STRUCTURAL BEHAVIOR OF THIN PRESTRESSED SLAB BEAMS IN BRIDGES

A Dissertation

Presented to

The Faculty of the Department of Civil and Environmental Engineering

University of Houston

In Partial Fulfillment

of the Requirements for the Degree

Doctor of Philosophy

in Civil Engineering

by

Sinjaya Tan

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STRUCTURAL BEHAVIOR OF THIN PRESTRESSED SLAB BEAMS IN BRIDGES

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ABSTRACT

In recent years, the need to rehabilitate or replace many short-span old bridges in the most economical way has given rise to the idea of designing a wide-and-shallow beam, so called Thin Prestressed Slab Beams (TPSBs). TPSBs are cost-effective owing to: (1) simple formwork, (2) simple reinforcement detailing, (3) ease of quality control, and (4) overall performance given that their behavior is more like slabs (governed by flexure) than beams (governed by flexure/shear). The Texas Department of Transportation (TxDOT), in 2003, officially introduced TPSBs with 305 mm (12 in.) and 381 mm (15 in.) in height, 1.22 m (4 ft.) and 1.52 m (5 ft.) in width, and up to 12.2 m (40 ft.) in length. The shear reinforcement design in TPSBs is guided by the AASHTO LRFD Specification. No tests on such TPSBs, however, had been performed in the past.

This research had four main objectives: (1) to characterize the behavior of TPSBs and their failure modes, i.e., flexure, shear, and/or anchorage bond; (2) to evaluate the effectiveness of shear reinforcement; (3) to check whether the shear design provisions in AASHTO LRFD are applicable to the design of TPSBs; and (4) to provide design recommendations for TPSBs.

The test results of full-scale TPSBs showed that the failure mode of TPSBs was governed by either a non-ductile anchorage bond failure or flexural failure. Anchorage bond failure resulted in lower capacity than those failing in flexure and/or shear.

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NOTATION

a = shear span or the distance between the centerline of loading and the center line of support. In AASHTO LRFD, a = depth of equivalent rectangular compression block and a_v = shear span

A_v = area of shear reinforcement

A_s = area of longitudinal reinforcement

a/d = shear span-to-depth ratio

A_{ps} = area of prestressing steel

b = width of compression face of member

b_v = width of web adjusted for the presence of ducts (in.); width of the interface

b_w = width of the web

c = distance from extreme compression fiber to neutral axis

d = distance from extreme compression fiber to centroid of longitudinal tension reinforcement

d_p = distance from extreme compression fiber to centroid of prestressing steel but shall not be less than $0.80h$

d_v = effective shear depth = $0.8d$

E_s = modulus of elasticity of mild steel

E_{ps} = modulus of elasticity of prestressing steel

$f_c^{'}$ = specified compressive strength of concrete

$f_{ci}^{'}$ = compressive strength of concrete at transfer, when prestressing steel is released

f_d = stress due to unfactored dead load, at extreme fiber of section where tensile stress is caused by externally applied loads

f_{pe} = compressive stress in concrete (after allowance for all prestress losses) at extreme fiber of section where tensile stress is caused by externally applied loads

f_{pc} = compressive stress in concrete (after allowance for all prestress losses) at centroid of cross section resisting externally applied loads or at junction of web and flange when the centroid lies within the flange

f_{po} = a parameter taken as modulus of elasticity of prestressing tendons multiplied by locked-in difference in strain between the prestressing tendons and the surrounding concrete. 0.7fpu will be appropriate for both pretensioned and post-tensioned members

f_{ps} = stress in prestressing steel at nominal flexural strength

f_{pu} = specified tensile strength of prestressing steel

f_{py} = specified yield strength of prestressing steel

f_{px} = nominal stress of prestressing steel at section-*x,* where the load is applied

f_{pxi} = initial stress of prestressing steel prior to applying the external load at section-*x,* where the load is applied

f_s = stress of tensile longitudinal reinforcement

f_{se} = effective stress in prestressing steel after considering all the losses

f_s' = stress of compressive longitudinal reinforcement

f_y = specified yield strength of reinforcement

f_{yt} = specified yield strength of transverse reinforcement

jd = distance from centroid of compression to centroid of tension

k = factor for type of prestressing steel

l_{fb} = length that is required by the strand in order to develop from f_{pe} to f_{ps}

l_d = development length in tension of pretensioned strand

l_{px} = distance from free end of strands to section – x

l_t = length that is required by the strands in order to develop to effective stress of strands after all the losses are considered

M_{cre} = moment causing flexural cracking at section due to externally applied loads

M_{max} = maximum factored moment at section due to externally applied loads

M_n = nominal flexural strength

M_u = factored moment

N_u = factored axial force

s = spacing of transverse reinforcement

S = ratio of average bond stress of TPSBs at ultimate to square root of specified concrete compressive strength

s_x = the lesser of either dv or the maximum distance between layers of longitudinal crack control reinforcement, where the area of the reinforcement in each layer is not less than $0.003b_v s_x$

s_{xe} = crack spacing

T = tensile force of longitudinal reinforcement at ultimate stage

u = bond stress

$\overline{u}$ = average bond stress within the flexural bond length

u_{ave} = uniform-average bond stress within transfer length

u_t = bond stress within transfer length

$u_t^{'}$ = bond stress within transfer length when prestressing steel is released

V_c = nominal shear strength provided by concrete

V_{ci} = nominal shear strength provided by concrete when diagonal cracking results from combined shear and moment

V_d = shear force at section due to unfactored dead load

V_i = factored shear force at section due to externally applied loads occurring simultaneously with M_{max}

V_n = nominal shear strength

V_p = vertical component of effective prestress force at section

v_u = factor shear stress

V_u = factor shear force

V_s = nominal shear strength provided by transverse reinforcement

V_{test} = ultimate reaction force at nominal moment strength from the test

$V_{prop.}$ = proposed shear strength

$y_{t.}$ = distance from centroidal axis of gross section, neglecting reinforcement, to tension face

α_1 = the angle of the normal to failure surface with respect to the longitudinal axis of the beam ($\alpha_1 = 45^0$ when an element is subjected to pure shear)

β = factor indicating ability of diagonally cracked concrete to transmit tension and shear (in one-way shear)

β_1 = factor relating depth of equivalent rectangular compressive stress block to neutral axis depth

γ_p = factor for type of prestressing steel

ε_s = net longitudinal tensile strain in the section at the centroid of the tension

$\overline{\varepsilon_1}$ = principal tensile strain

θ = angle of inclination of diagonal compressive stresses

λ = factor related to type of concrete, i.e. light weight concrete

ρ = ratio of A_s to bd

$\rho^{'}$ = ratio of $A_s^{'}$ to bd

ρ_l = ratio of area of longitudinal bars to effective area of concrete

ρ_p = ρ_l =ratio of A_{ps} to bd_p

ρ_t = ratio of A_v to bs

σ_2^c = compression strength of the concrete struts

ω = tension reinforcement index

$\omega^{'}$ = compression reinforcement index

$\sum O$ = sum of the circumference of seven-wire low-lax tendons, $\sum 0 = \sum \frac{4}{3}\pi d_b$

CHAPTER 1 INTRODUCTION

1.1 Overview of Research

Eugène Freyssinet (July 13th 1879 – June 8th 1962), a French structural and civil engineer, made a tremendous breakthrough in civil engineering. After serving in the army during the First World War, he designed three reinforced concrete truss spans bridge, Pont le Veurdre Bridge (the longest span at the time: 72.5 meters or 238 feet); the design used jacks to raise and connect the arches of the bridge, which had the effect of introducing a prestressing effect to bridge construction. Although Doehring held patents in methods for prestressing in early 1888, Freyssinet recognized brilliantly that only high-strength prestressing wire could counteract the effects of creep and relaxation. Nowadays, the use of prestressed concrete has become popular, especially in bridge structures. Prestressing methods also have wide application in buildings, underground structures, TV towers, floating storage and offshore structures, power stations, nuclear vessels, etc.

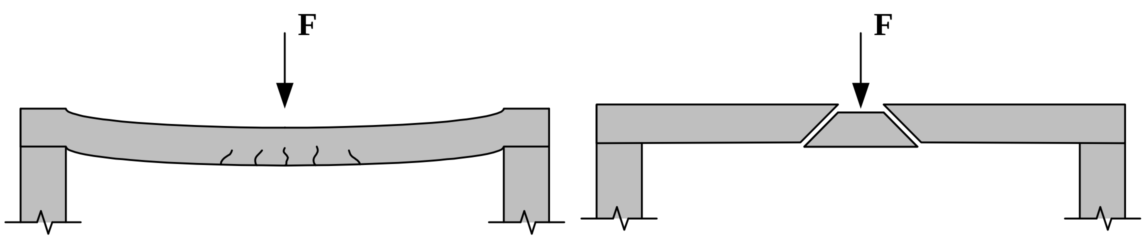
Precast prestressed concrete members have been widely used for many years. They have become well known mainly because the structural system can be completed quickly, the quality can be better controlled (because most of the prestressed concrete members are precast), and concrete structures can remain in service for many years with little or no maintenance costs.

Extensive research has been done with precast prestressed concrete members, especially pretensioned prestressed concrete members. In terms of their shape, researchers start with the simplest rectangular cross-section, which has a height-to-width aspect ratio of greater than one, then slowly advance to other shapes, such as T, I, double-T, box, hollow-core, and most recently, solid-wide and thin-rectangular. Solid-wide and thin-rectangular shaped prestressed concrete members are well known as Thin Prestressed Slab Beams (TPSBs) in the U.S. state of Texas; TPSBs actually have been used for more than a decade. Figure 1.1 shows typical TPSBs before they are shipped to a site.

Figure 1.1 Typical Thin Prestressed Slab Beams

TPSBs are being used for the many old bridges that need rehabilitation or replacement in the fastest and most economical way; past experience has shown TPSBs to be the best, and sole, solution at this time. Nowadays, TPSB bridges are uniquely suited to bridges located in rural areas where bridge span ranges from 20 to 40 ft. TPSBs have a simple shape and relatively simpler detailing as compared to other types of prestressed beams, which can increase productivity in a precast prestressed concrete plant. TPSBs also serve as construction formwork, so once the abutments are in place, TPSBs are arranged side-by-side, and the cast-in-place concrete deck is ready to be poured. Then, surface finishing and safety-curb installation, etc. take place. From start to finish, the superstructure is often completed in less than two weeks (Narer, 1997). TPSB bridges have shown themselves to be highly cost-effective.

