118	87
-7021	-0.177	-0.075	-0.074	71	53	138	102
-8010	-0.189	-0.083	-0.085	83	62	158	117
-9018	-0.202	-0.090	-0.095	95	76	178	134
-10016	-0.214	-0.104	-0.106	109	95	198	150
-11000	-0.226	-0.110	-0.118	124	116	218	165
-11998	-0.238	-0.116	-0.127	139	138	239	181
-13008	-0.250	-0.130	-0.139	155	161	260	198
-14014	-0.262	-0.141	-0.143	172	183	280	214
-15010	-0.273	-0.149	-0.159	188	205	300	231
-16004	-0.285	-0.158	-0.164	206	227	320	248
-17006	-0.296	-0.166	-0.178	224	249	341	266
-18000	-0.308	-0.174	-0.185	242	270	361	284
-19010	-0.319	-0.188	-0.199	259	292	381	305
-20002	-0.330	-0.196	-0.206	278	313	402	327
-20402	-0.335	-0.201	-0.212	286	322	410	335
Comments:							

Stiffness Test: 18		Date: 7/13/2005		Panel 1P, Cycle: 500000		Panel 4, Cycle: 90000	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Wire Pot 2 (in)	Strain Gage 1 ($\mu\epsilon$)	Strain Gage 2 ($\mu\epsilon$)	Strain Gage 3 ($\mu\epsilon$)	Strain Gage 4 ($\mu\epsilon$)
2	0.000	0.000	0.000	0	0	0	-1
-1006	-0.051	-0.016	-0.007	10	7	21	14
-2008	-0.093	-0.026	-0.021	20	14	41	28
-3002	-0.109	-0.031	-0.025	30	21	60	42
-4020	-0.124	-0.048	-0.042	41	30	79	57
-4986	-0.137	-0.052	-0.046	51	37	98	71
-6002	-0.151	-0.064	-0.062	62	45	117	87
-6995	-0.163	-0.076	-0.069	73	53	136	102
-7998	-0.177	-0.083	-0.081	85	62	156	117
-9011	-0.190	-0.100	-0.095	98	76	177	134
-10019	-0.202	-0.104	-0.104	112	95	197	150
-11014	-0.213	-0.109	-0.109	127	115	217	166
-12024	-0.225	-0.121	-0.122	142	137	238	183
-13023	-0.236	-0.134	-0.132	158	159	258	199
-14008	-0.248	-0.143	-0.143	174	181	278	216
-15004	-0.259	-0.150	-0.150	190	202	298	233
-16031	-0.271	-0.160	-0.166	208	225	319	251
-16999	-0.282	-0.165	-0.171	225	245	338	268
-18005	-0.294	-0.180	-0.185	243	267	359	289
-19013	-0.305	-0.190	-0.192	260	288	378	310
-19990	-0.316	-0.199	-0.199	278	308	399	331
-20403	-0.320	-0.201	-0.206	286	317	407	340
Comments:							

Stiffness Test: 19		Date: 7/13/2005		Panel 1P, Cycle: 510000		Panel 4, Cycle: 100000	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Wire Pot 2 (in)	Strain Gage 1 ($\mu\epsilon$)	Strain Gage 2 ($\mu\epsilon$)	Strain Gage 3 ($\mu\epsilon$)	Strain Gage 4 ($\mu\epsilon$)
2	0.000	0.000	0.000	0	0	-1	-1
-1001	-0.066	-0.014	-0.007	9	6	21	15
-2007	-0.105	-0.024	-0.016	18	13	40	28
-3000	-0.121	-0.030	-0.025	29	20	59	42
-3997	-0.136	-0.045	-0.039	38	28	77	56
-5007	-0.149	-0.050	-0.048	48	36	97	71
-6017	-0.163	-0.061	-0.062	60	44	116	87
-7002	-0.176	-0.075	-0.067	71	52	135	102
-8015	-0.189	-0.081	-0.083	82	61	156	118
-9014	-0.201	-0.095	-0.090	95	74	176	134
-10014	-0.213	-0.101	-0.102	109	92	196	149
-11003	-0.224	-0.106	-0.109	124	112	215	165
-11999	-0.236	-0.119	-0.122	139	134	236	182
-12997	-0.248	-0.133	-0.129	155	156	256	198
-13997	-0.259	-0.140	-0.143	171	178	276	215
-14997	-0.270	-0.147	-0.150	188	199	296	232
-16001	-0.282	-0.158	-0.164	206	222	317	250
-17010	-0.293	-0.164	-0.171	223	243	337	268
-18008	-0.304	-0.179	-0.178	241	265	357	289
-19016	-0.316	-0.186	-0.192	259	286	377	310
-20001	-0.326	-0.196	-0.199	276	307	397	331
-20403	-0.331	-0.200	-0.206	284	316	405	341
Comments:							

Stiffness Test: 20		Date: 7/13/2005		Panel 1P, Cycle: 600000		Panel 4, Cycle: 190000	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Wire Pot 2 (in)	Strain Gage 1 ($\mu\epsilon$)	Strain Gage 2 ($\mu\epsilon$)	Strain Gage 3 ($\mu\epsilon$)	Strain Gage 4 ($\mu\epsilon$)
0	0.000	0.001	0.000	0	0	0	0
-1004	-0.088	-0.013	-0.007	9	7	20	14
-1998	-0.127	-0.024	-0.021	19	14	39	28
-3011	-0.145	-0.030	-0.035	29	21	56	41
-4006	-0.160	-0.046	-0.046	39	29	75	55
-5009	-0.174	-0.050	-0.055	49	37	94	70
-6005	-0.187	-0.063	-0.062	60	45	113	84
-6999	-0.201	-0.075	-0.079	72	54	133	100
-8009	-0.213	-0.080	-0.083	84	63	153	117
-9008	-0.226	-0.094	-0.099	97	78	173	133
-10009	-0.238	-0.101	-0.106	112	97	194	149
-11011	-0.250	-0.107	-0.118	127	119	214	166
-11999	-0.262	-0.121	-0.127	143	140	234	182
-13007	-0.273	-0.133	-0.141	159	162	254	199
-14012	-0.285	-0.140	-0.148	176	184	275	217
-15003	-0.297	-0.149	-0.162	192	205	295	235
-16001	-0.308	-0.158	-0.169	209	228	315	253
-17003	-0.319	-0.165	-0.178	227	249	335	273
-18005	-0.330	-0.180	-0.189	244	270	355	295
-18989	-0.341	-0.188	-0.196	261	291	375	315
-19999	-0.352	-0.198	-0.210	280	312	396	337
-20402	-0.358	-0.201	-0.210	289	322	405	347
Comments:							

Stiffness Test: 21		Date: 7/14/2005		Panel 1P, Cycle: 681064		Panel 4, Cycle: 271064	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Wire Pot 2 (in)	Strain Gage 1 ($\mu\epsilon$)	Strain Gage 2 ($\mu\epsilon$)	Strain Gage 3 ($\mu\epsilon$)	Strain Gage 4 ($\mu\epsilon$)
3	0.000	-0.001	0.002	0	0	0	0
-1006	-0.088	-0.014	-0.005	10	8	20	15
-2007	-0.129	-0.024	-0.021	20	15	40	29
-3005	-0.145	-0.030	-0.032	30	22	59	43
-4003	-0.159	-0.045	-0.039	40	29	79	58
-4998	-0.173	-0.050	-0.051	50	36	98	72
-6007	-0.187	-0.069	-0.062	61	45	117	88
-7018	-0.200	-0.075	-0.074	73	53	137	104
-8010	-0.213	-0.081	-0.081	85	62	157	121
-9065	-0.225	-0.095	-0.095	98	74	178	138
-10013	-0.237	-0.100	-0.102	111	92	197	154
-11015	-0.248	-0.106	-0.115	126	112	217	170
-12013	-0.260	-0.118	-0.122	141	133	237	187
-13007	-0.271	-0.129	-0.134	156	154	257	204
-14006	-0.282	-0.139	-0.143	172	175	277	220
-15012	-0.294	-0.146	-0.150	188	197	297	238
-16005	-0.305	-0.155	-0.164	205	219	317	256
-17002	-0.317	-0.163	-0.171	222	241	337	275
-17997	-0.327	-0.176	-0.185	239	262	356	295
-19015	-0.338	-0.185	-0.189	257	283	376	316
-20011	-0.350	-0.195	-0.196	275	305	396	337
-20407	-0.354	-0.198	-0.206	282	313	404	346
Comments:							

Stiffness Test: 22		Date: 7/14/2005		Panel 1P, Cycle: 700000		Panel 4, Cycle: 290000	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Wire Pot 2 (in)	Strain Gage 1 ($\mu\epsilon$)	Strain Gage 2 ($\mu\epsilon$)	Strain Gage 3 ($\mu\epsilon$)	Strain Gage 4 ($\mu\epsilon$)
0	0.000	-0.001	0.000	0	0	0	-1
-1001	-0.051	-0.004	-0.007	9	6	20	14
-2019	-0.094	-0.021	-0.018	18	14	40	28
-3002	-0.109	-0.026	-0.025	28	20	58	42
-4009	-0.124	-0.034	-0.039	38	28	77	56
-5012	-0.138	-0.050	-0.046	49	35	96	71
-6005	-0.151	-0.055	-0.062	59	43	115	87
-7008	-0.164	-0.068	-0.069	70	51	135	103
-8010	-0.176	-0.076	-0.081	82	60	155	119
-9001	-0.188	-0.081	-0.088	94	70	176	136
-10008	-0.200	-0.092	-0.102	108	87	196	152
-11008	-0.212	-0.105	-0.109	123	108	216	169
-12009	-0.224	-0.115	-0.122	137	128	237	186
-13005	-0.235	-0.122	-0.129	153	149	257	202
-14005	-0.246	-0.131	-0.143	169	171	277	219
-15001	-0.257	-0.138	-0.150	185	193	296	236
-16001	-0.268	-0.149	-0.157	201	215	315	254
-17005	-0.279	-0.160	-0.171	219	236	335	273
-18011	-0.290	-0.170	-0.178	237	260	354	294
-19004	-0.301	-0.177	-0.192	254	280	374	314
-20011	-0.312	-0.184	-0.199	273	301	394	336
-20402	-0.316	-0.188	-0.196	279	310	402	344
Comments:							

Stiffness Test: 23		Date: 7/15/2005		Panel 1P, Cycle: 800000		Panel 4, Cycle: 390000	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Wire Pot 2 (in)	Strain Gage 1 ($\mu\epsilon$)	Strain Gage 2 ($\mu\epsilon$)	Strain Gage 3 ($\mu\epsilon$)	Strain Gage 4 ($\mu\epsilon$)
0	0.000	0.000	0.000	0	0	0	0
-1007	-0.099	-0.005	-0.009	9	6	21	14
-1996	-0.142	-0.011	-0.016	18	13	39	27
-3011	-0.159	-0.029	-0.030	29	20	57	41
-4010	-0.173	-0.033	-0.037	39	28	76	55
-5012	-0.187	-0.043	-0.051	49	36	95	70
-5999	-0.200	-0.058	-0.058	60	44	114	85
-7005	-0.213	-0.063	-0.072	71	52	134	101
-8001	-0.225	-0.076	-0.079	83	62	154	117
-9004	-0.237	-0.084	-0.092	97	73	174	134
-10006	-0.249	-0.089	-0.099	111	91	195	150
-10995	-0.261	-0.101	-0.113	126	111	215	167
-12006	-0.272	-0.113	-0.120	141	132	235	185
-13010	-0.283	-0.122	-0.134	157	153	255	202
-13999	-0.295	-0.129	-0.141	174	175	275	219
-15006	-0.306	-0.139	-0.155	191	196	295	236
-15998	-0.317	-0.145	-0.159	208	218	314	255
-17000	-0.328	-0.159	-0.173	225	240	334	276
-18015	-0.339	-0.169	-0.180	243	261	354	297
-19000	-0.350	-0.177	-0.187	259	281	373	317
-19999	-0.360	-0.185	-0.201	277	301	393	338
-20400	-0.366	-0.188	-0.201	286	311	402	347
Comments:							

Stiffness Test: 24		Date: 7/16/2005		Panel 1P, Cycle: 996196		Panel 4, Cycle: 586196	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Wire Pot 2 (in)	Strain Gage 1 ($\mu\epsilon$)	Strain Gage 2 ($\mu\epsilon$)	Strain Gage 3 ($\mu\epsilon$)	Strain Gage 4 ($\mu\epsilon$)
-3	0.000	0.000	0.002	0	0	0	0
-990	-0.052	-0.006	-0.014	9	6	20	14
-1996	-0.093	-0.015	-0.018	18	13	37	27
-3012	-0.108	-0.025	-0.035	28	20	54	39
-4010	-0.122	-0.036	-0.042	38	28	70	51
-5009	-0.135	-0.040	-0.053	49	35	88	65
-5997	-0.147	-0.058	-0.062	60	44	107	80
-7006	-0.160	-0.065	-0.079	71	52	127	96
-8004	-0.172	-0.075	-0.083	84	62	146	112
-8990	-0.184	-0.085	-0.092	97	74	165	128
-10005	-0.195	-0.091	-0.106	112	91	185	144
-11012	-0.207	-0.103	-0.115	127	111	206	161
-12012	-0.218	-0.114	-0.127	143	131	225	178
-13007	-0.229	-0.125	-0.132	160	153	245	194
-14017	-0.240	-0.133	-0.145	177	175	264	212
-14997	-0.251	-0.140	-0.155	193	196	283	229
-15998	-0.262	-0.149	-0.162	210	218	303	249
-17003	-0.273	-0.158	-0.173	228	241	322	270
-18011	-0.285	-0.173	-0.182	247	263	342	291
-19009	-0.295	-0.181	-0.194	265	284	362	312
-20010	-0.307	-0.189	-0.201	283	306	381	333
-20400	-0.311	-0.191	-0.206	291	314	389	342
Comments:							

Stiffness Test: 25		Date: 7/17/2005		Panel 1P, Cycle: 1043200		Panel 4, Cycle: 633200	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Wire Pot 2 (in)	Strain Gage 1 ($\mu\epsilon$)	Strain Gage 2 ($\mu\epsilon$)	Strain Gage 3 ($\mu\epsilon$)	Strain Gage 4 ($\mu\epsilon$)
0	0.000	0.000	0.002	0	0	0	0
-1007	-0.064	-0.007	-0.009	9	7	22	15
-2002	-0.098	-0.014	-0.016	18	14	40	28
-3011	-0.113	-0.030	-0.030	28	21	56	40
-4006	-0.126	-0.034	-0.037	38	29	72	52
-5002	-0.139	-0.044	-0.048	48	37	90	66
-6010	-0.152	-0.059	-0.062	60	45	110	81
-7006	-0.165	-0.064	-0.072	71	54	129	96
-8013	-0.177	-0.079	-0.081	83	63	149	112
-9004	-0.188	-0.085	-0.090	96	76	169	129
-10009	-0.200	-0.090	-0.097	111	93	189	145
-11000	-0.210	-0.104	-0.113	126	114	209	162
-12015	-0.222	-0.116	-0.120	143	137	228	180
-12987	-0.232	-0.124	-0.125	159	158	246	197
-13996	-0.243	-0.131	-0.141	175	179	265	215
-15012	-0.255	-0.141	-0.148	192	201	285	233
-15990	-0.265	-0.147	-0.155	208	221	303	251
-16994	-0.276	-0.163	-0.166	225	242	322	271
-17995	-0.287	-0.171	-0.173	243	264	341	292
-18992	-0.297	-0.181	-0.187	260	285	360	313
-19998	-0.308	-0.188	-0.194	278	307	379	334
-20402	-0.313	-0.191	-0.201	286	316	388	344
Comments:							

Stiffness Test: 26		Date: 7/18/2005		Panel 1P, Cycle: 1236201		Panel 4, Cycle: 826201	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Wire Pot 2 (in)	Strain Gage 1 ($\mu\epsilon$)	Strain Gage 2 ($\mu\epsilon$)	Strain Gage 3 ($\mu\epsilon$)	Strain Gage 4 ($\mu\epsilon$)
-2	0.000	0.000	0.000	0	0	0	0
-1010	-0.058	-0.006	-0.007	8	6	22	14
-2008	-0.093	-0.013	-0.018	17	13	41	27
-3017	-0.107	-0.029	-0.028	28	20	59	40
-4003	-0.120	-0.033	-0.037	37	27	75	53
-5010	-0.134	-0.040	-0.048	48	35	93	65
-6010	-0.146	-0.058	-0.060	59	43	113	80
-7003	-0.158	-0.063	-0.067	70	52	132	95
-8010	-0.171	-0.077	-0.081	83	61	153	112
-9001	-0.182	-0.084	-0.090	97	73	173	128
-9993	-0.193	-0.090	-0.102	111	90	194	144
-11011	-0.205	-0.103	-0.109	127	111	214	161
-12012	-0.216	-0.115	-0.120	143	131	235	178
-13004	-0.227	-0.124	-0.129	159	153	254	195
-14008	-0.238	-0.131	-0.136	176	174	274	213
-15013	-0.249	-0.140	-0.152	193	197	294	232
-16005	-0.260	-0.147	-0.157	211	219	313	252
-17010	-0.271	-0.161	-0.164	229	241	331	273
-18018	-0.282	-0.170	-0.178	247	263	351	294
-19013	-0.292	-0.180	-0.185	265	284	370	315
-20036	-0.303	-0.188	-0.192	284	306	390	337
-20399	-0.308	-0.190	-0.199	292	314	397	345
Comments:							

Stiffness Test: 27		Date: 7/19/2005		Panel 1P, Cycle: 1437015		Panel 4, Cycle: 1027015	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Wire Pot 2 (in)	Strain Gage 1 ($\mu\epsilon$)	Strain Gage 2 ($\mu\epsilon$)	Strain Gage 3 ($\mu\epsilon$)	Strain Gage 4 ($\mu\epsilon$)
-2	0.000	0.003	0.000	0	0	0	0
-1004	-0.035	-0.006	-0.005	8	5	22	14
-1998	-0.069	-0.016	-0.018	17	13	42	28
-3006	-0.085	-0.025	-0.032	27	19	59	40
-3997	-0.097	-0.037	-0.042	36	27	76	52
-5015	-0.110	-0.045	-0.051	47	35	92	64
-5997	-0.123	-0.050	-0.060	58	43	112	78
-6999	-0.135	-0.068	-0.072	70	52	132	94
-8004	-0.147	-0.075	-0.081	83	64	153	110
-9005	-0.159	-0.086	-0.090	97	83	175	127
-10002	-0.170	-0.095	-0.104	112	104	196	144
-11011	-0.181	-0.100	-0.109	128	126	217	160
-12009	-0.193	-0.113	-0.122	144	149	238	178
-13010	-0.204	-0.124	-0.129	161	173	258	196
-13996	-0.215	-0.134	-0.143	179	196	278	214
-15010	-0.226	-0.143	-0.150	198	220	298	235
-16022	-0.237	-0.150	-0.157	215	242	317	255
-17011	-0.248	-0.158	-0.171	234	265	336	276
-18005	-0.258	-0.170	-0.178	253	286	355	297
-19036	-0.269	-0.181	-0.185	273	309	375	319
-20005	-0.279	-0.191	-0.199	291	330	394	340
-20402	-0.284	-0.194	-0.199	300	340	402	349
Comments:							

Stiffness Test: 28		Date: 7/20/2005		Panel 1P, Cycle: 1623200		Panel 4, Cycle: 1213200	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Wire Pot 2 (in)	Strain Gage 1 ($\mu\epsilon$)	Strain Gage 2 ($\mu\epsilon$)	Strain Gage 3 ($\mu\epsilon$)	Strain Gage 4 ($\mu\epsilon$)
0	0.000	0.000	0.000	0	0	0	0
-1001	-0.038	-0.006	-0.007	8	5	24	15
-1998	-0.071	-0.011	-0.021	17	13	45	30
-3016	-0.086	-0.029	-0.037	27	20	64	43
-4006	-0.099	-0.034	-0.042	38	28	80	55
-4996	-0.111	-0.039	-0.055	48	35	95	66
-5997	-0.124	-0.056	-0.065	60	44	114	80
-7014	-0.138	-0.064	-0.079	72	55	136	97
-8009	-0.149	-0.074	-0.085	85	73	156	112
-9013	-0.160	-0.083	-0.099	101	94	178	130
-10002	-0.172	-0.089	-0.106	116	118	198	147
-11014	-0.183	-0.098	-0.115	132	141	220	165
-12015	-0.194	-0.114	-0.127	149	167	242	182
-13011	-0.205	-0.121	-0.134	166	190	262	200
-14011	-0.216	-0.129	-0.150	184	215	282	219
-15010	-0.227	-0.139	-0.155	202	239	301	239
-16002	-0.237	-0.145	-0.162	221	263	320	261
-17005	-0.249	-0.158	-0.176	241	288	339	283
-18009	-0.259	-0.168	-0.182	261	312	359	305
-19001	-0.270	-0.179	-0.194	281	334	377	327
-20008	-0.281	-0.186	-0.203	301	358	397	350
-20402	-0.286	-0.189	-0.206	310	368	405	360
Comments:							

Stiffness Test: 29		Date: 7/20/2005		Panel 1P, Cycle: 1679550		Panel 4, Cycle: 1269550	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Wire Pot 2 (in)	Strain Gage 1 ($\mu\epsilon$)	Strain Gage 2 ($\mu\epsilon$)	Strain Gage 3 ($\mu\epsilon$)	Strain Gage 4 ($\mu\epsilon$)
0	0.000	0.000	0.000	0	0	0	0
-1016	-0.055	-0.009	-0.007	9	6	26	16
-2011	-0.088	-0.014	-0.021	17	13	45	31
-3003	-0.103	-0.029	-0.035	27	20	62	43
-4015	-0.117	-0.037	-0.044	37	28	79	55
-5001	-0.130	-0.041	-0.055	48	36	94	66
-6005	-0.143	-0.058	-0.062	59	45	111	78
-7005	-0.156	-0.065	-0.076	72	59	130	93
-7981	-0.168	-0.074	-0.085	86	79	151	110
-9043	-0.180	-0.085	-0.097	103	103	174	129
-10028	-0.191	-0.091	-0.106	119	127	195	146
-11058	-0.204	-0.103	-0.118	136	152	217	165
-12065	-0.215	-0.114	-0.122	153	177	239	183
-13022	-0.226	-0.125	-0.136	171	201	259	203
-14038	-0.237	-0.134	-0.145	190	227	280	225
-15071	-0.248	-0.141	-0.159	209	250	300	247
-16047	-0.259	-0.149	-0.164	229	274	319	269
-17016	-0.270	-0.161	-0.178	249	299	339	292
-18001	-0.280	-0.171	-0.185	268	322	358	314
-19045	-0.292	-0.181	-0.192	290	347	378	339
-20037	-0.303	-0.189	-0.206	311	370	398	362
-20393	-0.307	-0.193	-0.208	319	379	406	371
Comments:							

Stiffness Test: 30		Date: 7/21/2005		Panel 1P, Cycle: 1798000		Panel 4, Cycle: 1388000	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Wire Pot 2 (in)	Strain Gage 1 ($\mu\epsilon$)	Strain Gage 2 ($\mu\epsilon$)	Strain Gage 3 ($\mu\epsilon$)	Strain Gage 4 ($\mu\epsilon$)
0	0.000	0.001	0.000	0	0	0	0
-998	-0.046	-0.001	-0.012	9	6	31	21
-2002	-0.080	-0.011	-0.018	18	13	58	40
-3008	-0.095	-0.016	-0.032	29	20	82	58
-4007	-0.109	-0.033	-0.046	40	28	105	74
-5015	-0.123	-0.037	-0.060	51	35	125	88
-6000	-0.137	-0.055	-0.069	63	45	143	100
-7009	-0.150	-0.064	-0.083	77	62	162	116
-8004	-0.162	-0.070	-0.095	92	82	180	132
-9011	-0.174	-0.084	-0.104	108	106	202	152
-10003	-0.186	-0.090	-0.115	125	131	225	172
-11004	-0.198	-0.098	-0.127	142	156	248	192
-12010	-0.210	-0.113	-0.136	160	182	271	214
-13002	-0.221	-0.122	-0.150	179	207	293	238
-14002	-0.233	-0.130	-0.157	198	233	314	263
-15012	-0.244	-0.139	-0.164	218	258	336	288
-16007	-0.255	-0.147	-0.178	239	284	358	315
-17010	-0.267	-0.158	-0.192	261	310	379	341
-17995	-0.278	-0.171	-0.196	282	333	399	366
-19009	-0.289	-0.181	-0.208	304	358	419	392
-20005	-0.300	-0.189	-0.217	324	381	438	416
-20399	-0.305	-0.191	-0.219	334	392	448	428
Comments:							

Stiffness Test: 31		Date: 7/22/2005		Panel 1P, Cycle: 1826337		Panel 4, Cycle: 1416337	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Wire Pot 2 (in)	Strain Gage 1 ($\mu\epsilon$)	Strain Gage 2 ($\mu\epsilon$)	Strain Gage 3 ($\mu\epsilon$)	Strain Gage 4 ($\mu\epsilon$)
-5	0.000	0.001	0.000	0	0	0	0
-1012	-0.042	-0.005	-0.007	10	6	37	30
-2057	-0.080	-0.014	-0.025	20	14	70	57
-3028	-0.096	-0.021	-0.037	31	21	98	80
-4058	-0.113	-0.036	-0.055	43	29	128	103
-5050	-0.128	-0.041	-0.067	54	37	156	124
-6007	-0.143	-0.059	-0.081	67	48	180	141
-7079	-0.158	-0.066	-0.095	82	67	206	162
-8093	-0.173	-0.080	-0.111	99	90	230	182
-9098	-0.186	-0.088	-0.122	115	114	252	202
-10074	-0.199	-0.095	-0.136	132	140	275	223
-11079	-0.213	-0.107	-0.150	151	167	298	245
-12068	-0.227	-0.122	-0.164	169	195	322	268
-13040	-0.239	-0.129	-0.171	188	221	346	290
-14031	-0.252	-0.140	-0.187	209	249	370	314
-15018	-0.264	-0.147	-0.199	229	275	393	337
-16034	-0.277	-0.156	-0.212	251	303	418	363
-17046	-0.290	-0.170	-0.219	273	329	441	388
-18032	-0.302	-0.179	-0.233	294	354	464	415
-19006	-0.314	-0.188	-0.247	317	381	489	445
-20024	-0.326	-0.194	-0.261	338	405	513	474
-20396	-0.333	-0.198	-0.261	348	417	526	488

Comments: Stiffness test after failure of panel 4

Stiffness Test: 32		Date: 7/25/2005		Panel 1P, Cycle: 1826337	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Strain Gage 1 ($\mu\epsilon$)	Strain Gage 2 ($\mu\epsilon$)	
-2	0.000	0.000	0	0	
-496	-0.077	-0.005	11	7	
-1015	-0.121	-0.022	23	16	
-1509	-0.168	-0.033	35	24	
-2001	-0.204	-0.039	47	32	
-2507	-0.230	-0.054	61	42	
-3000	-0.252	-0.059	74	54	
-3507	-0.273	-0.079	89	70	
-4007	-0.292	-0.086	105	90	
-4506	-0.310	-0.099	121	111	
-5027	-0.326	-0.106	138	135	
-5511	-0.341	-0.113	155	158	
-6000	-0.355	-0.124	172	182	
-6493	-0.368	-0.135	189	206	
-7002	-0.382	-0.145	209	232	
-7511	-0.395	-0.152	229	258	
-7994	-0.407	-0.163	248	282	
-8496	-0.420	-0.169	268	307	
-8993	-0.433	-0.182	290	333	
-9497	-0.446	-0.193	310	359	
-10002	-0.459	-0.204	333	385	
-10196	-0.466	-0.206	343	397	

Comments: Stiffness test after removing Panel 4

Stiffness Test: 33		Date: 7/26/2005	Panel 1P, Cycle: 1958400	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Strain Gage 1 ($\mu\epsilon$)	Strain Gage 2 ($\mu\epsilon$)
-3	0.000	0.000	0	0
-508	-0.024	-0.010	9	6
-998	-0.038	-0.014	20	13
-1503	-0.051	-0.022	32	20
-2002	-0.065	-0.036	44	28
-2510	-0.077	-0.041	57	36
-3061	-0.090	-0.060	72	49
-3505	-0.100	-0.066	85	63
-4017	-0.112	-0.079	101	84
-4505	-0.123	-0.088	117	107
-5013	-0.134	-0.094	135	133
-5514	-0.145	-0.105	153	160
-6007	-0.155	-0.118	172	187
-6506	-0.165	-0.128	192	214
-7012	-0.175	-0.134	213	241
-7510	-0.186	-0.144	234	267
-8012	-0.196	-0.151	257	294
-8534	-0.207	-0.164	279	319
-9002	-0.216	-0.173	299	342
-9507	-0.226	-0.184	322	367
-10005	-0.236	-0.190	343	391
-10199	-0.240	-0.193	352	400
Comments: Stiffness test after removing Panel 4				

Stiffness Test: 34		Date: 7/27/2005	Panel 1P, Cycle: 2132100	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Strain Gage 1 ($\mu\epsilon$)	Strain Gage 2 ($\mu\epsilon$)
0	0.000	0.000	0	0
-504	-0.024	-0.005	9	6
-1009	-0.040	-0.014	20	13
-1500	-0.053	-0.022	31	19
-2005	-0.066	-0.036	44	28
-2512	-0.079	-0.043	56	36
-2999	-0.091	-0.060	68	50
-3495	-0.103	-0.068	83	71
-4009	-0.115	-0.081	100	97
-4502	-0.126	-0.090	117	125
-5007	-0.138	-0.096	136	156
-5511	-0.148	-0.110	155	187
-6010	-0.159	-0.121	175	216
-6500	-0.169	-0.129	194	244
-7008	-0.179	-0.138	216	273
-7495	-0.189	-0.146	237	300
-8007	-0.200	-0.154	259	327
-8505	-0.209	-0.169	281	352
-9007	-0.219	-0.176	303	377
-9498	-0.229	-0.186	325	401
-10006	-0.239	-0.193	348	426
-10203	-0.243	-0.195	357	435
Comments:				

Stiffness Test: 35		Date: 7/28/2005	Panel 1P, Cycle: 2208618	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Strain Gage 1 ($\mu\epsilon$)	Strain Gage 2 ($\mu\epsilon$)
0	0.000	0.000	0	0
-508	-0.029	-0.005	10	6
-1006	-0.044	-0.013	21	13
-1512	-0.058	-0.029	32	21
-2011	-0.071	-0.034	44	30
-2506	-0.084	-0.052	55	37
-3002	-0.097	-0.060	68	53
-3498	-0.108	-0.071	83	74
-4009	-0.120	-0.083	99	100
-4508	-0.132	-0.088	117	130
-5010	-0.142	-0.100	135	161
-5521	-0.153	-0.114	155	193
-6002	-0.163	-0.122	175	222
-6500	-0.174	-0.130	197	252
-6997	-0.184	-0.139	218	279
-7504	-0.194	-0.146	241	307
-8015	-0.204	-0.159	262	333
-8499	-0.214	-0.169	284	358
-9016	-0.224	-0.177	307	383
-9521	-0.234	-0.184	329	409
-10022	-0.244	-0.191	352	433
-10206	-0.248	-0.198	361	444
Comments:				

Stiffness Test: 36		Date: 7/29/2005	Panel 1P, Cycle: 2390808	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Strain Gage 1 ($\mu\epsilon$)	Strain Gage 2 ($\mu\epsilon$)
-5	0.000	0.000	0	0
-508	-0.021	-0.004	8	4
-1007	-0.037	-0.011	18	11
-1505	-0.051	-0.029	29	18
-2021	-0.064	-0.033	40	27
-2512	-0.077	-0.051	52	43
-3011	-0.089	-0.059	66	64
-3510	-0.101	-0.070	82	91
-4014	-0.113	-0.080	100	122
-4496	-0.123	-0.086	118	153
-4998	-0.134	-0.096	137	184
-5501	-0.145	-0.110	157	216
-6005	-0.156	-0.120	178	246
-6495	-0.166	-0.129	199	275
-7006	-0.176	-0.136	222	304
-7513	-0.187	-0.144	246	333
-8001	-0.196	-0.156	268	359
-8494	-0.206	-0.166	291	384
-9005	-0.216	-0.177	313	409
-9507	-0.226	-0.184	336	432
-10002	-0.236	-0.190	359	457
-10200	-0.240	-0.194	368	466

Stiffness Test: 37		Date: 7/30/2005	Panel 1P, Cycle: 2522065	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Strain Gage 1 ($\mu\epsilon$)	Strain Gage 2 ($\mu\epsilon$)
-2	0.000	0.000	-1	-1
-499	-0.058	-0.007	6	2
-1012	-0.074	-0.015	17	13
-1511	-0.089	-0.034	29	28
-2011	-0.103	-0.040	41	47
-2515	-0.117	-0.058	56	70
-3014	-0.130	-0.066	72	98
-3511	-0.142	-0.079	91	129
-4003	-0.153	-0.088	109	161
-4514	-0.165	-0.095	130	194
-5015	-0.176	-0.107	152	226
-5505	-0.187	-0.121	173	257
-6007	-0.198	-0.129	195	287
-6495	-0.209	-0.139	219	318
-7009	-0.219	-0.146	244	350
-7491	-0.229	-0.155	266	377
-7990	-0.240	-0.169	292	405
-8505	-0.250	-0.179	317	433
-9008	-0.260	-0.186	341	460
-9498	-0.270	-0.194	364	485
-9996	-0.280	-0.203	388	510
-10206	-0.284	-0.210	398	521
Comments:				

Stiffness Test: 38		Date: 8/1/2005	Panel 1P, Cycle: 2639065	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Strain Gage 1 ($\mu\epsilon$)	Strain Gage 2 ($\mu\epsilon$)
-2	0.000	0.000	0	0
-505	-0.028	-0.009	10	5
-1012	-0.046	-0.019	21	16
-1497	-0.060	-0.035	33	33
-2005	-0.074	-0.043	46	53
-2512	-0.089	-0.056	61	74
-3014	-0.102	-0.069	77	98
-3507	-0.115	-0.079	93	125
-4007	-0.128	-0.091	111	155
-4506	-0.139	-0.098	131	187
-5005	-0.151	-0.111	151	218
-5517	-0.162	-0.122	172	250
-5993	-0.173	-0.133	194	280
-6496	-0.184	-0.140	216	311
-6997	-0.194	-0.150	239	342
-7501	-0.205	-0.158	263	373
-8004	-0.216	-0.173	288	403
-8503	-0.227	-0.184	312	432
-9001	-0.237	-0.193	336	461
-9527	-0.247	-0.199	360	489
-10006	-0.257	-0.208	384	516
-10203	-0.262	-0.214	393	526
Comments: Failure, Fatigue crack in bottom steel plate along edge of fillet weld				