No failure has ever been reported, over a period of decades, on TPSBs, and the performance of TPSBs has shown a promising future. The true behavior of TPSBs, however, still needs to be verified: the slab member supported on the columns and subjected to concentrated load, for example, fails either in flexure or shear/punching-shear failure. These failure modes are shown as sketched in Figure 1.2.



(a) Flexure Failure – Ductile (b) Shear/Punching-Shear Failure - Brittle

Figure 1.2 Typical Failure Mode in Slab Systems

The prestressed concrete beams, on the other hand, (generally I-shaped girders) have flexure failure and various shear failure modes. Figure 1.3 shows a typical I-shaped girder used in highway bridges. The two major shear failures that commonly occur are: (1) web shear failure near the supports, where the shear force is large and the bending moment is small and (2) flexural-shear failure near the one-third or quarter-point of the span, where both shear force and bending moment are relatively comparable. Laskar et al. (2010) successfully simulated the behavior of I-shaped girders through the isolated membrane element subjected to in-plane stresses, as shown in Figure 1.3(b).

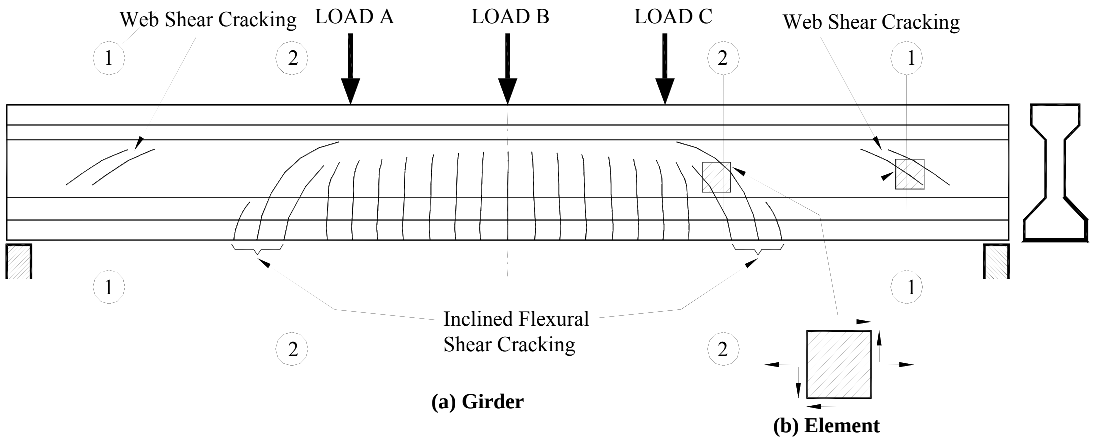


Figure 1.3 Typical Shear Failure Modes in I-Girders

Since the geometry of TPSBs is (relatively) between slab members and beams, the behavior of TPSBs as well can be predicted to occur between these two members. The goal of this research was to understand the behavior of TPSBs and to overcome the most destructive failure mode, i.e., shear failure or bond failure. Shear failure and bond failure most likely occur close to the end of the beam where the shear force is large and bending moment is small. The result of this research will likely provide design guidelines for TPSBs.

1.2 Research Significance

In 2003, the Texas Department of Transportation (TxDOT) officially introduced TPSBs with 12- and 15-inch heights and with spans of up to 40 ft. Since then, no major failure has been observed. TxDOT would like to introduce an even shallower beam than the existing one, one eight inches in height, with a span (most likely) of up to 30 ft.

TxDOT engineers have always designed shear strength of TPSBs based on AASHTO LRFD (AASHTO, 2010); the shear provision follows Modified Compression Field Theory (MCFT) (Vecchio & Collins, 1986), which is derived from a membrane element subjected to in-plane shear. The applicability of this theory in shear design of TPSBs is still questionable.

The ACI 318 Code (ACI Committee 318, 2011), moreover, specifies a minimum amount of shear reinforcement for flexural members (prestressed and nonprestressed) where V_u exceeds $0.5\phi V_c$; however, for solid slabs, this minimum amount of shear reinforcement can be neglected. Now, the question is, Do TPSBs really need shear reinforcement? If TPSBs do need shear reinforcement, the next question is, How much shear reinforcement do TPSBs need? Or, Does a minimum amount of shear reinforcement per code suffice for TPSBs? In short, research is needed to verify whether current design codes, i.e., ACI 318 Code (ACI Committee 318, 2011) and AASHTO LRFD (AASHTO, 2010), are safe or sufficiently cost effective to justify being implemented in TPSBs.

1.3 Objectives of Research

The main objective of this research was to understand the behavior of TPSBs, whether they were governed by flexure behavior, shear behavior, or anchorage bond behavior. The current detailing of TPSBs per TxDOT specification has a lot of shear reinforcement at the end zone of beams. This amount of shear reinforcement needs to be evaluated to obtain proper reinforcement needs so that TPSBs have better performance yet remain economical.

Fourteen full-scale TPSBs were tested and divided into two phases. The first phase consisted of six TPSBs, three at a height of 12-in. and three at a height of 15-in. The first phase results were capable of yielding the big-picture behavior of TPSBs. In the second phase, four out of eight full-scale TPSBs were at a height of eight inches; they were tested to serve as the basis in designing the new eight-inch high TPSBs. The main variables of the second phase of the experimental work were height, amount of stirrups, number of tendons, and deck effect.

A rational design guideline was proposed at the end of the research for predicting the strength of future TPSBs. By having such information, an economical and safe design can be achieved.

1.4 Outlines of Dissertation

This proposal is divided into nine chapters.

Chapter 1 introduces the problem statement, the motivation, and the objective of this research.

Chapter 2 provides a background of comprehensive literature related to this study. It includes the review of flexure and shear design provisions per AASHTO LRFD (AASHTO, 2010) and ACI 318 Code (ACI Committee 318, 2011), the shear design guidelines at the University of Houston (Hsu et al., 2010; Laskar et al., 2010), the bond characteristics and the development of bond theory, and the finite element program used in this research.

Chapter 3 introduces the experimental program used to study the variables influencing the structural behavior of pretensioned thin prestressed slab beam. This experimental program includes designing and manufacturing the beams, studied parameters, test setup, and instruments used.

Chapter 4 describes the experimental results of TPSBs including the reaction force vs. deflection relationships for all TPSBs, reaction force vs. relationships of LVDTs, and reaction force vs. relationships of strain gauges.

Chapter 5 shows the analysis of test results, the comparison of code provisions, and the serviceability analysis.

Chapter 6 shows the simulation of TPSBs using the finite element program developed at the University of Houston so-called Simulation of Concrete Structures (SCS) (Hsu & Mo, 2010). The analytical and experimental reaction (shear) force vs. deflection curves are compared.

Chapter 7 presents a detailed derivation of the proposed analytical model in predicting the strength of TPSBs. The proposed model has clear physical meaning, yet is simple. It is applicable to predicting typical wide-and-shallow prestressed members.

Chapter 8 summarizes the new design guidelines for predicting the strength of TPSBs. Design examples are provided to illustrate their use in TPSBs.

Chapter 9 concludes the findings of this research, both experimental and analytical points of view, and recommendations for further study.

CHAPTER 2 LITERATURE REVIEW

2.1 Flexure Design Provisions of Prestressed Concrete Members in Current Codes

The flexure theory for beam members has been widely accepted for many years, and it has only minor variations among the available design codes or guidelines. The nominal moment capacity of prestressed concrete beams can be computed as

$$M_n = A_{ps} f_{ps} jd. \tag{2-1}$$

Both ACI 318 Code (ACI Committee 318, 2011) and AASHTO (2010) provide a slightly different empirical formula to predict the nominal stress of tendons, f_{ps}. ACI 318 Code (ACI Committee 318, 2011) specifies

$$f_{ps} = f_{pu}\left\{1 - \frac{\gamma_p}{\beta_1}\left[\rho_p \frac{f_{pu}}{f_c^{'}} + \frac{d}{d_p}\left(\omega - \omega^{'}\right)\right]\right\},$$

(2-2)

where,

f_{pu} = specified tensile strength of prestressing steel;

γ_p = factor for type of prestressing steel (0.55 for f_{py}/f_{pu} not less than 0.80; 0.40 for f_{py}/f_{pu} not less than 0.85; 0.28 for f_{py}/f_{pu} not less than 0.90);

β_1 = factor relating depth of equivalent rectangular compressive stress block to neutral axis depth;

ρ_p = prestressing steel ratio (ratio of A_{ps} to bd_p);

$f_c^{'}$ = specified concrete strength of concrete;

d = distance from extreme compression fiber to centroid of longitudinal tension reinforcement;

d_p = distance from extreme compression fiber to centroid of prestressing steel but shall not be less than $0.80h$;

ω = tension – reinforcement index;

ω' = compression – reinforcement index.

Similarly, AASHTO (2010) specifies

$$f_{ps} = f_{pu}\left(1 - k\frac{c}{d_p}\right) \text{ and} \tag{2-3}$$

$$c = \frac{A_{ps}f_{pu} + A_s f_s - A_s' f_s'}{0.85 f_c' \beta_1 b + kA_{ps}\dfrac{f_{pu}}{d_p}}, \tag{2-4}$$

where,

c = distance from extreme compression fiber to the neutral axis assuming the prestressing tendon has yielded;

k = factor accounting for type of steel, taken as 0.28 for low relaxation strands.

Equations 2-2 and 2-3 involve the same parameters, such as type of prestressing steel, material properties, and geometry properties. As expected, both ACI 318 Code (ACI Committee 318, 2011) and AASHTO (2010) have a close prediction for flexure analysis.

2.2 Shear Design Provisions of Prestressed Concrete Members in Current Codes

Unlike flexure design provisions, the shear design provisions of prestressed concrete members in current codes are markedly different from one another. In this section, the shear design provisions per ACI 318 Code (ACI Committee 318, 2011) and AASHTO (2010) are described briefly, in Sections 2.2.1 and 2.2.2, respectively.

2.2.1 Shear Provisions per ACI 318 Code (ACI Committee 318, 2011)

ACI 318 Code (ACI Committee 318, 2011) specifies that the factored shear force at any section of Prestressed Concrete (PC) members, V_u, shall be less than the product of nominal shear strength, V_n, and the reduction factor, ϕ. The nominal shear strength, V_n, is defined as the summation of the nominal shear strength contributed by concrete, V_c, and the shear strength contributed by steel, V_s.

For PC members with the effective prestress force not less than 40 percent of the tensile strength of flexural reinforcement, the shear strength provided by concrete can be estimated as

$$V_c = \left(0.6\lambda\sqrt{f_c^{'}(psi)} + 700\frac{V_u d_p}{M_u}\right) b_w d. \tag{2-5}$$

The shear strength provided by concrete can be taken as the lesser of web-shear-cracking strength, V_{cw}, and flexural-shear-cracking strength, V_{ci}, as follows:

$$V_{cw} = \left(3.5\lambda\sqrt{f_c^{'}(psi)} + 0.3 f_{pc}\right) b_w d_p + V_p, \tag{2-6}$$

$$V_{ci} = 0.6\lambda\sqrt{f_c^{'}(psi)}\, b_w d_p + V_d + \frac{V_i M_{cre}}{M_{\max}}, \text{ and} \tag{2-7}$$

$$M_{cre} = \frac{1}{y_t}\left(6\lambda\sqrt{f_c^{'}(psi)} + f_{pe}(psi) - f_d(psi)\right). \tag{2-8}$$

The nominal shear strength provided by transverse steel, V_s, which is based on the 45-degree truss model, is calculated based on the number of stirrups cut by the 45-degree shear crack, as shown in Figure 2.1. Thus, the nominal shear strength provided by transverse steel, V_s, can be calculated as

$$V_s = A_v f_y \frac{d}{s}. \tag{2-9}$$

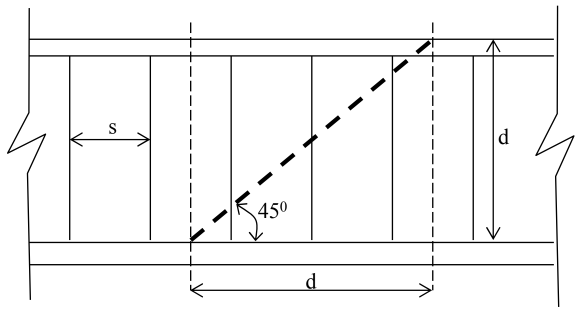


Figure 2.1 ACI 318 Code (ACI Committee 318, 2011) 45 Degree Truss Model

ACI 318 Code (ACI Committee 318, 2011) limits the maximum nominal shear strength provided by transverse steel to $8\sqrt{f_c^{'}(psi)}b_w d$, ensuring the transverse steel yields before concrete crushes at the ultimate load stage, so a certain ductility is preserved.

On the other hand, ACI 318 Code (ACI Committee 318, 2011) also specifies the minimum amount of transverse steel to prevent sudden shear failures when inclined cracking occurs as

$$A_{v,\min} = 0.75\sqrt{f_c^{'}(psi)}\frac{b_w s}{f_{yt}(psi)} \geq \frac{50 b_w s}{f_{yt}(psi)}. \tag{2-10}$$

For prestressed members, with effective prestress force not less than 40 percent of tensile strength of the flexural reinforcement, the minimum amount of transverse steel is

$$A_{v,\min} = \frac{A_{ps} f_{pu} s}{80 f_{yt} d}\sqrt{\frac{d}{b_w}}. \tag{2-11}$$

2.2.2 Shear Provisions per AASHTO (2010)

AASHTO (2010) provides three methods of predicting shear strength of prestressed concrete members:

1. Method 1: General procedure (Section 5.8.3.4.2)
2. Method 2: Simplified procedure (Section 5.8.3.4.3)

3. Method 3: General procedure with tables (Appendix B5)

Method 1 and Method 3 are essentially based on Modified Compression Field Theory (Vecchio & Collins, 1986), and Method 2 is similar to ACI 318 Code (ACI Committee 318, 2011); the only differences are the coefficients used in the formulas. In an earlier version of AASHTO code (AASHTO, 2007), Method 3 is inserted into the body of the code., In the latest version, however, Method 3 is moved into the appendix and is replaced by Method 1. Method 1 is the same as revised Canadian Code (Canadian Standards Association, 2004), which provides a set of straightforward and empirical equations, instead of tables, which is simpler.

AASHTO (2010) Method 1 defines the nominal shear strength of PC members, V_n, as being composed of three components, namely the nominal shear strength contributed by concrete, V_c, the nominal shear strength contributed by transverse steel, V_s, and the shear strength contributed by the vertical component of effective prestressing force, V_p.

To ensure that the transverse steel will yield before the concrete crushes in the shear element, the upper bound of nominal shear strength of PC members, V_n, is defined as

$$V_n \leq 0.25 f_c^{'}(ksi) b_w d_v + V_p , \tag{2-12}$$

where $d_v = 0.80\, d$.

The nominal shear strength contributed by concrete, V_c, can be computed as

$$V_c = 0.0316 \beta \sqrt{f_c^{'}(ksi)} b_w d_v , \tag{2-13}$$

and the nominal shear strength contributed by transverse steel, V_s, can be calculated as

$$V_s = A_v f_y \frac{d_v}{s} \cot\theta. \tag{2-14}$$

Both factor β for V_c term, and factor θ for the V_s term are functions of the shear stress ratio, v_u / f_c', and the longitudinal strain, ε_s, in the web. For simplification, the β factor for sections containing more than the minimum amount of transverse steel can be estimated as

$$\beta = \frac{4.8}{(1+750\varepsilon_s)} \text{ and} \tag{2-15}$$

$$\theta = 29 + 3500\varepsilon_s, \tag{2-16}$$

where,

$$\varepsilon_s = \frac{\left|\frac{M_u}{d_v}\right| + 0.5N_u + \left|V_u - V_p\right| - A_{ps}f_{po}}{\left(E_sA_s + E_pA_{ps}\right)} \leq 0.006. \tag{2-17}$$

For sections without transverse steel or less than the minimum requirements, the β factor is inversely proportional to the crack spacing parameter, s_{xe}, where

$$\beta = \frac{4.8}{(1+750\varepsilon_s)} \cdot \frac{51}{(39+s_{xe})} \text{ and} \tag{2-18}$$

$$s_{xe} = s_x \frac{1.38}{a_g + 0.63}, \tag{2-19}$$

where 12-in. < s_{xe} < 80 in., and s_x is the lesser of either d_v or the maximum distance between layers of longitudinal crack control reinforcement, where the area of the reinforcement in each layer is not less than $0.003b_vs_x$.

2.3 Shear Design Method of Prestressed Concrete Beams at University of Houston

The shear behavior and strength of PC beams are mainly counted on the web of the beams. The web can be generalized as a 2-D membrane element. The University of Houston has established extensive and outstanding research in the study and behavior of a

2-D membrane element subjected to shear using its Universal Panel Tester (Hsu et al., 1995).

By using the Universal Panel Tester, a series of shear analytical models have been developed at UH. A Rotating-Angle Softened-Truss Model at UH (Belarbi & Hsu, 1994; Pang & Hsu, 1995) treated a cracked reinforced concrete element as a smeared and continuous element. This model, however, could not predict the concrete contribution in shear. Hsu and colleagues then developed another theory of the so-called Fixed-Angle Softened-Truss Model (Hsu & Zhang, 1996; Pang & Hsu, 1996; Zhang & Hsu, 1998), which could physically interpret the concrete contribution in shear. The Fixed-Angle Softened-Truss Model could predict more accurately than the Rotating-Angle Softened-Truss Model; however, the Fixed-Angle Softened-Truss Model was incapable of predicting the post-peak behavior. Later, Zhu and Hsu (2002) discovered the Poisson effect of RC 2-D elements and quantified it using Hsu/Zhu ratios (Zhu & Hsu, 2002). By taking these ratios into account, the FA-STM was further refined, to become a Softened Membrane Model.

Having a clear understanding of the behavior of the 2D RC element in shear, the researchers have been able to further extend the SMM (Wang, 2006) to estimate the shear capacity of prestressed concrete membrane elements. Laskar and his colleagues (Laskar et al., 2007; Laskar, 2009; Laskar et al., 2010) implemented the softened truss model (Zhang & Hsu, 1998) to express the maximum shear strength $V_{n,\max}$ as

$$V_{n,\max} = \sigma_2^c b_w \left(0.9d\right) \sin\alpha_1 \cos\alpha_1, \tag{2-20}$$

where,

σ_2^c = the compression strength of the concrete struts;

$(0.9d)$ = the height of the truss measured from the centroid of the steel to the centroid of the compression zone;

α_1 = the angle of the normal to failure surface with respect to the longitudinal axis of the beam ($\alpha_1 = 45^0$ when an element is subjected to pure shear).

Zhang and Hsu (1998) studied full-sized reinforced concrete panels (55-in. x 55-in. x 7 in.) with concrete strength up to 14,500 psi. The test showed that the strength of the concrete struts in the principal compressive direction is softened by perpendicular principal tensile strain, $\overline{\varepsilon_1}$. Equation 2-20, therefore, can be written as

$$V_{n,\max} = 5.8\sqrt{f_c^{'}(MPa)} \cdot f\left(\overline{\varepsilon_1}\right) \cdot b_w \cdot (0.9d) \cdot (0.5). \tag{2-21}$$

For simplification, equation 2-21 can be written as

$$V_{n,\max} = C_1\sqrt{f_c^{'}(MPa)} \cdot b_w \cdot d , \tag{2-22}$$

where C_1 is a constant, which was determined by calibrating the balance condition constant, C_b. The balance condition means the state where concrete crushes and steel yields at the same time. Tests show in the literature that the balance condition of concrete girders was found to be 1.5. To ensure ductile shear failure, C_1 is taken to be 1.33; equation 2-22 can therefore be written as

$$V_{n,\max} = 1.33\sqrt{f_c^{'}(MPa)}b_w d \text{ or} \tag{2-23}$$

$$V_{n,\max} = 16\sqrt{f_c^{'}(psi)}b_w d . \tag{2-24}$$

The maximum shear strength $V_{n,\max}$ for prestressed concrete members of straight tendon configuration must be equivalent to the summation of shear strength contributed by concrete and steel, which can be expressed as

$$V_{n,\max} = V_c + V_s \,. \tag{2-25}$$

The contribution of concrete in shear strength is derived based on the shear friction concept (Loov, 2002) and calibrated based on the available tests on prestressed concrete girders in literature. According to Loov's shear friction model, the concrete contribution at ultimate stage can be shown by the inclined force "S" along the failure crack, as shown in Figure 2.2. This concept is different from current design codes (AASHTO, 2010; ACI Committee 318, 2011), which assumes that the concrete contribution to the shear strength of beams is based on tensile stress of concrete.