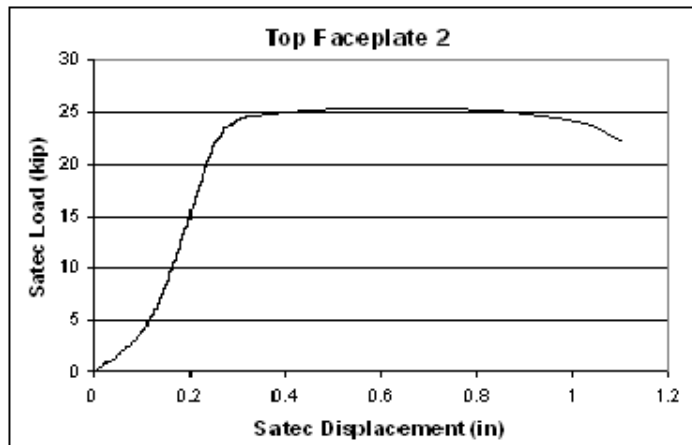
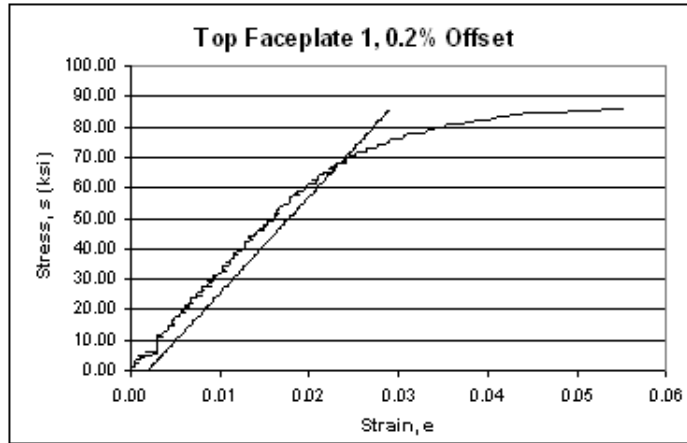
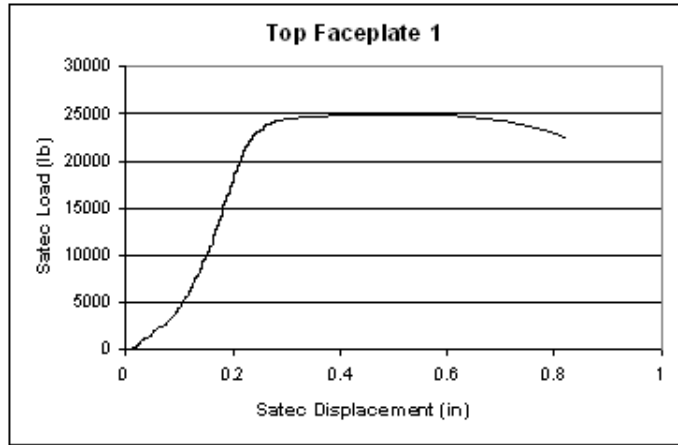
A.2 Dynamic Effects Test

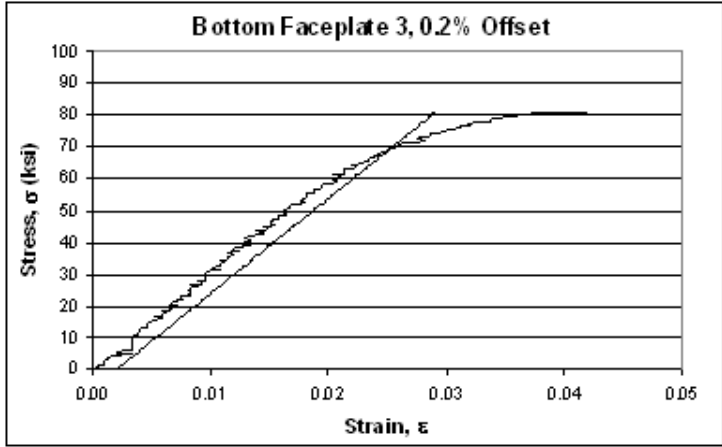
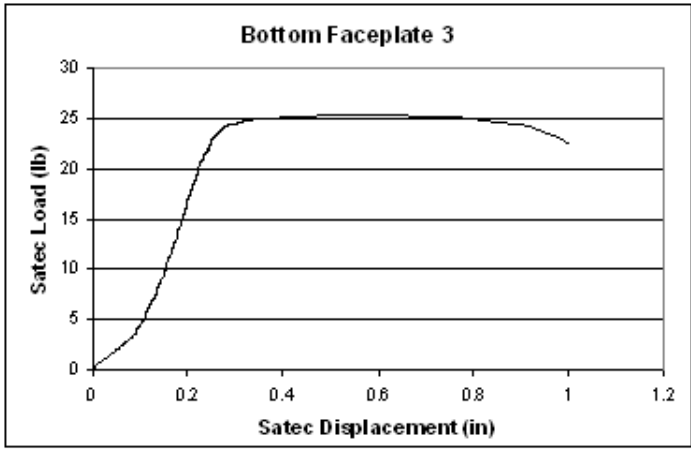
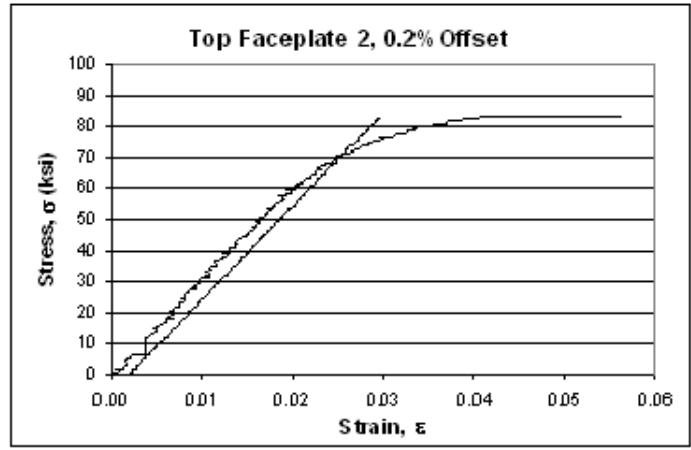
Dynamic Effects Test, at 2.1 Hz				
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Strain Gage 1 ($\mu\epsilon$)	Strain Gage 2 ($\mu\epsilon$)
-951	-0.071	-0.033	33	34
-952	-0.071	-0.033	33	34
-971	-0.071	-0.031	34	35
-1004	-0.071	-0.033	35	35
-1050	-0.072	-0.033	35	35
-1109	-0.074	-0.033	37	37
-1190	-0.076	-0.033	38	38
-1286	-0.078	-0.034	39	38
-1398	-0.081	-0.035	42	40
-1528	-0.084	-0.036	46	43
-1671	-0.087	-0.039	48	44
-1831	-0.091	-0.045	51	47
-2010	-0.095	-0.052	56	52
-2204	-0.099	-0.056	61	57
-2423	-0.104	-0.060	65	64
-2658	-0.109	-0.063	72	73
-2892	-0.115	-0.068	79	83
-3147	-0.121	-0.074	86	93
-3426	-0.127	-0.080	95	107
-3708	-0.133	-0.084	105	122
-3995	-0.139	-0.088	114	138
-4300	-0.145	-0.091	124	154
-4609	-0.151	-0.098	135	173
-4922	-0.157	-0.106	146	192
-5239	-0.164	-0.114	157	209
-5555	-0.170	-0.120	171	228
-5869	-0.176	-0.125	184	247
-6190	-0.182	-0.129	195	264
-6512	-0.189	-0.135	209	282
-6829	-0.195	-0.140	223	300
-7145	-0.201	-0.144	235	316
-7455	-0.206	-0.147	248	332
-7751	-0.212	-0.154	261	348
-8036	-0.217	-0.160	273	362
-8297	-0.222	-0.166	283	375
-8541	-0.227	-0.171	295	387
-8790	-0.231	-0.175	305	399
-9018	-0.235	-0.179	313	408
-9210	-0.239	-0.181	321	417
-9398	-0.242	-0.184	330	426
-9568	-0.245	-0.186	336	433
-9709	-0.248	-0.188	342	438
-9840	-0.251	-0.189	349	445
-9953	-0.253	-0.190	353	450
-10038	-0.255	-0.191	356	452
-10109	-0.256	-0.191	359	456
-10157	-0.257	-0.193	361	459
-10182	-0.257	-0.193	361	459
-10190	-0.257	-0.193	361	459

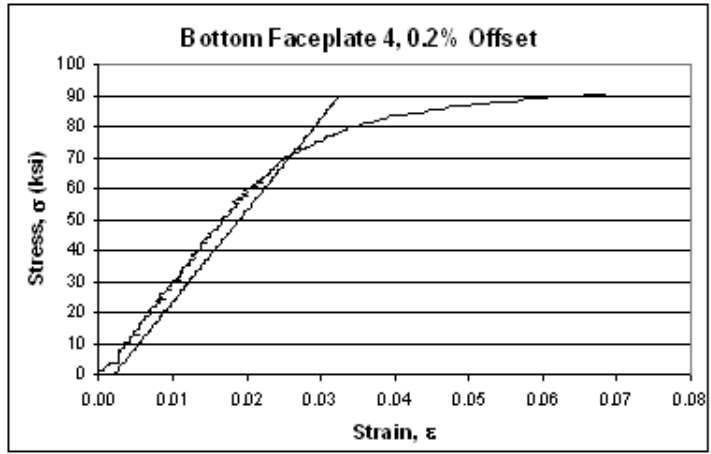
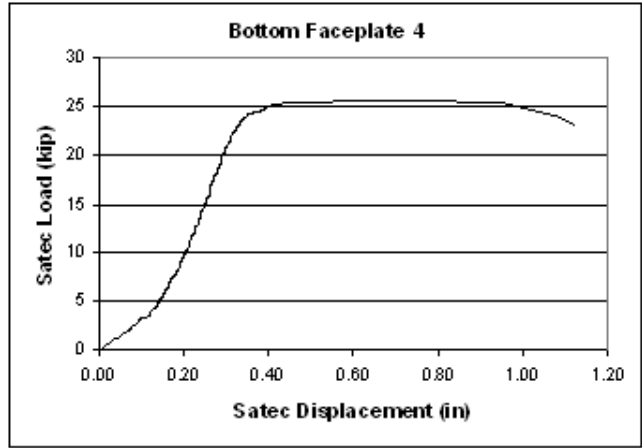
A.3 Structural Stresses for Test Series 1 and 2

	Draw Down Stresses		45.2 kN		Structural Stress Range		10% Offset	
	At Weld Toe	Above Weld Toe	At Weld Toe	Above Weld Toe	At Weld Toe	Above Weld Toe	At Weld Toe	Above Weld Toe
Position of Structural Stress	$\sigma_s = \sigma_b + \sigma_m$ (MPa)	$\sigma_s = \sigma_b + \sigma_m$ (MPa)	$\sigma_s = \sigma_b + \sigma_m$ (MPa)	$\sigma_s = \sigma_b + \sigma_m$ (MPa)	(MPa)	(MPa)	(MPa)	(MPa)
9.1	130.4	90.0	-259.3	332.4	-389.8	242.4	91.5	114.2
27.2	153.3	55.7	-291.3	338.3	-444.6	282.6	108.9	84.0
45.4	165.4	38.9	-290.1	334.0	-455.5	295.1	119.8	68.4
63.5	177.2	26.4	-290.7	331.6	-468.0	305.2	130.4	56.9
81.6	185.2	18.5	-289.5	329.1	-474.7	310.6	137.7	49.6
99.8	191.5	12.9	-288.3	326.9	-479.8	314.0	143.5	44.3
117.9	196.2	8.9	-287.1	325.1	-483.3	316.2	147.9	40.5
133.3	199.5	6.3	-286.4	324.1	-485.9	317.7	150.9	38.1
149.0	202.1	4.3	-286.0	323.4	-488.1	319.0	153.3	36.2
168.1	204.8	2.5	-285.7	322.8	-490.4	320.4	155.7	34.5
187.2	206.8	1.1	-285.6	322.6	-492.4	321.5	157.5	33.2
206.3	208.2	0.1	-285.6	322.5	-493.8	322.4	158.9	32.3
225.4	209.2	-0.6	-285.6	322.4	-494.8	323.0	159.7	31.7
244.5	209.7	-0.9	-285.6	322.4	-495.3	323.3	160.1	31.4
263.5	209.7	-0.9	-285.6	322.4	-495.3	323.3	160.1	31.4
282.6	209.2	-0.6	-285.6	322.4	-494.8	323.0	159.7	31.7
301.7	208.2	0.1	-285.6	322.5	-493.8	322.4	158.9	32.3
320.8	206.8	1.1	-285.6	322.6	-492.4	321.5	157.5	33.2
339.9	204.8	2.5	-285.7	322.8	-490.4	320.4	155.7	34.5
359.0	202.1	4.3	-286.0	323.4	-488.1	319.0	153.3	36.2
374.8	199.5	6.3	-286.4	324.1	-485.9	317.7	150.9	38.1
390.1	196.2	8.9	-287.1	325.1	-483.3	316.2	147.9	40.5
408.2	191.5	12.9	-288.3	326.9	-479.8	314.0	143.5	44.3
426.4	185.2	18.5	-289.5	329.1	-474.7	310.6	137.7	49.6
444.5	177.2	26.4	-290.7	331.6	-468.0	305.2	130.4	56.9
462.6	165.4	38.9	-290.1	334.0	-455.5	295.1	119.8	68.4
480.8	153.3	55.7	-291.3	338.3	-444.6	282.6	108.9	84.0
498.9	130.4	90.0	-259.3	332.4	-389.8	242.4	91.5	114.2

A.4 Coupon Test for Test Series 1 and 2







APPENDIX B:
EXPERIMENTAL RESULTS FOR TEST SERIES 2
PANELS A AND C

B.1 Stiffness Test for Test Series 2, Panels A and C

Stiffness Test: 1		Date: 9/12/2005		Panel A, Cycle: 1		Panel C, Cycle: 1	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Wire Pot 2 (in)	Strain Gage 1 ($\mu\epsilon$)	Strain Gage 2 ($\mu\epsilon$)	Strain Gage 3 ($\mu\epsilon$)	Strain Gage 4 ($\mu\epsilon$)
0	0.000	0.000	0.000	0	0	0	0
-1012	-0.066	-0.005	-0.007	13	15	14	16
-1995	-0.095	-0.018	-0.016	25	28	31	33
-3008	-0.120	-0.026	-0.023	38	42	51	52
-4015	-0.141	-0.035	-0.034	52	56	72	70
-5028	-0.159	-0.039	-0.039	68	72	91	88
-6008	-0.176	-0.054	-0.051	84	89	111	106
-7018	-0.192	-0.058	-0.057	100	107	131	125
-7997	-0.206	-0.064	-0.067	117	125	151	143
-9007	-0.219	-0.076	-0.071	134	144	171	163
-10011	-0.233	-0.085	-0.080	152	165	191	183
-11023	-0.246	-0.092	-0.092	171	184	212	203
-12013	-0.258	-0.101	-0.101	189	203	232	223
-13030	-0.270	-0.113	-0.108	208	222	251	244
-14023	-0.282	-0.118	-0.113	227	242	272	264
-15056	-0.294	-0.124	-0.129	246	262	293	286
-15982	-0.305	-0.134	-0.136	264	280	311	306
-17052	-0.317	-0.144	-0.143	285	301	333	328
-18035	-0.328	-0.154	-0.149	304	320	353	349
-19094	-0.340	-0.161	-0.163	325	341	374	371
-20025	-0.351	-0.170	-0.170	344	361	393	391
-20382	-0.356	-0.171	-0.170	351	368	400	399

Comments:

Stiffness Test: 2		Date: 9/12/2005		Panel A, Cycle: 10		Panel C, Cycle: 10	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Wire Pot 2 (in)	Strain Gage 1 ($\mu\epsilon$)	Strain Gage 2 ($\mu\epsilon$)	Strain Gage 3 ($\mu\epsilon$)	Strain Gage 4 ($\mu\epsilon$)
-2	0.000	0.000	0.000	0	0	0	0
-1003	-0.044	-0.005	-0.005	15	20	10	14
-2010	-0.062	-0.018	-0.011	29	38	25	31
-3000	-0.075	-0.031	-0.018	43	54	43	50
-4010	-0.088	-0.036	-0.023	58	72	61	69
-5022	-0.100	-0.045	-0.032	75	92	80	88
-6004	-0.112	-0.056	-0.044	93	112	99	108
-7008	-0.123	-0.061	-0.048	110	133	118	128
-8000	-0.134	-0.074	-0.060	128	153	137	148
-9010	-0.146	-0.083	-0.069	147	174	157	169
-10000	-0.156	-0.091	-0.076	165	194	176	190
-11004	-0.168	-0.100	-0.083	184	214	197	212
-12003	-0.178	-0.113	-0.090	203	234	216	233
-13023	-0.189	-0.116	-0.094	222	253	236	255
-14034	-0.200	-0.122	-0.110	241	273	257	276
-14984	-0.210	-0.134	-0.117	260	291	276	297
-16027	-0.221	-0.143	-0.124	280	311	296	319
-17032	-0.232	-0.154	-0.131	300	331	317	341
-18043	-0.242	-0.160	-0.140	319	350	337	363
-19035	-0.253	-0.169	-0.152	339	369	357	384
-19998	-0.263	-0.180	-0.159	358	387	376	404
-20402	-0.267	-0.185	-0.159	365	395	384	413

Stiffness Test: 3		Date: 9/12/2005		Panel A, Cycle 100		Panel C, Cycle: 100	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Wire Pot 2 (in)	Strain Gage 1 ($\mu\epsilon$)	Strain Gage 2 ($\mu\epsilon$)	Strain Gage 3 ($\mu\epsilon$)	Strain Gage 4 ($\mu\epsilon$)
-2	0.000	0.000	0.000	0	0	0	0
-1007	-0.046	-0.005	-0.002	14	19	9	13
-1990	-0.063	-0.019	-0.009	28	36	24	30
-3009	-0.077	-0.031	-0.016	43	53	43	48
-3986	-0.090	-0.036	-0.023	57	71	61	66
-4986	-0.102	-0.048	-0.032	74	91	79	85
-5981	-0.113	-0.056	-0.041	92	111	98	105
-7028	-0.125	-0.061	-0.051	110	132	118	126
-8087	-0.137	-0.075	-0.060	129	154	139	148
-9011	-0.148	-0.084	-0.067	146	173	157	167
-10026	-0.159	-0.091	-0.074	165	194	177	188
-11035	-0.170	-0.101	-0.080	184	214	198	210
-11999	-0.181	-0.113	-0.087	202	233	217	230
-13046	-0.192	-0.118	-0.099	222	253	237	252
-14034	-0.203	-0.124	-0.108	242	273	257	273
-15067	-0.214	-0.136	-0.115	262	293	279	296
-16056	-0.224	-0.145	-0.122	281	312	298	317
-17035	-0.235	-0.155	-0.129	300	330	318	338
-18044	-0.245	-0.160	-0.145	319	350	338	360
-19036	-0.255	-0.169	-0.152	338	368	357	381
-20091	-0.266	-0.182	-0.159	358	387	377	401
-20391	-0.270	-0.186	-0.163	365	394	385	410

Comments:

Stiffness Test: 4		Date: 9/12/2005		Panel A, Cycle 1000		Panel C, Cycle: 1000	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Wire Pot 2 (in)	Strain Gage 1 ($\mu\epsilon$)	Strain Gage 2 ($\mu\epsilon$)	Strain Gage 3 ($\mu\epsilon$)	Strain Gage 4 ($\mu\epsilon$)
-9	0.000	0.001	-0.002	0	0	0	0
-1033	-0.043	-0.006	-0.002	14	19	8	12
-2008	-0.060	-0.016	-0.009	27	34	21	26
-3086	-0.074	-0.031	-0.016	43	53	41	47
-4050	-0.087	-0.036	-0.025	58	71	58	65
-5030	-0.098	-0.049	-0.037	74	91	77	84
-6005	-0.110	-0.055	-0.044	92	111	96	102
-7021	-0.122	-0.064	-0.051	110	132	116	123
-8019	-0.133	-0.076	-0.057	127	153	135	143
-9005	-0.144	-0.084	-0.064	145	173	155	164
-10008	-0.155	-0.091	-0.071	164	193	175	184
-11012	-0.166	-0.100	-0.083	182	212	194	205
-12009	-0.177	-0.113	-0.094	201	232	214	227
-13005	-0.187	-0.116	-0.101	220	251	234	247
-14011	-0.198	-0.122	-0.108	239	271	254	269
-14995	-0.208	-0.135	-0.115	258	289	274	289
-16008	-0.219	-0.144	-0.124	277	309	294	311
-17003	-0.229	-0.154	-0.136	296	328	313	331
-18069	-0.240	-0.160	-0.143	317	348	334	354
-19061	-0.250	-0.168	-0.149	335	367	354	374
-20024	-0.260	-0.181	-0.156	354	384	372	394
-20399	-0.264	-0.184	-0.163	362	392	380	403

Comments:

Stiffness Test: 5		Date: 9/13/2005		Panel A, Cycle 10000		Panel C, Cycle: 10000	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Wire Pot 2 (in)	Strain Gage 1 ($\mu\epsilon$)	Strain Gage 2 ($\mu\epsilon$)	Strain Gage 3 ($\mu\epsilon$)	Strain Gage 4 ($\mu\epsilon$)
-2	0.000	-0.001	0.000	0	0	0	0
-1045	-0.056	-0.013	-0.007	13	16	14	17
-2019	-0.077	-0.021	-0.014	25	29	31	34
-3014	-0.096	-0.031	-0.021	39	43	51	51
-3998	-0.112	-0.035	-0.028	53	58	70	68
-5004	-0.126	-0.048	-0.034	69	76	89	86
-6017	-0.140	-0.054	-0.041	87	95	109	104
-7000	-0.153	-0.061	-0.055	105	115	129	123
-8007	-0.165	-0.074	-0.064	123	135	149	142
-9004	-0.177	-0.081	-0.071	140	155	169	161
-10008	-0.189	-0.090	-0.078	158	176	190	182
-11008	-0.200	-0.099	-0.085	177	196	209	202
-12010	-0.211	-0.110	-0.092	196	217	230	223
-13019	-0.222	-0.115	-0.103	215	237	249	244
-14015	-0.233	-0.120	-0.113	234	257	269	265
-15013	-0.244	-0.133	-0.120	253	277	289	286
-15992	-0.254	-0.141	-0.129	272	296	307	307
-17011	-0.265	-0.151	-0.136	291	316	327	328
-18009	-0.276	-0.158	-0.145	311	336	347	350
-18992	-0.286	-0.166	-0.156	329	354	366	370
-19996	-0.296	-0.176	-0.161	349	374	385	391
-20399	-0.301	-0.180	-0.161	357	382	393	400

Comments:

Stiffness Test: 6		Date: 9/13/2005		Panel A, Cycle 100000		Panel C, Cycle: 100000	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Wire Pot 2 (in)	Strain Gage 1 ($\mu\epsilon$)	Strain Gage 2 ($\mu\epsilon$)	Strain Gage 3 ($\mu\epsilon$)	Strain Gage 4 ($\mu\epsilon$)
0	0.000	0.000	0.000	0	0	0	0
-997	-0.050	-0.006	0.002	14	19	10	13
-2008	-0.067	-0.020	-0.005	28	35	27	29
-3025	-0.082	-0.025	-0.011	43	52	45	46
-4014	-0.095	-0.039	-0.021	59	70	64	64
-4992	-0.107	-0.044	-0.030	76	90	83	82
-6052	-0.120	-0.051	-0.041	95	112	104	102
-7015	-0.131	-0.063	-0.048	112	132	123	121
-8015	-0.143	-0.072	-0.055	130	154	144	141
-9007	-0.154	-0.081	-0.062	148	174	163	161
-10014	-0.165	-0.090	-0.069	166	195	184	182
-11006	-0.176	-0.101	-0.080	185	216	203	203
-11998	-0.187	-0.106	-0.092	204	235	223	223
-13002	-0.198	-0.113	-0.097	223	256	243	244
-14002	-0.208	-0.125	-0.106	242	275	263	266
-15033	-0.219	-0.135	-0.113	261	296	283	287
-15978	-0.229	-0.143	-0.126	280	314	301	307
-17040	-0.240	-0.150	-0.133	300	334	322	329
-18014	-0.251	-0.156	-0.138	318	353	341	350
-19004	-0.261	-0.171	-0.149	338	373	361	372
-20008	-0.271	-0.174	-0.161	358	392	380	392
-20405	-0.276	-0.177	-0.161	365	399	388	401

Comments:

Stiffness Test: 7		Date: 9/14/2005		Panel A, Cycle 208899		Panel C, Cycle: 208899	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Wire Pot 2 (in)	Strain Gage 1 ($\mu\epsilon$)	Strain Gage 2 ($\mu\epsilon$)	Strain Gage 3 ($\mu\epsilon$)	Strain Gage 4 ($\mu\epsilon$)
-9	0.000	0.000	0.000	0	-1	-1	-1
-1003	-0.039	-0.006	0.000	13	17	5	10
-2002	-0.055	-0.019	-0.007	27	34	17	26
-3016	-0.069	-0.025	-0.014	41	52	34	43
-4043	-0.082	-0.034	-0.021	57	70	53	62
-5033	-0.094	-0.044	-0.028	74	91	72	81
-6011	-0.105	-0.050	-0.034	91	111	91	99
-7011	-0.117	-0.063	-0.046	109	131	111	119
-8001	-0.128	-0.071	-0.057	126	152	131	139
-8998	-0.138	-0.080	-0.064	144	172	150	159
-10017	-0.150	-0.089	-0.071	163	194	171	180
-11020	-0.160	-0.100	-0.078	181	213	190	201
-12003	-0.170	-0.105	-0.087	200	233	210	221
-12997	-0.181	-0.111	-0.099	219	252	230	242
-14006	-0.191	-0.124	-0.108	238	272	249	264
-15001	-0.202	-0.131	-0.113	257	291	269	284
-16031	-0.212	-0.143	-0.120	277	311	289	305
-17054	-0.222	-0.147	-0.131	296	330	309	327
-18063	-0.233	-0.156	-0.143	315	349	328	347
-19015	-0.243	-0.169	-0.149	334	368	347	368
-20039	-0.253	-0.175	-0.154	354	387	367	388
-20400	-0.257	-0.177	-0.159	361	394	374	396
Comments:							

Stiffness Test: 8		Date: 9/15/2005		Panel A, Cycle 355555		Panel C, Cycle: 355555	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Wire Pot 2 (in)	Strain Gage 1 ($\mu\epsilon$)	Strain Gage 2 ($\mu\epsilon$)	Strain Gage 3 ($\mu\epsilon$)	Strain Gage 4 ($\mu\epsilon$)
-6	0.000	0.000	-0.002	0	0	0	0
-1016	-0.037	-0.003	-0.002	14	18	7	12
-2013	-0.053	-0.010	-0.009	27	36	18	27
-3000	-0.066	-0.024	-0.023	42	52	34	44
-4009	-0.079	-0.029	-0.023	57	70	52	63
-5033	-0.091	-0.041	-0.037	75	91	71	82
-5993	-0.102	-0.050	-0.044	92	112	90	101
-7012	-0.114	-0.060	-0.051	110	133	112	121
-7989	-0.124	-0.068	-0.062	127	153	131	141
-9024	-0.135	-0.079	-0.067	146	173	151	161
-10017	-0.145	-0.084	-0.076	164	194	171	182
-11012	-0.156	-0.089	-0.087	182	213	190	202
-12015	-0.166	-0.100	-0.094	202	233	210	224
-12994	-0.176	-0.110	-0.101	220	252	229	244
-14003	-0.187	-0.121	-0.108	239	271	249	265
-15003	-0.197	-0.126	-0.115	258	290	268	286
-16037	-0.207	-0.135	-0.129	278	310	288	307
-16996	-0.217	-0.143	-0.136	296	327	306	327
-18000	-0.227	-0.154	-0.143	315	346	325	348
-18996	-0.237	-0.156	-0.149	333	365	344	368
-20014	-0.247	-0.171	-0.156	353	384	364	388
-20402	-0.252	-0.175	-0.163	361	392	371	397
Comments:							

Stiffness Test: 9		Date: 9/20/2005		Panel A, Cycle 538300		Panel C, Cycle: 538300	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Wire Pot 2 (in)	Strain Gage 1 ($\mu\epsilon$)	Strain Gage 2 ($\mu\epsilon$)	Strain Gage 3 ($\mu\epsilon$)	Strain Gage 4 ($\mu\epsilon$)
-9	0.000	0.001	-0.002	0	-1	0	0
-1001	-0.035	-0.003	0.000	13	17	6	11
-1998	-0.053	-0.016	-0.009	27	35	18	27
-3020	-0.067	-0.022	-0.023	42	52	35	45
-4001	-0.079	-0.030	-0.030	57	70	53	62
-5022	-0.091	-0.043	-0.037	76	92	73	82
-6031	-0.103	-0.051	-0.044	94	113	93	100
-7011	-0.114	-0.060	-0.051	111	133	113	120
-8013	-0.125	-0.069	-0.057	129	154	133	140
-9008	-0.136	-0.080	-0.069	147	175	152	159
-9971	-0.146	-0.085	-0.080	165	194	172	179
-11012	-0.157	-0.091	-0.087	183	214	192	200
-12039	-0.168	-0.104	-0.092	203	235	213	222
-12994	-0.178	-0.111	-0.101	221	254	232	242
-14026	-0.189	-0.122	-0.115	240	274	252	263
-14998	-0.198	-0.126	-0.122	258	291	270	282
-16016	-0.209	-0.135	-0.129	278	311	290	303
-17046	-0.219	-0.149	-0.133	296	329	310	324
-18026	-0.229	-0.154	-0.143	316	349	329	344
-19019	-0.239	-0.159	-0.156	334	367	347	364
-20025	-0.250	-0.173	-0.163	354	386	367	385
-20400	-0.254	-0.175	-0.163	362	394	375	393
Comments:							

Stiffness Test: 10		Date: 9/22/2005		Panel A, Cycle 559475		Panel C, Cycle: 559475a	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Wire Pot 2 (in)	Strain Gage 1 ($\mu\epsilon$)	Strain Gage 2 ($\mu\epsilon$)	Strain Gage 3 ($\mu\epsilon$)	Strain Gage 4 ($\mu\epsilon$)
-2	0.000	-0.001	0.000	0	0	0	0
-1041	-0.039	-0.013	-0.007	15	19	8	13
-2011	-0.056	-0.019	-0.009	29	38	22	29
-3078	-0.070	-0.026	-0.021	45	57	40	48
-4068	-0.083	-0.039	-0.028	62	77	58	66
-5117	-0.095	-0.045	-0.034	80	98	77	85
-6055	-0.106	-0.056	-0.041	97	118	97	103
-7047	-0.117	-0.066	-0.048	114	139	117	123
-8137	-0.129	-0.075	-0.055	134	162	138	144
-9065	-0.139	-0.083	-0.069	151	181	157	163
-10028	-0.149	-0.095	-0.076	168	200	176	183
-11059	-0.160	-0.100	-0.085	188	221	197	204
-12016	-0.170	-0.105	-0.092	205	239	215	224
-13123	-0.181	-0.114	-0.099	227	261	237	247
-14163	-0.192	-0.125	-0.108	246	281	257	268
-15047	-0.201	-0.135	-0.120	262	298	274	286
-16050	-0.211	-0.141	-0.126	281	317	295	308
-17095	-0.222	-0.151	-0.133	302	337	315	330
-18043	-0.231	-0.155	-0.140	318	354	333	348
-19041	-0.241	-0.170	-0.147	338	373	352	369
-20126	-0.252	-0.174	-0.161	358	393	372	391
-20396	-0.255	-0.175	-0.161	364	398	378	397
Comments:							

Stiffness Test: 11		Date: 9/26/2005		Panel A, Cycle 559475		Panel C, Cycle: 559475b	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Wire Pot 2 (in)	Strain Gage 1 ($\mu\epsilon$)	Strain Gage 2 ($\mu\epsilon$)	Strain Gage 3 ($\mu\epsilon$)	Strain Gage 4 ($\mu\epsilon$)
0	0.000	0.000	0.002	-1	-1	0	0
-1061	-0.090	-0.004	-0.007	13	14	15	18
-2024	-0.125	-0.016	-0.014	25	27	33	35
-3032	-0.157	-0.021	-0.021	36	39	53	52
-4012	-0.183	-0.032	-0.035	51	53	73	70
-4998	-0.206	-0.037	-0.042	66	67	94	87
-6005	-0.228	-0.050	-0.048	82	83	116	106
-7017	-0.248	-0.056	-0.065	100	100	137	126
-8006	-0.266	-0.065	-0.072	117	116	158	144
-8999	-0.284	-0.072	-0.079	134	133	179	164
-9997	-0.300	-0.078	-0.088	151	150	200	184
-11008	-0.316	-0.096	-0.095	170	169	220	205
-11984	-0.329	-0.100	-0.099	188	187	240	225
-12996	-0.343	-0.103	-0.113	205	206	260	247
-13991	-0.356	-0.117	-0.120	224	224	280	268
-15009	-0.369	-0.121	-0.127	242	243	301	290
-16007	-0.383	-0.134	-0.134	261	262	321	311
-16994	-0.395	-0.138	-0.148	279	280	340	332
-18011	-0.408	-0.144	-0.155	298	299	360	353
-18996	-0.422	-0.158	-0.164	317	320	380	376
-20001	-0.434	-0.171	-0.171	337	339	399	397
-20399	-0.440	-0.174	-0.178	345	349	407	406
Comments:							

Stiffness Test: 12		Date: 9/30/2005		Panel A, Cycle 816900		Panel C, Cycle: 816900	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Wire Pot 2 (in)	Strain Gage 1 ($\mu\epsilon$)	Strain Gage 2 ($\mu\epsilon$)	Strain Gage 3 ($\mu\epsilon$)	Strain Gage 4 ($\mu\epsilon$)
-2	0.000	0.000	-0.002	0	0	0	0
-1013	-0.035	-0.009	-0.009	14	17	8	13
-2001	-0.050	-0.012	-0.012	28	35	23	30
-3045	-0.063	-0.026	-0.021	43	52	40	49
-4052	-0.075	-0.039	-0.030	58	69	57	66
-5007	-0.086	-0.046	-0.037	76	90	76	85
-6002	-0.098	-0.055	-0.046	93	109	95	104
-7011	-0.109	-0.062	-0.053	110	128	115	123
-7998	-0.119	-0.068	-0.060	127	147	133	142
-9025	-0.130	-0.082	-0.069	147	168	153	163
-10042	-0.141	-0.091	-0.079	165	187	173	184
-11021	-0.151	-0.096	-0.088	184	207	192	204
-12021	-0.161	-0.110	-0.095	203	226	211	226
-13062	-0.171	-0.113	-0.102	222	246	231	246
-14023	-0.181	-0.126	-0.109	239	263	248	265
-15023	-0.191	-0.131	-0.115	258	282	268	287
-16040	-0.201	-0.137	-0.129	278	302	288	309
-17061	-0.211	-0.149	-0.136	297	320	307	330
-18014	-0.220	-0.159	-0.143	314	338	324	349
-19003	-0.231	-0.167	-0.150	331	354	342	367
-19998	-0.240	-0.173	-0.157	351	374	362	388
-20399	-0.245	-0.176	-0.164	359	381	370	397
Comments:							

Stiffness Test: 13		Date: 10/1/2005		Panel A, Cycle 1068555		Panel C, Cycle: 1068555	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Wire Pot 2 (in)	Strain Gage 1 ($\mu\epsilon$)	Strain Gage 2 ($\mu\epsilon$)	Strain Gage 3 ($\mu\epsilon$)	Strain Gage 4 ($\mu\epsilon$)
2	0.000	0.000	0.000	0	-1	0	0
-1024	-0.040	-0.005	-0.007	14	17	7	13
-2057	-0.055	-0.015	-0.007	28	35	20	29
-3096	-0.068	-0.025	-0.018	43	52	36	48
-4039	-0.080	-0.037	-0.028	58	70	53	65
-5001	-0.091	-0.049	-0.035	74	90	72	84
-6013	-0.103	-0.057	-0.042	93	110	92	103
-7034	-0.114	-0.065	-0.048	110	130	112	123
-7994	-0.125	-0.071	-0.055	127	148	130	142
-9005	-0.135	-0.080	-0.069	145	169	150	162
-9997	-0.146	-0.095	-0.076	164	188	169	183
-11008	-0.157	-0.098	-0.083	183	208	189	203
-12009	-0.167	-0.110	-0.092	201	227	207	224
-13005	-0.177	-0.117	-0.099	220	246	227	244
-14009	-0.187	-0.125	-0.111	239	265	246	265
-15001	-0.198	-0.136	-0.120	258	283	265	285
-16016	-0.208	-0.141	-0.125	277	302	285	307
-17006	-0.218	-0.152	-0.132	295	321	304	327
-17995	-0.228	-0.162	-0.145	314	339	323	347
-18993	-0.238	-0.172	-0.155	333	357	341	367
-20019	-0.248	-0.178	-0.162	352	377	361	388
-20400	-0.252	-0.179	-0.162	360	384	369	396
Comments:							

Stiffness Test: 14		Date: 10/2/2005		Panel A, Cycle 1252100		Panel C, Cycle: 1252100	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Wire Pot 2 (in)	Strain Gage 1 ($\mu\epsilon$)	Strain Gage 2 ($\mu\epsilon$)	Strain Gage 3 ($\mu\epsilon$)	Strain Gage 4 ($\mu\epsilon$)
2	0.000	0.001	0.000	0	-1	-1	-1
-1029	-0.038	-0.001	0.000	13	16	6	11
-1976	-0.054	-0.017	-0.007	26	32	17	27
-3035	-0.068	-0.022	-0.016	41	50	34	45
-4017	-0.080	-0.032	-0.025	57	70	52	64
-5005	-0.092	-0.046	-0.035	74	89	72	83
-6010	-0.103	-0.050	-0.044	92	109	91	101
-7006	-0.114	-0.059	-0.051	109	128	110	121
-8016	-0.126	-0.072	-0.058	127	148	130	141
-9014	-0.136	-0.081	-0.065	145	168	149	161
-10011	-0.147	-0.088	-0.072	164	188	168	181
-10982	-0.157	-0.095	-0.088	182	206	187	201
-12007	-0.168	-0.107	-0.092	202	226	207	223
-13005	-0.178	-0.116	-0.099	220	245	226	243
-13999	-0.188	-0.123	-0.109	239	264	245	263
-15015	-0.198	-0.134	-0.115	258	283	265	285
-16016	-0.209	-0.139	-0.129	276	302	284	305
-17010	-0.219	-0.147	-0.136	295	320	303	325
-18003	-0.228	-0.158	-0.143	314	338	321	345
-19000	-0.238	-0.164	-0.150	332	356	340	365
-20004	-0.248	-0.168	-0.157	352	375	359	386
-20399	-0.252	-0.172	-0.164	359	382	367	394
Comments:							

Stiffness Test: 15		Date: 10/3/2005		Panel A, Cycle 1372156		Panel C, Cycle: 1372156	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Wire Pot 2 (in)	Strain Gage 1 ($\mu\epsilon$)	Strain Gage 2 ($\mu\epsilon$)	Strain Gage 3 ($\mu\epsilon$)	Strain Gage 4 ($\mu\epsilon$)
2	0.000	0.000	0.002	0	0	0	0
-998	-0.037	-0.001	-0.007	14	17	8	13
-1996	-0.053	-0.007	-0.014	28	35	19	29
-2999	-0.066	-0.020	-0.021	41	51	34	46
-4038	-0.079	-0.029	-0.028	57	70	52	65
-4980	-0.090	-0.039	-0.035	74	89	70	84
-6000	-0.102	-0.050	-0.044	93	110	90	103
-7032	-0.113	-0.059	-0.051	110	130	110	124
-7997	-0.124	-0.067	-0.062	128	149	129	143
-9057	-0.135	-0.075	-0.072	145	169	148	163
-10054	-0.146	-0.081	-0.079	165	189	169	184
-10992	-0.156	-0.096	-0.085	182	208	187	203
-11993	-0.166	-0.103	-0.092	202	227	206	225
-13020	-0.176	-0.108	-0.099	220	246	225	244
-14023	-0.187	-0.121	-0.115	240	265	245	267
-15009	-0.196	-0.125	-0.120	256	282	263	284
-16002	-0.206	-0.137	-0.127	275	301	282	305
-17046	-0.217	-0.143	-0.134	297	321	303	328
-18021	-0.227	-0.149	-0.143	314	339	321	348
-18995	-0.236	-0.162	-0.157	333	357	340	368
-20010	-0.246	-0.173	-0.162	352	376	359	388
-20399	-0.250	-0.177	-0.164	360	384	367	397
Comments:							

Stiffness Test: 16		Date: 10/4/2005		Panel A, Cycle 1554010		Panel C, Cycle: 1554010	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Wire Pot 2 (in)	Strain Gage 1 ($\mu\epsilon$)	Strain Gage 2 ($\mu\epsilon$)	Strain Gage 3 ($\mu\epsilon$)	Strain Gage 4 ($\mu\epsilon$)
-2	0.000	0.000	0.000	-1	-1	-1	-1
-1004	-0.037	-0.005	-0.005	12	15	6	11
-2005	-0.052	-0.016	-0.007	26	32	17	27
-3008	-0.066	-0.026	-0.016	41	50	33	45
-4023	-0.078	-0.035	-0.023	56	68	50	63
-4975	-0.089	-0.049	-0.032	72	87	68	81
-6002	-0.101	-0.054	-0.044	90	108	88	101
-7998	-0.123	-0.072	-0.058	126	147	127	141
-8993	-0.134	-0.078	-0.065	142	166	146	160
-8993	-0.134	-0.081	-0.072	144	167	147	162
-10006	-0.145	-0.095	-0.076	162	185	165	180
-11030	-0.155	-0.100	-0.083	180	205	185	201
-11981	-0.166	-0.112	-0.090	200	225	205	223
-13001	-0.176	-0.118	-0.097	218	243	223	242
-14041	-0.186	-0.122	-0.104	238	262	243	264
-15044	-0.196	-0.134	-0.115	255	281	262	283
-16016	-0.206	-0.138	-0.125	274	300	281	305
-16999	-0.216	-0.148	-0.129	291	316	298	323
-18015	-0.226	-0.159	-0.139	311	336	318	345
-19000	-0.236	-0.172	-0.148	331	355	338	366
-20010	-0.246	-0.177	-0.162	351	374	357	386
-20399	-0.250	-0.178	-0.157	357	380	364	394
Comments:							

Stiffness Test: 17		Date: 10/5/2005		Panel A, Cycle 1736600		Panel C, Cycle: 1736600	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Wire Pot 2 (in)	Strain Gage 1 ($\mu\epsilon$)	Strain Gage 2 ($\mu\epsilon$)	Strain Gage 3 ($\mu\epsilon$)	Strain Gage 4 ($\mu\epsilon$)
2	0.000	0.001	-0.002	0	0	0	0
-1012	-0.042	0.000	0.000	14	17	7	12
-2010	-0.058	-0.010	-0.007	27	34	18	28
-3019	-0.071	-0.024	-0.021	42	52	35	46
-4017	-0.084	-0.035	-0.028	57	70	52	64
-5004	-0.095	-0.047	-0.037	75	91	72	84
-6017	-0.107	-0.055	-0.044	94	111	91	104
-6995	-0.117	-0.064	-0.051	110	130	110	122
-8029	-0.128	-0.071	-0.058	127	149	129	141
-9010	-0.139	-0.076	-0.065	146	169	148	162
-10009	-0.149	-0.087	-0.076	164	188	167	182
-10985	-0.159	-0.098	-0.083	183	208	186	202
-12028	-0.170	-0.103	-0.092	203	228	206	224
-13051	-0.181	-0.117	-0.099	222	247	226	246
-13983	-0.190	-0.121	-0.106	240	264	244	265
-15003	-0.200	-0.133	-0.120	259	284	263	285
-15993	-0.210	-0.139	-0.127	277	301	282	306
-17000	-0.220	-0.146	-0.134	296	321	301	327
-18006	-0.230	-0.157	-0.141	315	339	320	347
-19022	-0.240	-0.167	-0.148	334	358	340	368
-20007	-0.250	-0.176	-0.162	354	377	359	388
-20400	-0.254	-0.178	-0.162	360	384	366	396

Comments:

Stiffness Test: 18		Date: 10/6/2005		Panel A, Cycle 1899000		Panel C, Cycle: 1899000	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Wire Pot 2 (in)	Strain Gage 1 ($\mu\epsilon$)	Strain Gage 2 ($\mu\epsilon$)	Strain Gage 3 ($\mu\epsilon$)	Strain Gage 4 ($\mu\epsilon$)
-2	0.000	0.000	0.000	0	0	0	0
-1012	-0.039	0.000	0.000	14	18	8	13
-2004	-0.055	-0.015	-0.007	27	34	18	28
-3008	-0.068	-0.026	-0.014	42	52	34	46
-3997	-0.080	-0.036	-0.021	58	71	52	64
-5004	-0.092	-0.049	-0.035	75	91	71	83
-6004	-0.104	-0.056	-0.042	93	111	90	102
-7066	-0.115	-0.065	-0.048	111	131	110	122
-8024	-0.126	-0.072	-0.055	129	151	129	141
-9014	-0.136	-0.078	-0.065	147	170	148	162
-9999	-0.147	-0.092	-0.072	165	190	167	181
-11011	-0.158	-0.101	-0.083	184	210	187	202
-12009	-0.168	-0.106	-0.090	202	228	205	222
-13013	-0.178	-0.120	-0.097	222	247	225	243
-13997	-0.188	-0.125	-0.104	241	267	244	264
-14992	-0.198	-0.137	0.194	260	285	264	284
-16008	-0.209	-0.141	-0.115	278	303	282	305
-17011	-0.218	-0.147	-0.134	297	323	302	326
-18008	-0.228	-0.159	-0.141	316	341	320	346
-19019	-0.238	-0.169	-0.145	335	359	339	366
-20013	-0.249	-0.178	-0.155	355	379	358	386
-20397	-0.252	-0.181	-0.162	361	385	366	394

Comments:

Stiffness Test: 19		Date: 10/7/2005		Panel A, Cycle 2076200		Panel C, Cycle: 2076200	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Wire Pot 2 (in)	Strain Gage 1 ($\mu\epsilon$)	Strain Gage 2 ($\mu\epsilon$)	Strain Gage 3 ($\mu\epsilon$)	Strain Gage 4 ($\mu\epsilon$)
-2	0.000	-0.002	0.000	0	0	0	0
-993	-0.035	-0.009	-0.005	14	18	8	13
-2031	-0.051	-0.019	-0.009	28	35	19	29
-3008	-0.064	-0.029	-0.023	43	52	35	47
-4036	-0.076	-0.037	-0.023	59	72	53	66
-4969	-0.088	-0.046	-0.037	76	91	71	83
-6004	-0.099	-0.050	-0.043	95	113	91	104
-7011	-0.110	-0.057	-0.050	112	132	111	123
-8007	-0.121	-0.071	-0.059	131	153	130	142
-9043	-0.132	-0.077	-0.073	150	173	149	163
-9987	-0.142	-0.085	-0.080	168	192	168	182
-11004	-0.153	-0.093	-0.084	187	212	188	203
-12018	-0.163	-0.099	-0.091	206	231	207	224
-12997	-0.173	-0.108	-0.105	225	250	226	244
-13989	-0.183	-0.112	-0.112	243	268	245	265
-15035	-0.193	-0.121	-0.119	263	288	264	286
-16007	-0.203	-0.130	-0.128	281	306	283	306
-17010	-0.213	-0.139	-0.137	299	324	302	326
-18014	-0.223	-0.146	-0.148	318	343	321	346
-19001	-0.233	-0.151	-0.155	338	362	340	367
-20034	-0.243	-0.153	-0.164	357	380	359	387
-20396	-0.247	-0.170	-0.169	363	387	366	394

Comments:

Stiffness Test: 20		Date: 10/8/2005		Panel A, Cycle 2255720		Panel C, Cycle: 2255720	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Wire Pot 2 (in)	Strain Gage 1 ($\mu\epsilon$)	Strain Gage 2 ($\mu\epsilon$)	Strain Gage 3 ($\mu\epsilon$)	Strain Gage 4 ($\mu\epsilon$)
0	0.000	0.000	0.000	0	0	0	0
-1010	-0.034	-0.009	0.000	12	16	6	11
-2004	-0.049	-0.016	-0.007	26	33	17	27
-3014	-0.062	-0.029	-0.014	41	51	34	45
-3980	-0.074	-0.039	-0.023	56	70	51	63
-5010	-0.086	-0.047	-0.032	74	91	71	82
-6007	-0.097	-0.055	-0.043	92	111	90	101
-7003	-0.108	-0.062	-0.050	110	130	109	121
-8013	-0.119	-0.069	-0.057	128	150	128	140
-9001	-0.130	-0.082	-0.064	148	171	148	161
-10013	-0.140	-0.092	-0.071	167	191	167	182
-11015	-0.151	-0.098	-0.078	185	210	186	201
-11996	-0.161	-0.108	-0.091	203	228	205	221
-13026	-0.171	-0.115	-0.098	223	248	225	243
-14031	-0.181	-0.126	-0.107	242	267	244	264
-15007	-0.192	-0.131	-0.114	260	286	263	284
-16013	-0.202	-0.140	-0.121	279	304	282	304
-16996	-0.211	-0.150	-0.135	298	323	301	325
-18024	-0.222	-0.158	-0.142	317	342	320	346
-19022	-0.231	-0.167	-0.148	336	360	338	365
-19999	-0.241	-0.174	-0.155	355	379	357	385
-20399	-0.245	-0.176	-0.162	362	386	365	393

Comments:

Stiffness Test: 21		Date: 10/10/2005		Panel A, Cycle 2546800		Panel C, Cycle: 2546800	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Wire Pot 2 (in)	Strain Gage 1 ($\mu\epsilon$)	Strain Gage 2 ($\mu\epsilon$)	Strain Gage 3 ($\mu\epsilon$)	Strain Gage 4 ($\mu\epsilon$)
0	0.000	0.000	0.000	0	0	0	0
-980	-0.036	-0.006	-0.007	13	17	7	12
-1990	-0.052	-0.014	-0.014	27	34	18	28
-3002	-0.065	-0.025	-0.014	42	51	34	46
-4015	-0.077	-0.036	-0.027	58	71	52	65
-5004	-0.088	-0.043	-0.037	75	91	71	83
-5982	-0.099	-0.052	-0.043	94	111	90	103
-6986	-0.110	-0.060	-0.053	111	130	109	121
-8000	-0.121	-0.068	-0.064	130	150	129	142
-9005	-0.132	-0.079	-0.071	149	170	148	162
-10017	-0.143	-0.088	-0.078	167	190	168	182
-11009	-0.152	-0.096	-0.084	186	209	186	202
-12001	-0.163	-0.105	-0.096	205	229	205	223
-13028	-0.173	-0.112	-0.105	224	247	225	244
-13991	-0.183	-0.122	-0.112	243	266	244	265
-15128	-0.194	-0.128	-0.121	263	286	265	287
-16004	-0.203	-0.137	-0.128	280	303	281	305
-17011	-0.213	-0.147	-0.137	299	321	300	326
-17982	-0.222	-0.156	-0.148	316	339	319	345
-19013	-0.233	-0.166	-0.155	336	359	338	367
-19996	-0.242	-0.172	-0.162	355	377	357	386
-20400	-0.246	-0.173	-0.164	363	385	365	395

Comments:

Stiffness Test: 22		Date: 10/11/2005		Panel A, Cycle 2764900		Panel C, Cycle: 2764900	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Wire Pot 2 (in)	Strain Gage 1 ($\mu\epsilon$)	Strain Gage 2 ($\mu\epsilon$)	Strain Gage 3 ($\mu\epsilon$)	Strain Gage 4 ($\mu\epsilon$)
0	0.000	0.000	0.000	0	0	0	0
-1016	-0.035	-0.011	-0.005	14	18	8	13
-1988	-0.049	-0.016	-0.011	27	34	19	28
-3032	-0.063	-0.027	-0.014	41	51	34	46
-4010	-0.075	-0.039	-0.027	58	71	52	65
-5010	-0.087	-0.049	-0.034	75	91	71	83
-6017	-0.099	-0.056	-0.046	95	112	91	103
-7032	-0.110	-0.063	-0.050	112	132	110	122
-8001	-0.120	-0.071	-0.064	130	152	129	141
-9013	-0.131	-0.079	-0.071	150	172	148	162
-10020	-0.142	-0.094	-0.075	168	191	167	182
-10997	-0.152	-0.099	-0.084	187	211	186	202
-12010	-0.162	-0.110	-0.089	205	230	205	223
-13016	-0.173	-0.117	-0.105	225	249	225	244
-14006	-0.182	-0.124	-0.112	244	268	244	264
-15004	-0.192	-0.133	-0.119	261	286	263	283
-16013	-0.202	-0.140	-0.126	281	305	282	305
-17010	-0.212	-0.151	-0.137	300	324	301	326
-17989	-0.222	-0.160	-0.146	318	341	319	345
-19001	-0.232	-0.170	-0.153	337	360	338	365
-20001	-0.242	-0.177	-0.160	356	379	357	385
-20397	-0.246	-0.179	-0.164	364	386	364	393

Comments:

Stiffness Test: 23		Date: 10/12/2005		Panel A, Cycle: 2943700		Panel C, Cycle: 2943700	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Wire Pot 2 (in)	Strain Gage 1 ($\mu\epsilon$)	Strain Gage 2 ($\mu\epsilon$)	Strain Gage 3 ($\mu\epsilon$)	Strain Gage 4 ($\mu\epsilon$)
0	0.000	0.000	0.000	0	0	0	0
-1000	-0.033	-0.004	-0.002	13	16	6	11
-1990	-0.049	-0.014	-0.007	27	33	16	26
-2976	-0.062	-0.023	-0.016	41	51	30	43
-4009	-0.075	-0.033	-0.027	57	70	48	62
-5036	-0.087	-0.042	-0.037	75	91	68	81
-6000	-0.098	-0.051	-0.043	93	110	87	99
-7005	-0.109	-0.059	-0.053	111	130	106	119
-8012	-0.120	-0.068	-0.064	129	151	125	138
-8999	-0.130	-0.079	-0.071	147	169	143	156
-10005	-0.141	-0.087	-0.078	165	188	162	176
-11009	-0.151	-0.095	-0.084	183	207	181	196
-12010	-0.161	-0.105	-0.091	204	228	201	218
-12994	-0.171	-0.112	-0.105	223	247	220	239
-14012	-0.182	-0.121	-0.112	242	266	240	259
-15047	-0.192	-0.128	-0.119	261	285	259	280
-16010	-0.202	-0.136	-0.126	279	303	278	300
-17032	-0.212	-0.146	-0.137	299	322	297	321
-18001	-0.221	-0.154	-0.148	316	340	315	341
-19016	-0.232	-0.164	-0.153	336	359	335	361
-20014	-0.242	-0.170	-0.160	355	378	353	381
-20397	-0.246	-0.172	-0.160	361	384	360	387

Comments:

Stiffness Test: 24		Date: 10/13/2005		Panel A, Cycle: 3079735		Panel C, Cycle: 3079735	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Wire Pot 2 (in)	Strain Gage 1 ($\mu\epsilon$)	Strain Gage 2 ($\mu\epsilon$)	Strain Gage 3 ($\mu\epsilon$)	Strain Gage 4 ($\mu\epsilon$)
0	0.000	0.000	0.002	-1	-1	0	-1
-995	-0.037	-0.006	-0.007	13	16	7	12
-2011	-0.054	-0.017	-0.011	27	35	18	28
-3020	-0.067	-0.026	-0.018	42	52	34	45
-4009	-0.078	-0.037	-0.030	58	71	51	64
-5001	-0.090	-0.047	-0.039	75	91	70	83
-6005	-0.101	-0.055	-0.048	94	112	89	102
-6997	-0.112	-0.063	-0.055	112	131	108	121
-8013	-0.123	-0.071	-0.062	130	151	128	141
-9010	-0.134	-0.081	-0.073	149	171	147	161
-9991	-0.143	-0.091	-0.078	166	189	165	179
-11009	-0.154	-0.099	-0.091	187	209	185	201
-12024	-0.164	-0.105	-0.096	205	229	204	222
-12996	-0.174	-0.115	-0.103	223	247	222	241
-14009	-0.184	-0.124	-0.112	243	266	242	262
-14991	-0.194	-0.132	-0.119	260	284	261	282
-16008	-0.205	-0.140	-0.132	281	303	281	304
-17002	-0.215	-0.148	-0.139	299	322	299	324
-18014	-0.225	-0.157	-0.146	319	341	319	346
-19012	-0.234	-0.167	-0.153	337	358	337	364
-19998	-0.244	-0.177	-0.160	356	377	355	384
-20403	-0.248	-0.179	-0.167	364	385	363	392

Comments:

Stiffness Test: 25		Date: 10/14/2005		Panel A, Cycle: 3249000		Panel C, Cycle: 3249000	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Wire Pot 2 (in)	Strain Gage 1 ($\mu\epsilon$)	Strain Gage 2 ($\mu\epsilon$)	Strain Gage 3 ($\mu\epsilon$)	Strain Gage 4 ($\mu\epsilon$)
-2	0.000	0.000	0.000	0	0	0	0
-1018	-0.035	-0.009	0.000	14	18	8	13
-2007	-0.051	-0.021	-0.016	29	36	20	30
-3011	-0.063	-0.027	-0.023	43	52	35	47
-3995	-0.075	-0.039	-0.030	59	71	52	66
-4998	-0.086	-0.046	-0.037	76	91	71	84
-6028	-0.098	-0.053	-0.043	95	112	91	104
-7000	-0.109	-0.065	-0.057	113	131	110	124
-8019	-0.120	-0.073	-0.064	131	151	129	143
-8993	-0.130	-0.085	-0.071	150	170	147	162
-10013	-0.140	-0.091	-0.078	169	190	167	183
-10995	-0.150	-0.098	-0.084	188	209	186	203
-12006	-0.161	-0.108	-0.094	207	228	205	224
-13019	-0.171	-0.115	-0.105	225	247	224	244
-14018	-0.181	-0.124	-0.112	244	266	243	265
-15013	-0.191	-0.131	-0.119	261	283	262	285
-16007	-0.201	-0.141	-0.126	281	302	281	306
-16997	-0.211	-0.151	-0.139	299	320	299	326
-18052	-0.221	-0.160	-0.148	319	339	319	347
-19012	-0.231	-0.168	-0.155	338	358	338	367
-20001	-0.240	-0.173	-0.162	356	376	356	386
-20400	-0.244	-0.174	-0.162	364	383	363	394
Comments:							

Stiffness Test: 26		Date: 10/15/2005		Panel A, Cycle: 3570500		Panel C, Cycle: 3570500	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Wire Pot 2 (in)	Strain Gage 1 ($\mu\epsilon$)	26	Strain Gage 3 ($\mu\epsilon$)	Strain Gage 4 ($\mu\epsilon$)
0	0.000	0.000	0.000	0	0	0	0
-1012	-0.039	-0.005	0.000	13	16	6	11
-2007	-0.054	-0.016	-0.014	27	34	16	26
-3009	-0.068	-0.029	-0.021	41	51	30	43
-4004	-0.080	-0.036	-0.027	57	69	47	61
-5018	-0.092	-0.049	-0.039	75	89	67	80
-6016	-0.103	-0.058	-0.050	93	110	87	100
-7029	-0.114	-0.063	-0.055	110	129	105	118
-8015	-0.124	-0.071	-0.064	129	149	125	138
-9002	-0.135	-0.079	-0.071	148	168	144	157
-10017	-0.145	-0.094	-0.078	166	187	162	177
-11018	-0.156	-0.101	-0.091	185	207	182	198
-12007	-0.167	-0.110	-0.098	205	226	202	219
-12987	-0.176	-0.117	-0.103	219	241	217	235
-14063	-0.187	-0.124	-0.112	242	264	240	260
-16033	-0.206	-0.141	-0.130	279	300	277	300
-17000	-0.216	-0.150	-0.139	296	317	294	318
-18011	-0.226	-0.160	-0.146	315	336	313	339
-19013	-0.236	-0.170	-0.155	335	356	333	360
-20001	-0.246	-0.177	-0.160	353	373	351	379
-20397	-0.250	-0.179	-0.169	361	382	359	388
-20399	-0.251	-0.180	-0.169	363	382	360	389
Comments:							

Stiffness Test: 27		Date: 10/16/2005		Panel A, Cycle: 3903201		Panel C, Cycle: 3903201	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Wire Pot 2 (in)	Strain Gage 1 (me)	Strain Gage 2 (me)	Strain Gage 3 (me)	Strain Gage 4 (me)
-2	0.000	0.000	0.000	0	0	0	0
-914	-0.031	-0.007	-0.005	13	16	7	12
-2001	-0.048	-0.016	-0.014	27	34	17	28
-3005	-0.061	-0.029	-0.021	42	51	32	45
-4006	-0.073	-0.039	-0.030	58	70	50	64
-5005	-0.085	-0.049	-0.041	76	89	69	83
-5996	-0.096	-0.056	-0.050	93	108	88	101
-7011	-0.107	-0.063	-0.057	111	128	107	120
-8016	-0.118	-0.071	-0.064	129	147	126	140
-9016	-0.128	-0.081	-0.071	148	167	145	160
-10008	-0.139	-0.094	-0.082	166	186	164	180
-10992	-0.149	-0.098	-0.091	185	205	183	199
-12003	-0.159	-0.110	-0.098	204	224	202	220
-13005	-0.169	-0.117	-0.105	222	242	221	241
-14015	-0.179	-0.124	-0.112	241	261	240	261
-15013	-0.189	-0.133	-0.121	260	279	259	282
-15999	-0.199	-0.140	-0.135	277	297	277	301
-16985	-0.208	-0.148	-0.139	296	315	295	321
-18006	-0.218	-0.160	-0.148	315	334	314	341
-19006	-0.228	-0.170	-0.155	334	353	333	362
-20010	-0.238	-0.176	-0.162	353	371	352	382
-20400	-0.242	-0.179	-0.169	361	379	360	390
Comments:							

Stiffness Test: 28		Date: 10/17/2005		Panel A, Cycle: 4084000		Panel C, Cycle: 4084000	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Wire Pot 2 (in)	Strain Gage 1 (me)	Strain Gage 2 (me)	Strain Gage 3 (me)	Strain Gage 4 (me)
-2	0.000	0.000	0.000	0	-1	0	-1
-998	-0.034	-0.005	-0.007	14	17	8	12
-1978	-0.049	-0.017	-0.014	27	34	18	28
-3032	-0.063	-0.027	-0.021	43	52	33	45
-4000	-0.074	-0.037	-0.032	57	69	49	62
-5007	-0.086	-0.049	-0.043	76	90	68	82
-6010	-0.097	-0.056	-0.048	93	108	87	100
-7026	-0.109	-0.065	-0.057	112	129	107	120
-7990	-0.119	-0.071	-0.064	129	147	125	139
-9001	-0.130	-0.079	-0.073	147	167	144	159
-10011	-0.140	-0.094	-0.082	167	187	164	180
-11015	-0.151	-0.099	-0.091	186	206	183	200
-12007	-0.161	-0.108	-0.100	205	225	203	222
-13002	-0.171	-0.118	-0.105	222	244	221	241
-14003	-0.181	-0.124	-0.114	243	263	241	262
-15006	-0.192	-0.134	-0.128	260	281	259	282
-16004	-0.201	-0.140	-0.135	278	299	278	302
-17016	-0.211	-0.150	-0.142	298	318	297	323
-18001	-0.221	-0.160	-0.148	316	336	315	343
-19003	-0.231	-0.170	-0.158	335	355	334	363
-20002	-0.241	-0.179	-0.169	354	373	353	383
-20400	-0.245	-0.180	-0.169	362	381	361	391
Comments:							

Stiffness Test: 29		Date: 10/18/2005		Panel A, Cycle: 4326200		Panel C, Cycle: 4326200	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Wire Pot 2 (in)	Strain Gage 1 (me)	Strain Gage 2 (me)	Strain Gage 3 (me)	Strain Gage 4 (me)
0	0.000	0.001	0.007	0	-1	0	0
-1003	-0.035	-0.006	-0.002	13	17	8	12
-1987	-0.050	-0.014	-0.009	27	33	17	27
-3016	-0.064	-0.026	-0.016	41	50	30	44
-3992	-0.075	-0.037	-0.027	56	68	47	61
-5047	-0.087	-0.046	-0.037	74	88	67	81
-6002	-0.098	-0.053	-0.043	91	106	85	99
-7018	-0.109	-0.061	-0.050	109	127	104	119
-8041	-0.120	-0.069	-0.059	127	146	123	138
-9036	-0.130	-0.081	-0.068	147	166	143	159
-9999	-0.140	-0.091	-0.078	163	183	160	176
-11020	-0.151	-0.096	-0.087	183	203	180	198
-12015	-0.161	-0.107	-0.094	201	221	199	217
-13007	-0.171	-0.112	-0.098	220	241	218	238
-14002	-0.181	-0.122	-0.110	238	259	237	258
-14989	-0.191	-0.130	-0.121	256	277	255	278
-16005	-0.201	-0.136	-0.128	275	295	274	298
-17006	-0.211	-0.147	-0.135	293	313	293	319
-18006	-0.221	-0.157	-0.142	313	332	312	339
-19009	-0.231	-0.167	-0.151	332	351	331	359
-20011	-0.241	-0.172	-0.162	350	369	349	379
-20403	-0.245	-0.173	-0.162	357	376	357	387
Comments:							

Stiffness Test: 30		Date: 10/19/2005		Panel A, Cycle: 4591099		Panel C, Cycle: 4591099	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Wire Pot 2 (in)	Strain Gage 1 (me)	Strain Gage 2 (me)	Strain Gage 3 (me)	Strain Gage 4 (me)
0	0.000	0.000	-0.002	0	0	0	0
-1009	-0.034	-0.005	0.000	14	18	8	12
-2014	-0.050	-0.015	-0.009	27	34	17	26
-3008	-0.062	-0.020	-0.014	42	51	30	43
-4026	-0.074	-0.033	-0.025	58	70	48	62
-5027	-0.085	-0.037	-0.037	75	89	66	80
-6031	-0.097	-0.053	-0.043	93	109	85	99
-7012	-0.108	-0.060	-0.050	110	128	104	117
-8041	-0.118	-0.069	-0.057	129	148	123	138
-9059	-0.129	-0.075	-0.068	147	167	142	157
-9984	-0.139	-0.079	-0.078	165	185	160	176
-11006	-0.149	-0.096	-0.084	184	205	179	196
-12010	-0.159	-0.099	-0.091	202	223	198	216
-13030	-0.170	-0.114	-0.098	222	243	218	237
-14002	-0.179	-0.120	-0.107	239	260	236	257
-14998	-0.189	-0.127	-0.121	259	280	255	278
-16015	-0.199	-0.134	-0.128	277	298	274	298
-17011	-0.209	-0.141	-0.135	296	316	293	318
-18006	-0.219	-0.156	-0.142	314	334	311	338
-19012	-0.229	-0.160	-0.151	333	352	330	357
-20008	-0.239	-0.166	-0.162	352	371	349	377
-20400	-0.243	-0.174	-0.162	359	379	356	385
Comments:							

Stiffness Test: 31		Date: 10/20/2005		Panel A, Cycle: 4781000		Panel C, Cycle: 4781000	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Wire Pot 2 (in)	Strain Gage 1 (me)	Strain Gage 2 (me)	Strain Gage 3 (me)	Strain Gage 4 (me)
-2	0.000	0.000	0.000	0	0	0	0
-1018	-0.029	-0.005	0.000	14	18	8	12
-2007	-0.046	-0.015	-0.005	27	35	16	25
-3003	-0.059	-0.026	-0.018	41	52	29	41
-4009	-0.071	-0.037	-0.027	58	72	46	59
-5002	-0.083	-0.045	-0.034	77	93	65	78
-6005	-0.094	-0.053	-0.041	92	110	82	95
-7020	-0.105	-0.061	-0.048	111	131	103	115
-8018	-0.116	-0.069	-0.059	129	151	122	134
-9033	-0.127	-0.084	-0.068	149	171	142	155
-10013	-0.137	-0.089	-0.078	166	189	160	173
-11020	-0.148	-0.098	-0.082	185	208	179	193
-12010	-0.158	-0.107	-0.089	204	227	198	213
-13008	-0.168	-0.114	-0.100	223	247	218	234
-13994	-0.178	-0.124	-0.112	242	264	236	254
-15003	-0.188	-0.130	-0.119	260	283	255	274
-16015	-0.198	-0.140	-0.128	280	302	275	296
-17026	-0.208	-0.150	-0.135	298	320	293	315
-18006	-0.218	-0.160	-0.146	316	338	312	334
-19038	-0.228	-0.168	-0.153	335	357	331	355
-19988	-0.237	-0.172	-0.160	354	375	350	374
-20403	-0.242	-0.173	-0.160	363	384	358	384
Comments:							