Assuming the inclined plane as the failure surface, and taking the force equilibrium of free body forces along the crack direction, Figure 2.2 shows that the shear capacity can be calculated as

$$V = \frac{S - T\sin\alpha_1}{\cos\alpha_1} + \sum F_v \,, \tag{2-26}$$

where,

$\sum F_v$ = contribution of steel to shear strength or V_s, which is the summation of vertical forces in stirrups intersected by the failure crack at ultimate stage;

T = tensile force of longitudinal reinforcement at ultimate stage;

α_1 = angle between the normal-to-failure crack and the longitudinal axis.

The first term of equation 2-26, $\frac{S - T\sin\alpha_1}{\cos\alpha_1}$ is the concrete contribution V_c, and the unknown variables, S, T, and α_1, can be derived directly from the tests.

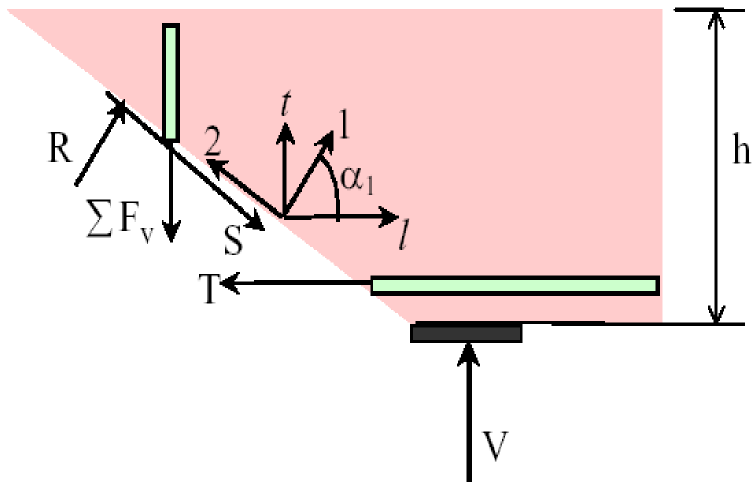


Figure 2.2 Loov's Model for Calculating Shear Strength of Beams (Laskar, 2009)

We know from the study of reinforced concrete membrane elements with concrete strength up to 14,500 psi (Zhang & Hsu, 1998), that the softened compressive strength of a concrete strut is proportional to $\sqrt{f_c^{'}}$. In addition, results of tests of prestressed concrete girders done at UH (Laskar et al., 2007; Laskar et al., 2010), that shear span-to-depth ratio (*a/d* ratio) is a sensitive parameter. Based on the analysis of tested beams in literature, therefore, a new and simple equation to predict the concrete contribution can be presented as

$$V_c = \frac{1.4}{(a/d)^{0.7}}\sqrt{f_c^{'}(psi)}b_w d \le 10\sqrt{f_c^{'}(psi)}b_w d\,, \qquad (2\text{-}27)$$

where,

b_w = width of the web, inches;

a = shear span or the distance between the centerline of loading and the center line of support, inches;

d = effective depth of beam or distance between centroid of the tendons to the extreme top fiber of the beam, inches. The value of d shall not be less than 80 percent of the height of the beam.

Past research also found that the amount of prestressing force does not affect shear strength (Lyngberg, 1976), especially for straight tendon girders. The shear strength contributed by steel can be observed based on the ultimate shear crack, not the initial crack. For simplification, assume a 45 degree crack angle, which seems to be reasonable, and, like ACI Code, has been proven to be accurate through the study of shear energy dissipation in the failure zone (Laskar, 2009). The nature of crack is smart enough to propagate through the minimum shear resistance path. To be on the conservative side, the minimum number of stirrups intersected by a 45 degree crack angle is taken to be [(d/s)-1], as shown in Figure 2.3. This concept is different from ACI Code, which is based on the concept of smearing the result, as shown in Figure 2.1. The steel contribution on shear strength, therefore, can be computed as

$$V_s = A_v f_y \left(\frac{d}{s} - 1 \right). \tag{2-28}$$

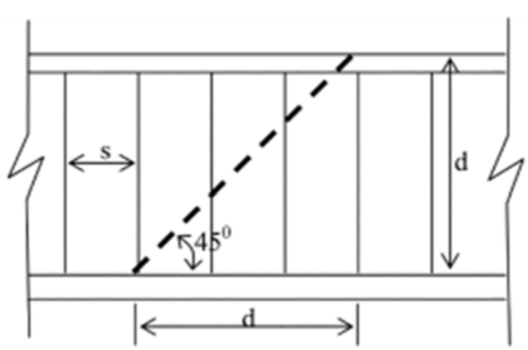


Figure 2.3 Determination of Number of Stirrups for V_s (Laskar, 2009)

To prevent sudden and abrupt failure, a minimum amount of shear reinforcement, $A_{v,\min}$, is required. As shown through literature review, (Laskar et al. (2010), the proposed minimum amount of shear reinforcement is

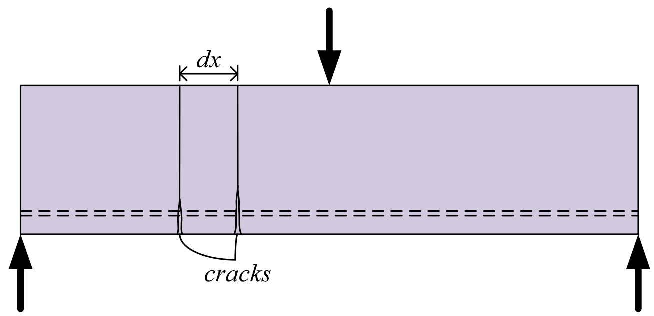
$$A_{v,\min} = \frac{0.75\sqrt{f_c^{'}\left(psi\right)}b_w s}{f_y} \quad for\ \frac{a}{d} \leq 2\ and\ \frac{a}{d} \geq 4, \tag{2-29}$$

$$A_{v,\min} = \frac{1.5\sqrt{f_c^{'}\left(psi\right)}b_w s}{f_y} \quad for\ 2 < \frac{a}{d} < 4,\ and \tag{2-30}$$

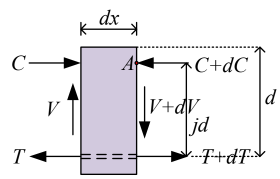
$$A_{v,\min} \geq \frac{50 b_w s}{f_y}. \tag{2-31}$$

2.4 Bond in Reinforced Concrete

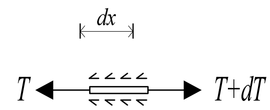
To understand the bond behavior in prestressed concrete, first, the background of bond in reinforced concrete must be understood. A simply supported reinforced concrete beam subjected to a concentrated load at mid-span is shown in Figure 2.4(a). The force is transferred from the loading point to the reaction, and as the load increases, the flexural cracks are formed near the bottom fiber. Once concrete cracks, the tensile stress is primarily resisted by the reinforcement through the force transfer mechanism, or so-called *bond*, between concrete and reinforcement. Based on statics, the free-body diagram of an element between two cracks, *dx*, can be seen in Figure 2.4(b). The free diagram of an isolated bar, which can be seen in Figure 2.4(c), illustrates an instance in which reinforcement is isolated from the concrete.



(a) RC Beam Subjected to A Concentrated Load



(b) Free Body Diagram of *dx*



(c) Free Body Diagram of An Isolated Bar

Figure 2.4 RC Beam and Free Body Diagrams

The bond stresses must exist to maintain force equilibrium. If bond stresses disappear, the bar will be pulled out of the concrete, and the tensile force, *T*, in Figure 2.4(b), will vanish and cause the beam fail. By taking the force equilibrium in the longitudinal direction from Figure 2.4(c), equation 2-32 can be derived as

$$\sum F_x = 0,$$

$$\left(T + dT\right) - T = u\left(\pi d_b\right)\left(d_x\right), \text{ and}$$

$$dT = u\left(\pi d_b\right)(dx), \tag{2-32}$$

where *dT* is the increment of tensile force, *u* is the true bond stress acting in the length *dx*, and d_b is the diameter of the bar. Equation 2-32 shows that the increment of tensile force in the bar is directly proportional to the bond stress. Also, taking the moment equilibrium about A, see Figure 2.4(b), the following equation is obtained

$$\sum M_A = 0,$$

$$V(dx) = \left(T + dT\right) jd - Tjd = dTjd,$$

$$V(dx) = u\left(\pi d_b\right)(dx)jd, \text{ and}$$

$$u = \frac{V}{\left(\pi d_b\right) jd}. \qquad \text{(2-33)}$$

where V is the shear force acting on the section and jd is the lever arm. If more than one bar exists, the circumference (πd_b), is replaced by the sum of the circumference, $\sum \mathrm{O}$, and it yields to the following equation, which shows that the bond stress is directly proportional to the shear force

$$u = \frac{V}{\left(\sum \mathrm{O}\right) jd}. \qquad \text{(2-34)}$$

2.5 Bond in (Pre-tensioned) Prestressed Concrete

In pre-tensioned, prestressed concrete, the bond action depends on several transfer mechanisms being developed between the surface of the strand and concrete: adhesion, friction, and mechanical action; the adhesion mechanism takes care of the early stage of the bond action. Once the slip occurs, the friction mechanism and mechanical action are activated. At the transfer stage, the bond stresses are induced by radial compressive stresses surrounding the strand. These radial compressive stresses represent the nature of concrete responding to the Hoyer effect (Hoyer & Friedrich, 1939). The Hoyer effect is a radial Poisson expansion in the strand upon the transfer of prestress force to a member through the interface between concrete and steel.

Janney (1954) was the a pioneer in the study of the nature of bond in pretensioned prestressed concrete. He studied the diameter, surface condition, and initial pretension of wire reinforcement. His test results showed that the transfer bond was significantly affected by friction between concrete and steel, two minor contributions from adhesion between concrete and steel, and mechanical resistance provided by deformation. Janney (1954) also showed that when the peak of a high bond stress wave reached the transfer length, a general bond slip occurred and caused a reduction of frictional resistance.

Thorsen (1956) visualized future needs of large tendons in pretensioned concrete. His study concluded that bond properties not only depended on type of steel, but also on initial stress of prestressing and concrete strength. He recommended that concrete strength at release should be no less than 4,000 psi. Thorsen also proposed minimum spacing, so cover for different types of prestressing steel were proposed.