Stiffness Test: 32		Date: 10/21/2005		Panel A, Cycle: 5031500		Panel C, Cycle: 5031500	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Wire Pot 2 (in)	Strain Gage 1 (me)	Strain Gage 2 (me)	Strain Gage 3 (me)	Strain Gage 4 (me)
-5	0.000	0.000	0.000	-1	-1	0	-1
-1010	-0.033	-0.009	-0.009	14	17	7	12
-1970	-0.048	-0.016	-0.016	27	35	16	25
-3000	-0.062	-0.029	-0.023	42	52	30	42
-4023	-0.074	-0.040	-0.030	59	72	48	60
-5010	-0.086	-0.049	-0.041	78	93	67	80
-5991	-0.097	-0.058	-0.050	95	113	86	98
-7012	-0.108	-0.065	-0.057	113	132	104	117
-8004	-0.119	-0.072	-0.064	132	152	124	138
-9028	-0.130	-0.085	-0.071	150	171	143	156
-10000	-0.140	-0.094	-0.082	170	191	162	177
-11014	-0.151	-0.101	-0.091	188	209	181	196
-12001	-0.161	-0.111	-0.098	206	228	200	216
-13007	-0.171	-0.117	-0.105	226	248	220	238
-13988	-0.181	-0.127	-0.114	244	266	238	257
-15023	-0.191	-0.133	-0.128	262	284	257	277
-16008	-0.201	-0.141	-0.135	283	304	277	299
-16999	-0.211	-0.152	-0.142	300	321	294	318
-18008	-0.221	-0.162	-0.148	319	339	313	338
-19015	-0.232	-0.172	-0.162	339	359	333	359
-20010	-0.242	-0.176	-0.162	357	378	352	379
-20400	-0.246	-0.179	-0.169	365	385	360	386
Comments:							

Stiffness Test: 33		Date: 10/22/2005		Panel A, Cycle: 5368700		Panel C, Cycle: 5368700	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Wire Pot 2 (in)	Strain Gage 1 (me)	Strain Gage 2 (me)	Strain Gage 3 (me)	Strain Gage 4 (me)
0	0.000	0.001	0.000	0	0	0	-1
-1009	-0.033	-0.004	0.000	14	17	8	12
-2043	-0.049	-0.015	-0.009	28	35	19	28
-3006	-0.062	-0.023	-0.016	43	52	33	45
-4012	-0.073	-0.035	-0.027	59	71	51	63
-5039	-0.085	-0.046	-0.037	78	91	70	83
-5994	-0.096	-0.053	-0.043	96	110	88	101
-7011	-0.107	-0.062	-0.050	114	130	108	120
-8018	-0.118	-0.069	-0.057	134	150	127	140
-9011	-0.128	-0.078	-0.064	152	169	146	160
-10009	-0.139	-0.088	-0.073	171	188	165	180
-11004	-0.149	-0.099	-0.084	190	208	184	200
-11999	-0.159	-0.105	-0.091	208	226	203	221
-12994	-0.169	-0.115	-0.098	227	245	222	241
-14005	-0.179	-0.121	-0.105	246	263	241	261
-15035	-0.189	-0.130	-0.112	264	282	260	282
-15999	-0.199	-0.137	-0.126	283	300	278	302
-17002	-0.209	-0.144	-0.132	301	318	296	322
-18020	-0.219	-0.154	-0.139	321	337	316	343
-18998	-0.228	-0.166	-0.146	339	355	334	362
-20004	-0.239	-0.174	-0.153	358	374	353	383
-20400	-0.243	-0.179	-0.162	366	381	360	391
Comments:							

Stiffness Test: 34		Date: 10/23/2005		Panel A, Cycle: 5561000		Panel C, Cycle: 5561000	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Wire Pot 2 (in)	Strain Gage 1 (me)	Strain Gage 2 (me)	Strain Gage 3 (me)	Strain Gage 4 (me)
0	0.000	0.000	0.000	0	0	0	0
-1015	-0.166	-0.005	-0.002	13	16	7	11
-1992	-0.181	-0.013	-0.007	28	35	17	26
-3016	-0.194	-0.023	-0.018	44	52	31	44
-4032	-0.206	-0.035	-0.030	61	72	49	63
-5013	-0.218	-0.043	-0.037	78	91	67	81
-6022	-0.229	-0.053	-0.043	95	109	85	99
-7040	-0.240	-0.061	-0.050	113	129	104	118
-8018	-0.251	-0.069	-0.057	133	149	124	138
-9019	-0.261	-0.076	-0.064	151	169	143	158
-10014	-0.271	-0.085	-0.075	169	186	162	176
-11000	-0.281	-0.098	-0.087	189	207	181	198
-11986	-0.291	-0.105	-0.091	206	224	199	216
-12982	-0.301	-0.112	-0.098	225	243	218	237
-14032	-0.312	-0.122	-0.105	246	263	238	259
-15036	-0.322	-0.128	-0.116	262	280	256	278
-15996	-0.331	-0.137	-0.126	281	299	275	298
-17013	-0.342	-0.144	-0.135	301	318	294	319
-17994	-0.351	-0.152	-0.139	318	334	311	338
-19010	-0.361	-0.164	-0.146	336	353	329	357
-20005	-0.371	-0.174	-0.158	357	373	349	379
-20397	-0.375	-0.179	-0.160	364	380	356	386
Comments:							

Stiffness Test: 35		Date: 10/24/2005		Panel A, Cycle: 5844400		Panel C, Cycle: 5844400	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Wire Pot 2 (in)	Strain Gage 1 (me)	Strain Gage 2 (me)	Strain Gage 3 (me)	Strain Gage 4 (me)
3	0.042	0.000	0.000	0	-1	0	-1
-1021	-0.169	-0.004	0.000	12	15	7	11
-1975	-0.184	-0.019	-0.014	25	32	15	24
-2987	-0.196	-0.027	-0.016	41	50	31	43
-4072	-0.209	-0.036	-0.021	57	68	48	61
-5007	-0.219	-0.047	-0.030	76	88	67	80
-6075	-0.231	-0.055	-0.043	95	108	87	100
-7002	-0.241	-0.062	-0.050	111	126	104	117
-8018	-0.252	-0.069	-0.055	129	144	123	136
-9034	-0.263	-0.078	-0.062	148	164	142	156
-10040	-0.273	-0.092	-0.071	168	184	162	178
-11065	-0.283	-0.098	-0.078	187	203	181	198
-12082	-0.293	-0.105	-0.089	206	222	200	218
-13054	-0.303	-0.115	-0.098	224	240	218	238
-13999	-0.313	-0.121	-0.105	242	258	236	257
-15009	-0.322	-0.131	-0.112	261	277	255	278
-16004	-0.332	-0.137	-0.119	278	294	273	298
-17020	-0.342	-0.144	-0.126	298	313	293	318
-17983	-0.352	-0.154	-0.139	314	329	309	336
-19003	-0.362	-0.166	-0.148	335	349	329	358
-20072	-0.372	-0.174	-0.153	354	368	348	378
-20397	-0.375	-0.177	-0.155	362	375	355	386
Comments:							

Stiffness Test: 36		Date: 10/25/2005		Panel A, Cycle: 6074000		Panel C, Cycle: 6074000	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Wire Pot 2 (in)	Strain Gage 1 (me)	Strain Gage 2 (me)	Strain Gage 3 (me)	Strain Gage 4 (me)
2	-0.008	0.000	0.000	0	0	0	0
-989	-0.168	-0.005	-0.007	14	17	8	13
-2014	-0.185	-0.016	-0.016	28	34	18	28
-3005	-0.197	-0.023	-0.023	43	52	33	46
-4070	-0.209	-0.036	-0.030	60	70	50	64
-5016	-0.220	-0.043	-0.037	78	89	68	83
-6029	-0.232	-0.051	-0.048	97	109	88	102
-7031	-0.242	-0.059	-0.057	114	128	106	121
-8004	-0.252	-0.066	-0.066	132	147	125	140
-9008	-0.263	-0.079	-0.073	150	166	144	159
-10003	-0.273	-0.087	-0.080	168	184	163	179
-10988	-0.284	-0.094	-0.089	189	204	182	200
-12070	-0.294	-0.105	-0.098	208	224	203	222
-12993	-0.304	-0.111	-0.107	224	240	220	240
-14044	-0.314	-0.120	-0.114	244	260	239	261
-15047	-0.324	-0.127	-0.121	264	279	258	282
-16085	-0.334	-0.133	-0.128	281	296	276	300
-17006	-0.343	-0.146	-0.142	299	314	294	321
-18015	-0.353	-0.156	-0.148	318	332	312	341
-19010	-0.363	-0.164	-0.155	336	350	331	360
-20022	-0.372	-0.170	-0.162	355	368	349	379
-20399	-0.376	-0.172	-0.162	362	375	356	387
Comments:							

Stiffness Test: 37		Date: 10/26/2005		Panel A, Cycle: 6356199		Panel C, Cycle: 6356199	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Wire Pot 2 (in)	Strain Gage 1 (me)	Strain Gage 2 (me)	Strain Gage 3 (me)	Strain Gage 4 (me)
-2	-0.026	0.000	0.000	0	0	0	0
-1010	-0.168	-0.011	-0.005	13	17	8	12
-2002	-0.183	-0.017	-0.011	27	34	17	27
-3009	-0.196	-0.029	-0.021	42	51	30	44
-4007	-0.208	-0.039	-0.025	58	69	47	62
-5001	-0.219	-0.049	-0.041	76	89	66	81
-6014	-0.231	-0.056	-0.048	94	107	85	99
-7060	-0.242	-0.063	-0.055	112	127	105	118
-8018	-0.252	-0.071	-0.064	131	147	124	139
-9001	-0.262	-0.079	-0.068	149	165	142	156
-10008	-0.273	-0.094	-0.078	168	185	162	178
-11006	-0.283	-0.099	-0.091	188	204	180	198
-12010	-0.293	-0.108	-0.098	205	222	199	217
-13020	-0.303	-0.115	-0.103	225	241	219	239
-14028	-0.313	-0.124	-0.112	243	259	237	258
-15021	-0.323	-0.133	-0.121	261	277	255	279
-16016	-0.334	-0.138	-0.132	281	297	275	300
-16988	-0.343	-0.148	-0.139	298	314	292	318
-18001	-0.353	-0.158	-0.146	317	332	311	339
-19009	-0.363	-0.168	-0.153	336	350	329	358
-19995	-0.372	-0.176	-0.160	354	367	347	377
-20400	-0.376	-0.179	-0.167	363	376	355	386
Comments:							

Stiffness Test: 38		Date: 10/27/2005		Panel A, Cycle: 6601300		Panel C, Cycle: 6601300	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Wire Pot 2 (in)	Strain Gage 1 (me)	Strain Gage 2 (me)	Strain Gage 3 (me)	Strain Gage 4 (me)
2	-0.118	0.000	0.000	-1	-1	-1	-1
-1012	-0.168	-0.011	-0.007	13	16	7	10
-1995	-0.183	-0.019	-0.011	24	31	15	22
-3014	-0.196	-0.032	-0.018	41	50	29	42
-4014	-0.208	-0.041	-0.027	57	68	46	60
-4995	-0.219	-0.049	-0.037	75	87	64	78
-6014	-0.231	-0.058	-0.048	95	108	84	98
-6988	-0.241	-0.065	-0.057	112	127	103	117
-7992	-0.251	-0.071	-0.062	129	144	121	134
-8999	-0.262	-0.084	-0.071	149	166	141	156
-10006	-0.273	-0.094	-0.078	168	184	160	175
-11004	-0.283	-0.099	-0.089	187	204	179	196
-12007	-0.293	-0.111	-0.098	205	222	198	216
-13010	-0.303	-0.115	-0.105	224	240	216	236
-14015	-0.313	-0.126	-0.112	242	258	235	255
-15015	-0.323	-0.133	-0.119	259	275	253	275
-16013	-0.333	-0.141	-0.132	280	296	273	297
-17006	-0.343	-0.151	-0.139	298	313	291	316
-17995	-0.352	-0.160	-0.144	316	330	308	334
-19003	-0.362	-0.170	-0.153	333	348	326	354
-20005	-0.372	-0.177	-0.160	353	367	345	374
-20400	-0.376	-0.179	-0.160	360	374	353	382
Comments:							

Stiffness Test: 39		Date: 10/28/2005		Panel A, Cycle: 6861000		Panel C, Cycle: 6861000	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Wire Pot 2 (in)	Strain Gage 1 (me)	Strain Gage 2 (me)	Strain Gage 3 (me)	Strain Gage 4 (me)
0	0.251	0.001	0.000	0	0	0	0
-1003	-0.168	-0.005	0.000	14	17	7	12
-2019	-0.183	-0.014	-0.007	28	35	17	27
-3002	-0.195	-0.023	-0.014	41	50	29	42
-3991	-0.207	-0.035	-0.021	57	68	46	60
-4998	-0.219	-0.043	-0.034	76	89	65	80
-6010	-0.230	-0.051	-0.041	94	107	84	98
-7002	-0.240	-0.058	-0.050	112	127	103	117
-8006	-0.251	-0.066	-0.057	129	145	122	136
-8989	-0.262	-0.079	-0.064	147	163	140	154
-9993	-0.272	-0.087	-0.071	165	182	159	174
-10983	-0.282	-0.094	-0.078	185	202	178	195
-11993	-0.292	-0.105	-0.084	203	220	197	214
-13016	-0.303	-0.111	-0.098	222	239	216	235
-14041	-0.313	-0.120	-0.105	241	257	235	255
-15001	-0.322	-0.126	-0.114	260	276	253	275
-16011	-0.332	-0.134	-0.119	278	294	272	296
-17026	-0.342	-0.146	-0.126	296	312	290	315
-18008	-0.352	-0.156	-0.137	315	330	308	334
-19003	-0.362	-0.164	-0.146	333	348	326	354
-20046	-0.372	-0.170	-0.155	353	367	346	374
-20402	-0.376	-0.172	-0.162	361	375	354	383
Comments:							

Stiffness Test: 40		Date: 10/29/2005		Panel A, Cycle: 7191000		Panel C, Cycle: 7191000	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Wire Pot 2 (in)	Strain Gage 1 (me)	Strain Gage 2 (me)	Strain Gage 3 (me)	Strain Gage 4 (me)
2	0.115	0.000	0.000	0	0	0	0
-1012	-0.168	-0.005	-0.007	14	17	8	12
-2014	-0.183	-0.015	-0.011	28	34	17	27
-3002	-0.195	-0.023	-0.018	43	51	31	44
-4020	-0.208	-0.037	-0.027	61	71	49	64
-5024	-0.220	-0.045	-0.034	78	90	68	82
-6033	-0.231	-0.051	-0.041	95	108	87	100
-7020	-0.242	-0.059	-0.048	113	127	106	119
-8012	-0.252	-0.066	-0.055	131	146	124	138
-9022	-0.262	-0.079	-0.062	150	165	143	158
-10048	-0.273	-0.087	-0.073	169	184	163	178
-11014	-0.283	-0.094	-0.082	187	203	181	198
-12024	-0.293	-0.104	-0.089	206	221	200	218
-13065	-0.303	-0.111	-0.096	225	240	219	239
-14002	-0.313	-0.121	-0.103	242	258	237	258
-15007	-0.323	-0.126	-0.112	261	276	256	278
-16004	-0.333	-0.134	-0.121	279	294	274	298
-17010	-0.342	-0.144	-0.132	298	312	292	318
-18001	-0.352	-0.154	-0.139	316	330	310	338
-18996	-0.361	-0.163	-0.146	335	348	328	357
-20014	-0.372	-0.168	-0.153	355	367	348	377
-20399	-0.375	-0.170	-0.160	362	374	355	385
Comments:							

Stiffness Test: 41		Date: 10/30/2005		Panel A, Cycle: 7463100		Panel C, Cycle: 7463100	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Wire Pot 2 (in)	Strain Gage 1 (me)	Strain Gage 2 (me)	Strain Gage 3 (me)	Strain Gage 4 (me)
0	0.029	0.000	0.002	0	0	0	-1
-1010	-0.167	-0.005	-0.007	13	17	7	12
-2022	-0.182	-0.017	-0.011	27	34	16	27
-3003	-0.194	-0.026	-0.021	42	51	30	43
-4017	-0.208	-0.037	-0.027	61	71	49	64
-4996	-0.218	-0.043	-0.034	77	89	66	81
-6043	-0.229	-0.050	-0.041	95	108	86	99
-7005	-0.240	-0.060	-0.048	112	126	104	117
-7989	-0.250	-0.069	-0.055	130	144	123	137
-9028	-0.261	-0.073	-0.066	148	164	142	156
-10064	-0.272	-0.087	-0.075	168	183	162	177
-11043	-0.282	-0.092	-0.082	186	202	180	197
-12051	-0.292	-0.104	-0.089	205	221	199	217
-12996	-0.301	-0.111	-0.096	222	238	217	236
-14043	-0.312	-0.117	-0.103	242	257	236	257
-15044	-0.322	-0.124	-0.112	260	275	255	277
-16027	-0.331	-0.132	-0.123	278	293	273	297
-17031	-0.341	-0.146	-0.130	297	311	291	316
-18015	-0.350	-0.153	-0.137	315	329	310	336
-19033	-0.361	-0.160	-0.146	334	348	328	356
-20010	-0.370	-0.166	-0.158	353	366	347	376
-20402	-0.375	-0.173	-0.162	361	374	355	384
Comments:							

Stiffness Test: 42		Date: 10/31/2005		Panel A, Cycle: 7660000		Panel C, Cycle: 7660000	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Wire Pot 2 (in)	Strain Gage 1 (me)	Strain Gage 2 (me)	Strain Gage 3 (me)	Strain Gage 4 (me)
0	0.053	0.001	0.000	-2	-2	-1	-1
-1013	-0.168	-0.005	-0.007	13	17	8	13
-2007	-0.182	-0.010	-0.014	26	33	16	26
-3008	-0.195	-0.025	-0.021	42	51	30	43
-4010	-0.207	-0.032	-0.027	56	67	45	60
-5031	-0.219	-0.036	-0.037	75	88	64	80
-6013	-0.230	-0.051	-0.050	94	107	84	99
-6982	-0.240	-0.061	-0.055	109	124	101	115
-8019	-0.251	-0.069	-0.064	129	145	121	137
-9027	-0.262	-0.075	-0.071	147	164	141	156
-10042	-0.272	-0.081	-0.078	166	183	160	176
-11018	-0.282	-0.095	-0.082	183	201	178	195
-12007	-0.293	-0.102	-0.089	201	219	196	214
-12996	-0.303	-0.111	-0.098	220	238	215	235
-13970	-0.312	-0.121	-0.110	238	256	234	254
-15004	-0.323	-0.124	-0.119	258	275	253	276
-15979	-0.333	-0.138	-0.126	274	291	270	294
-17005	-0.342	-0.146	-0.132	294	311	289	314
-18034	-0.352	-0.151	-0.139	313	329	308	334
-19003	-0.362	-0.156	-0.146	332	347	326	354
-20004	-0.372	-0.170	-0.158	351	366	345	374
-20402	-0.376	-0.172	-0.160	358	373	353	382
Comments:							

Stiffness Test: 43		Date: 11/2/2005		Panel A, Cycle: 8194001		Panel C, Cycle: 8194001	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Wire Pot 2 (in)	Strain Gage 1 (me)	Strain Gage 2 (me)	Strain Gage 3 (me)	Strain Gage 4 (me)
0	0.052	0.000	0.000	0	0	0	0
-1007	-0.166	-0.005	-0.002	13	17	7	12
-2025	-0.182	-0.017	-0.016	27	34	17	26
-3003	-0.194	-0.029	-0.023	42	51	29	43
-4041	-0.207	-0.037	-0.030	58	69	46	60
-5012	-0.218	-0.049	-0.037	76	88	64	79
-6017	-0.229	-0.056	-0.043	95	108	84	99
-6974	-0.240	-0.063	-0.050	111	126	103	116
-8030	-0.251	-0.071	-0.057	130	146	122	137
-9031	-0.261	-0.079	-0.066	148	165	141	156
-10026	-0.272	-0.094	-0.078	167	184	161	176
-11012	-0.282	-0.098	-0.084	185	202	179	195
-12010	-0.292	-0.108	-0.091	205	222	198	216
-13002	-0.302	-0.115	-0.098	222	239	216	235
-14025	-0.313	-0.124	-0.105	242	259	236	256
-14995	-0.322	-0.133	-0.114	260	276	254	276
-16002	-0.332	-0.140	-0.128	278	295	272	296
-17008	-0.342	-0.148	-0.135	297	313	291	316
-18023	-0.353	-0.160	-0.142	316	332	310	336
-19058	-0.362	-0.170	-0.153	335	350	329	356
-20014	-0.372	-0.176	-0.155	354	368	347	375
-20400	-0.376	-0.179	-0.162	360	375	354	383
Comments:							

Stiffness Test: 44		Date: 11/3/2005		Panel A, Cycle: 8450001		Panel C, Cycle: 8450001	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Wire Pot 2 (in)	Strain Gage 1 (me)	Strain Gage 2 (me)	Strain Gage 3 (me)	Strain Gage 4 (me)
0	0.115	0.001	0.000	1	1	1	1
-1015	-0.166	-0.009	0.000	14	18	9	13
-2016	-0.182	-0.019	-0.007	29	36	19	28
-2997	-0.195	-0.031	-0.021	43	52	30	44
-4014	-0.207	-0.040	-0.025	61	71	48	63
-5028	-0.219	-0.050	-0.034	78	91	67	81
-6025	-0.230	-0.057	-0.043	96	109	86	100
-7002	-0.241	-0.065	-0.050	112	127	104	118
-7997	-0.251	-0.072	-0.057	130	146	123	137
-9018	-0.262	-0.086	-0.064	149	166	142	157
-10000	-0.272	-0.093	-0.071	167	184	161	177
-11003	-0.283	-0.100	-0.078	187	204	180	197
-12012	-0.293	-0.111	-0.085	205	222	199	216
-13040	-0.303	-0.117	-0.098	224	241	219	238
-14032	-0.313	-0.126	-0.105	242	259	236	257
-15039	-0.323	-0.133	-0.112	260	276	255	277
-16031	-0.333	-0.141	-0.119	280	296	274	298
-17020	-0.343	-0.151	-0.130	299	314	293	318
-17997	-0.353	-0.162	-0.139	315	330	309	335
-19010	-0.363	-0.171	-0.148	334	349	328	356
-20005	-0.372	-0.176	-0.155	355	369	348	377
-20399	-0.376	-0.178	-0.155	362	376	355	385
Comments:							

Stiffness Test: 45		Date: 11/4/2005		Panel A, Cycle: 8704000		Panel C, Cycle: 8704000	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Wire Pot 2 (in)	Strain Gage 1 (me)	Strain Gage 2 (me)	Strain Gage 3 (me)	Strain Gage 4 (me)
0	0.023	0.001	0.000	1	1	1	1
-997	-0.227	-0.007	-0.002	14	17	8	13
-2010	-0.243	-0.015	-0.011	28	35	18	28
-2994	-0.255	-0.027	-0.018	44	52	30	45
-4021	-0.268	-0.037	-0.023	60	71	48	64
-5004	-0.279	-0.045	-0.030	76	88	65	80
-6004	-0.290	-0.053	-0.039	95	108	85	100
-7015	-0.301	-0.061	-0.050	112	126	103	118
-8015	-0.312	-0.069	-0.059	129	145	122	137
-9025	-0.322	-0.082	-0.066	148	165	141	157
-10017	-0.332	-0.089	-0.073	166	183	160	177
-11009	-0.343	-0.096	-0.080	185	202	179	197
-11992	-0.353	-0.107	-0.087	203	220	197	216
-13002	-0.363	-0.114	-0.096	223	239	217	237
-14035	-0.373	-0.124	-0.107	240	257	235	256
-15010	-0.383	-0.130	-0.114	259	275	253	277
-16004	-0.392	-0.137	-0.121	277	293	271	296
-17010	-0.402	-0.148	-0.132	296	312	291	317
-18011	-0.412	-0.158	-0.142	316	330	309	337
-19013	-0.422	-0.167	-0.151	334	349	327	356
-19999	-0.431	-0.172	-0.158	353	367	346	376
-20397	-0.436	-0.174	-0.162	360	374	354	384
Comments:							

Stiffness Test: 46		Date: 11/5/2005		Panel A, Cycle: 9052500		Panel C, Cycle: 9052500	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Wire Pot 2 (in)	Strain Gage 1 (me)	Strain Gage 2 (me)	Strain Gage 3 (me)	Strain Gage 4 (me)
0	0.000	0.000	0.000	0	0	0	0
-1007	-0.163	-0.011	0.000	13	16	7	12
-2014	-0.178	-0.019	-0.005	27	33	16	26
-3043	-0.192	-0.032	-0.014	42	51	30	43
-4012	-0.203	-0.041	-0.018	59	69	47	61
-5031	-0.215	-0.050	-0.027	77	89	66	80
-6019	-0.226	-0.058	-0.039	95	108	85	99
-7009	-0.237	-0.066	-0.048	112	127	104	117
-8016	-0.248	-0.072	-0.055	130	145	123	137
-9042	-0.258	-0.084	-0.062	149	165	143	156
-9990	-0.268	-0.095	-0.068	167	183	161	175
-11044	-0.279	-0.101	-0.078	186	203	180	196
-11995	-0.288	-0.111	-0.087	204	221	198	215
-13026	-0.299	-0.118	-0.091	223	239	217	235
-14005	-0.309	-0.126	-0.103	241	257	236	256
-14991	-0.319	-0.134	-0.110	260	275	254	275
-16005	-0.329	-0.141	-0.121	279	294	273	296
-17006	-0.339	-0.152	-0.132	297	312	291	316
-17998	-0.348	-0.160	-0.139	316	330	309	335
-19025	-0.359	-0.170	-0.146	335	349	328	356
-19998	-0.368	-0.177	-0.153	353	367	346	375
-20403	-0.372	-0.179	-0.160	361	375	355	383
Comments:							

Stiffness Test: 47		Date: 11/6/2005		Panel A, Cycle: 9306500		Panel C, Cycle: 9306500	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Wire Pot 2 (in)	Strain Gage 1 (me)	Strain Gage 2 (me)	Strain Gage 3 (me)	Strain Gage 4 (me)
0	0.000	0.000	0.000	0	0	0	0
-1018	-0.231	-0.005	-0.005	14	18	8	13
-2011	-0.245	-0.011	-0.011	28	35	17	27
-3011	-0.258	-0.023	-0.018	42	52	31	43
-3920	-0.268	-0.030	-0.025	57	68	46	60
-5036	-0.281	-0.041	-0.032	77	90	67	81
-6017	-0.292	-0.052	-0.041	95	109	86	99
-7031	-0.303	-0.060	-0.053	113	128	105	118
-8004	-0.314	-0.069	-0.059	130	146	123	137
-9005	-0.324	-0.076	-0.066	149	166	142	156
-9988	-0.334	-0.084	-0.073	167	184	161	175
-11033	-0.345	-0.096	-0.080	187	204	181	196
-12016	-0.355	-0.105	-0.089	205	222	199	216
-13031	-0.365	-0.111	-0.100	224	241	219	236
-14028	-0.375	-0.121	-0.107	242	259	236	256
-15026	-0.385	-0.127	-0.114	261	277	255	276
-15996	-0.395	-0.136	-0.126	279	295	273	296
-17016	-0.405	-0.143	-0.135	298	313	292	316
-17998	-0.414	-0.150	-0.144	316	331	310	335
-18986	-0.424	-0.160	-0.151	334	349	328	355
-19999	-0.434	-0.172	-0.158	354	368	347	374
-20400	-0.438	-0.176	-0.164	362	376	355	383
Comments:							

Stiffness Test: 48		Date: 11/7/2005		Panel A, Cycle: 9500001		Panel C, Cycle: 9500001	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Wire Pot 2 (in)	Strain Gage 1 (me)	Strain Gage 2 (me)	Strain Gage 3 (me)	Strain Gage 4 (me)
0	0.000	0.000	0.000	1	0	0	0
-1013	-0.304	-0.007	0.000	13	15	7	10
-2039	-0.319	-0.017	-0.007	27	33	16	24
-3045	-0.332	-0.029	-0.014	43	51	30	42
-4044	-0.344	-0.037	-0.021	59	69	47	61
-5045	-0.355	-0.049	-0.027	77	89	66	79
-6008	-0.366	-0.056	-0.039	94	106	83	96
-7015	-0.377	-0.063	-0.048	111	125	103	115
-8024	-0.388	-0.071	-0.057	130	144	121	135
-9034	-0.398	-0.079	-0.062	149	164	141	155
-10038	-0.408	-0.094	-0.071	167	183	160	174
-10998	-0.418	-0.099	-0.075	184	200	177	193
-12007	-0.429	-0.107	-0.087	205	221	198	215
-12999	-0.439	-0.115	-0.096	223	239	216	235
-14005	-0.449	-0.122	-0.105	241	256	235	254
-14989	-0.458	-0.133	-0.112	261	275	253	275
-16007	-0.468	-0.140	-0.123	279	294	272	295
-17011	-0.478	-0.148	-0.132	296	311	289	314
-18014	-0.488	-0.160	-0.139	316	330	309	335
-18996	-0.498	-0.170	-0.151	334	347	326	353
-19995	-0.508	-0.177	-0.155	354	367	346	374
-20400	-0.512	-0.179	-0.162	361	374	353	382
Comments:							

Stiffness Test: 49		Date: 11/8/2005		Panel A, Cycle: 9771201		Panel C, Cycle: 9771201	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Wire Pot 2 (in)	Strain Gage 1 (me)	Strain Gage 2 (me)	Strain Gage 3 (me)	Strain Gage 4 (me)
0	0.000	0.000	0.000	-1	-1	-1	-1
-1009	-0.324	-0.005	-0.007	14	16	7	12
-2001	-0.339	-0.011	-0.009	27	34	16	25
-3011	-0.352	-0.026	-0.021	41	50	29	42
-4041	-0.364	-0.032	-0.030	58	69	46	60
-5012	-0.375	-0.042	-0.037	75	88	63	78
-6017	-0.386	-0.051	-0.043	94	107	83	98
-7029	-0.397	-0.060	-0.053	112	127	103	116
-8004	-0.408	-0.066	-0.059	129	144	120	135
-9011	-0.419	-0.078	-0.071	147	163	139	154
-10003	-0.429	-0.082	-0.078	168	184	160	176
-11015	-0.440	-0.097	-0.084	187	203	178	196
-11993	-0.450	-0.105	-0.091	205	221	196	215
-13008	-0.459	-0.114	-0.103	222	238	215	234
-13994	-0.469	-0.120	-0.112	241	257	233	255
-15073	-0.480	-0.127	-0.119	262	278	254	277
-15993	-0.489	-0.134	-0.126	277	293	270	294
-16997	-0.499	-0.146	-0.137	296	311	288	314
-18012	-0.509	-0.154	-0.146	316	330	308	335
-19022	-0.519	-0.162	-0.153	333	348	325	354
-20010	-0.529	-0.170	-0.160	354	367	345	374
-20402	-0.533	-0.172	-0.169	362	375	354	384
Comments:							

Stiffness Test: 50		Date: 11/9/2005		Panel A, Cycle: 10000000		Panel C, Cycle: 10000000	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Wire Pot 2 (in)	Strain Gage 1 (me)	Strain Gage 2 (me)	Strain Gage 3 (me)	Strain Gage 4 (me)
0	-0.001	0.000	0.002	-1	-1	0	1
-1019	-0.170	-0.005	-0.007	14	17	8	14
-2037	-0.184	-0.009	-0.014	29	35	21	31
-3016	-0.196	-0.021	-0.021	43	51	35	47
-4035	-0.208	-0.030	-0.027	58	68	51	64
-5019	-0.219	-0.041	-0.039	78	90	72	84
-5994	-0.230	-0.052	-0.050	94	107	89	101
-7029	-0.241	-0.060	-0.055	113	129	109	121
-8033	-0.252	-0.069	-0.062	131	148	128	140
-9018	-0.263	-0.076	-0.068	150	168	148	160
-10009	-0.273	-0.084	-0.075	168	185	165	178
-11004	-0.284	-0.097	-0.084	191	207	187	201
-12044	-0.295	-0.105	-0.098	210	226	206	222
-13007	-0.305	-0.111	-0.105	228	245	224	241
-14043	-0.315	-0.122	-0.112	246	263	243	262
-14986	-0.325	-0.127	-0.123	263	279	260	280
-16022	-0.335	-0.137	-0.132	284	300	280	303
-17014	-0.345	-0.144	-0.139	303	318	299	323
-18047	-0.355	-0.152	-0.146	321	336	317	342
-19010	-0.364	-0.160	-0.153	340	355	336	363
-19996	-0.374	-0.172	-0.167	358	372	354	382
-20396	-0.378	-0.176	-0.167	366	380	362	390
Comments:							

APPENDIX C:
EXPERIMENTAL RESULTS FOR TEST SERIES 3
PANELS B AND D

C.1 Stiffness Test For Test Series 3, Panels B and D

Stiffness Test: 1		Date: 11/16/2005		Panel B, 1 Cycle:		Panel D, 1 Cycle:	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Wire Pot 2 (in)	Strain Gage 1 ($\mu\epsilon$)	Strain Gage 2 ($\mu\epsilon$)	Strain Gage 3 ($\mu\epsilon$)	Strain Gage 4 ($\mu\epsilon$)
-2	0.000	0.000	0.000	-1	0	0	0
-1105	-0.037	-0.004	0.000	11	16	13	19
-2059	-0.052	-0.021	-0.007	20	28	25	35
-2977	-0.064	-0.025	-0.014	29	41	38	52
-3966	-0.077	-0.030	-0.021	40	55	53	70
-5002	-0.089	-0.040	-0.034	51	68	68	88
-6081	-0.102	-0.052	-0.043	69	85	87	109
-6966	-0.112	-0.059	-0.050	85	99	101	126
-8097	-0.124	-0.064	-0.055	105	117	120	146
-9019	-0.134	-0.077	-0.064	125	135	136	165
-10183	-0.147	-0.087	-0.073	147	156	156	187
-11133	-0.157	-0.098	-0.073	166	175	173	206
-12089	-0.167	-0.103	-0.091	184	193	190	224
-13054	-0.177	-0.110	-0.098	204	213	208	244
-14028	-0.187	-0.119	-0.103	222	230	226	262
-15009	-0.197	-0.126	-0.112	241	250	244	281
-15992	-0.207	-0.131	-0.119	261	269	263	300
-16979	-0.217	-0.145	-0.126	281	289	281	320
-17968	-0.227	-0.149	-0.132	300	308	300	339
-18955	-0.237	-0.161	-0.146	319	327	319	358
-19946	-0.247	-0.170	-0.155	340	347	338	378
-20933	-0.257	-0.175	-0.160	357	364	357	397
-21923	-0.267	-0.179	-0.167	377	385	376	417
-22912	-0.277	-0.196	-0.174	396	404	396	436
-23906	-0.287	-0.198	-0.183	417	423	416	456
-24898	-0.297	-0.208	-0.194	437	443	435	476
-25891	-0.307	-0.218	-0.203	456	462	455	496
-27135	-0.319	-0.229	-0.210	482	487	481	521
-28136	-0.329	-0.231	-0.217	502	507	501	541
-29224	-0.343	-0.248	-0.231	527	531	526	567
Comments:							

Stiffness Test: 2		Date: 11/16/2005		Panel B, Cycle: 10		Panel D, Cycle: 10	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Wire Pot 2 (in)	Strain Gage 1 ($\mu\epsilon$)	Strain Gage 2 ($\mu\epsilon$)	Strain Gage 3 ($\mu\epsilon$)	Strain Gage 4 ($\mu\epsilon$)
0	0.000	0.000	0.000	-2	-2	-1	-1
-1044	-0.234	-0.006	-0.002	10	14	11	16
-2033	-0.249	-0.020	-0.009	19	27	23	33
-3034	-0.263	-0.025	-0.023	29	40	37	51
-4039	-0.275	-0.031	-0.030	40	54	52	70
-5002	-0.287	-0.045	-0.037	49	65	66	87
-6020	-0.299	-0.053	-0.043	67	82	83	107
-7011	-0.311	-0.059	-0.050	84	96	98	126
-7990	-0.322	-0.072	-0.064	106	114	116	145
-9076	-0.334	-0.077	-0.071	127	134	135	167
-10020	-0.344	-0.092	-0.078	146	152	151	185
-11020	-0.354	-0.097	-0.084	164	170	169	204
-12028	-0.365	-0.103	-0.091	186	191	188	224
-13036	-0.375	-0.111	-0.098	206	211	207	244
-14052	-0.386	-0.120	-0.105	225	231	226	263
-15042	-0.396	-0.125	-0.119	245	251	244	283
-16016	-0.406	-0.141	-0.126	264	270	263	302
-17058	-0.417	-0.144	-0.132	285	290	283	322
-18084	-0.427	-0.153	-0.142	305	311	303	342
-19097	-0.438	-0.166	-0.146	323	330	322	362
-20025	-0.447	-0.170	-0.155	343	349	340	381
-21081	-0.459	-0.184	-0.169	365	371	362	403
-22001	-0.468	-0.192	-0.176	383	388	380	421
-23053	-0.478	-0.194	-0.183	403	409	401	441
-24013	-0.488	-0.204	-0.189	423	428	420	461
-25026	-0.498	-0.215	-0.196	442	448	440	481
-26026	-0.508	-0.224	-0.210	461	466	459	501
-26995	-0.518	-0.228	-0.217	481	485	479	520
-28037	-0.528	-0.240	-0.224	502	506	501	541
-29232	-0.541	-0.248	-0.237	526	529	525	566

Comments:

Stiffness Test: 3		Date: 11/16/2005		Panel B, Cycle: 100		Panel D, Cycle: 100	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Wire Pot 2 (in)	Strain Gage 1 ($\mu\epsilon$)	Strain Gage 2 ($\mu\epsilon$)	Strain Gage 3 ($\mu\epsilon$)	Strain Gage 4 ($\mu\epsilon$)
0	0.000	0.000	0.000	-2	-1	-1	-1
-1007	-0.052	-0.015	-0.009	10	15	9	15
-2060	-0.067	-0.019	-0.014	19	29	21	33
-3057	-0.079	-0.024	-0.021	29	42	34	50
-4015	-0.091	-0.032	-0.030	39	55	47	68
-5013	-0.103	-0.045	-0.037	51	69	62	86
-6033	-0.114	-0.053	-0.043	68	85	78	106
-7009	-0.125	-0.059	-0.055	87	100	94	125
-8007	-0.136	-0.071	-0.062	107	117	110	144
-9019	-0.147	-0.077	-0.068	126	135	127	163
-10006	-0.157	-0.089	-0.078	146	155	145	183
-11043	-0.168	-0.095	-0.082	165	174	163	202
-12060	-0.179	-0.103	-0.091	188	196	183	223
-13022	-0.188	-0.111	-0.100	206	214	201	242
-14018	-0.199	-0.120	-0.112	226	235	220	261
-15143	-0.210	-0.131	-0.119	248	256	241	283
-16005	-0.219	-0.140	-0.126	265	274	258	300
-17055	-0.230	-0.144	-0.132	286	294	278	321
-17998	-0.239	-0.156	-0.142	305	314	296	339
-19073	-0.250	-0.165	-0.151	323	333	316	359
-20017	-0.259	-0.168	-0.160	342	351	335	378
-21066	-0.270	-0.178	-0.167	362	371	356	399
-22091	-0.280	-0.189	-0.176	382	391	376	419
-23019	-0.290	-0.193	-0.183	401	409	395	438
-24043	-0.300	-0.210	-0.194	421	429	415	458
-25009	-0.309	-0.213	-0.203	441	448	434	477
-25998	-0.319	-0.223	-0.210	458	466	454	496
-27027	-0.329	-0.225	-0.217	478	486	474	517
-28008	-0.339	-0.240	-0.224	499	505	495	537
-29215	-0.351	-0.245	-0.237	523	529	520	561
Comments:							

Stiffness Test: 4		Date: 11/16/2005		Panel B, Cycle: 1000		Panel D, Cycle: 1000	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Wire Pot 2 (in)	Strain Gage 1 ($\mu\epsilon$)	Strain Gage 2 ($\mu\epsilon$)	Strain Gage 3 ($\mu\epsilon$)	Strain Gage 4 ($\mu\epsilon$)
-2	0.000	0.000	0.000	0	0	0	0
-993	-0.049	-0.012	-0.009	9	15	9	14
-2028	-0.064	-0.017	-0.016	20	30	21	32
-3026	-0.077	-0.024	-0.021	29	42	32	49
-4018	-0.088	-0.031	-0.030	39	55	46	67
-5024	-0.100	-0.043	-0.037	52	70	61	86
-6052	-0.112	-0.052	-0.046	68	85	77	106
-7028	-0.123	-0.057	-0.057	87	101	93	125
-8039	-0.134	-0.069	-0.064	107	118	110	144
-9004	-0.144	-0.077	-0.071	126	136	126	163
-10017	-0.155	-0.088	-0.078	146	155	144	182
-11035	-0.165	-0.094	-0.084	167	176	162	202
-11999	-0.176	-0.103	-0.091	186	195	181	222
-13023	-0.186	-0.111	-0.098	205	215	200	241
-14011	-0.196	-0.119	-0.110	224	234	218	260
-15010	-0.206	-0.130	-0.119	243	253	237	280
-16042	-0.217	-0.137	-0.126	262	272	256	300
-17042	-0.227	-0.142	-0.132	283	293	276	319
-18020	-0.237	-0.155	-0.139	302	312	295	338
-19015	-0.247	-0.163	-0.151	320	330	314	357
-20039	-0.257	-0.167	-0.160	338	349	333	377
-21098	-0.268	-0.181	-0.167	359	370	355	398
-22076	-0.277	-0.187	-0.174	378	389	374	417
-23047	-0.287	-0.191	-0.183	399	409	394	437
-24010	-0.297	-0.207	-0.187	416	425	412	455
-25044	-0.307	-0.212	-0.203	437	446	433	476
-26035	-0.317	-0.220	-0.210	456	465	453	495
-26982	-0.327	-0.224	-0.217	474	483	472	515
-28084	-0.338	-0.239	-0.224	496	504	494	537
-29223	-0.350	-0.246	-0.237	521	528	518	561

Comments:

Stiffness Test: 5		Date: 11/16/2005		Panel B, Cycle: 10000		Panel D, Cycle: 10000	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Wire Pot 2 (in)	Strain Gage 1 ($\mu\epsilon$)	Strain Gage 2 ($\mu\epsilon$)	Strain Gage 3 ($\mu\epsilon$)	Strain Gage 4 ($\mu\epsilon$)
2	0.000	0.000	0.000	0	0	0	-1
-1022	-0.122	-0.016	-0.007	10	15	9	14
-2022	-0.137	-0.019	-0.014	19	29	20	31
-3025	-0.150	-0.025	-0.021	29	42	31	48
-4049	-0.162	-0.032	-0.027	40	56	45	67
-5031	-0.173	-0.046	-0.037	53	71	59	86
-6051	-0.185	-0.056	-0.041	69	85	74	105
-7031	-0.196	-0.059	-0.048	88	101	91	124
-8050	-0.207	-0.072	-0.062	108	119	108	144
-9024	-0.217	-0.077	-0.068	127	137	125	163
-9999	-0.228	-0.090	-0.075	145	154	142	181
-11021	-0.238	-0.095	-0.082	165	176	161	202
-11996	-0.248	-0.103	-0.089	183	193	179	220
-12991	-0.259	-0.113	-0.098	203	214	198	240
-13997	-0.269	-0.120	-0.107	221	233	216	259
-15023	-0.279	-0.126	-0.119	242	254	237	279
-16036	-0.289	-0.140	-0.126	261	273	255	299
-17020	-0.299	-0.144	-0.132	279	292	274	318
-18069	-0.310	-0.156	-0.139	300	312	295	338
-19030	-0.320	-0.165	-0.146	318	330	314	357
-20028	-0.330	-0.170	-0.158	338	351	334	377
-21034	-0.340	-0.179	-0.167	358	370	354	397
-22027	-0.350	-0.191	-0.176	377	389	373	417
-23039	-0.360	-0.193	-0.183	397	409	393	436
-24037	-0.370	-0.209	-0.187	414	425	413	455
-25008	-0.380	-0.213	-0.199	434	445	432	474
-26007	-0.390	-0.223	-0.210	454	465	453	495
-27004	-0.400	-0.226	-0.215	472	482	472	514
-28049	-0.410	-0.240	-0.224	493	503	493	535
-29221	-0.422	-0.245	-0.237	516	525	517	559
Comments:							

Stiffness Test: 6		Date: 11/16/2005		Panel B, Cycle: 100000		Panel D, Cycle: 100000	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Wire Pot 2 (in)	Strain Gage 1 ($\mu\epsilon$)	Strain Gage 2 ($\mu\epsilon$)	Strain Gage 3 ($\mu\epsilon$)	Strain Gage 4 ($\mu\epsilon$)
-2	0.000	0.001	0.000	-1	0	0	0
-1010	-0.137	-0.009	-0.007	9	14	9	15
-2030	-0.152	-0.012	-0.014	19	28	19	32
-3006	-0.166	-0.019	-0.021	29	42	31	49
-4001	-0.178	-0.033	-0.030	39	55	43	67
-5005	-0.190	-0.042	-0.034	51	69	57	86
-5994	-0.201	-0.048	-0.041	69	84	72	105
-7038	-0.213	-0.057	-0.055	89	101	89	125
-7995	-0.224	-0.064	-0.062	107	118	106	144
-9008	-0.234	-0.080	-0.071	127	136	124	164
-10009	-0.245	-0.084	-0.078	146	156	142	183
-11027	-0.255	-0.090	-0.084	165	175	161	203
-11998	-0.266	-0.099	-0.091	184	195	179	222
-12996	-0.276	-0.109	-0.105	203	214	198	242
-14006	-0.286	-0.114	-0.112	222	233	216	261
-15038	-0.296	-0.129	-0.119	241	254	236	280
-16034	-0.306	-0.132	-0.126	260	272	255	300
-16985	-0.316	-0.137	-0.132	279	291	273	318
-18027	-0.326	-0.152	-0.139	298	311	294	338
-18981	-0.336	-0.158	-0.153	316	329	312	357
-20059	-0.347	-0.163	-0.160	337	349	333	378
-21012	-0.357	-0.179	-0.167	355	367	352	396
-21997	-0.367	-0.182	-0.176	373	386	371	416
-23018	-0.377	-0.187	-0.180	393	406	391	436
-24026	-0.387	-0.202	-0.189	412	425	411	455
-25014	-0.397	-0.209	-0.203	431	443	430	474
-26048	-0.407	-0.215	-0.210	451	462	451	495
-27016	-0.416	-0.224	-0.217	470	481	470	513
-28000	-0.426	-0.234	-0.224	489	500	489	533
-29224	-0.439	-0.248	-0.237	514	523	514	558
Comments:							

Stiffness Test: 7		Date: 11/17/2005		Panel B, Cycle: 270000		Panel D, Cycle: 270000	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Wire Pot 2 (in)	Strain Gage 1 ($\mu\epsilon$)	Strain Gage 2 ($\mu\epsilon$)	Strain Gage 3 ($\mu\epsilon$)	Strain Gage 4 ($\mu\epsilon$)
-2	0.000	0.002	0.000	-1	-1	-1	-1
-1006	-0.168	-0.007	0.000	6	11	7	12
-2001	-0.183	-0.011	-0.007	15	25	17	28
-3012	-0.197	-0.017	-0.014	26	40	29	46
-3974	-0.209	-0.031	-0.025	37	53	40	64
-4999	-0.221	-0.038	-0.032	50	69	55	84
-5994	-0.233	-0.046	-0.041	64	80	68	102
-7015	-0.244	-0.053	-0.050	87	100	86	123
-8003	-0.255	-0.063	-0.055	102	114	102	141
-9018	-0.266	-0.074	-0.064	125	136	121	162
-10017	-0.277	-0.083	-0.078	145	155	140	182
-10992	-0.287	-0.088	-0.080	161	172	157	200
-12009	-0.298	-0.097	-0.089	180	192	175	220
-13013	-0.308	-0.105	-0.098	200	213	195	240
-14003	-0.319	-0.113	-0.103	218	231	213	260
-15042	-0.329	-0.127	-0.112	239	252	233	280
-16013	-0.340	-0.131	-0.121	255	268	251	298
-17019	-0.350	-0.136	-0.132	275	288	271	318
-18006	-0.360	-0.150	-0.139	295	309	290	337
-19003	-0.370	-0.157	-0.146	315	328	310	357
-20013	-0.380	-0.162	-0.153	332	346	329	376
-21015	-0.391	-0.178	-0.164	353	367	350	397
-22024	-0.401	-0.181	-0.174	367	381	368	415
-23018	-0.411	-0.186	-0.183	390	403	389	435
-23994	-0.421	-0.202	-0.189	410	423	408	454
-25031	-0.431	-0.208	-0.196	428	441	428	474
-26007	-0.441	-0.214	-0.208	447	459	447	494
-26984	-0.451	-0.224	-0.217	465	477	466	512
-28017	-0.461	-0.233	-0.224	485	497	486	532
-29226	-0.474	-0.248	-0.237	511	522	512	558
Comments:							

Stiffness Test: 8		Date: 11/18/2005		Panel B, Cycle: 533400		Panel D, Cycle: 533400	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Wire Pot 2 (in)	Strain Gage 1 ($\mu\epsilon$)	Strain Gage 2 ($\mu\epsilon$)	Strain Gage 3 ($\mu\epsilon$)	Strain Gage 4 ($\mu\epsilon$)
-5	0.000	0.000	0.002	-1	-1	0	0
-1009	-0.175	-0.014	-0.005	8	14	9	15
-1999	-0.191	-0.019	-0.011	18	28	19	32
-3029	-0.206	-0.025	-0.018	29	42	31	50
-4020	-0.218	-0.032	-0.027	39	56	44	69
-5009	-0.231	-0.047	-0.032	50	69	57	87
-6007	-0.242	-0.056	-0.046	68	85	73	107
-7029	-0.254	-0.059	-0.055	89	103	90	128
-8050	-0.265	-0.072	-0.062	109	120	108	148
-9040	-0.276	-0.079	-0.068	126	137	125	167
-10005	-0.286	-0.090	-0.073	141	152	142	186
-11014	-0.297	-0.097	-0.087	165	177	163	207
-12045	-0.308	-0.105	-0.096	182	195	181	226
-13028	-0.318	-0.114	-0.103	201	214	200	246
-13992	-0.328	-0.120	-0.110	219	233	218	265
-15000	-0.339	-0.132	-0.116	238	252	238	285
-16019	-0.349	-0.140	-0.126	258	272	257	304
-17019	-0.359	-0.144	-0.137	276	290	276	323
-18015	-0.370	-0.158	-0.144	295	310	296	343
-19025	-0.380	-0.166	-0.153	314	329	315	363
-20036	-0.390	-0.170	-0.160	333	348	335	382
-20985	-0.400	-0.187	-0.167	352	366	353	401
-22017	-0.410	-0.191	-0.180	372	387	374	421
-23008	-0.420	-0.194	-0.187	389	404	392	440
-24025	-0.431	-0.210	-0.194	407	422	412	459
-25040	-0.440	-0.215	-0.203	428	442	432	480
-26029	-0.450	-0.224	-0.212	446	460	451	499
-27013	-0.460	-0.228	-0.221	465	478	471	518
-27993	-0.470	-0.241	-0.231	484	498	490	537
-29220	-0.483	-0.251	-0.242	510	522	515	563
Comments:							

Stiffness Test: 9		Date: 11/19/2005		Panel B, Cycle: 698750		Panel D, Cycle: 698750	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Wire Pot 2 (in)	Strain Gage 1 ($\mu\epsilon$)	Strain Gage 2 ($\mu\epsilon$)	Strain Gage 3 ($\mu\epsilon$)	Strain Gage 4 ($\mu\epsilon$)
0	0.000	0.001	0.002	2	2	0	0
-1058	-0.157	-0.014	0.000	12	17	10	16
-2016	-0.172	-0.019	-0.007	20	30	19	31
-3020	-0.184	-0.024	-0.016	33	45	31	49
-3997	-0.197	-0.032	-0.023	44	60	44	67
-5021	-0.209	-0.045	-0.030	54	73	58	86
-6008	-0.221	-0.053	-0.043	71	88	72	106
-7002	-0.232	-0.058	-0.048	89	102	88	125
-8021	-0.243	-0.071	-0.057	110	121	107	146
-9001	-0.254	-0.078	-0.062	126	137	124	165
-10008	-0.264	-0.089	-0.068	146	156	143	184
-11008	-0.275	-0.095	-0.080	163	175	161	203
-12009	-0.285	-0.104	-0.091	182	194	179	223
-13043	-0.296	-0.111	-0.098	203	215	199	244
-14047	-0.306	-0.119	-0.105	221	233	217	262
-15016	-0.316	-0.129	-0.112	237	250	235	281
-16004	-0.326	-0.137	-0.119	256	270	254	300
-17002	-0.336	-0.141	-0.130	277	290	274	320
-18012	-0.346	-0.155	-0.142	295	309	294	339
-19003	-0.356	-0.163	-0.146	314	327	313	359
-20011	-0.367	-0.167	-0.153	331	345	332	378
-20990	-0.377	-0.186	-0.164	352	365	352	398
-21994	-0.387	-0.188	-0.176	371	384	372	417
-22983	-0.397	-0.192	-0.183	389	402	391	436
-23997	-0.407	-0.208	-0.189	408	421	410	455
-25018	-0.417	-0.213	-0.196	427	440	430	475
-25983	-0.426	-0.220	-0.203	444	456	448	493
-27001	-0.436	-0.224	-0.217	464	475	468	513
-28029	-0.447	-0.239	-0.224	484	495	488	533
-29226	-0.459	-0.248	-0.237	509	519	513	557
Comments:							

Stiffness Test: 10		Date: 11/20/2005		Panel B, Cycle: 1008582		Panel D, Cycle: 1008582	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Wire Pot 2 (in)	Strain Gage 1 ($\mu\epsilon$)	Strain Gage 2 ($\mu\epsilon$)	Strain Gage 3 ($\mu\epsilon$)	Strain Gage 4 ($\mu\epsilon$)
-3	0.000	0.001	0.000	-2	-1	-1	-1
-1006	-0.122	-0.014	-0.007	8	14	8	14
-2008	-0.139	-0.017	-0.014	17	28	18	30
-3003	-0.153	-0.028	-0.030	28	42	29	48
-4010	-0.165	-0.040	-0.037	40	56	42	67
-5024	-0.178	-0.050	-0.043	51	71	55	86
-6017	-0.189	-0.054	-0.050	69	87	71	106
-7008	-0.200	-0.064	-0.057	86	101	87	125
-8036	-0.211	-0.072	-0.062	105	118	105	145
-9014	-0.222	-0.087	-0.078	125	137	122	165
-10002	-0.233	-0.092	-0.084	144	157	141	185
-11001	-0.243	-0.097	-0.091	163	176	160	204
-12027	-0.254	-0.108	-0.098	182	196	179	225
-13004	-0.264	-0.116	-0.105	200	214	197	244
-14005	-0.275	-0.121	-0.119	219	233	216	263
-14994	-0.285	-0.136	-0.126	238	253	235	283
-16010	-0.295	-0.139	-0.132	254	270	253	301
-17019	-0.305	-0.149	-0.139	274	289	273	321
-17977	-0.315	-0.162	-0.146	294	309	292	340
-19019	-0.326	-0.166	-0.158	313	329	312	361
-19987	-0.336	-0.171	-0.169	331	347	331	379
-21003	-0.346	-0.187	-0.176	350	365	350	399
-22035	-0.356	-0.189	-0.180	368	383	370	418
-23025	-0.367	-0.200	-0.189	387	403	390	438
-24022	-0.377	-0.209	-0.196	406	421	409	457
-25009	-0.386	-0.220	-0.210	426	441	429	477
-25986	-0.396	-0.223	-0.217	445	459	447	496
-26995	-0.406	-0.236	-0.224	463	477	467	515
-28022	-0.417	-0.240	-0.231	484	498	487	535
-29221	-0.429	-0.255	-0.244	509	521	512	560
Comments:							

Stiffness Test: 11		Date: 11/21/2005		Panel B, Cycle: 1271443		Panel D, Cycle: 1271443	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Wire Pot 2 (in)	Strain Gage 1 ($\mu\epsilon$)	Strain Gage 2 ($\mu\epsilon$)	Strain Gage 3 ($\mu\epsilon$)	Strain Gage 4 ($\mu\epsilon$)
3	0.000	0.000	0.000	-1	-1	-1	-1
-1004	-0.117	-0.001	-0.007	7	12	8	14
-2025	-0.135	-0.011	-0.014	18	28	19	30
-3012	-0.147	-0.015	-0.021	28	40	29	47
-3991	-0.160	-0.030	-0.027	39	55	42	65
-4990	-0.172	-0.038	-0.034	49	68	55	85
-6005	-0.184	-0.043	-0.041	67	83	70	104
-7011	-0.195	-0.056	-0.055	88	101	88	125
-7994	-0.206	-0.059	-0.062	105	117	105	144
-9002	-0.217	-0.075	-0.068	123	135	123	165
-10000	-0.228	-0.080	-0.075	144	156	143	185
-11006	-0.239	-0.088	-0.080	160	172	160	204
-12004	-0.249	-0.097	-0.094	181	193	180	224
-13005	-0.260	-0.104	-0.105	200	213	199	244
-14006	-0.270	-0.113	-0.112	218	232	217	263
-15021	-0.280	-0.124	-0.119	237	251	237	283
-16031	-0.291	-0.127	-0.123	255	270	255	302
-17006	-0.301	-0.141	-0.137	270	285	273	320
-18009	-0.311	-0.150	-0.146	293	308	294	341
-18981	-0.321	-0.153	-0.153	311	326	313	360
-19995	-0.331	-0.163	-0.160	329	344	332	379
-20994	-0.341	-0.173	-0.167	349	364	352	398
-21989	-0.352	-0.177	-0.180	367	381	371	418
-22998	-0.362	-0.194	-0.189	387	401	391	438
-24002	-0.372	-0.198	-0.196	406	420	411	457
-24986	-0.381	-0.207	-0.203	424	437	429	476
-25992	-0.392	-0.213	-0.217	444	457	449	496
-27005	-0.402	-0.225	-0.224	463	476	469	516
-28009	-0.412	-0.229	-0.231	483	495	488	535
-29221	-0.424	-0.241	-0.242	505	517	512	559
Comments:							

Stiffness Test: 12		Date: 11/22/2005		Panel B, Cycle: 1519652		Panel D, Cycle: 1519652	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Wire Pot 2 (in)	Strain Gage 1 ($\mu\epsilon$)	Strain Gage 2 ($\mu\epsilon$)	Strain Gage 3 ($\mu\epsilon$)	Strain Gage 4 ($\mu\epsilon$)
-2	0.000	0.000	0.005	0	0	0	-1
-986	-0.170	-0.002	-0.002	9	15	8	13
-2005	-0.186	-0.010	-0.007	19	29	18	29
-2994	-0.199	-0.020	-0.014	28	41	29	46
-3989	-0.212	-0.031	-0.021	40	57	42	65
-4987	-0.225	-0.038	-0.027	50	69	55	84
-5959	-0.236	-0.047	-0.041	68	85	70	104
-6992	-0.247	-0.056	-0.050	88	102	87	124
-7998	-0.258	-0.068	-0.055	105	117	104	144
-9007	-0.269	-0.075	-0.062	124	136	123	164
-10003	-0.280	-0.083	-0.075	143	155	142	184
-10994	-0.291	-0.090	-0.082	161	173	159	203
-11999	-0.301	-0.099	-0.089	179	192	178	222
-13043	-0.312	-0.105	-0.098	200	213	198	243
-14008	-0.322	-0.120	-0.105	217	231	215	261
-15026	-0.332	-0.124	-0.112	236	251	235	281
-16004	-0.342	-0.127	-0.119	253	268	254	300
-16991	-0.352	-0.142	-0.130	273	288	272	319
-18058	-0.363	-0.150	-0.139	294	308	293	340
-18996	-0.373	-0.155	-0.146	311	326	312	359
-20013	-0.383	-0.171	-0.155	330	345	331	378
-20991	-0.394	-0.173	-0.164	347	362	350	397
-22003	-0.403	-0.178	-0.176	368	382	370	417
-22996	-0.413	-0.194	-0.180	384	399	389	436
-24002	-0.424	-0.200	-0.187	402	417	408	455
-25002	-0.434	-0.207	-0.196	423	437	428	475
-26006	-0.444	-0.218	-0.210	443	457	448	496
-27001	-0.454	-0.225	-0.217	462	475	468	515
-28002	-0.464	-0.234	-0.224	483	495	487	534
-29223	-0.476	-0.241	-0.237	506	518	511	558
Comments:							

Stiffness Test: 13		Date: 11/23/2005		Panel B, Cycle: 1795560		Panel D, Cycle: 1795560	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Wire Pot 2 (in)	Strain Gage 1 ($\mu\epsilon$)	Strain Gage 2 ($\mu\epsilon$)	Strain Gage 3 ($\mu\epsilon$)	Strain Gage 4 ($\mu\epsilon$)
-3	0.000	0.001	-0.002	1	1	0	0
-1009	-0.236	-0.004	-0.005	7	13	8	14
-2002	-0.251	-0.009	-0.011	20	30	19	30
-3005	-0.265	-0.024	-0.021	29	43	30	47
-4003	-0.278	-0.035	-0.030	42	58	43	67
-5001	-0.289	-0.038	-0.037	52	70	56	85
-6013	-0.301	-0.051	-0.043	68	86	72	105
-7008	-0.313	-0.056	-0.050	88	102	88	126
-8007	-0.324	-0.071	-0.059	105	117	105	145
-9005	-0.334	-0.075	-0.071	125	137	124	166
-10000	-0.345	-0.083	-0.075	141	153	141	184
-11008	-0.356	-0.092	-0.084	162	175	161	205
-12006	-0.366	-0.099	-0.089	179	192	179	224
-13020	-0.376	-0.105	-0.103	198	212	198	244
-14008	-0.386	-0.120	-0.112	216	229	216	262
-15007	-0.397	-0.123	-0.119	235	249	235	281
-16022	-0.407	-0.134	-0.126	254	268	255	302
-17005	-0.418	-0.145	-0.132	273	288	274	321
-18011	-0.428	-0.150	-0.144	293	307	294	341
-19007	-0.438	-0.155	-0.153	309	323	312	360
-20005	-0.449	-0.171	-0.162	328	343	332	379
-21005	-0.459	-0.175	-0.169	348	362	352	399
-22000	-0.469	-0.191	-0.178	365	380	370	418
-23001	-0.479	-0.193	-0.187	385	399	390	437
-24002	-0.489	-0.203	-0.196	402	416	409	456
-25005	-0.500	-0.207	-0.203	422	436	429	477
-26006	-0.510	-0.220	-0.210	441	455	449	496
-26996	-0.519	-0.224	-0.224	459	472	467	514
-28002	-0.529	-0.238	-0.231	479	491	487	534
-29223	-0.541	-0.241	-0.237	503	515	511	558
Comments:							

Stiffness Test: 14		Date: 11/29/2005		Panel B, Cycle: 1920100		Panel D, Cycle: 1920100	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Wire Pot 2 (in)	Strain Gage 1 ($\mu\epsilon$)	Strain Gage 2 ($\mu\epsilon$)	Strain Gage 3 ($\mu\epsilon$)	Strain Gage 4 ($\mu\epsilon$)
0	0.000	0.000	0.000	-1	-1	0	0
-1018	-0.252	-0.004	0.000	9	14	8	14
-2016	-0.268	-0.009	-0.007	20	29	19	31
-3006	-0.281	-0.021	-0.018	29	43	31	48
-4036	-0.295	-0.031	-0.027	40	57	43	67
-4984	-0.306	-0.040	-0.037	52	71	57	86
-6017	-0.319	-0.048	-0.041	69	85	72	105
-6983	-0.329	-0.056	-0.048	89	102	88	125
-8023	-0.341	-0.071	-0.057	109	121	107	146
-9013	-0.352	-0.075	-0.068	126	137	124	165
-10043	-0.363	-0.082	-0.075	146	159	143	186
-11032	-0.373	-0.090	-0.082	164	177	161	204
-11972	-0.383	-0.099	-0.089	182	196	178	223
-12996	-0.394	-0.105	-0.096	200	214	197	243
-13988	-0.404	-0.121	-0.112	219	234	216	262
-15001	-0.414	-0.125	-0.119	239	254	236	282
-16016	-0.425	-0.130	-0.126	258	273	255	302
-17011	-0.436	-0.146	-0.137	277	293	274	322
-18012	-0.446	-0.151	-0.142	296	312	294	341
-18996	-0.456	-0.155	-0.151	314	330	312	360
-20022	-0.466	-0.171	-0.160	332	348	332	379
-21006	-0.477	-0.175	-0.167	352	367	351	399
-21989	-0.487	-0.179	-0.174	369	385	370	418
-23013	-0.498	-0.196	-0.189	390	406	391	438
-24029	-0.508	-0.204	-0.196	409	425	411	458
-25008	-0.517	-0.209	-0.201	426	441	430	477
-26001	-0.527	-0.219	-0.210	445	460	449	496
-26996	-0.537	-0.225	-0.217	464	479	468	515
-27994	-0.547	-0.235	-0.231	484	498	487	535
-29224	-0.560	-0.243	-0.237	509	522	513	559
Comments:							

Stiffness Test: 15		Date: 11/30/2005		Panel B, Cycle: 2311000		Panel D, Cycle: 2311000	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Wire Pot 2 (in)	Strain Gage 1 ($\mu\epsilon$)	Strain Gage 2 ($\mu\epsilon$)	Strain Gage 3 ($\mu\epsilon$)	Strain Gage 4 ($\mu\epsilon$)
-2	0.000	0.000	0.000	0	-1	0	-1
-997	-0.260	-0.002	-0.007	10	14	9	14
-2017	-0.277	-0.009	-0.014	20	29	19	30
-2991	-0.290	-0.024	-0.021	29	42	30	47
-4009	-0.303	-0.032	-0.027	41	57	43	66
-5012	-0.315	-0.038	-0.034	53	71	56	86
-6019	-0.327	-0.051	-0.046	71	87	72	106
-7005	-0.338	-0.056	-0.053	88	103	88	125
-7997	-0.349	-0.071	-0.064	107	120	105	145
-9007	-0.360	-0.075	-0.071	125	138	123	164
-9997	-0.370	-0.083	-0.078	143	156	141	184
-10995	-0.381	-0.093	-0.087	161	176	160	203
-12013	-0.392	-0.100	-0.098	180	196	178	223
-13016	-0.402	-0.108	-0.105	199	214	197	243
-14006	-0.412	-0.121	-0.112	217	233	215	262
-15032	-0.423	-0.123	-0.119	235	253	235	281
-15944	-0.432	-0.134	-0.130	253	270	252	299
-17002	-0.443	-0.145	-0.137	272	290	272	320
-18008	-0.454	-0.150	-0.148	292	309	292	339
-18993	-0.465	-0.162	-0.155	310	329	312	360
-20037	-0.476	-0.171	-0.162	330	348	332	379
-21009	-0.486	-0.175	-0.176	348	366	351	398
-22017	-0.496	-0.189	-0.183	367	385	370	418
-23015	-0.505	-0.194	-0.189	385	403	389	437
-24052	-0.516	-0.203	-0.196	405	422	409	456
-25002	-0.525	-0.207	-0.205	423	441	428	475
-26001	-0.536	-0.220	-0.217	442	459	447	495
-26975	-0.545	-0.225	-0.224	461	477	466	513
-28020	-0.555	-0.238	-0.233	481	497	486	534
-29221	-0.568	-0.243	-0.244	505	520	510	558
Comments:							

Stiffness Test: 16		Date: 12/1/2005		Panel B, Cycle: 2653740		Panel D, Cycle: 2653740	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Wire Pot 2 (in)	Strain Gage 1 ($\mu\epsilon$)	Strain Gage 2 ($\mu\epsilon$)	Strain Gage 3 ($\mu\epsilon$)	Strain Gage 4 ($\mu\epsilon$)
-2	0.000	0.000	0.000	0	0	0	0
-1006	-0.434	-0.004	0.000	9	14	9	14
-2021	-0.451	-0.009	-0.009	19	28	19	30
-2987	-0.464	-0.024	-0.014	29	41	30	46
-3995	-0.477	-0.033	-0.027	40	56	42	65
-5009	-0.489	-0.040	-0.034	52	70	57	85
-6008	-0.500	-0.051	-0.041	68	86	72	104
-7020	-0.512	-0.056	-0.053	86	102	89	124
-8029	-0.523	-0.071	-0.064	104	119	106	144
-8996	-0.534	-0.075	-0.071	121	136	122	164
-10006	-0.544	-0.083	-0.078	140	155	140	183
-11040	-0.555	-0.093	-0.082	159	175	160	204
-11999	-0.566	-0.100	-0.096	176	193	178	223
-13014	-0.576	-0.108	-0.103	194	212	196	242
-13997	-0.586	-0.119	-0.112	212	230	215	261
-15006	-0.596	-0.123	-0.119	231	250	234	281
-16005	-0.607	-0.136	-0.128	249	269	253	300
-16997	-0.617	-0.145	-0.135	267	287	271	319
-18024	-0.627	-0.150	-0.146	286	306	291	338
-18992	-0.637	-0.158	-0.155	305	324	310	358
-20013	-0.648	-0.170	-0.162	323	343	329	378
-21011	-0.659	-0.176	-0.174	342	362	350	398
-21998	-0.669	-0.189	-0.176	360	380	368	416
-22992	-0.679	-0.196	-0.192	379	399	388	436
-23991	-0.689	-0.203	-0.199	398	417	407	454
-24998	-0.699	-0.207	-0.205	416	436	426	474
-26009	-0.709	-0.220	-0.219	435	455	446	494
-27007	-0.719	-0.224	-0.226	455	473	465	513
-28011	-0.729	-0.236	-0.233	474	492	485	532
-29218	-0.741	-0.241	-0.240	498	515	508	556
Comments:							