Hanson and Kaar (1959) tested forty-seven pretensioned prestressed beams to study variables affecting bond performance of strands such as embeded length, diameter of strands, amount of prestressing steel, concrete strength, strand surface condition, and anchorage condition. Test results confirmed the flexural bond wave theory proposed by Janney (1954). Results also found that strand size and embedded length were the main parameters affecting the average bond stresses. Results further showed that concrete strength, percentage of steel, and embedded length were interrelated. For conservatism, Hanson and Kaar (1959) recommended that the design criteria should be governed by the first bond slip rather than final bond failure. This recommendation seemed reasonable, as test data was relatively scattered; although the mechanical interlock often provided additional capacity, it was not reliable. Hanson and Kaar recommended that the average bond stress within transfer length should be 400 psi. The findings of this study were later incorporated into the ACI Building Code (ACI Committee 318, 1963), and it is still used in present ACI Building Code (ACI Committee 318, 2011).

Martin and Scott (1976) studied the tests done by Hanson and Kaar (1959) and Kaar et al. (1963). These tests showed that the prestressing strand could not reach the stress at nominal flexural strength for members loaded within the development length. Based on this limited test data, Martin and Scott (1976) proposed a design method for predicting the stress of a prestressing strand of members with spans less than the development length.

A few decades later, a series of load tests on AASHTO Type II girders with a testing span or shear span-to-depth ratio of 1.37 to 1.52 were tested by Shahawy and Batchelor (1996). The tests showed that the tendons slipped and caused the shear strength of the girders to be reduced. Ma et al. (2000) tested similar girders with a shear span-to-depth ratio of 1.16 to 1.28. Test results concluded that the “shear bond capacity” was 25 percent less than “web shear capacity.”

2.6 Development Length of Prestressing Steel

In laboratory tests, actual bond stress is a qualitative measurement, which is difficult to measure. Researchers try, therefore, to quantify bond stress in terms of the development length of prestressing steel from the end of the beam. The development length of prestressing steel can be separated into two major categories: transfer length and flexural bond length. Transfer length is the length required by prestressing steel to build up the stress from zero at the free end of the beam to effective prestress (considering all the losses). Once the beam is loaded, the flexural crack is formed; therefore, at the crack section, the stress in prestressing steel may increase to its nominal stress. The length required by prestressing steel to develop from effective prestress to nominal stress is called flexural bond length.

Since the first generation of development length published in ACI 318-63 (ACI Committee 318, 1963), many researchers have tried to develop a more accurate development length by taking an increasing number of factors into account.

Kaar et al. (1963) studied the influence of concrete strength on the transfer length. By varying concrete strength up to 5,000 psi, he was able to show that concrete strength had little effect on transfer length.

Some researchers have also studied the effect of the releasing method on transfer length. In flame-cutting strands, for example, transfer length was six to thirty percent higher than slowly released strands (Kaar et al., 1963; Kaar & Hanson, 1975; Cousins et al., 1990). Zia and Mostafa (1977) found that the transfer length was a function of initial stress in the strand and the concrete strength at release.

In 1988, the Federal Highway Administration (FHWA) (U.S. Department of Transportation, 1988) issued a memorandum regarding the development length of pretensioned prestressed concrete structures, emphasizing three main points: (1) the use of 15.2 mm (0.6 in.) diameter strands was disallowed, (2) four-times the diameter of strand as the minimum center-to-center strand spacing was required, and (3) development length for fully bonded and de-bonded strands needed to be multiplied by 1.6 and 2.0 times AASHTO Equation 9-32 (AASHTO, 1973), respectively. The memorandum was issued because the material properties used in past research were different from current practices. By the time the AASHTO equation was derived, the stress at the strand could not exceed 70 percent of ultimate capacity, but with the current low-relaxation strand, it can go up to

75 percent of ultimate capacity. It was also reported that the uncoated strands with an ultimate strength of 1860 MPa (270 ksi) had a longer development length than that predicted by the AASHTO equation.

Mitchell et al. (1993) studied the influence of high-strength concrete and summarized past research of the transfer and development length of prestressing strand. Twenty-two precast pretensioned concrete beams were tested to capture the nature of transfer and development length of prestressing strands under high-strength concrete. The conclusion drawn from the test was the higher the concrete strength, the shorter the transfer length. The researchers also proposed bilinear equations for the design of development length, which took concrete strength into account.

Cousins et al. (1994) tested twelve pretensioned T-beams to evaluate the effect of strand spacing. ACI Building Code (ACI Committee 318, 1989) specified that the minimum center-to-center spacing of strand was two-inch so as to reserve space for concrete aggregate passage and prevent local failure in the transfer zone at transfer. The test showed, however, no significant effect when the strand's spacing was reduced from 2-in. to 1.75-in.

Buckner (1995) published a state-of-the-art report summarizing the literature studies then available and proposing new design equations for the development length of pretensioned concrete members. Based on many studies, he suggested that the transfer length should be increased by 20 percent, to 60 d_b, to account for the longer transfer length of Grade 270 strands.

Martin and Korkosz (1995) observed that the strength of prestressed concrete members reduced significantly at the section where the strands were not fully developed.

They emphasized that the engineers must check the capacity of a section at frequent intervals along the development length because when the strands slipped, they could not develop the required stress: The stress needed to be reduced, and the strain compatibility should be considered for a more accurate estimation. Martin and Korkosz (1995) also provided design examples to illustrate this issue and showed that an appropriate ϕ reduction factor should be used in design because behavior is no longer governed by pure flexure.

In 1996, the FHWA issued another report (U.S. Department of Transportation, 1996) to update the previous memorandum. The FHWA took the first point out and allowed the center-to-center strand spacing to be 50.8 mm (2-in.) for 15.2 mm (0.6 in.) diameter strand, 44.4 mm (1.75-in.) for 12.7 mm (0.5-in.) diameter strand. The FHWA still retained the third point from the 1988 memorandum; in addition, the FHWA published a report (Lane, 1998) proposing a new development length equation for pretensioned strands, which took many factors into account.

Martí-Vargas et al. (2013) verified, experimentally, the Stress Wave Theory (Janney, 1954). Engaging the ECADA test method (Martí-Vargas et al., 2006), they tested pretensioned specimens with the embedment length equal to the transfer length while applying the loading statically after prestress transfer. The maximum stress just before initial measured slip was equal to the effective prestressing stress. Marti-Vargas et al. also performed the test under various embedment lengths: Specimens that had an embedded length that was less than their transfer length, showed their average bond stress at the ultimate stage with a slip that could increase by 30 percent from the average bond along their transfer length.

2.7 Code Provisions on Development Length of Prestressing Steel

Seventeen analytical models used to predict the development length of 0.5-in. diameter prestressing steel are summarized by Martí-Vargas et al. (2007) and Martí-Vargas et al. (2012). The first generation equation of development length was specified in ACI 318-63 (ACI Committee 318, 1963), however, it remains the same currently, at the time of ACI 318 Code (ACI Committee 318, 2011).

Assume a prestressed concrete beam has been subjected to a concentrated load beyond the specified development length and a stress of tendons and bond stress (between concrete and tendon); the profile with respect to distance from the end of the beam can be seen in Figure 2.5. Figure 2.5(a) shows that the ACI code simplifies the stress profile of the development length by assuming bilinear relationship. The stress profile in the flexural bond length develops from path 1 to path 3 as the load increases. Figure 2.5(b) shows that the true bond stress profile is represented by a solid line, a quadratic relationship, in which the maximum bond stress occurs at the end of the beam and slowly reduces to zero as it reaches the transfer length. In the flexural bond zone, the bond stress is regenerated from path 1 to path 3 as the load increases (Janney, 1954). Owing to the complexity of measuring the bond stress accurately, ACI simply assumes the bond stress at an average uniform bond stress.

Generally, the transfer length can be derived by taking the force equilibrium of an isolated tendon up to the transfer length, l_t, as seen in Figure 2.6(a) where it yields

$$l_t\left(\sum 0\right)u_{av} = f_{se}A_{ps},$$

$$\Rightarrow l_t = \frac{A_{ps}f_{se}}{\left(\sum 0\right)u_{av}}, \tag{2-35}$$

where,

f_{se} = effective stress in prestressing steel after considering all the losses;

u_{av} = average bond stress within the transfer length;

$\sum 0 = n - bar \times \frac{4}{3} \pi d_b$;

$A_{ps} = 0.725 \frac{\pi d_b^2}{4}$.

Taking a force equilibrium of an isolated tendon from the transfer length to the crack section, as seen in Figure 2.6(b), it yields

$$\left(f_{ps} - f_{se}\right) A_{ps} = l_{fb} \left(\sum 0\right) \bar{u},$$

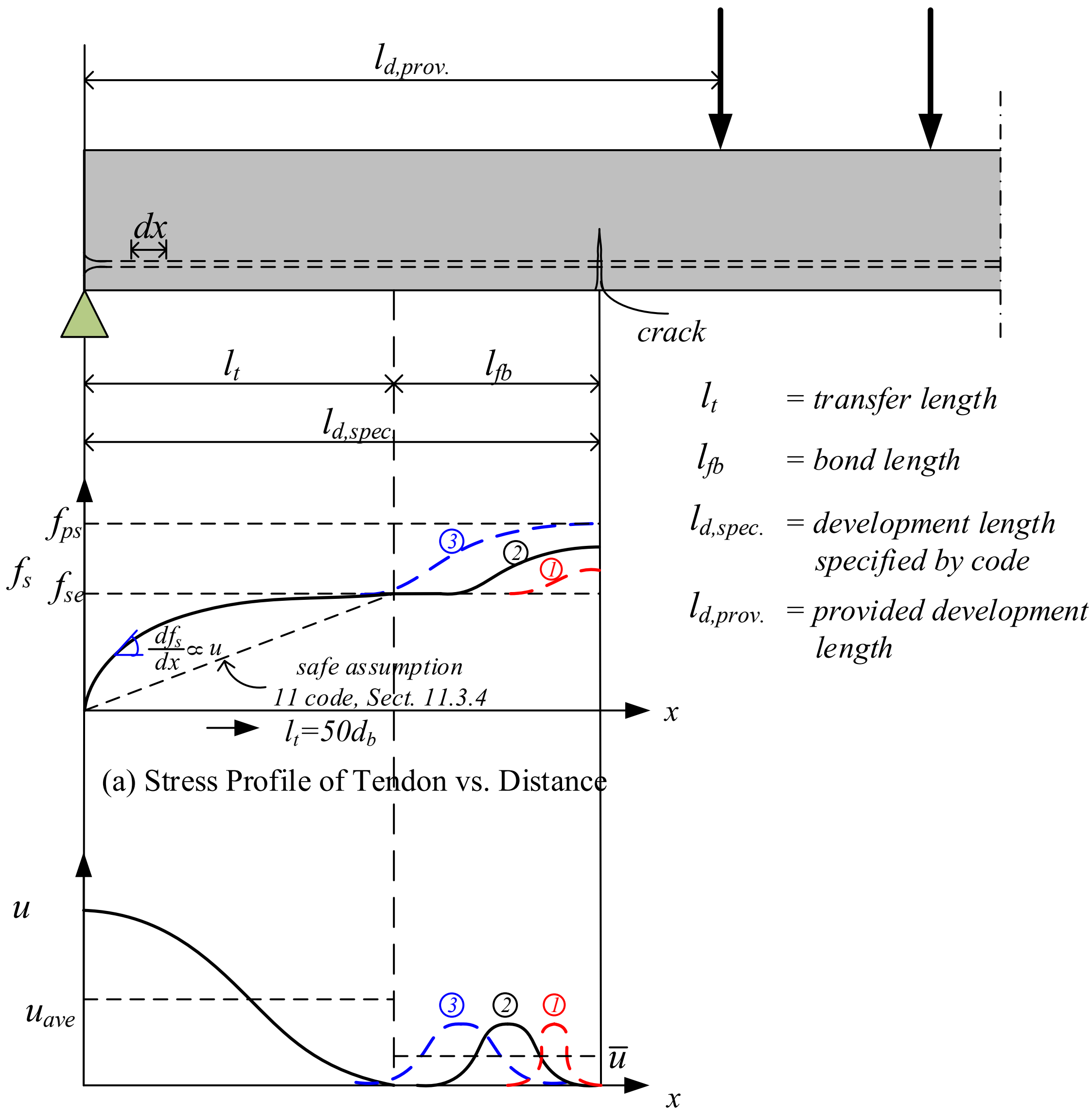
$$\Rightarrow l_{fb} = \frac{\left(f_{ps} - f_{se}\right) A_{ps}}{\left(\sum 0\right) \bar{u}}, \tag{2-36}$$