Stiffness Test: 17		Date: 12/2/2005		Panel B, Cycle: 3027001		Panel D, Cycle: 3027001	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Wire Pot 2 (in)	Strain Gage 1 ($\mu\epsilon$)	Strain Gage 2 ($\mu\epsilon$)	Strain Gage 3 ($\mu\epsilon$)	Strain Gage 4 ($\mu\epsilon$)
-2	0.000	0.001	0.000	0	0	0	-1
-995	-0.220	-0.002	-0.007	9	14	9	14
-2001	-0.236	-0.016	-0.014	19	29	19	29
-3025	-0.250	-0.025	-0.014	29	43	30	47
-4006	-0.263	-0.032	-0.027	41	57	43	65
-5018	-0.275	-0.040	-0.034	53	71	57	85
-6008	-0.286	-0.050	-0.043	68	86	72	104
-7023	-0.298	-0.063	-0.050	86	103	89	125
-8021	-0.309	-0.068	-0.062	104	119	106	144
-9014	-0.319	-0.074	-0.071	122	136	123	164
-10003	-0.330	-0.083	-0.078	139	154	141	184
-11014	-0.341	-0.093	-0.084	157	172	160	203
-12006	-0.352	-0.099	-0.094	175	191	178	223
-13017	-0.362	-0.114	-0.103	192	210	197	242
-13997	-0.372	-0.118	-0.112	211	228	215	262
-15000	-0.383	-0.124	-0.121	230	247	235	281
-16004	-0.393	-0.139	-0.128	247	266	254	301
-17008	-0.403	-0.144	-0.135	265	285	273	320
-17982	-0.413	-0.147	-0.144	284	303	292	339
-18993	-0.423	-0.163	-0.153	302	321	311	358
-20002	-0.433	-0.166	-0.162	321	340	330	378
-20999	-0.444	-0.172	-0.169	339	358	350	397
-22055	-0.455	-0.188	-0.183	359	378	371	418
-23001	-0.464	-0.196	-0.187	376	396	389	436
-23999	-0.474	-0.200	-0.199	395	413	407	454
-25008	-0.484	-0.209	-0.205	414	432	427	474
-26033	-0.494	-0.218	-0.215	433	451	446	494
-26993	-0.504	-0.228	-0.226	452	470	466	513
-28009	-0.514	-0.234	-0.233	471	488	485	532
-29223	-0.526	-0.241	-0.240	495	511	509	556
Comments:							

Stiffness Test: 18		Date: 12/3/2005		Panel B, Cycle: 3404200		Panel D, Cycle: 30404200	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Wire Pot 2 (in)	Strain Gage 1 ($\mu\epsilon$)	Strain Gage 2 ($\mu\epsilon$)	Strain Gage 3 ($\mu\epsilon$)	Strain Gage 4 ($\mu\epsilon$)
-3	0.000	0.000	0.000	-1	0	0	0
-1003	-0.228	-0.004	-0.005	9	14	9	14
-2004	-0.243	-0.016	-0.014	19	29	19	30
-3008	-0.257	-0.026	-0.021	29	43	30	47
-4006	-0.270	-0.033	-0.027	41	57	42	66
-4999	-0.282	-0.040	-0.034	53	71	56	85
-6008	-0.294	-0.050	-0.043	68	86	72	105
-7012	-0.305	-0.063	-0.055	86	102	88	125
-8007	-0.316	-0.069	-0.062	104	119	106	145
-9011	-0.327	-0.075	-0.068	122	136	123	164
-10014	-0.337	-0.084	-0.075	139	154	141	184
-11020	-0.348	-0.093	-0.082	157	172	160	203
-12003	-0.358	-0.099	-0.096	175	190	177	222
-13036	-0.369	-0.114	-0.105	193	209	197	242
-14012	-0.379	-0.118	-0.112	210	227	215	261
-15006	-0.389	-0.125	-0.119	229	246	234	280
-16013	-0.399	-0.136	-0.126	247	264	252	300
-16991	-0.409	-0.144	-0.137	265	282	271	319
-18003	-0.420	-0.149	-0.146	283	301	291	338
-19004	-0.430	-0.165	-0.155	301	319	310	358
-20024	-0.440	-0.167	-0.162	320	338	329	377
-21002	-0.450	-0.175	-0.174	338	357	349	396
-22001	-0.460	-0.188	-0.180	357	375	367	415
-23002	-0.470	-0.194	-0.189	375	394	387	435
-23981	-0.480	-0.200	-0.196	393	412	405	453
-25006	-0.490	-0.209	-0.203	412	430	425	473
-26004	-0.500	-0.218	-0.217	431	448	445	492
-27010	-0.511	-0.226	-0.224	451	467	464	512
-28012	-0.520	-0.234	-0.231	470	486	484	531
-29220	-0.532	-0.241	-0.244	494	508	507	555
Comments:							

Stiffness Test: 19		Date: 12/5/2005		Panel B, Cycle: 4002999		Panel D, Cycle: 4002999	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Wire Pot 2 (in)	Strain Gage 1 ($\mu\epsilon$)	Strain Gage 2 ($\mu\epsilon$)	Strain Gage 3 ($\mu\epsilon$)	Strain Gage 4 ($\mu\epsilon$)
-2	0.000	0.001	0.000	0	0	0	0
-1009	-0.345	-0.004	-0.002	9	14	9	14
-2004	-0.361	-0.011	-0.009	20	29	19	30
-2997	-0.375	-0.025	-0.016	30	43	30	47
-4006	-0.388	-0.033	-0.023	42	58	43	66
-5024	-0.400	-0.038	-0.030	55	72	57	85
-5996	-0.412	-0.051	-0.043	69	87	72	104
-7018	-0.423	-0.057	-0.050	88	104	89	125
-7998	-0.434	-0.069	-0.059	106	120	106	145
-9010	-0.445	-0.075	-0.064	123	137	124	165
-9994	-0.456	-0.083	-0.073	141	154	141	184
-11009	-0.466	-0.092	-0.084	160	173	160	204
-12001	-0.477	-0.099	-0.094	176	191	178	223
-12997	-0.487	-0.109	-0.100	194	210	197	242
-14009	-0.498	-0.118	-0.107	213	228	215	262
-15029	-0.508	-0.124	-0.119	231	247	235	282
-16034	-0.519	-0.136	-0.130	250	266	254	301
-16985	-0.528	-0.144	-0.137	267	283	272	319
-18006	-0.539	-0.149	-0.144	285	302	291	339
-19006	-0.549	-0.166	-0.151	305	321	311	359
-19995	-0.559	-0.168	-0.158	323	339	330	378
-21012	-0.570	-0.173	-0.171	342	359	350	398
-22010	-0.580	-0.189	-0.178	360	377	369	417
-23010	-0.590	-0.196	-0.187	379	396	389	436
-24002	-0.600	-0.202	-0.196	397	413	407	454
-24995	-0.610	-0.207	-0.208	416	431	427	474
-26030	-0.620	-0.220	-0.215	435	450	446	494
-26999	-0.630	-0.224	-0.221	454	469	465	513
-27987	-0.640	-0.236	-0.233	474	488	485	532
-29224	-0.653	-0.241	-0.240	498	511	509	557
Comments:							

Stiffness Test: 20		Date: 12/6/2005		Panel B, Cycle: 4403299		Panel D, Cycle: 4403299	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Wire Pot 2 (in)	Strain Gage 1 ($\mu\epsilon$)	Strain Gage 2 ($\mu\epsilon$)	Strain Gage 3 ($\mu\epsilon$)	Strain Gage 4 ($\mu\epsilon$)
0	0.000	0.001	0.000	-1	0	0	-1
-998	-0.157	-0.004	0.000	9	15	9	14
-2013	-0.174	-0.014	-0.011	19	29	19	30
-3058	-0.188	-0.025	-0.014	30	44	31	48
-4001	-0.200	-0.033	-0.023	43	57	43	66
-5009	-0.212	-0.038	-0.034	55	72	57	85
-6028	-0.224	-0.051	-0.041	70	88	72	105
-7008	-0.235	-0.058	-0.048	87	103	88	125
-8009	-0.246	-0.069	-0.059	105	120	106	145
-8993	-0.257	-0.075	-0.068	122	136	123	164
-9999	-0.268	-0.084	-0.078	140	154	141	184
-10983	-0.278	-0.093	-0.084	158	172	159	203
-12025	-0.289	-0.099	-0.091	176	190	178	223
-12994	-0.299	-0.109	-0.100	193	208	196	242
-14017	-0.310	-0.119	-0.112	212	227	215	262
-15006	-0.320	-0.123	-0.119	230	245	234	281
-16011	-0.331	-0.136	-0.126	248	263	253	301
-17008	-0.341	-0.145	-0.135	266	282	272	320
-18006	-0.351	-0.149	-0.144	284	300	291	339
-19000	-0.361	-0.165	-0.155	303	319	310	358
-20008	-0.371	-0.168	-0.162	322	337	329	378
-21003	-0.382	-0.172	-0.169	340	356	349	397
-22020	-0.392	-0.189	-0.180	359	375	369	417
-23025	-0.402	-0.194	-0.189	377	393	388	436
-24002	-0.412	-0.202	-0.199	397	412	407	455
-25012	-0.422	-0.207	-0.203	415	430	427	474
-26006	-0.432	-0.219	-0.217	433	448	445	493
-26990	-0.442	-0.224	-0.226	452	466	464	512
-28009	-0.452	-0.235	-0.233	472	485	484	532
-29220	-0.464	-0.240	-0.247	495	508	507	555
Comments:							

Stiffness Test: 21		Date: 12/7/2005		Panel B, Cycle: 4763000		Panel D, Cycle: 4763000	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Wire Pot 2 (in)	Strain Gage 1 ($\mu\epsilon$)	Strain Gage 2 ($\mu\epsilon$)	Strain Gage 3 ($\mu\epsilon$)	Strain Gage 4 ($\mu\epsilon$)
-2	0.000	0.000	0.002	0	0	0	0
-1012	-0.229	-0.004	-0.002	9	14	9	14
-2001	-0.245	-0.010	-0.011	19	29	19	29
-3008	-0.259	-0.025	-0.016	30	43	30	47
-3991	-0.271	-0.033	-0.023	43	57	42	65
-5012	-0.284	-0.040	-0.030	55	72	57	85
-6007	-0.295	-0.051	-0.043	70	86	72	104
-7014	-0.306	-0.056	-0.053	88	103	88	125
-8001	-0.317	-0.069	-0.059	104	118	105	144
-9013	-0.328	-0.074	-0.066	123	136	123	164
-10013	-0.338	-0.082	-0.075	140	152	141	183
-11033	-0.349	-0.092	-0.084	158	171	160	203
-11989	-0.359	-0.099	-0.096	176	188	177	222
-13037	-0.370	-0.108	-0.103	194	207	196	242
-14026	-0.380	-0.118	-0.110	211	225	215	261
-15010	-0.390	-0.123	-0.116	229	243	233	280
-15999	-0.401	-0.135	-0.128	247	261	252	299
-17002	-0.411	-0.144	-0.139	266	281	271	319
-18017	-0.422	-0.149	-0.146	284	299	291	338
-19007	-0.432	-0.160	-0.153	303	317	310	358
-20010	-0.442	-0.167	-0.162	322	336	329	377
-21003	-0.453	-0.173	-0.176	339	354	349	396
-22010	-0.462	-0.187	-0.183	358	373	368	415
-23015	-0.473	-0.193	-0.189	377	391	387	435
-24005	-0.483	-0.202	-0.196	395	409	406	454
-24998	-0.493	-0.207	-0.208	414	427	426	473
-26003	-0.503	-0.219	-0.217	432	445	445	493
-26999	-0.512	-0.224	-0.224	451	464	464	511
-28012	-0.523	-0.236	-0.240	471	483	484	532
-29227	-0.535	-0.240	-0.247	496	507	508	556
Comments:							

Stiffness Test: 22		Date: 12/8/2005		Panel B, Cycle: 5114300		Panel D, Cycle: 5114300	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Wire Pot 2 (in)	Strain Gage 1 ($\mu\epsilon$)	Strain Gage 2 ($\mu\epsilon$)	Strain Gage 3 ($\mu\epsilon$)	Strain Gage 4 ($\mu\epsilon$)
0	0.000	-0.001	0.000	0	-1	0	0
-998	-0.323	-0.004	-0.005	10	14	9	14
-2016	-0.340	-0.011	-0.009	20	29	20	30
-2999	-0.353	-0.024	-0.021	30	42	30	47
-4003	-0.366	-0.033	-0.021	43	57	43	65
-5001	-0.378	-0.038	-0.034	55	71	57	85
-6014	-0.390	-0.051	-0.046	71	87	72	105
-7017	-0.401	-0.057	-0.057	88	103	89	125
-8003	-0.412	-0.071	-0.064	106	120	106	145
-8993	-0.423	-0.077	-0.071	123	136	123	164
-10003	-0.434	-0.083	-0.080	141	153	141	184
-11014	-0.445	-0.094	-0.091	159	171	160	203
-12013	-0.455	-0.100	-0.100	176	189	177	222
-13004	-0.465	-0.106	-0.107	194	207	196	242
-14000	-0.476	-0.119	-0.116	212	225	215	261
-15038	-0.486	-0.124	-0.123	231	244	234	281
-15993	-0.496	-0.136	-0.132	248	261	252	300
-17031	-0.507	-0.145	-0.142	267	281	272	320
-18006	-0.517	-0.150	-0.151	284	299	290	338
-19000	-0.527	-0.158	-0.158	303	317	309	358
-20051	-0.538	-0.170	-0.167	322	336	330	378
-21011	-0.548	-0.175	-0.178	339	354	349	396
-22064	-0.559	-0.189	-0.187	360	374	369	417
-23022	-0.568	-0.194	-0.194	376	391	387	435
-24002	-0.578	-0.203	-0.203	395	409	406	454
-25000	-0.588	-0.208	-0.215	414	428	425	473
-25993	-0.598	-0.219	-0.224	432	446	445	492
-27010	-0.608	-0.225	-0.231	451	464	464	512
-28002	-0.619	-0.239	-0.244	472	484	485	533
-29221	-0.631	-0.243	-0.249	495	506	508	556
Comments:							

Stiffness Test: 23		Date: 12/9/2005		Panel B, Cycle: 5493000		Panel D, Cycle: 5493000	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Wire Pot 2 (in)	Strain Gage 1 ($\mu\epsilon$)	Strain Gage 2 ($\mu\epsilon$)	Strain Gage 3 ($\mu\epsilon$)	Strain Gage 4 ($\mu\epsilon$)
0	0.000	0.000	0.000	0	0	0	0
-1024	-0.200	-0.004	0.000	10	15	10	15
-2004	-0.215	-0.012	-0.007	20	29	20	31
-3002	-0.229	-0.025	-0.014	31	43	31	48
-3985	-0.242	-0.033	-0.021	44	58	43	66
-5021	-0.255	-0.038	-0.027	56	73	58	87
-5975	-0.265	-0.051	-0.043	71	87	73	105
-6995	-0.277	-0.059	-0.050	88	104	90	126
-8003	-0.288	-0.071	-0.059	106	120	107	146
-9008	-0.299	-0.075	-0.071	124	137	124	166
-10009	-0.310	-0.084	-0.080	143	155	143	186
-11014	-0.320	-0.094	-0.087	161	173	161	205
-11989	-0.331	-0.100	-0.091	177	189	179	224
-12997	-0.342	-0.111	-0.105	195	208	198	244
-13996	-0.352	-0.118	-0.114	213	227	217	263
-14994	-0.362	-0.124	-0.123	231	244	235	283
-16011	-0.373	-0.136	-0.130	250	263	255	302
-17006	-0.383	-0.145	-0.137	267	281	273	321
-18012	-0.393	-0.150	-0.148	286	300	293	341
-18998	-0.403	-0.163	-0.155	304	318	311	360
-19991	-0.414	-0.168	-0.167	322	336	331	378
-21022	-0.424	-0.173	-0.174	341	356	351	399
-21998	-0.434	-0.188	-0.178	359	373	370	418
-23001	-0.444	-0.194	-0.192	377	391	389	437
-24002	-0.454	-0.202	-0.201	396	410	408	456
-25005	-0.464	-0.207	-0.208	414	428	427	474
-25986	-0.474	-0.219	-0.219	433	446	446	494
-27008	-0.483	-0.225	-0.231	452	465	466	513
-28011	-0.493	-0.235	-0.237	471	483	486	533
-29223	-0.506	-0.241	-0.247	495	507	510	557
Comments:							

Stiffness Test: 24		Date: 12/10/2005		Panel B, Cycle: 5830000		Panel D, Cycle: 5830000	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Wire Pot 2 (in)	Strain Gage 1 ($\mu\epsilon$)	Strain Gage 2 ($\mu\epsilon$)	Strain Gage 3 ($\mu\epsilon$)	Strain Gage 4 ($\mu\epsilon$)
-3	0.000	0.000	0.000	-1	-1	-1	-1
-1019	-0.156	-0.005	-0.002	9	15	8	14
-2011	-0.170	-0.011	-0.007	19	28	19	29
-3048	-0.185	-0.024	-0.014	31	43	30	47
-4033	-0.197	-0.032	-0.021	43	57	43	65
-5002	-0.209	-0.038	-0.027	55	71	57	84
-6007	-0.220	-0.050	-0.043	71	87	74	104
-7015	-0.231	-0.058	-0.050	87	102	91	124
-8056	-0.243	-0.069	-0.057	105	119	109	145
-8998	-0.253	-0.075	-0.066	121	135	125	163
-10026	-0.264	-0.083	-0.078	141	153	145	184
-11027	-0.274	-0.092	-0.084	158	170	162	203
-12045	-0.285	-0.099	-0.094	176	188	181	222
-13025	-0.295	-0.109	-0.100	192	205	200	241
-14021	-0.306	-0.118	-0.110	211	224	219	261
-15015	-0.316	-0.123	-0.121	228	242	238	279
-16015	-0.326	-0.135	-0.130	246	260	256	299
-17005	-0.336	-0.144	-0.137	264	279	276	319
-17997	-0.346	-0.149	-0.144	282	297	295	337
-19007	-0.356	-0.158	-0.153	300	315	314	357
-20011	-0.367	-0.167	-0.164	319	334	334	376
-21018	-0.377	-0.172	-0.174	338	352	354	396
-22006	-0.387	-0.187	-0.180	356	371	373	414
-23018	-0.397	-0.193	-0.187	374	389	392	434
-23981	-0.407	-0.200	-0.199	391	406	411	452
-25034	-0.417	-0.205	-0.210	412	426	432	472
-26016	-0.427	-0.218	-0.217	430	444	451	491
-26993	-0.436	-0.224	-0.224	448	462	470	510
-28019	-0.447	-0.235	-0.237	468	481	489	530
-29220	-0.459	-0.240	-0.244	491	504	513	554
Comments:							

Stiffness Test: 25		Date: 12/11/2005		Panel B, Cycle: 6280200		Panel D, Cycle: 6280200	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Wire Pot 2 (in)	Strain Gage 1 ($\mu\epsilon$)	Strain Gage 2 ($\mu\epsilon$)	Strain Gage 3 ($\mu\epsilon$)	Strain Gage 4 ($\mu\epsilon$)
2	0.000	0.000	0.000	0	0	0	0
-1016	-0.295	-0.001	0.000	10	15	9	15
-2002	-0.311	-0.012	-0.005	20	29	20	31
-3008	-0.324	-0.020	-0.014	32	43	31	48
-4009	-0.336	-0.026	-0.021	44	57	45	66
-4998	-0.348	-0.032	-0.027	56	71	60	85
-6008	-0.360	-0.045	-0.039	72	87	76	106
-7023	-0.371	-0.053	-0.048	89	104	93	126
-8010	-0.382	-0.061	-0.059	106	120	111	146
-9011	-0.392	-0.066	-0.068	124	136	129	166
-10016	-0.403	-0.074	-0.078	142	153	147	185
-11018	-0.414	-0.083	-0.084	160	171	166	205
-12003	-0.424	-0.092	-0.091	176	188	184	224
-13004	-0.434	-0.099	-0.103	194	206	203	243
-14023	-0.445	-0.109	-0.112	213	225	222	263
-15012	-0.455	-0.116	-0.121	230	243	241	282
-16010	-0.466	-0.126	-0.128	248	261	260	302
-16994	-0.475	-0.134	-0.135	265	279	279	320
-18023	-0.486	-0.141	-0.144	284	298	298	340
-19059	-0.497	-0.153	-0.158	303	317	319	360
-20027	-0.506	-0.158	-0.164	321	335	337	378
-21026	-0.517	-0.166	-0.174	340	353	357	398
-22009	-0.526	-0.177	-0.180	357	371	376	417
-23002	-0.537	-0.184	-0.187	375	389	395	436
-24031	-0.547	-0.192	-0.199	394	408	415	455
-25003	-0.556	-0.199	-0.208	412	426	434	474
-26004	-0.567	-0.209	-0.215	431	444	454	494
-27013	-0.577	-0.220	-0.226	450	463	473	513
-28016	-0.586	-0.230	-0.237	469	481	493	533
-29224	-0.599	-0.234	-0.244	493	505	517	556
Comments:							

Stiffness Test: 26		Date: 12/12/2005		Panel B, Cycle: 6522001		Panel D, Cycle: 6522001	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Wire Pot 2 (in)	Strain Gage 1 ($\mu\epsilon$)	Strain Gage 2 ($\mu\epsilon$)	Strain Gage 3 ($\mu\epsilon$)	Strain Gage 4 ($\mu\epsilon$)
0	0.000	0.001	0.000	0	0	0	-1
-1009	-0.141	-0.001	-0.002	9	15	9	14
-2001	-0.156	-0.010	-0.005	19	29	19	29
-3011	-0.170	-0.022	-0.018	31	43	30	46
-3997	-0.182	-0.031	-0.018	43	57	43	64
-5016	-0.194	-0.035	-0.032	56	72	58	84
-6005	-0.206	-0.047	-0.043	71	87	74	104
-7014	-0.217	-0.057	-0.055	88	103	92	124
-8024	-0.228	-0.066	-0.062	105	120	109	145
-9008	-0.238	-0.073	-0.068	123	136	127	163
-10014	-0.249	-0.080	-0.075	140	153	145	183
-10997	-0.260	-0.089	-0.082	159	171	163	203
-12012	-0.270	-0.097	-0.094	176	188	181	222
-13020	-0.281	-0.105	-0.105	193	206	201	242
-14009	-0.291	-0.115	-0.112	211	224	219	261
-15016	-0.301	-0.121	-0.119	230	243	239	280
-16028	-0.312	-0.131	-0.128	247	261	257	300
-16997	-0.322	-0.140	-0.135	265	279	276	319
-17994	-0.334	-0.151	-0.153	285	299	298	340
-19016	-0.343	-0.157	-0.155	302	317	316	358
-20010	-0.353	-0.165	-0.162	320	335	335	377
-21017	-0.363	-0.172	-0.171	338	353	354	396
-22017	-0.374	-0.183	-0.183	356	371	374	416
-23007	-0.383	-0.191	-0.192	375	390	393	435
-23991	-0.393	-0.199	-0.201	393	409	413	454
-25017	-0.403	-0.205	-0.208	412	427	432	473
-25989	-0.413	-0.217	-0.217	430	444	451	492
-26996	-0.422	-0.225	-0.228	448	463	470	511
-27988	-0.433	-0.236	-0.235	468	481	489	530
-29227	-0.445	-0.239	-0.249	492	505	514	555
Comments:							

Stiffness Test: 27		Date: 12/13/2005		Panel B, Cycle: 6862000		Panel D, Cycle: 6862000	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Wire Pot 2 (in)	Strain Gage 1 ($\mu\epsilon$)	Strain Gage 2 ($\mu\epsilon$)	Strain Gage 3 ($\mu\epsilon$)	Strain Gage 4 ($\mu\epsilon$)
0	0.000	0.000	0.000	0	0	0	0
-1009	-0.211	-0.002	0.002	9	14	9	14
-2017	-0.226	-0.010	-0.007	20	28	19	30
-3020	-0.240	-0.022	-0.014	31	43	30	47
-4009	-0.252	-0.031	-0.021	44	57	43	65
-4998	-0.264	-0.037	-0.025	56	72	58	85
-6011	-0.276	-0.043	-0.041	72	87	74	105
-7020	-0.287	-0.056	-0.048	89	104	91	125
-8000	-0.298	-0.066	-0.062	105	120	108	145
-9025	-0.309	-0.072	-0.068	123	137	126	165
-10032	-0.320	-0.080	-0.078	142	154	145	185
-11018	-0.330	-0.089	-0.084	160	172	162	204
-12001	-0.341	-0.097	-0.094	176	189	181	223
-13020	-0.352	-0.105	-0.103	194	207	200	243
-14034	-0.362	-0.115	-0.112	212	226	219	262
-15013	-0.372	-0.123	-0.123	230	244	238	282
-16025	-0.383	-0.130	-0.130	248	262	257	301
-17000	-0.393	-0.140	-0.135	266	281	276	320
-18017	-0.403	-0.147	-0.144	283	298	295	339
-19003	-0.413	-0.155	-0.155	302	317	314	358
-20011	-0.424	-0.166	-0.164	320	335	334	378
-20993	-0.433	-0.172	-0.174	338	353	353	397
-22013	-0.444	-0.179	-0.180	356	372	373	416
-22998	-0.454	-0.191	-0.192	375	390	392	435
-24011	-0.464	-0.198	-0.203	394	409	411	454
-25015	-0.474	-0.205	-0.208	412	427	431	474
-25981	-0.484	-0.213	-0.217	430	444	449	493
-26998	-0.494	-0.225	-0.231	448	463	469	512
-27997	-0.504	-0.235	-0.240	467	481	488	531
-29221	-0.516	-0.243	-0.251	492	505	513	556
Comments:							

Stiffness Test: 28		Date: 12/14/2005		Panel B, Cycle: 7222222		Panel D, Cycle: 7222222	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Wire Pot 2 (in)	Strain Gage 1 ($\mu\epsilon$)	Strain Gage 2 ($\mu\epsilon$)	Strain Gage 3 ($\mu\epsilon$)	Strain Gage 4 ($\mu\epsilon$)
0	0.000	0.000	0.000	0	0	0	0
-1006	-0.180	-0.004	0.000	9	15	9	14
-2011	-0.196	-0.011	-0.007	20	29	19	30
-3008	-0.209	-0.022	-0.016	31	43	31	46
-4029	-0.222	-0.031	-0.021	44	57	44	65
-5004	-0.234	-0.035	-0.027	57	72	59	85
-6016	-0.245	-0.046	-0.039	72	87	75	104
-6999	-0.257	-0.057	-0.050	88	103	92	125
-7997	-0.268	-0.067	-0.062	105	119	109	145
-9013	-0.278	-0.073	-0.068	123	136	126	164
-10019	-0.289	-0.080	-0.080	141	154	145	184
-11023	-0.300	-0.089	-0.087	158	170	163	203
-12035	-0.311	-0.098	-0.094	176	188	182	223
-13010	-0.321	-0.105	-0.105	193	206	201	242
-14009	-0.331	-0.115	-0.112	210	224	219	261
-15045	-0.342	-0.123	-0.123	229	243	239	281
-15999	-0.352	-0.134	-0.130	246	260	257	300
-17026	-0.362	-0.141	-0.137	265	279	277	320
-18037	-0.372	-0.147	-0.148	283	298	296	339
-19030	-0.383	-0.156	-0.158	301	316	315	358
-20011	-0.393	-0.166	-0.167	318	334	334	377
-20990	-0.403	-0.173	-0.174	336	352	353	396
-21991	-0.413	-0.183	-0.180	355	370	373	416
-23012	-0.423	-0.191	-0.196	373	389	393	435
-24011	-0.434	-0.199	-0.203	392	408	412	454
-24998	-0.444	-0.205	-0.210	411	426	432	473
-26003	-0.453	-0.217	-0.221	429	444	450	493
-27008	-0.463	-0.226	-0.231	447	462	470	512
-28009	-0.473	-0.236	-0.244	466	480	489	531
-29218	-0.485	-0.240	-0.251	490	504	513	555
Comments:							

Stiffness Test: 29		Date: 12/15/2005		Panel B, Cycle: 7510000		Panel D, Cycle: 7510000	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Wire Pot 2 (in)	Strain Gage 1 ($\mu\epsilon$)	Strain Gage 2 ($\mu\epsilon$)	Strain Gage 3 ($\mu\epsilon$)	Strain Gage 4 ($\mu\epsilon$)
0	0.000	0.001	0.000	0	0	0	0
-1004	-0.221	-0.004	0.000	9	15	9	14
-2017	-0.237	-0.011	-0.007	20	29	19	29
-3009	-0.250	-0.022	-0.014	31	43	30	46
-4014	-0.262	-0.031	-0.021	44	57	44	64
-5016	-0.274	-0.036	-0.030	56	71	59	84
-6014	-0.286	-0.047	-0.043	73	88	75	104
-7018	-0.297	-0.057	-0.055	88	103	92	124
-8012	-0.308	-0.066	-0.062	105	119	109	144
-8998	-0.318	-0.073	-0.071	122	136	127	163
-10023	-0.329	-0.080	-0.078	141	153	146	183
-11017	-0.340	-0.089	-0.089	158	170	164	203
-11970	-0.350	-0.098	-0.096	175	187	182	221
-13020	-0.360	-0.104	-0.105	193	206	201	241
-13953	-0.370	-0.115	-0.114	209	222	218	259
-15006	-0.381	-0.123	-0.123	228	241	239	280
-16013	-0.391	-0.132	-0.130	245	259	257	299
-17013	-0.401	-0.140	-0.139	264	278	277	318
-18006	-0.412	-0.147	-0.148	281	296	296	337
-19016	-0.422	-0.155	-0.158	299	314	315	357
-19984	-0.431	-0.165	-0.167	317	332	334	375
-21005	-0.442	-0.171	-0.174	336	351	354	395
-22029	-0.452	-0.182	-0.180	354	369	374	414
-23002	-0.462	-0.191	-0.189	372	387	392	433
-24008	-0.472	-0.198	-0.203	390	406	412	452
-25023	-0.483	-0.208	-0.215	409	425	432	472
-26004	-0.493	-0.215	-0.221	428	443	451	492
-27014	-0.503	-0.226	-0.231	447	461	471	511
-28012	-0.513	-0.236	-0.242	466	480	490	531
-29224	-0.525	-0.240	-0.251	489	503	514	555
Comments:							

Stiffness Test: 30		Date: 12/16/2005		Panel B, Cycle: 7895800		Panel D, Cycle: 7895800	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Wire Pot 2 (in)	Strain Gage 1 ($\mu\epsilon$)	Strain Gage 2 ($\mu\epsilon$)	Strain Gage 3 ($\mu\epsilon$)	Strain Gage 4 ($\mu\epsilon$)
6	0.000	0.001	0.000	0	-1	-1	-1
-1013	-0.081	-0.002	-0.005	11	15	7	12
-2011	-0.097	-0.015	-0.011	20	29	18	27
-3003	-0.110	-0.022	-0.011	31	42	30	44
-4006	-0.122	-0.027	-0.025	44	56	45	62
-5012	-0.134	-0.036	-0.025	56	70	61	82
-6002	-0.145	-0.048	-0.039	71	85	78	101
-7006	-0.156	-0.057	-0.050	87	100	95	121
-8019	-0.167	-0.064	-0.062	104	117	114	141
-9011	-0.178	-0.073	-0.068	121	134	132	161
-10009	-0.189	-0.080	-0.078	140	151	151	181
-11006	-0.200	-0.089	-0.087	158	168	170	202
-12007	-0.210	-0.098	-0.096	176	186	188	221
-13005	-0.221	-0.108	-0.107	193	204	208	241
-14003	-0.231	-0.115	-0.112	211	223	227	261
-15004	-0.242	-0.125	-0.121	229	241	245	281
-16007	-0.252	-0.134	-0.130	248	259	265	301
-17010	-0.263	-0.140	-0.139	266	279	283	321
-18001	-0.273	-0.150	-0.146	284	298	303	341
-19010	-0.284	-0.160	-0.158	303	316	322	361
-20008	-0.294	-0.166	-0.164	322	335	342	380
-21006	-0.304	-0.177	-0.171	340	354	362	400
-22003	-0.315	-0.184	-0.180	358	372	381	419
-23007	-0.325	-0.192	-0.189	377	391	401	438
-24011	-0.335	-0.200	-0.201	395	410	420	458
-25008	-0.345	-0.212	-0.208	414	427	439	477
-26007	-0.355	-0.222	-0.215	432	446	458	497
-27008	-0.365	-0.231	-0.226	451	465	478	517
-28006	-0.375	-0.233	-0.237	470	483	497	536
-29221	-0.387	-0.246	-0.251	493	506	521	559
Comments:							