where,

l_{fb} = flexural bond length;

f_{ps} = average stress in prestressing steel at the time for which the nominal resistance of member is required;

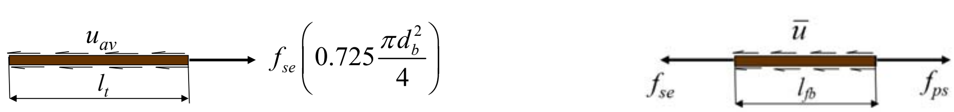
$\bar{u}$ = average bond stress within the flexural bond length.



(a) Stress Profile of Tendon vs. Distance

(b) Bond Stress Profile vs. Distance

Figure 2.5 Stress Profile of Tendons vs. Distance and Bond Stress vs. Distance



(a) At Transfer Length Zone

(b) At Flexural Bond Length Zone

Figure 2.6 Stress Body Diagram of An Isolated Tendon

Based on this test (Hanson & Kaar, 1959), ACI 318-63 (ACI Committee 318, 1963) believes that the bond stress of prestressing strands within the transfer length to be between the bond stress of deformed bars and plain bars or wires. By taking 400 psi as the average bond stress within the transfer length, therefore, seems to be reasonable. Substituting $u_{av} = 400\ psi$, equation 2-35 becomes

$$l_t = \frac{0.725 \frac{\pi d_b^2}{4} f_{se}}{(4\pi d_b / 3)400} = \frac{f_{se}}{2,943} d_b \approx \frac{f_{se}(psi)}{3,000} d_b, \tag{2-37}$$

where d_b is the diameter of prestressing steel. The average bond stress within the flexural bond length is proposed implicitly by Mattock (1962) as $136\,psi$. Substituting $\bar{u} = 136\ psi$ into equation 2-36, one obtains

$$l_b = \frac{(f_{ps} - f_{se}) 0.725 \frac{\pi d_b^2}{4}}{(4\pi d_b / 3)136} \approx \frac{(f_{ps} - f_{se})(psi)}{1,000} d_b. \tag{2-38}$$

The development length of the prestressing strand, therefore, is represented as

$$l_d = \frac{f_{se}(psi)}{3,000} d_b + \frac{(f_{ps} - f_{se})(psi)}{1,000} d_b. \tag{2-39}$$

Instead of expressing the development length for prestressing strands as a function of stress and the diameter of the bar, the most current AASHTO (2010) provision evaluates the development length in a reverse expression, but it is based on the same concept. The provision expresses the relationship between steel stress and distance from the free end of the strand as

$$f_{px} = \frac{f_{pe}(ksi) l_{px}}{60 d_b} \qquad \text{for } l_{px} \le 60 d_b \text{ and} \tag{2-40}$$

$$f_{px} = f_{pe}(ksi) + \frac{(l_{px} - 60d_b)}{(l_d - 60d_b)}(f_{ps} - f_{pe})(ksi) \leq f_{ps}(ksi) \qquad \text{for } l_{px} > 60d_b, \qquad (2\text{-}41)$$

where,

$f_{pe} = f_{se}$ = effective stress in prestressing steel after considering all the losses;

l_{px} = distance from free end of strands to section – x;

l_d = length required by prestressing steel to develop to its stress at nominal stage.

Generally, the provision can be simplified as depicted in Figure 2.7.

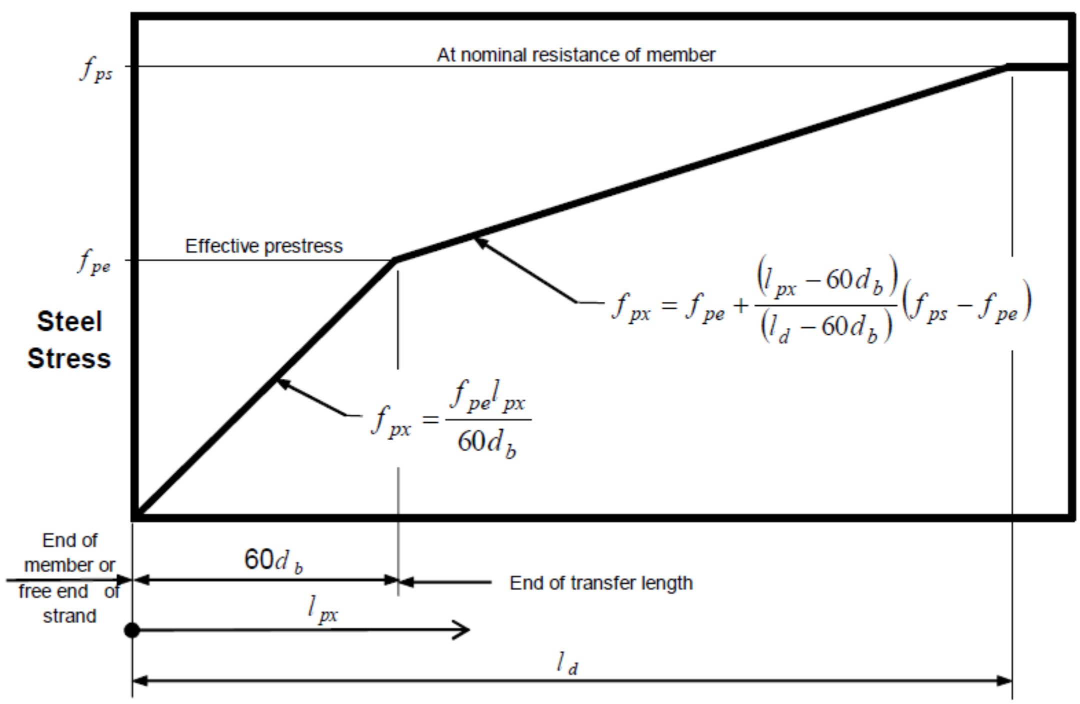


Figure 2.7 Idealized Relationship Between Steel Stress and Distance From the Free End of Strand (AASHTO, 2010)

Equation 2-40 implies that the length required by prestressing steel to develop to effective stress in prestressing steel (after considering all losses) is 60 d_b. This transfer length is slightly larger than the ACI 318 Code (ACI Committee 318, 2011), which is approximately 50 d_b.

2.8 OpenSees Finite Element Modeling

Finite element analysis was used to simulate the nonlinear behavior of the tested TPSBs. The analysis was performed using a finite element software called OpenSees, Open System for Earthquake Engineering Simulation, (Fenves, 2005). OpenSees is an open source software with an object-oriented framework for finite element simulation in earthquake engineering developed at the Pacific Earthquake Engineering Research (PEER) Center, the University of California, Berkeley. OpenSees cannot predict accurately the behavior of reinforced concrete structures at an early stage of their development. The researchers at the University of Houston have successfully used the OpenSees framework to predict the nonlinear behavior of concrete structures by developing constitutive laws and plane stress elements for a series of materials and incorporating them into OpenSees (Mo et al., 2008). Several constitutive laws of materials used in the analysis of TPSBs are explained below:

2.8.1 ConcreteS01 and ConcreteS02

ConcreteS01 and ConcreteS02 are the uniaxial constitutive laws of concrete used in analyzing the TPSBs. They are modified from the previous version of concrete material developed at UH, concreteZ01 (Zhong, 2005). Figure 2.8 shows the stress-strain curve of concreteZ01.

ConcreteZ01 was developed to be integrated into a 2-D element, and it takes the softening effect into account. ConcreteZ01 is well-suited to simulating the concrete material subjected to shear. In the case of TPSBs, however, the main failure mode can be either flexure or anchorage bond; ConcreteS01 and ConcreteS02 were introduced for this purpose. Both ConcreteS01 and ConcreteS02 are uniaxial material models, which do not take concrete softening into account. The modulus of elasticity of ConcreteS01, E_c, is the same as the modulus of elasticity of ConcreteZ01, which is $2.0\frac{f_c^{'}}{\varepsilon_{c0}}$, meanwhile, the modulus of elasticity of ConcreteS02, E_c, is reduced to $3875\sqrt{f_c^{'}(MPa)}$ (Hsu & Mo, 2010). The tensile stress of ConcreteS01 and ConcreteS02 is set at $0.31\sqrt{f_c^{'}(MPa)}$, and the corresponding cracking strain is 0.00008. The stress-strain curve result for ConcreteS01 and ConcreteS02 can be seen in Figure 2.9.

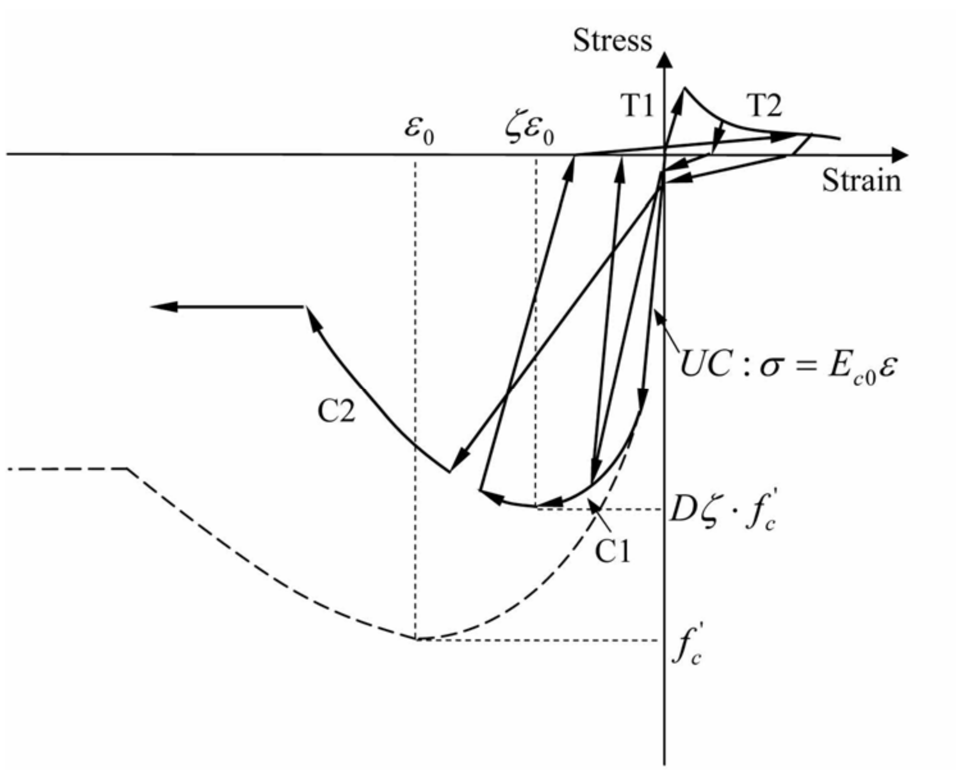


Figure 2.8 Stress-Strain Relationship of ConcreteZ01 (Zhong, 2005)

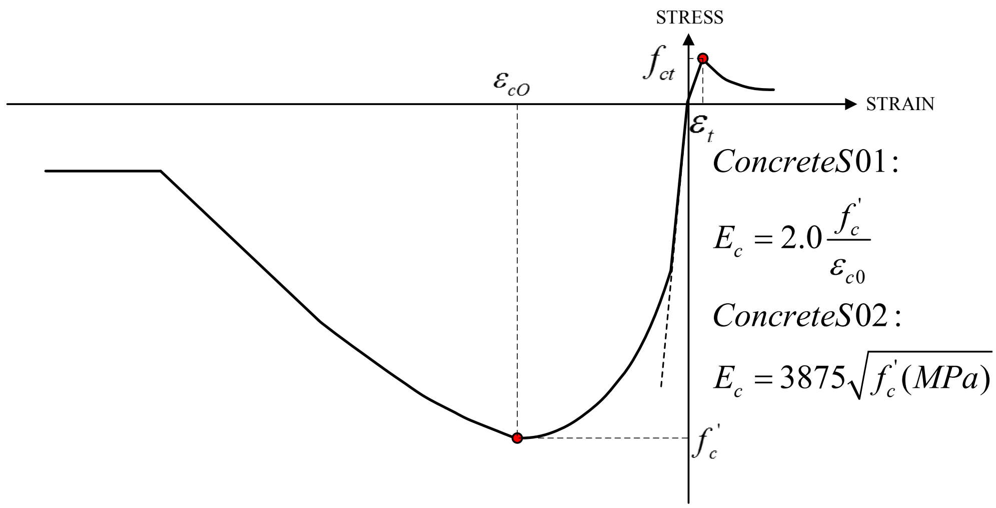


Figure 2.9 Stress-Strain Relationship of ConcreteS01 and ConcreteS02

Concrete S01 is used in all TPSBs that failed because of flexure failure. In the case of anchorage bond failure, concrete modulus elasticity needs to be reduced in some specimens; therefore, either ConcreteS01 or ConcreteS02 was implemented in SCS.

2.8.2 Steel01

The Steel01 module is a uniaxial material used to model the behavior of steel. The model simply assumes the bilinear stress-strain curve, as shown in Figure 2.10. It shows elastic linear behavior before yielding and linear strain-hardening behavior after yielding. The slope and pattern of the compressive stage are the same as for the tensile stage with the exception of a negative sign convention for the compressive stage. This model has been used in OpenSees by many researchers at UC Berkeley (Fenves, 2005); in this research, Steel01 is used in modeling the material of mild reinforcement.

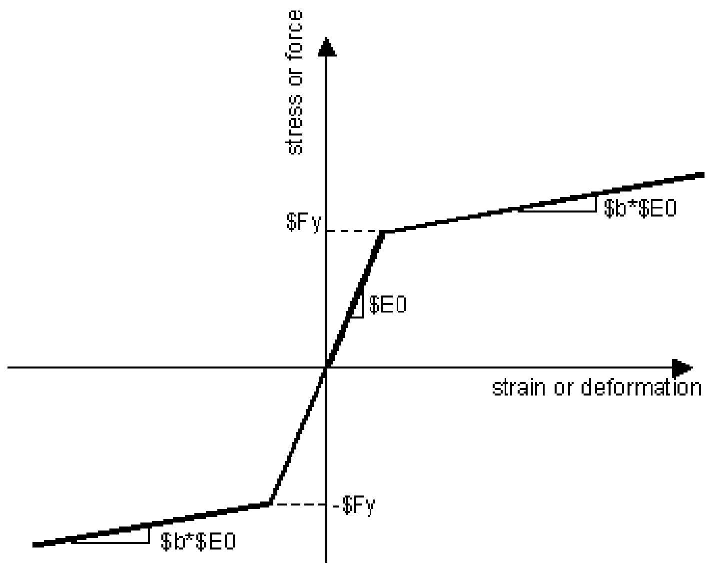


Figure 2.10 Stress-Strain Relationship of Steel01 (Fenves, 2005)

2.8.3 Steel02

The Steel02 material module represents a uniaxial Giuffre-Menegotto-Pinto steel material object with isotropic strain hardening (Filippou et al., 1983); it is similar to the Steel01 model, constructing a bilinear stress-strain curve of steel, as shown in Figure 2.11., In the Steel02 model, however, the initial stress of the steel can be specified as a feature used to model the prestressing steel, which is prestressed prior to any external loading stage. A smooth transition from linear elastic stage to a strain-hardening path is also introduced.

In the case of flexure failure, clearly, the prestressing strands yield, and concrete crushes at the ultimate loading stage. The prestressing strand in the anchorage-bond failure, however, cannot be developed to nominal stress; therefore, the yielding stress in the Steel02 needs to be reduced. Right after the tendons slip, the stress on them drops as well. Theoretically, since the stress on the tendons is still in elastic stage, so too, the stress drops, and the strain on the tendons reduces. When the slippage occurs, however, the deflection of TPSB remains constant, and the modulus of elasticity of the tendons reduces (because of slippage) during the re-loading stage. To impose this behavior, therefore, the negative slope of the nonlinear stress-strain relationship is introduced, as shown in Figure 2.12.

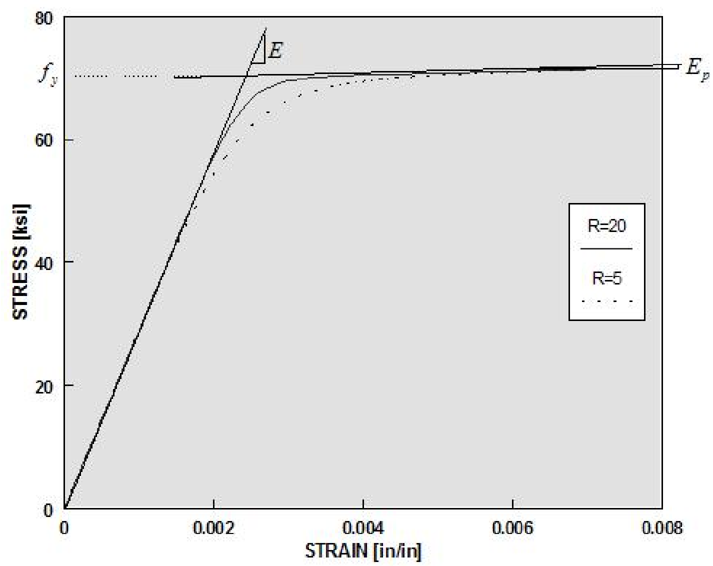


Figure 2.11 Stress-Strain Relationship of Steel02 (Filippou et al., 1983)

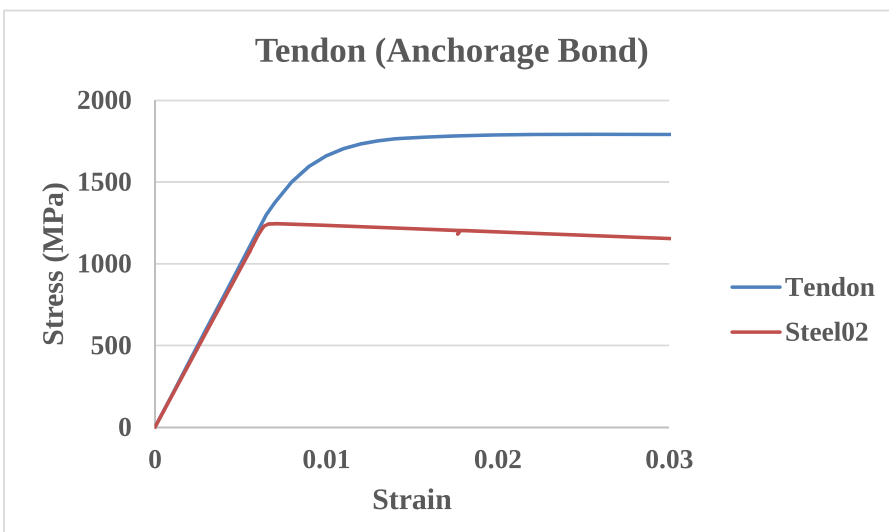


Figure 2.12 Modified Stress-Strain Relationship of Tendons for TPSBs That Failed in Anchorage Bond

CHAPTER 3 EXPERIMENTAL PROGRAM

3.1 Introduction

Design, fabrication, test setup, and instrumentation used in testing Thin Prestressed Slab Beams (TPSBs) are presented in this chapter. Fourteen TPSBs were proposed and approved by Texas Department of Transportation (TxDOT) Research Monitoring Committee for the experimental studies; detail of each process is explained below.