Stiffness Test: 31		Date: 12/17/2005		Panel B, Cycle: 8135000		Panel D, Cycle: 8135000	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Wire Pot 2 (in)	Strain Gage 1 ($\mu\epsilon$)	Strain Gage 2 ($\mu\epsilon$)	Strain Gage 3 ($\mu\epsilon$)	Strain Gage 4 ($\mu\epsilon$)
2	0.000	0.000	0.000	0	0	0	0
-1016	-0.131	-0.002	-0.002	10	15	9	14
-1998	-0.146	-0.012	-0.009	20	29	19	29
-3003	-0.159	-0.024	-0.011	32	43	31	46
-4052	-0.172	-0.032	-0.023	44	58	45	66
-5030	-0.184	-0.036	-0.027	57	73	60	85
-6016	-0.195	-0.047	-0.041	73	88	76	105
-7012	-0.206	-0.058	-0.050	89	105	93	125
-8013	-0.217	-0.067	-0.057	106	121	110	145
-8993	-0.228	-0.074	-0.068	123	137	127	163
-9988	-0.239	-0.083	-0.078	142	156	146	184
-11004	-0.249	-0.092	-0.087	160	173	164	203
-12012	-0.260	-0.099	-0.096	177	192	183	223
-12987	-0.270	-0.109	-0.103	195	209	201	242
-14029	-0.281	-0.118	-0.110	213	228	220	261
-14984	-0.291	-0.125	-0.121	230	245	239	280
-16002	-0.301	-0.135	-0.128	249	264	258	300
-16993	-0.312	-0.144	-0.137	266	282	277	319
-17982	-0.321	-0.149	-0.146	283	300	296	338
-19010	-0.332	-0.158	-0.153	302	319	316	358
-20014	-0.342	-0.168	-0.160	321	338	336	378
-20996	-0.352	-0.175	-0.169	339	356	354	396
-21975	-0.362	-0.187	-0.180	356	374	374	415
-23021	-0.373	-0.193	-0.189	376	393	394	435
-24025	-0.383	-0.200	-0.199	394	411	413	454
-24995	-0.392	-0.208	-0.205	412	429	432	472
-26009	-0.402	-0.219	-0.215	431	448	452	492
-26990	-0.412	-0.230	-0.226	448	465	470	511
-28003	-0.422	-0.239	-0.233	467	484	490	531
-29223	-0.435	-0.241	-0.247	491	507	514	555
Comments:							

Stiffness Test: 32		Date: 12/19/2005		Panel B, Cycle: 8866201		Panel D, Cycle: 8866201	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Wire Pot 2 (in)	Strain Gage 1 ($\mu\epsilon$)	Strain Gage 2 ($\mu\epsilon$)	Strain Gage 3 ($\mu\epsilon$)	Strain Gage 4 ($\mu\epsilon$)
-2	0.000	0.001	0.002	-1	0	-1	-1
-1001	-0.066	-0.002	-0.002	9	15	8	14
-2007	-0.082	-0.010	-0.009	20	29	19	29
-3005	-0.095	-0.022	-0.014	30	42	30	46
-3998	-0.107	-0.030	-0.023	44	57	44	65
-5012	-0.120	-0.036	-0.030	57	72	59	85
-6002	-0.131	-0.043	-0.041	72	87	75	104
-7006	-0.142	-0.056	-0.050	88	103	92	124
-8009	-0.154	-0.066	-0.059	106	121	110	145
-9011	-0.165	-0.073	-0.071	123	137	127	164
-10008	-0.175	-0.080	-0.078	141	155	146	185
-11006	-0.186	-0.088	-0.087	159	172	164	204
-12009	-0.196	-0.098	-0.096	177	190	183	223
-13007	-0.207	-0.105	-0.103	194	208	202	243
-14002	-0.217	-0.116	-0.112	211	226	220	262
-15004	-0.228	-0.123	-0.121	230	245	240	281
-16005	-0.238	-0.134	-0.130	248	263	259	301
-17005	-0.248	-0.141	-0.139	266	281	279	320
-18006	-0.259	-0.149	-0.146	284	300	298	340
-19003	-0.269	-0.157	-0.155	302	319	318	360
-20008	-0.279	-0.167	-0.162	321	337	337	379
-21008	-0.290	-0.173	-0.174	339	355	356	398
-22006	-0.300	-0.184	-0.183	357	374	376	417
-23002	-0.310	-0.193	-0.192	376	392	395	437
-24003	-0.320	-0.200	-0.199	394	411	415	456
-25000	-0.330	-0.208	-0.210	413	429	434	475
-26001	-0.341	-0.219	-0.219	432	448	454	495
-27004	-0.350	-0.229	-0.226	450	466	473	514
-28006	-0.361	-0.240	-0.240	469	485	493	533
-29221	-0.373	-0.243	-0.247	493	509	517	558
Comments:							

Stiffness Test: 33		Date: 12/20/2005		Panel B, Cycle: 9257301		Panel D, Cycle: 9257301	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Wire Pot 2 (in)	Strain Gage 1 ($\mu\epsilon$)	Strain Gage 2 ($\mu\epsilon$)	Strain Gage 3 ($\mu\epsilon$)	Strain Gage 4 ($\mu\epsilon$)
5	0.000	0.000	0.000	-2	-1	-1	-1
-1010	-0.078	-0.004	-0.005	9	14	8	13
-2004	-0.093	-0.011	-0.009	20	28	18	28
-3005	-0.107	-0.024	-0.009	31	42	30	45
-4006	-0.119	-0.032	-0.025	43	57	43	64
-5010	-0.131	-0.036	-0.025	57	72	59	84
-6013	-0.143	-0.046	-0.039	72	88	75	104
-7003	-0.154	-0.058	-0.053	89	104	92	124
-8010	-0.165	-0.067	-0.062	105	120	109	144
-9008	-0.176	-0.074	-0.068	122	137	127	164
-10003	-0.186	-0.082	-0.080	140	154	145	183
-11011	-0.197	-0.090	-0.087	158	172	164	204
-12006	-0.208	-0.100	-0.096	176	189	183	223
-13002	-0.218	-0.106	-0.105	193	207	202	242
-14000	-0.228	-0.116	-0.112	211	225	220	261
-15009	-0.239	-0.124	-0.123	229	243	239	280
-16002	-0.249	-0.134	-0.130	246	261	258	300
-17008	-0.259	-0.144	-0.142	265	280	278	320
-18009	-0.270	-0.150	-0.148	282	298	297	339
-19009	-0.280	-0.158	-0.155	300	317	316	358
-20007	-0.290	-0.168	-0.162	318	335	336	377
-20997	-0.301	-0.175	-0.171	337	353	355	396
-22003	-0.311	-0.186	-0.183	356	372	375	416
-22999	-0.320	-0.194	-0.192	373	390	394	435
-24010	-0.331	-0.202	-0.201	391	408	413	454
-25006	-0.341	-0.208	-0.208	410	427	432	473
-26007	-0.351	-0.220	-0.217	429	446	452	493
-27001	-0.361	-0.230	-0.228	447	463	471	512
-28005	-0.371	-0.240	-0.242	466	482	491	532
-29224	-0.384	-0.248	-0.258	491	507	515	556
Comments:							

Stiffness Test: 34		Date: 12/21/2005		Panel B, Cycle: 9628801		Panel D, Cycle: 9628801	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Wire Pot 2 (in)	Strain Gage 1 ($\mu\epsilon$)	Strain Gage 2 ($\mu\epsilon$)	Strain Gage 3 ($\mu\epsilon$)	Strain Gage 4 ($\mu\epsilon$)
-2	0.000	0.000	-0.002	0	0	-1	-1
-1004	-0.085	-0.002	-0.002	9	14	7	13
-2002	-0.100	-0.011	-0.009	20	29	18	29
-3002	-0.113	-0.022	-0.016	32	42	29	45
-4006	-0.126	-0.031	-0.023	44	57	43	64
-5005	-0.138	-0.036	-0.030	57	72	57	84
-6004	-0.149	-0.047	-0.043	72	87	73	103
-7005	-0.161	-0.058	-0.055	88	103	90	124
-8004	-0.172	-0.067	-0.064	105	120	108	144
-9001	-0.183	-0.074	-0.073	122	137	125	164
-10008	-0.193	-0.082	-0.080	139	153	144	183
-11008	-0.204	-0.090	-0.087	157	170	162	203
-12001	-0.215	-0.099	-0.098	175	188	181	222
-12997	-0.225	-0.108	-0.107	192	206	200	242
-14009	-0.236	-0.118	-0.116	210	225	219	262
-15004	-0.246	-0.125	-0.126	228	243	238	281
-16001	-0.257	-0.134	-0.132	246	261	257	301
-17000	-0.267	-0.142	-0.139	263	279	276	320
-18006	-0.277	-0.150	-0.151	281	297	295	339
-19003	-0.287	-0.160	-0.160	299	316	315	359
-20004	-0.298	-0.167	-0.169	317	335	334	378
-21012	-0.308	-0.175	-0.176	336	353	354	398
-22003	-0.318	-0.186	-0.183	355	371	373	417
-23004	-0.328	-0.194	-0.194	372	390	392	436
-24007	-0.339	-0.202	-0.205	391	409	412	455
-25003	-0.349	-0.209	-0.212	410	427	431	475
-26006	-0.359	-0.220	-0.221	429	445	451	494
-27002	-0.369	-0.231	-0.233	446	464	470	513
-28005	-0.378	-0.238	-0.247	465	482	490	532
-29223	-0.390	-0.241	-0.256	488	505	513	556
Comments:							

Stiffness Test: 35		Date: 38722		Panel B, Cycle: 10000000		Panel D, Cycle: 10000000	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Wire Pot 2 (in)	Strain Gage 1 ($\mu\epsilon$)	Strain Gage 2 ($\mu\epsilon$)	Strain Gage 3 ($\mu\epsilon$)	Strain Gage 4 ($\mu\epsilon$)
0	0.000	0.000	0.000	0	0	0	0
-1009	-0.183	-0.010	-0.005	10	13	12	16
-2005	-0.209	-0.020	-0.018	21	25	26	33
-3009	-0.231	-0.024	-0.025	32	37	41	50
-4012	-0.252	-0.031	-0.032	45	49	58	69
-5005	-0.269	-0.046	-0.039	58	62	76	87
-6005	-0.286	-0.053	-0.046	72	75	94	105
-7017	-0.301	-0.058	-0.053	88	89	114	125
-8024	-0.315	-0.066	-0.066	103	103	133	144
-8990	-0.328	-0.077	-0.073	119	118	152	162
-10000	-0.341	-0.085	-0.082	137	133	173	182
-10989	-0.353	-0.094	-0.089	154	149	193	201
-12016	-0.365	-0.100	-0.096	172	166	213	221
-13002	-0.377	-0.109	-0.112	189	182	234	241
-13985	-0.389	-0.118	-0.119	207	200	255	261
-15007	-0.401	-0.125	-0.126	225	218	275	280
-16001	-0.412	-0.132	-0.132	243	237	295	300
-16982	-0.423	-0.142	-0.142	262	255	315	320
-17983	-0.434	-0.150	-0.155	280	274	335	340
-18986	-0.446	-0.161	-0.162	299	294	355	361
-20024	-0.457	-0.167	-0.169	319	314	375	381
-20996	-0.468	-0.175	-0.178	338	333	394	401
-21974	-0.479	-0.186	-0.185	356	352	413	421
-22989	-0.490	-0.193	-0.192	376	373	432	442
-23999	-0.501	-0.200	-0.205	396	393	452	462
-24992	-0.512	-0.210	-0.212	415	413	471	482
-26006	-0.522	-0.218	-0.221	435	433	491	503
-26998	-0.533	-0.226	-0.228	455	454	510	524
-28005	-0.544	-0.235	-0.240	475	475	529	544
-29218	-0.556	-0.248	-0.249	500	499	552	568

Comments: Stiffness test completed two weeks after reaching 10,000,000 cycles.

C.2 Dynamic Effect Test, For Test Series 3, Panels B and D

Date: 11/29/05	Panel B	Panel D	Panel B		Panel D	
Load (kN)	Defl. (mm)	Defl. (mm)	SG1 ($\mu\epsilon$)	SG2 ($\mu\epsilon$)	SG3 ($\mu\epsilon$)	SG4 ($\mu\epsilon$)
6.68	0.99	0.69	42	52	42	61
6.78	1.02	0.64	43	53	43	63
7.33	1.02	0.69	46	58	47	68
8.27	1.09	0.81	50	63	52	75
9.63	1.19	0.86	57	72	60	87
11.40	1.40	1.09	70	85	73	104
13.51	1.65	1.35	86	100	88	123
15.96	1.93	1.57	106	117	105	144
18.65	2.21	1.73	129	138	126	169
21.52	2.46	2.03	153	162	149	194
24.59	2.74	2.31	177	187	173	219
27.79	3.10	2.54	203	214	199	247
31.05	3.43	2.90	231	243	227	276
34.35	3.76	3.20	257	270	253	303
37.62	4.06	3.43	283	296	279	329
40.84	4.39	3.71	309	323	306	356
43.99	4.67	4.01	334	348	331	381
47.05	4.98	4.29	359	372	356	406
50.05	5.31	4.52	384	397	381	430
52.95	5.61	4.80	408	421	405	454
55.69	5.87	5.05	429	442	427	475
58.22	6.10	5.21	450	463	448	496
60.47	6.32	5.46	468	482	467	514
62.37	6.50	5.69	484	497	482	529
63.82	6.65	5.79	496	509	494	540
64.69	6.78	5.87	504	517	502	548
64.98	6.81	5.87	505	518	503	548

APPENDIX D:
EXPERIMENTAL RESULTS FOR TEST SERIES 4
PANELS B AND D

D.1 Stiffness Test For Test Series 4, Panels B and D

Stiffness Test: 1		Date: 1/11/2006		Panel B, Cycle: 1		Panel D, Cycle: 1	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Wire Pot 2 (in)	Strain Gage 1 ($\mu\epsilon$)	Strain Gage 2 ($\mu\epsilon$)	Strain Gage 3 ($\mu\epsilon$)	Strain Gage 4 ($\mu\epsilon$)
0	0.000	0.000	0.000	0	0	0	0
-1059	-0.121	-0.002	-0.005	11	16	10	17
-2053	-0.136	-0.009	-0.011	23	32	24	35
-3098	-0.149	-0.019	-0.011	39	47	41	56
-4032	-0.161	-0.030	-0.025	56	61	56	74
-5027	-0.173	-0.040	-0.032	75	77	74	95
-6039	-0.184	-0.043	-0.041	94	95	92	114
-6985	-0.194	-0.053	-0.050	111	112	109	133
-8012	-0.205	-0.062	-0.062	131	132	129	153
-9045	-0.215	-0.071	-0.068	150	153	148	174
-10081	-0.226	-0.078	-0.078	170	173	169	195
-11070	-0.236	-0.085	-0.087	189	193	188	215
-12019	-0.246	-0.094	-0.094	206	211	207	233
-13081	-0.257	-0.103	-0.105	226	232	228	254
-14034	-0.267	-0.110	-0.112	245	251	247	274
-15030	-0.277	-0.120	-0.119	263	270	267	294
-16065	-0.288	-0.129	-0.130	284	290	288	315
-16996	-0.297	-0.137	-0.139	302	309	307	334
-18049	-0.308	-0.146	-0.146	322	329	328	355
-19007	-0.318	-0.152	-0.153	341	348	348	374
-20039	-0.328	-0.162	-0.164	361	368	368	394
-21078	-0.339	-0.171	-0.171	382	389	389	416
-22023	-0.349	-0.177	-0.178	400	407	408	435
-23073	-0.359	-0.189	-0.187	421	427	429	455
-24036	-0.369	-0.196	-0.196	440	445	448	474
-25066	-0.379	-0.204	-0.208	460	466	468	495
-26055	-0.388	-0.210	-0.215	480	485	488	514
-27066	-0.398	-0.223	-0.224	500	505	508	535
-28096	-0.409	-0.234	-0.237	521	524	529	555
-29035	-0.418	-0.243	-0.244	540	543	548	574
-30054	-0.428	-0.244	-0.249	560	562	569	594
-31052	-0.438	-0.257	-0.256	581	582	589	615
-32066	-0.448	-0.266	-0.265	601	602	610	636
-33079	-0.459	-0.272	-0.276	622	622	631	656
-33987	-0.468	-0.283	-0.283	641	640	651	675
-35026	-0.478	-0.288	-0.292	662	660	672	696
-36050	-0.488	-0.303	-0.297	682	679	693	717
-37094	-0.499	-0.304	-0.311	704	700	715	738
-38045	-0.508	-0.322	-0.317	723	719	735	758
-39026	-0.518	-0.325	-0.324	743	739	755	779
-40038	-0.529	-0.329	-0.338	765	759	777	800
-41056	-0.540	-0.344	-0.345	787	780	798	822
-42071	-0.550	-0.348	-0.352	808	800	819	843
-43024	-0.559	-0.358	-0.363	827	819	839	862
Comments:							

Stiffness Test: 2		Date: 1/11/2006		Panel B, Cycle: 10		Panel D, Cycle: 10	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Wire Pot 2 (in)	Strain Gage 1 ($\mu\epsilon$)	Strain Gage 2 ($\mu\epsilon$)	Strain Gage 3 ($\mu\epsilon$)	Strain Gage 4 ($\mu\epsilon$)
0	0.000	0.000	0.000	-1	0	0	0
-1039	-0.132	-0.004	-0.007	13	17	13	19
-2050	-0.147	-0.010	-0.014	25	31	27	37
-3125	-0.161	-0.019	-0.014	43	48	45	58
-4050	-0.172	-0.028	-0.023	60	62	60	76
-5036	-0.183	-0.038	-0.027	79	79	77	96
-6011	-0.194	-0.043	-0.039	98	97	95	115
-7063	-0.206	-0.053	-0.053	118	117	114	136
-8053	-0.216	-0.063	-0.059	137	136	133	156
-9010	-0.226	-0.071	-0.071	155	155	151	175
-10103	-0.238	-0.080	-0.078	176	177	173	197
-11067	-0.248	-0.089	-0.084	194	197	192	216
-12019	-0.258	-0.098	-0.096	213	216	211	235
-13075	-0.269	-0.105	-0.103	233	236	231	256
-14057	-0.279	-0.114	-0.114	252	256	251	276
-15113	-0.290	-0.123	-0.121	272	276	272	297
-16047	-0.299	-0.130	-0.130	291	295	291	316
-17072	-0.310	-0.139	-0.137	310	315	311	336
-18005	-0.320	-0.149	-0.148	329	334	331	355
-19054	-0.330	-0.155	-0.155	349	354	351	376
-20027	-0.340	-0.163	-0.164	368	373	371	395
-21046	-0.351	-0.172	-0.174	389	394	392	416
-22023	-0.361	-0.179	-0.180	408	412	411	436
-23033	-0.371	-0.189	-0.187	428	432	431	456
-24052	-0.381	-0.198	-0.196	448	452	452	476
-25024	-0.391	-0.205	-0.205	467	471	471	495
-26059	-0.401	-0.213	-0.217	488	491	492	516
-27083	-0.411	-0.224	-0.224	508	511	513	537
-28041	-0.421	-0.235	-0.231	528	530	532	556
-29090	-0.431	-0.245	-0.247	548	550	554	577
-30036	-0.441	-0.246	-0.253	568	568	573	597
-31025	-0.451	-0.259	-0.260	588	588	594	617
-32128	-0.462	-0.270	-0.267	610	609	616	639
-33053	-0.471	-0.276	-0.274	629	627	635	658
-34057	-0.482	-0.286	-0.285	650	647	657	679
-35025	-0.492	-0.290	-0.292	669	666	677	699
-36065	-0.502	-0.304	-0.299	690	686	698	720
-37057	-0.512	-0.307	-0.313	711	706	719	741
-38051	-0.522	-0.324	-0.320	731	725	739	761
-39046	-0.532	-0.328	-0.326	752	745	761	782
-40084	-0.542	-0.332	-0.338	772	765	781	803
-41060	-0.552	-0.347	-0.347	793	785	802	823
-42019	-0.562	-0.350	-0.354	813	804	822	843
-43037	-0.573	-0.361	-0.361	834	825	844	865
-43847	-0.583	-0.369	-0.374	853	843	862	884
Comments:							

Stiffness Test: 3		Date: 1/11/2006		Panel B, Cycle: 100		Panel D, Cycle: 100	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Wire Pot 2 (in)	Strain Gage 1 ($\mu\epsilon$)	Strain Gage 2 ($\mu\epsilon$)	Strain Gage 3 ($\mu\epsilon$)	Strain Gage 4 ($\mu\epsilon$)
0	0.000	0.000	0.000	-1	-1	-1	-1
-1039	-0.053	-0.004	0.000	11	16	11	17
-1747	-0.065	-0.009	-0.007	20	28	20	31
-3025	-0.081	-0.021	-0.014	39	46	39	55
-4041	-0.093	-0.030	-0.021	59	63	55	75
-5106	-0.105	-0.036	-0.027	79	81	74	96
-6023	-0.115	-0.043	-0.039	97	98	90	114
-7035	-0.126	-0.054	-0.050	116	117	108	134
-8099	-0.137	-0.063	-0.057	136	138	128	155
-9016	-0.147	-0.071	-0.066	153	156	145	173
-10077	-0.158	-0.079	-0.075	174	178	165	194
-11065	-0.168	-0.088	-0.084	193	197	185	214
-11877	-0.177	-0.095	-0.091	209	213	201	230
-13026	-0.189	-0.105	-0.100	232	237	224	253
-14040	-0.199	-0.114	-0.107	251	257	244	274
-15050	-0.209	-0.121	-0.119	270	276	263	293
-16031	-0.220	-0.130	-0.128	290	296	283	313
-17040	-0.230	-0.140	-0.135	308	315	303	333
-18095	-0.240	-0.147	-0.144	329	336	324	353
-19135	-0.251	-0.155	-0.153	350	357	345	374
-20060	-0.260	-0.165	-0.160	368	375	364	393
-21009	-0.270	-0.172	-0.167	387	393	383	412
-22007	-0.280	-0.181	-0.176	406	413	403	431
-23099	-0.291	-0.191	-0.187	427	433	424	452
-24060	-0.300	-0.198	-0.196	446	452	444	472
-25017	-0.310	-0.204	-0.203	465	470	462	491
-26088	-0.321	-0.215	-0.212	486	491	484	512
-27031	-0.330	-0.225	-0.224	505	510	504	531
-28017	-0.340	-0.236	-0.233	524	528	524	551
-29050	-0.350	-0.240	-0.247	545	548	545	571
-30070	-0.360	-0.245	-0.253	565	568	566	592
-31028	-0.370	-0.257	-0.251	584	586	586	611
-32038	-0.380	-0.267	-0.263	604	605	607	631
-33082	-0.390	-0.280	-0.274	625	626	629	653
-34051	-0.400	-0.283	-0.281	646	645	649	674
-35051	-0.410	-0.295	-0.288	665	664	670	693
-36027	-0.420	-0.300	-0.299	685	683	690	714
-37044	-0.430	-0.304	-0.306	706	703	711	735
-38048	-0.440	-0.322	-0.313	726	723	732	755
-39049	-0.450	-0.324	-0.324	746	742	753	776
-40030	-0.461	-0.340	-0.333	767	761	773	796
-41071	-0.471	-0.343	-0.340	788	782	795	817
-42060	-0.481	-0.349	-0.349	807	801	815	837
-43067	-0.492	-0.363	-0.361	830	822	837	858
-43842	-0.500	-0.366	-0.368	847	838	854	876
Comments:							

Stiffness Test: 4		Date: 1/11/2006		Panel B, Cycle: 1000		Panel D, Cycle: 1000	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Wire Pot 2 (in)	Strain Gage 1 ($\mu\epsilon$)	Strain Gage 2 ($\mu\epsilon$)	Strain Gage 3 ($\mu\epsilon$)	Strain Gage 4 ($\mu\epsilon$)
0	0.000	0.000	0.000	-1	-1	-1	-1
-990	-0.094	-0.006	-0.002	11	15	10	16
-2014	-0.110	-0.014	-0.007	24	31	23	35
-3016	-0.123	-0.022	-0.014	40	47	38	55
-4049	-0.135	-0.031	-0.021	59	63	55	75
-5042	-0.146	-0.036	-0.027	78	79	71	95
-6043	-0.157	-0.045	-0.041	97	98	89	115
-7073	-0.168	-0.056	-0.053	117	118	107	135
-8125	-0.180	-0.064	-0.062	137	138	127	156
-9057	-0.189	-0.071	-0.071	155	157	145	174
-10038	-0.200	-0.079	-0.078	174	177	163	194
-11131	-0.211	-0.089	-0.084	194	198	185	216
-12071	-0.221	-0.097	-0.094	212	217	203	234
-13069	-0.231	-0.104	-0.105	232	237	223	254
-14034	-0.241	-0.114	-0.112	250	256	242	274
-15039	-0.251	-0.121	-0.121	270	276	262	293
-16031	-0.261	-0.131	-0.130	289	295	282	313
-17119	-0.272	-0.140	-0.137	310	316	303	334
-18020	-0.281	-0.146	-0.146	327	334	321	352
-19012	-0.292	-0.153	-0.153	346	353	341	372
-20046	-0.302	-0.165	-0.160	367	373	362	393
-21037	-0.312	-0.171	-0.171	386	393	381	412
-22049	-0.322	-0.182	-0.183	406	412	402	432
-22972	-0.331	-0.189	-0.189	424	430	420	451
-24026	-0.342	-0.198	-0.196	444	450	442	471
-25056	-0.352	-0.204	-0.205	464	470	462	492
-26077	-0.362	-0.215	-0.219	484	489	483	512
-27103	-0.372	-0.226	-0.226	504	509	505	532
-28138	-0.383	-0.238	-0.237	524	528	526	553
-29096	-0.392	-0.239	-0.247	544	547	545	572
-30047	-0.401	-0.248	-0.253	562	565	565	591
-31094	-0.412	-0.259	-0.260	582	585	586	612
-32133	-0.422	-0.267	-0.267	603	604	608	633
-33062	-0.431	-0.277	-0.272	621	622	627	652
-34057	-0.441	-0.281	-0.283	641	642	648	672
-35099	-0.452	-0.297	-0.295	663	663	670	694
-36043	-0.462	-0.300	-0.299	682	680	690	713
-37077	-0.472	-0.307	-0.311	703	701	711	735
-38065	-0.482	-0.321	-0.320	723	720	732	754
-39119	-0.492	-0.323	-0.326	743	740	752	775
-40058	-0.502	-0.338	-0.333	763	758	772	795
-41033	-0.511	-0.340	-0.345	783	778	792	814
-42049	-0.522	-0.349	-0.354	804	798	813	835
-43049	-0.532	-0.361	-0.361	825	818	834	856
-43845	-0.542	-0.366	-0.368	843	836	853	875
Comments:							

Stiffness Test: 5		Date: 1/12/2006		Panel B, Cycle: 10000		Panel D, Cycle: 10000	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Wire Pot 2 (in)	Strain Gage 1 ($\mu\epsilon$)	Strain Gage 2 ($\mu\epsilon$)	Strain Gage 3 ($\mu\epsilon$)	Strain Gage 4 ($\mu\epsilon$)
3	0.000	0.000	0.002	0	0	0	0
-1022	-0.112	-0.004	-0.007	12	16	12	19
-2059	-0.128	-0.014	-0.007	25	32	26	38
-3113	-0.141	-0.022	-0.016	43	49	42	58
-4061	-0.153	-0.031	-0.021	61	64	57	78
-5047	-0.164	-0.036	-0.027	80	81	74	98
-6069	-0.176	-0.045	-0.041	100	100	92	118
-7052	-0.187	-0.056	-0.053	118	120	110	138
-8041	-0.198	-0.064	-0.059	136	138	127	158
-9101	-0.209	-0.073	-0.071	157	160	147	179
-10054	-0.219	-0.080	-0.078	176	180	166	198
-11017	-0.229	-0.088	-0.084	194	199	185	217
-12027	-0.240	-0.097	-0.094	214	219	204	238
-13033	-0.250	-0.105	-0.105	233	239	224	258
-14025	-0.261	-0.115	-0.116	253	259	244	278
-15038	-0.271	-0.123	-0.123	272	279	264	298
-16051	-0.281	-0.132	-0.130	292	298	284	318
-17068	-0.292	-0.141	-0.137	311	318	304	338
-18035	-0.302	-0.147	-0.144	330	337	323	358
-19053	-0.312	-0.157	-0.158	350	356	344	378
-20028	-0.322	-0.166	-0.164	367	374	363	396
-20994	-0.332	-0.173	-0.174	387	394	383	416
-22065	-0.343	-0.184	-0.183	408	414	405	437
-23042	-0.353	-0.192	-0.189	426	433	424	457
-24045	-0.363	-0.199	-0.201	446	452	445	476
-25040	-0.373	-0.207	-0.210	465	471	465	496
-26042	-0.383	-0.218	-0.217	485	491	486	517
-26992	-0.393	-0.230	-0.233	504	509	506	536
-28073	-0.403	-0.238	-0.237	525	530	528	557
-29035	-0.413	-0.240	-0.244	544	548	549	577
-30054	-0.423	-0.251	-0.251	564	568	570	598
-31010	-0.433	-0.264	-0.260	583	586	590	617
-32029	-0.443	-0.269	-0.269	603	605	611	637
-33048	-0.453	-0.278	-0.279	623	625	632	658
-34034	-0.463	-0.283	-0.285	642	644	652	678
-35017	-0.473	-0.297	-0.295	662	663	673	698
-36053	-0.484	-0.301	-0.306	682	682	694	719
-37080	-0.494	-0.317	-0.313	703	702	715	740
-38043	-0.504	-0.321	-0.320	724	722	736	760
-39023	-0.514	-0.324	-0.333	744	741	756	780
-40021	-0.524	-0.339	-0.340	764	760	776	800
-40999	-0.534	-0.343	-0.347	784	780	796	821
-42060	-0.545	-0.354	-0.361	806	801	818	842
-43035	-0.555	-0.363	-0.368	826	821	838	862
-43845	-0.565	-0.368	-0.372	846	839	857	882
Comments:							

Stiffness Test:6		Date: 1/12/2006		Panel B, Cycle: 20000		Panel D, Cycle: 20000	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Wire Pot 2 (in)	Strain Gage 1 ($\mu\epsilon$)	Strain Gage 2 ($\mu\epsilon$)	Strain Gage 3 ($\mu\epsilon$)	Strain Gage 4 ($\mu\epsilon$)
3	0.000	0.001	0.000	0	0	0	0
-1007	-0.159	-0.002	-0.005	11	16	11	18
-2030	-0.175	-0.016	-0.005	24	32	25	37
-3035	-0.189	-0.020	-0.018	41	48	40	57
-4033	-0.201	-0.027	-0.018	60	64	56	77
-5086	-0.214	-0.037	-0.034	81	83	73	98
-6007	-0.224	-0.046	-0.046	98	101	89	116
-7046	-0.236	-0.057	-0.055	119	121	107	138
-8027	-0.246	-0.063	-0.062	137	141	126	158
-9014	-0.257	-0.071	-0.071	156	161	144	177
-10006	-0.268	-0.079	-0.082	175	181	163	197
-11017	-0.278	-0.089	-0.091	194	201	182	217
-11998	-0.289	-0.097	-0.100	214	221	202	237
-13063	-0.300	-0.104	-0.105	234	242	222	258
-14046	-0.310	-0.114	-0.114	253	261	241	278
-15074	-0.320	-0.123	-0.126	274	281	261	298
-16030	-0.330	-0.132	-0.132	292	300	280	317
-17074	-0.341	-0.140	-0.144	312	321	301	338
-18056	-0.351	-0.147	-0.151	331	340	321	357
-19044	-0.361	-0.157	-0.158	351	359	340	377
-20054	-0.372	-0.165	-0.164	370	378	361	396
-21057	-0.382	-0.172	-0.174	389	398	380	416
-22055	-0.392	-0.183	-0.183	409	416	401	436
-23095	-0.402	-0.192	-0.194	428	436	422	456
-23982	-0.411	-0.197	-0.201	445	452	440	474
-25005	-0.422	-0.207	-0.212	466	473	461	495
-26024	-0.432	-0.218	-0.221	485	492	482	515
-27053	-0.442	-0.230	-0.231	505	512	503	536
-28057	-0.453	-0.234	-0.244	525	531	525	556
-29014	-0.462	-0.238	-0.251	545	550	545	575
-30016	-0.472	-0.251	-0.258	563	569	565	595
-31040	-0.483	-0.261	-0.265	584	588	586	616
-32017	-0.492	-0.271	-0.272	603	607	607	636
-33018	-0.503	-0.276	-0.281	623	626	628	657
-34005	-0.513	-0.286	-0.290	643	646	648	676
-35042	-0.523	-0.293	-0.299	664	666	670	698
-36018	-0.533	-0.298	-0.304	683	684	690	718
-37027	-0.544	-0.316	-0.317	705	705	711	739
-38055	-0.554	-0.318	-0.324	726	725	733	760
-39050	-0.564	-0.333	-0.333	745	743	753	780
-40020	-0.574	-0.337	-0.345	766	763	773	800
-41086	-0.585	-0.344	-0.352	788	784	795	822
-42002	-0.595	-0.355	-0.358	806	803	814	841
-43009	-0.605	-0.361	-0.372	827	823	834	862
-43832	-0.614	-0.366	-0.379	845	840	852	879
Comments:							

Stiffness Test:7		Date: 1/12/2006		Panel B, Cycle: 30000		Panel D, Cycle: 30000	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Wire Pot 2 (in)	Strain Gage 1 ($\mu\epsilon$)	Strain Gage 2 ($\mu\epsilon$)	Strain Gage 3 ($\mu\epsilon$)	Strain Gage 4 ($\mu\epsilon$)
0	0.000	0.001	0.000	0	0	0	0
-1010	-0.163	-0.004	0.000	10	15	10	16
-2060	-0.180	-0.015	-0.007	24	31	24	36
-3028	-0.193	-0.024	-0.016	40	46	38	55
-4032	-0.205	-0.030	-0.021	60	62	54	75
-5012	-0.216	-0.037	-0.032	78	80	69	95
-6028	-0.228	-0.047	-0.043	98	99	87	115
-7014	-0.239	-0.056	-0.050	117	120	104	135
-8097	-0.251	-0.064	-0.062	137	141	123	157
-9062	-0.261	-0.072	-0.071	156	161	142	176
-10032	-0.272	-0.080	-0.080	176	181	161	196
-11035	-0.283	-0.090	-0.089	195	201	180	217
-11998	-0.293	-0.097	-0.096	213	220	198	235
-13017	-0.303	-0.106	-0.105	234	241	218	256
-14014	-0.314	-0.114	-0.114	252	260	237	276
-15067	-0.324	-0.124	-0.126	272	280	257	296
-16030	-0.334	-0.132	-0.132	292	300	277	316
-17011	-0.345	-0.141	-0.139	310	319	297	335
-18063	-0.355	-0.149	-0.148	330	339	317	356
-19105	-0.366	-0.158	-0.158	351	359	338	376
-20017	-0.375	-0.165	-0.164	368	377	356	394
-21034	-0.386	-0.175	-0.176	387	395	376	414
-22053	-0.396	-0.183	-0.183	407	415	397	434
-23025	-0.406	-0.191	-0.192	426	433	417	453
-24034	-0.417	-0.198	-0.203	445	452	438	473
-25032	-0.427	-0.209	-0.212	465	472	459	494
-26062	-0.437	-0.220	-0.221	485	492	480	514
-27036	-0.447	-0.230	-0.233	503	510	500	534
-28040	-0.457	-0.234	-0.240	523	529	521	554
-29026	-0.467	-0.243	-0.247	542	548	541	573
-30009	-0.477	-0.252	-0.253	562	567	562	594
-31043	-0.487	-0.261	-0.260	582	587	584	615
-32021	-0.497	-0.272	-0.269	602	606	604	635
-33035	-0.508	-0.276	-0.281	622	625	625	656
-33998	-0.517	-0.290	-0.288	641	644	645	675
-35037	-0.528	-0.293	-0.297	663	665	667	697
-36044	-0.538	-0.304	-0.308	683	684	688	718
-37024	-0.549	-0.314	-0.315	703	703	708	737
-38022	-0.559	-0.318	-0.324	723	723	729	758
-39044	-0.569	-0.333	-0.336	744	743	750	779
-40036	-0.579	-0.337	-0.340	764	762	770	799
-41034	-0.590	-0.347	-0.352	785	782	791	819
-42017	-0.599	-0.356	-0.363	804	801	810	839
-42994	-0.610	-0.361	-0.368	826	822	832	860
-43839	-0.619	-0.368	-0.374	844	839	850	878
Comments:							

Stiffness Test:8		Date: 1/19/2006		Panel B, Cycle: 100000		Panel D, Cycle: 100000	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Wire Pot 2 (in)	Strain Gage 1 ($\mu\epsilon$)	Strain Gage 2 ($\mu\epsilon$)	Strain Gage 3 ($\mu\epsilon$)	Strain Gage 4 ($\mu\epsilon$)
0	0.000	0.000		0	0		
-505	-0.151	-0.004		10	14		
-1019	-0.198	-0.012		22	28		
-1525	-0.220	-0.019		37	42		
-2062	-0.238	-0.028		57	58		
-2504	-0.252	-0.035		74	71		
-2997	-0.267	-0.043		94	89		
-3528	-0.280	-0.051		114	109		
-4017	-0.293	-0.059		133	128		
-4528	-0.305	-0.067		152	149		
-5028	-0.317	-0.075		171	169		
-5523	-0.328	-0.084		190	189		
-5990	-0.339	-0.092		208	208		
-6493	-0.350	-0.099		227	228		
-6988	-0.361	-0.108		246	247		
-8010	-0.383	-0.129		285	288		
-8490	-0.394	-0.134		303	307		
-8996	-0.405	-0.139		322	327		
-9532	-0.415	-0.151		342	347		
-10048	-0.426	-0.161		361	366		
-10498	-0.435	-0.171		378	384		
-11006	-0.446	-0.176		398	404		
-11507	-0.456	-0.184		417	423		
-12024	-0.466	-0.193		436	443		
-13017	-0.486	-0.214		474	480		
-14003	-0.506	-0.220		512	518		
-14492	-0.518	-0.238		532	539		
-14991	-0.527	-0.241		551	558		
-16036	-0.547	-0.260		591	597		
-16517	-0.556	-0.264		610	616		
-17029	-0.566	-0.272		630	635		
-17496	-0.575	-0.283		649	654		
-18005	-0.585	-0.296		670	675		
-18502	-0.595	-0.300		690	694		
-19000	-0.605	-0.309		710	713		
-19506	-0.614	-0.317		729	733		
-20010	-0.625	-0.328		751	755		
-20498	-0.635	-0.334		771	773		
-21000	-0.645	-0.350		792	794		
-21502	-0.656	-0.356		813	815		
-21927	-0.665	-0.361		832	833		
Comments:							

Stiffness Test:9		Date: 1/19/2006		Panel B, Cycle: 130000		Panel D, Cycle: 130000	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Wire Pot 2 (in)	Strain Gage 1 ($\mu\epsilon$)	Strain Gage 2 ($\mu\epsilon$)	Strain Gage 3 ($\mu\epsilon$)	Strain Gage 4 ($\mu\epsilon$)
0	0.000	0.000		0	0		
-505	-0.243	-0.002		9	14		
-1015	-0.260	-0.010		21	27		
-1543	-0.273	-0.020		34	41		
-2030	-0.284	-0.026		51	54		
-2513	-0.295	-0.035		70	69		
-3016	-0.305	-0.043		89	86		
-3510	-0.316	-0.051		109	103		
-4006	-0.326	-0.059		128	122		
-4510	-0.336	-0.067		147	141		
-5027	-0.346	-0.075		167	160		
-5506	-0.355	-0.084		186	179		
-6007	-0.365	-0.090		205	198		
-6532	-0.375	-0.100		224	217		
-7029	-0.384	-0.111		243	237		
-7517	-0.394	-0.119		262	255		
-8019	-0.403	-0.124		281	274		
-8514	-0.413	-0.132		300	293		
-9059	-0.423	-0.144		321	313		
-9510	-0.431	-0.151		338	330		
-10022	-0.441	-0.160		358	350		
-10504	-0.450	-0.166		376	367		
-11006	-0.460	-0.177		395	386		
-11503	-0.469	-0.183		414	404		
-12009	-0.479	-0.189		433	424		
-12521	-0.488	-0.204		452	442		
-13020	-0.498	-0.208		472	461		
-13509	-0.508	-0.220		491	480		
-14026	-0.517	-0.225		511	500		
-14504	-0.526	-0.233		530	518		
-15009	-0.536	-0.244		549	538		
-15509	-0.545	-0.250		568	556		
-16011	-0.555	-0.257		589	575		
-16518	-0.564	-0.266		608	595		
-17010	-0.574	-0.278		628	614		
-17501	-0.583	-0.286		648	633		
-18014	-0.593	-0.292		668	652		
-18510	-0.602	-0.301		688	672		
-19013	-0.612	-0.313		709	692		
-19497	-0.621	-0.318		729	711		
-20016	-0.631	-0.329		749	731		
-20501	-0.640	-0.342		770	750		
-21005	-0.650	-0.349		791	771		
-21495	-0.659	-0.354		811	790		
-21923	-0.668	-0.368		829	808		
Comments:							

Stiffness Test: 10		Date: 1/20/2006		Panel B, Cycle: 200000		Panel D, Cycle: 200000	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Wire Pot 2 (in)	Strain Gage 1 ($\mu\epsilon$)	Strain Gage 2 ($\mu\epsilon$)	Strain Gage 3 ($\mu\epsilon$)	Strain Gage 4 ($\mu\epsilon$)
0	0.000	0.000		0	0		
-522	-0.242	0.000		12	14		
-1065	-0.263	-0.009		24	28		
-1517	-0.278	-0.019		37	39		
-2011	-0.290	-0.025		54	53		
-2536	-0.303	-0.033		75	69		
-3011	-0.313	-0.041		93	84		
-3502	-0.324	-0.048		113	102		
-3994	-0.334	-0.056		132	120		
-4505	-0.345	-0.066		152	139		
-5025	-0.355	-0.073		172	159		
-5506	-0.365	-0.082		190	178		
-6025	-0.375	-0.088		210	198		
-6529	-0.385	-0.098		229	217		
-7000	-0.395	-0.108		248	236		
-7527	-0.405	-0.116		267	255		
-8016	-0.414	-0.121		286	274		
-8526	-0.424	-0.127		306	293		
-9007	-0.433	-0.139		324	312		
-9510	-0.442	-0.147		344	331		
-10000	-0.452	-0.156		363	350		
-10507	-0.462	-0.163		382	368		
-11015	-0.471	-0.171		401	387		
-11528	-0.481	-0.179		421	407		
-12018	-0.490	-0.187		440	425		
-12505	-0.499	-0.199		458	443		
-13023	-0.509	-0.204		478	463		
-13513	-0.518	-0.210		497	481		
-14005	-0.528	-0.222		517	501		
-14511	-0.537	-0.229		536	520		
-15009	-0.547	-0.238		556	539		
-15508	-0.556	-0.245		576	558		
-16005	-0.565	-0.252		595	577		
-16492	-0.575	-0.260		615	597		
-17003	-0.584	-0.270		636	615		
-17502	-0.594	-0.281		656	635		
-18006	-0.604	-0.287		677	656		
-18504	-0.613	-0.296		696	675		
-19003	-0.622	-0.303		716	694		
-19495	-0.631	-0.314		736	713		
-20027	-0.641	-0.321		758	734		
-20509	-0.651	-0.334		778	753		
-21002	-0.660	-0.343		799	773		
-21505	-0.669	-0.350		819	793		
-21927	-0.677	-0.355		837	810		
Comments:							

Stiffness Test:11		Date: 1/21/2006		Panel B, Cycle: 393647		Panel D, Cycle: 393647	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Wire Pot 2 (in)	Strain Gage 1 ($\mu\epsilon$)	Strain Gage 2 ($\mu\epsilon$)	Strain Gage 3 ($\mu\epsilon$)	Strain Gage 4 ($\mu\epsilon$)
2	0.000	0.000		0	0		
-507	-0.106	-0.009		10	15		
-1010	-0.132	-0.017		23	31		
-1509	-0.147	-0.025		41	49		
-2022	-0.160	-0.033		61	70		
-2510	-0.173	-0.043		81	92		
-2997	-0.184	-0.052		103	115		
-3516	-0.195	-0.059		127	140		
-4015	-0.206	-0.069		151	164		
-4520	-0.217	-0.077		176	187		
-4999	-0.227	-0.085		200	210		
-5492	-0.237	-0.094		224	232		
-6019	-0.248	-0.105		249	256		
-6509	-0.258	-0.114		274	278		
-7047	-0.269	-0.119		299	302		
-7508	-0.278	-0.127		321	323		
-8023	-0.288	-0.139		346	346		
-8499	-0.298	-0.147		370	367		
-9004	-0.308	-0.156		394	390		
-9510	-0.318	-0.163		419	413		
-10019	-0.328	-0.175		444	436		
-10530	-0.338	-0.181		468	458		
-11008	-0.348	-0.192		493	480		
-11999	-0.367	-0.207		541	525		
-12537	-0.379	-0.218		568	550		
-13043	-0.389	-0.224		593	572		
-13527	-0.398	-0.234		617	594		
-14026	-0.408	-0.244		642	616		
-14502	-0.417	-0.250		667	638		
-15000	-0.427	-0.259		692	661		
-15497	-0.436	-0.270		716	683		
-16004	-0.446	-0.280		740	706		
-16524	-0.456	-0.285		765	728		
-17016	-0.465	-0.295		789	751		
-17505	-0.475	-0.304		814	773		
-18008	-0.484	-0.312		838	796		
-18507	-0.494	-0.322		864	820		
-19019	-0.504	-0.335		890	842		
-19514	-0.514	-0.342		916	866		
-20011	-0.524	-0.349		941	889		
-20501	-0.533	-0.358		971	913		
-21026	-0.544	-0.370		1000	938		
-21502	-0.554	-0.377		1030	965		
-21920	-0.562	-0.385		1056	987		
Comments:							

APPENDIX E:
EXPERIMENTAL RESULTS FOR TEST SERIES 5
PANELS A AND C

E.1 Stiffness Test For Test Series 5, Panels A and C

Stiffness Test: 1		Date: 3/1/2006		Panel A, Cycle: 1		Panel C, Cycle: 1	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Wire Pot 2 (in)	Strain Gage 1 (me)	Strain Gage 2 (me)	Strain Gage 3 (me)	Strain Gage 4 (me)
0	0.000	0.000	0.002	0	0	0	0
-1122	-0.187	-0.002	-0.005	13	14	24	25
-2104	-0.206	-0.011	-0.014	28	28	45	46
-3083	-0.221	-0.020	-0.025	44	42	67	69
-4082	-0.234	-0.028	-0.032	62	56	89	92
-5077	-0.249	-0.036	-0.046	81	73	113	118
-6156	-0.262	-0.039	-0.053	100	92	135	143
-7084	-0.273	-0.049	-0.060	117	108	156	166
-8166	-0.286	-0.059	-0.072	137	130	178	191
-9083	-0.298	-0.066	-0.079	155	147	197	212
-10061	-0.309	-0.074	-0.090	173	166	218	235
-11102	-0.322	-0.081	-0.100	193	186	239	259
-12062	-0.333	-0.090	-0.106	210	204	259	281
-13110	-0.344	-0.096	-0.113	230	224	281	304
-14183	-0.356	-0.111	-0.123	249	243	303	329
-15154	-0.366	-0.115	-0.134	267	261	323	351
-16059	-0.376	-0.119	-0.141	284	279	342	371
-18085	-0.397	-0.136	-0.155	323	317	383	417
-19096	-0.408	-0.144	-0.164	341	335	404	439
-20121	-0.419	-0.154	-0.176	362	356	425	462
-21218	-0.430	-0.161	-0.183	383	377	448	487
-22335	-0.442	-0.168	-0.190	405	399	471	512
-23131	-0.450	-0.176	-0.197	421	414	487	530
-24097	-0.460	-0.187	-0.208	439	433	507	551
-24843	-0.468	-0.194	-0.215	454	448	523	569
-26228	-0.483	-0.203	-0.222	482	476	551	600
-27103	-0.492	-0.210	-0.229	500	494	570	620
-28170	-0.503	-0.220	-0.243	522	515	592	644
-29093	-0.513	-0.227	-0.250	541	535	612	665
-30082	-0.524	-0.236	-0.257	561	555	633	688
-31200	-0.536	-0.249	-0.264	584	577	656	713
-32202	-0.546	-0.257	-0.278	604	597	676	735
-33103	-0.556	-0.263	-0.285	624	617	696	757
-34101	-0.566	-0.271	-0.292	644	637	717	778
-35096	-0.577	-0.283	-0.299	665	658	738	801
-36119	-0.588	-0.287	-0.306	687	680	760	825
-37096	-0.598	-0.299	-0.319	708	700	781	847
-38033	-0.608	-0.302	-0.329	727	720	801	868
-39232	-0.620	-0.314	-0.336	752	744	826	894
-40091	-0.630	-0.319	-0.340	771	763	845	914
-41077	-0.641	-0.334	-0.356	792	784	866	937
-42052	-0.651	-0.338	-0.363	813	805	887	959
-43034	-0.662	-0.355	-0.370	835	825	909	982
-44094	-0.673	-0.359	-0.384	858	848	931	1006
-45191	-0.685	-0.367	-0.391	880	870	954	1029
-46231	-0.696	-0.375	-0.398	903	892	977	1053
-47123	-0.705	-0.388	-0.405	922	911	996	1073
-48082	-0.716	-0.393	-0.421	943	932	1017	1095
-49081	-0.727	-0.408	-0.426	967	955	1040	1119
-49498	-0.733	-0.409	-0.433	977	966	1050	1131

Stiffness Test: 2		Date: 3/1/2006		Panel A, Cycle: 10		Panel C, Cycle: 10	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Wire Pot 2 (in)	Strain Gage 1 (me)	Strain Gage 2 (me)	Strain Gage 3 (me)	Strain Gage 4 (me)
-2	0.000	0.001	-0.002	-1	-1	-1	-2
-1125	-0.117	0.000	-0.002	10	12	22	22
-2149	-0.134	-0.010	-0.016	24	26	45	45
-3176	-0.147	-0.018	-0.023	41	40	67	70
-4085	-0.159	-0.023	-0.030	56	53	88	92
-5106	-0.172	-0.028	-0.042	74	68	110	117
-6095	-0.185	-0.038	-0.051	92	86	133	142
-7238	-0.199	-0.049	-0.063	113	107	157	170
-8221	-0.211	-0.057	-0.072	131	126	177	192
-9315	-0.225	-0.065	-0.086	152	147	200	218
-10397	-0.237	-0.071	-0.090	172	168	222	243
-11194	-0.246	-0.081	-0.100	187	183	239	262
-12215	-0.257	-0.085	-0.104	206	202	260	285
-13207	-0.268	-0.095	-0.113	224	221	281	308
-14247	-0.279	-0.106	-0.125	244	240	302	331
-15224	-0.289	-0.109	-0.132	262	259	322	353
-16300	-0.301	-0.122	-0.139	282	279	344	377
-17519	-0.313	-0.128	-0.153	306	303	369	405
-18412	-0.323	-0.135	-0.160	323	320	387	424
-19012	-0.329	-0.141	-0.167	335	333	401	438
-20225	-0.342	-0.150	-0.174	358	356	425	465
-21125	-0.351	-0.156	-0.181	376	373	444	486
-22221	-0.362	-0.165	-0.185	397	395	466	510
-23163	-0.372	-0.174	-0.197	416	414	485	531
-24075	-0.382	-0.183	-0.208	435	433	505	552
-25005	-0.392	-0.188	-0.215	453	451	524	573
-26120	-0.403	-0.198	-0.222	477	474	548	598
-27211	-0.414	-0.206	-0.229	499	496	570	623
-28218	-0.425	-0.216	-0.241	519	517	591	645
-29139	-0.435	-0.222	-0.248	539	536	610	666
-30144	-0.445	-0.236	-0.255	559	557	631	688
-31239	-0.456	-0.244	-0.262	581	578	654	712
-32208	-0.467	-0.253	-0.278	601	598	674	734
-33213	-0.477	-0.258	-0.282	621	618	695	756
-34219	-0.488	-0.273	-0.289	644	641	717	780
-35090	-0.497	-0.275	-0.296	661	658	734	798
-36148	-0.508	-0.289	-0.303	684	680	758	822
-37172	-0.519	-0.292	-0.317	704	700	778	845
-38095	-0.528	-0.306	-0.324	723	718	798	864
-39153	-0.539	-0.308	-0.331	745	740	820	888
-39839	-0.547	-0.316	-0.340	760	755	835	904
-41208	-0.561	-0.327	-0.354	788	782	864	934
-42167	-0.572	-0.332	-0.361	808	802	884	954
-43095	-0.581	-0.348	-0.368	828	820	903	974
-44047	-0.591	-0.351	-0.375	848	840	924	996
-45136	-0.603	-0.361	-0.389	871	862	946	1019
-46141	-0.613	-0.369	-0.396	892	882	967	1041
-47099	-0.624	-0.382	-0.405	913	903	988	1063
-48082	-0.634	-0.396	-0.410	934	923	1009	1085
-49055	-0.645	-0.400	-0.426	955	944	1030	1106
-49525	-0.651	-0.402	-0.424	967	955	1041	1119

Stiffness Test: 3		Date: 3/1/2006		Panel A, Cycle: 100		Panel C, Cycle: 100	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Wire Pot 2 (in)	Strain Gage 1 (me)	Strain Gage 2 (me)	Strain Gage 3 (me)	Strain Gage 4 (me)
-2	0.000	0.000	0.000	-1	-1	-1	-1
-1149	-0.066	-0.002	-0.009	11	13	24	25
-2155	-0.082	-0.011	-0.016	25	26	46	48
-3141	-0.095	-0.017	-0.021	41	40	68	72
-4247	-0.109	-0.023	-0.037	60	55	93	100
-5132	-0.121	-0.029	-0.044	76	70	113	122
-6150	-0.134	-0.039	-0.053	95	87	136	146
-7053	-0.147	-0.047	-0.063	112	105	154	168
-8172	-0.161	-0.055	-0.074	133	127	178	194
-9112	-0.172	-0.063	-0.083	151	145	197	216
-10136	-0.184	-0.070	-0.090	169	164	218	240
-11143	-0.195	-0.080	-0.097	188	184	239	263
-12254	-0.207	-0.086	-0.109	209	205	262	288
-13150	-0.217	-0.097	-0.118	226	222	281	309
-14154	-0.227	-0.103	-0.125	245	241	302	332
-15099	-0.238	-0.109	-0.132	264	261	322	354
-16089	-0.248	-0.119	-0.139	283	279	343	376
-17206	-0.260	-0.127	-0.153	304	301	365	401
-18160	-0.270	-0.134	-0.160	323	320	385	423
-19157	-0.280	-0.144	-0.167	342	340	406	446
-20115	-0.291	-0.151	-0.181	363	360	427	469
-21186	-0.303	-0.163	-0.192	385	384	451	495
-22241	-0.313	-0.167	-0.194	405	402	470	516
-23251	-0.323	-0.177	-0.201	424	421	490	538
-24164	-0.333	-0.184	-0.206	441	440	509	558
-25021	-0.341	-0.189	-0.215	460	457	528	578
-26225	-0.354	-0.200	-0.227	483	482	552	605
-27170	-0.364	-0.209	-0.234	503	501	572	626
-28078	-0.373	-0.216	-0.241	522	520	590	646
-28934	-0.382	-0.224	-0.250	540	537	609	665
-29891	-0.392	-0.235	-0.255	559	557	629	687
-31004	-0.404	-0.243	-0.269	583	579	652	712
-32124	-0.415	-0.252	-0.278	605	602	675	736
-32997	-0.425	-0.257	-0.282	623	620	694	756
-34001	-0.435	-0.270	-0.289	644	641	715	778
-35063	-0.447	-0.275	-0.306	666	663	738	802
-36111	-0.458	-0.286	-0.313	688	684	760	825
-37146	-0.469	-0.292	-0.319	709	705	781	848
-38188	-0.479	-0.303	-0.326	730	726	803	871
-39089	-0.489	-0.308	-0.340	749	744	822	891
-40223	-0.501	-0.323	-0.347	772	767	845	915
-41126	-0.511	-0.327	-0.354	792	786	866	936
-42087	-0.521	-0.343	-0.361	812	805	885	957
-43012	-0.531	-0.346	-0.373	831	824	905	977
-44077	-0.542	-0.353	-0.382	853	845	927	1000
-45034	-0.552	-0.361	-0.389	873	865	947	1020
-46092	-0.563	-0.373	-0.396	895	886	969	1044
-47065	-0.573	-0.381	-0.410	916	906	989	1064
-47842	-0.582	-0.393	-0.417	932	921	1006	1081
-48967	-0.594	-0.398	-0.424	956	944	1030	1106
-49525	-0.600	-0.400	-0.433	968	956	1042	1119

Stiffness Test: 4		Date: 3/1/2006		Panel A, Cycle: 1000		Panel C, Cycle: 1000	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Wire Pot 2 (in)	Strain Gage 1 (me)	Strain Gage 2 (me)	Strain Gage 3 (me)	Strain Gage 4 (me)
0	0.000	0.001	-0.002	-2	-2	-2	-2
-987	-0.097	-0.005	-0.007	6	8	18	19
-2155	-0.113	-0.012	-0.014	22	23	45	47
-3249	-0.126	-0.016	-0.028	40	38	69	73
-4235	-0.138	-0.020	-0.032	56	52	90	97
-5041	-0.147	-0.027	-0.042	71	66	108	116
-6168	-0.160	-0.037	-0.053	92	85	133	144
-7031	-0.169	-0.044	-0.060	108	101	151	164
-8103	-0.181	-0.053	-0.069	127	121	174	190
-9140	-0.192	-0.060	-0.081	147	141	196	215
-10115	-0.202	-0.069	-0.090	165	159	217	238
-11246	-0.214	-0.076	-0.097	186	181	241	264
-12141	-0.223	-0.081	-0.104	202	198	259	284
-13034	-0.233	-0.093	-0.111	220	215	278	305
-13959	-0.242	-0.100	-0.125	237	233	297	326
-15128	-0.254	-0.107	-0.132	260	256	322	353
-16132	-0.265	-0.117	-0.139	279	276	343	376
-17225	-0.276	-0.124	-0.153	300	297	366	401
-18111	-0.285	-0.131	-0.160	317	314	383	421
-19178	-0.295	-0.140	-0.167	338	335	406	445
-20129	-0.305	-0.145	-0.174	357	354	426	466
-21200	-0.315	-0.152	-0.188	377	375	448	491
-22261	-0.326	-0.165	-0.194	399	396	470	515
-23153	-0.335	-0.172	-0.199	416	414	488	534
-24150	-0.345	-0.179	-0.208	436	433	509	557
-25078	-0.354	-0.187	-0.213	454	452	528	577
-26222	-0.365	-0.197	-0.227	477	475	552	602
-27210	-0.375	-0.206	-0.234	497	495	573	625
-28151	-0.385	-0.213	-0.241	517	514	592	646
-29084	-0.394	-0.222	-0.248	536	533	612	666
-30115	-0.404	-0.232	-0.255	557	553	634	689
-31165	-0.415	-0.241	-0.269	578	575	655	713
-32191	-0.425	-0.248	-0.275	599	595	676	734
-33163	-0.435	-0.262	-0.282	618	615	697	755
-34201	-0.445	-0.265	-0.292	641	636	719	779
-35179	-0.455	-0.276	-0.303	660	656	739	800
-36136	-0.465	-0.281	-0.313	680	675	759	821
-37300	-0.477	-0.292	-0.317	703	699	783	846
-38124	-0.485	-0.299	-0.326	720	715	800	864
-38832	-0.493	-0.302	-0.331	735	729	815	880
-40102	-0.505	-0.317	-0.347	762	755	842	908
-41254	-0.517	-0.322	-0.354	785	778	865	931
-42115	-0.526	-0.338	-0.361	802	795	883	949
-43082	-0.536	-0.342	-0.368	822	814	903	970
-44080	-0.546	-0.349	-0.382	844	835	924	991
-45095	-0.556	-0.357	-0.389	864	855	945	1013
-46067	-0.566	-0.371	-0.396	885	875	965	1034
-47078	-0.577	-0.377	-0.403	906	894	986	1056
-48105	-0.587	-0.391	-0.419	928	916	1008	1077
-49045	-0.597	-0.393	-0.424	947	935	1028	1098
-49490	-0.602	-0.399	-0.431	958	945	1038	1109

Stiffness Test: 5		Date: 3/3/2006		Panel A, Cycle: 2027		Panel C, Cycle:	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Wire Pot 2 (in)	Strain Gage 1 (me)	Strain Gage 2 (me)	Strain Gage 3 (me)	Strain Gage 4 (me)
0	0.000	0.000	0.000	0	0		
-507	-0.177	-0.005	0.000	17	15		
-1056	-0.212	-0.015	-0.014	37	33		
-1552	-0.234	-0.021	-0.021	55	48		
-2054	-0.252	-0.027	-0.028	74	66		
-2513	-0.269	-0.041	-0.035	94	81		
-3069	-0.285	-0.044	-0.044	117	101		
-3638	-0.300	-0.057	-0.056	140	122		
-4143	-0.313	-0.063	-0.063	159	140		
-4563	-0.323	-0.069	-0.069	176	156		
-4984	-0.333	-0.076	-0.076	193	172		
-5564	-0.346	-0.086	-0.083	215	194		
-6147	-0.358	-0.092	-0.097	238	217		
-6561	-0.367	-0.098	-0.104	254	234		
-7063	-0.378	-0.108	-0.111	273	252		
-7591	-0.389	-0.118	-0.120	294	272		
-8110	-0.400	-0.125	-0.125	312	292		
-8592	-0.409	-0.131	-0.132	331	310		
-9033	-0.418	-0.140	-0.141	347	326		
-9526	-0.428	-0.149	-0.155	367	346		
-10074	-0.439	-0.156	-0.162	388	368		
-10547	-0.449	-0.165	-0.169	406	386		
-11062	-0.459	-0.177	-0.176	425	406		
-11558	-0.469	-0.183	-0.190	445	427		
-12047	-0.478	-0.192	-0.197	464	446		
-12550	-0.488	-0.199	-0.204	483	466		
-13115	-0.499	-0.209	-0.211	505	488		
-13617	-0.508	-0.215	-0.225	525	509		
-14031	-0.516	-0.225	-0.231	541	525		
-14498	-0.526	-0.229	-0.238	560	544		
-15026	-0.535	-0.242	-0.245	581	564		
-15601	-0.546	-0.247	-0.259	603	588		
-16097	-0.556	-0.262	-0.266	623	608		
-16572	-0.565	-0.264	-0.275	642	627		
-17032	-0.574	-0.273	-0.280	660	645		
-17620	-0.585	-0.284	-0.294	683	668		
-18149	-0.594	-0.291	-0.301	704	689		
-18548	-0.602	-0.299	-0.308	721	705		
-19036	-0.612	-0.305	-0.315	740	725		
-19531	-0.622	-0.318	-0.329	761	745		
-20089	-0.633	-0.334	-0.266	784	768		
-20672	-0.643	-0.337	-0.350	806	789		
-21148	-0.652	-0.346	-0.354	825	808		
-21545	-0.660	-0.355	-0.361	841	823		
-22111	-0.670	-0.360	-0.370	864	845		
-22606	-0.679	-0.372	-0.384	884	865		
-23059	-0.688	-0.376	-0.391	902	883		
-23497	-0.697	-0.387	-0.396	921	901		
-24055	-0.707	-0.398	-0.403	944	922		
-24531	-0.717	-0.402	-0.417	963	941		
-24745	-0.722	-0.404	-0.414	972	949		

Stiffness Test: 6		Date: 3/3/2006		Panel A, Cycle: 10000		Panel C, Cycle: 10000	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Wire Pot 2 (in)	Strain Gage 1 (me)	Strain Gage 2 (me)	Strain Gage 3 (me)	Strain Gage 4 (me)
2	0.000	0.001	0.005	-3	-3		
-572	-0.378	-0.002	0.002	14	15		
-1113	-0.396	-0.010	-0.005	31	30		
-1557	-0.409	-0.018	-0.012	46	45		
-2164	-0.424	-0.026	-0.025	69	66		
-2605	-0.433	-0.032	-0.032	86	81		
-3087	-0.443	-0.042	-0.039	105	98		
-3568	-0.453	-0.048	-0.049	125	116		
-4178	-0.465	-0.058	-0.056	149	139		
-4714	-0.475	-0.066	-0.067	169	159		
-5164	-0.483	-0.072	-0.074	188	176		
-5543	-0.491	-0.077	-0.081	203	190		
-6133	-0.502	-0.088	-0.090	226	214		
-6593	-0.510	-0.097	-0.095	244	232		
-7089	-0.519	-0.104	-0.102	263	250		
-7673	-0.530	-0.113	-0.118	285	273		
-8247	-0.540	-0.123	-0.125	307	294		
-8627	-0.547	-0.129	-0.130	320	308		
-9066	-0.555	-0.136	-0.139	338	325		
-9504	-0.563	-0.144	-0.146	354	341		
-9988	-0.572	-0.154	-0.153	373	360		
-10557	-0.582	-0.162	-0.167	395	382		
-11157	-0.593	-0.172	-0.174	418	404		
-11676	-0.602	-0.181	-0.183	438	425		
-12144	-0.610	-0.189	-0.190	456	442		
-12570	-0.618	-0.193	-0.199	472	458		
-13045	-0.627	-0.205	-0.211	492	477		
-13556	-0.636	-0.210	-0.218	511	497		
-14072	-0.646	-0.221	-0.225	531	516		
-14550	-0.655	-0.226	-0.229	550	535		
-15074	-0.664	-0.238	-0.245	570	555		
-15517	-0.672	-0.243	-0.252	589	573		
-16056	-0.682	-0.248	-0.257	609	593		
-16523	-0.691	-0.264	-0.264	627	611		
-17043	-0.701	-0.269	-0.280	650	633		
-17486	-0.709	-0.275	-0.287	668	650		
-18076	-0.720	-0.284	-0.292	690	673		
-18604	-0.729	-0.297	-0.308	712	694		
-19018	-0.737	-0.302	-0.313	727	709		
-19596	-0.748	-0.316	-0.319	752	733		
-20069	-0.757	-0.319	-0.331	771	752		
-20568	-0.766	-0.333	-0.343	791	771		
-21049	-0.775	-0.338	-0.347	810	790		
-21542	-0.784	-0.345	-0.354	829	809		
-22036	-0.793	-0.354	-0.366	849	828		
-22516	-0.802	-0.357	-0.375	868	847		
-23045	-0.812	-0.376	-0.382	890	868		
-23451	-0.820	-0.380	-0.389	907	884		
-24046	-0.832	-0.385	-0.403	931	908		
-24513	-0.841	-0.402	-0.410	950	926		
-24759	-0.846	-0.404	-0.410	961	937		

Stiffness Test:7		Date: 3/8/2006		Panel A, Cycle: 85840		Panel C, Cycle: 85840	
Load (lbs)	LVDT (in)	Wire Pot 1 (in)	Wire Pot 2 (in)	Strain Gage 1 (me)	Strain Gage 2 (me)	Strain Gage 3 (me)	Strain Gage 4 (me)
-2	0.000	-0.001	0.000	0	0		
-504	-0.427	-0.007	-0.005	17	17		
-1016	-0.472	-0.014	-0.014	36	36		
-1523	-0.509	-0.021	-0.021	56	54		
-2021	-0.536	-0.032	-0.032	78	74		
-2539	-0.560	-0.038	-0.042	101	95		
-3051	-0.580	-0.049	-0.049	123	117		
-3606	-0.599	-0.057	-0.053	146	140		
-4061	-0.613	-0.061	-0.063	166	161		
-4615	-0.629	-0.072	-0.067	188	186		
-5106	-0.642	-0.079	-0.083	209	210		
-5529	-0.653	-0.086	-0.088	226	229		
-6100	-0.667	-0.095	-0.095	249	254		
-6608	-0.679	-0.104	-0.106	270	278		
-7073	-0.690	-0.112	-0.113	288	298		
-7574	-0.704	-0.119	-0.125	310	323		
-8105	-0.715	-0.130	-0.132	331	348		
-8604	-0.725	-0.138	-0.139	351	371		
-9066	-0.736	-0.145	-0.148	368	392		
-9578	-0.747	-0.154	-0.162	389	417		
-10067	-0.758	-0.165	-0.169	409	441		
-10595	-0.769	-0.173	-0.176	430	466		
-11067	-0.779	-0.179	-0.183	448	487		
-11484	-0.788	-0.186	-0.192	466	508		
-12051	-0.800	-0.198	-0.204	488	534		
-12564	-0.811	-0.203	-0.211	508	557		
-13063	-0.821	-0.213	-0.218	528	580		
-13547	-0.831	-0.219	-0.227	547	602		
-14025	-0.842	-0.227	-0.238	567	624		
-14598	-0.855	-0.237	-0.245	591	652		
-15139	-0.866	-0.248	-0.259	612	675		
-15584	-0.874	-0.254	-0.266	630	695		
-16077	-0.884	-0.259	-0.275	650	717		
-16584	-0.895	-0.274	-0.282	670	741		
-17083	-0.905	-0.279	-0.294	690	762		
-17531	-0.914	-0.286	-0.301	709	784		
-18075	-0.925	-0.295	-0.308	730	806		
-18560	-0.934	-0.306	-0.317	750	828		
-19029	-0.944	-0.314	-0.329	770	849		
-19538	-0.953	-0.326	-0.336	790	872		
-20051	-0.963	-0.330	-0.343	812	896		
-20529	-0.975	-0.343	-0.356	834	922		
-21051	-0.985	-0.349	-0.363	855	943		
-21547	-0.994	-0.356	-0.370	875	967		
-22052	-1.004	-0.365	-0.382	896	991		
-22574	-1.014	-0.371	-0.391	918	1016		
-23057	-1.023	-0.387	-0.398	938	1039		
-23549	-1.032	-0.392	-0.405	961	1067		
-24019	-1.041	-0.398	-0.417	981	1092		
-24538	-1.051	-0.414	-0.426	1004	1118		
-24753	-1.056	-0.415	-0.426	1021	1141		