3.2 Design of Thin Prestressed Slab Beams (TPSBs)

Throughout the preliminary studies, 5 ft.-wide by 20 ft.-long TPSBs were selected for the experimental studies, and multiple variables were considered, such as: number of strands, amount of transverse reinforcement, height, and presence of cast-in-place (CIP) deck. The experimental program was separated into two phases: six TPSBs were completed in the first phase, and eight TPSBs were completed in the second phase. The experimental matrix of the 14 TPSBs can be grouped based on the height of TPSBs, summarized in Table 3.1.

The specimen labels shown in the second column of Table 3.1 start with a number indicating a width of 5 ft., followed by two letters, “SB”, standing for “Slab Beam”. The letters 5SB are followed in sequence by the five variables involved in the test program: (1) the height of 8-inch, 12-inch, or 15-inch, slab beams (2) a letter indicating the amount of transverse reinforcement T, M, or N (T = amount based on TxDOT specifications (2014), M = Minimum amount per AASHTO LRFD, N = No stirrup) (3) the span-to-depth ratio of 1.2, 1.6, or 2.0 (4) the number of strands 8, 10, or 14 (5) the letter indicating the presence (D) or absence (ND) of CIP deck. A superscript (L) is used to indicate the presence of 4-

ft. #4 longitudinal mild steel at the end zone (next to each strand). Since each specimen was tested one end at a time, therefore, 28 data points were obtained from the fourteen TPSBs.

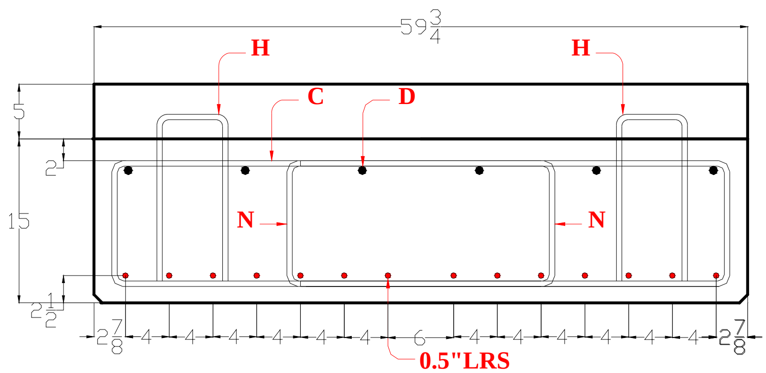
The typical cross-section and top view of 15-in., 12-in., and 8-in. TPSBs are shown in Figures 3.1 to 3.4, respectively. Specimens having a minimum amount of stirrups per AASHTO LRFD typically have the same section as Figure 3.1 except for having only two legs of #4 stirrups (absence of bars N). And specimens with no shear reinforcement, both bars C and bars N will disappear. Bars H, as shown in Figures 3.1 to 3.4, were used to connect the beam and the 5-in. CIP deck, so for slab beams without a 5-in. CIP deck, bars H were absent as well. Two types of detailing were proposed for 8-in. slab beams in this study. The detailing in Figure 3.3 were proposed by the UH team that adopted the idea from TxDOT detailing for 12-in. and 15-in. TPSBs, which have four legs of stirrups. The detailing in Figure 3.4, meanwhile, is primarily based on the past project done by the precast prestressed concrete plant, Flexicore of Texas (2014).

Seven-wire low-relaxation strands of 0.5-in. diameter were used in all specimens. According to TxDOT specifications for 20-ft. long TPSBs, eight and ten strands are placed in TPSBs of 12-in. and 15-in. height, respectively; the maximum amount of fully bonded TPSB strand is 14.

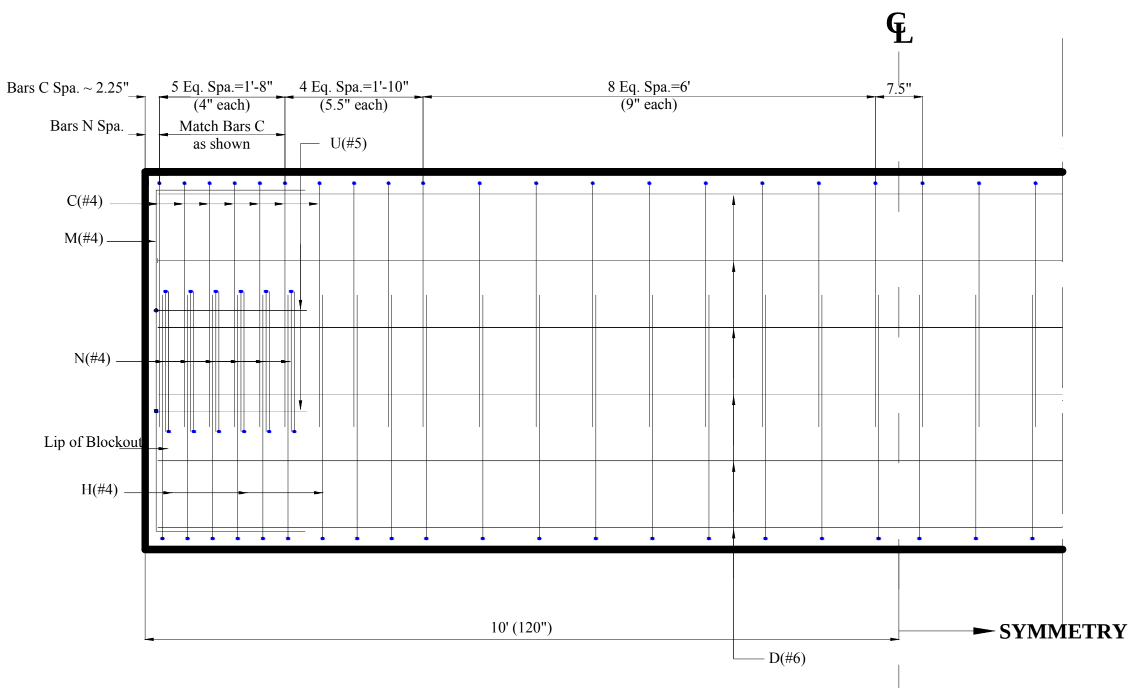
Table 3.1 Experimental Matrix and Concrete Strength

Group	Specimen ID	*b* *(in)*	d_p *(in)*	ρ_t	ρ_p	*a/d*	Concrete Strength on Test Day (*ksi*)
A	5SB8T-1.2-14-D	59.75	10.5	0.243%	0.341%	1.24	10.3
	5SB8T-2.0-14-D	59.75	10.5	0.243%	0.341%	1.95	10.3
	5SB8M-1.2-14-D	59.75	10.5	0.122%	0.341%	1.24	9.9
	5SB8M-2.0-14-D	59.75	10.5	0.122%	0.341%	1.95	9.9
	5SB8T-1.2-14-D^L	59.75	10.5	0.243%	0.341%	1.26	10.2
	5SB8T-2.0-14-D^L	59.75	10.5	0.243%	0.341%	1.98	10.2
	5SB8M-1.2-14-D^L	59.75	10.5	0.122%	0.341%	1.24	9.8
	5SB8M-2.0-14-D^L	59.75	10.5	0.122%	0.341%	1.98	9.8
B	5SB12T-1.2-10-D	59.75	14.5	0.335%	0.177%	1.23	10.7*
	5SB12T-2.0-10-D	59.75	14.5	0.327%	0.177%	1.94	10.7*
	5SB12T-1.2-10-ND	59.75	9.6	0.335%	0.267%	1.25	9.6
	5SB12T-1.6-10-ND	59.75	9.6	0.335%	0.267%	1.62	9.6
	5SB12M-1.2-10-ND	59.75	9.6	0.122%	0.267%	1.16	11.1*
	5SB12M-1.6-10-ND	59.75	9.6	0.122%	0.267%	1.63	11.1*
	5SB12N-1.2-10-ND	59.75	9.6	0.000%	0.267%	1.2	10.9*
	5SB12N-1.6-10-ND	59.75	9.6	0.000%	0.267%	1.63	10.9*
	5SB12T-1.2-14-D	59.75	14.5	0.335%	0.247%	1.23	9.6
	5SB12T-2.0-14-D	59.75	14.5	0.327%	0.247%	2.00	9.6
C	5SB15T-1.2-08-D	59.75	17.5	0.335%	0.117%	1.15	9.7*
	5SB15T-2.0-08-D	59.75	17.5	0.281%	0.117%	2.2	9.7*
	5SB15T-1.2-08-ND	59.75	12.5	0.335%	0.164%	1.23	8.5
	5SB15T-2.0-08-ND	59.75	12.5	0.294%	0.164%	2.02	8.5
	5SB15M-1.2-08-ND	59.75	12.5	0.122%	0.164%	1.25	10.5*
	5SB15M-2.0-08-ND	59.75	12.5	0.122%	0.164%	1.99	10.5*
	5SB15N-1.2-08-ND	59.75	12.5	0.000%	0.164%	1.23	9.9*
	5SB15N-2.0-08-ND	59.75	12.5	0.000%	0.164%	1.96	9.9*
	5SB15T-1.2-14-D	59.75	17.5	0.335%	0.205%	1.21	9.1
	5SB15T-2.0-14-D	59.75	17.5	0.281%	0.205%	2.17	9.3

* = Cast in Phase I

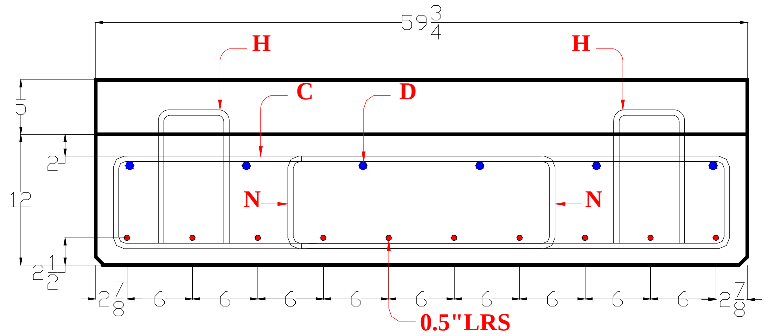


(a) Typical Cross-section of 15-in. TPSBs

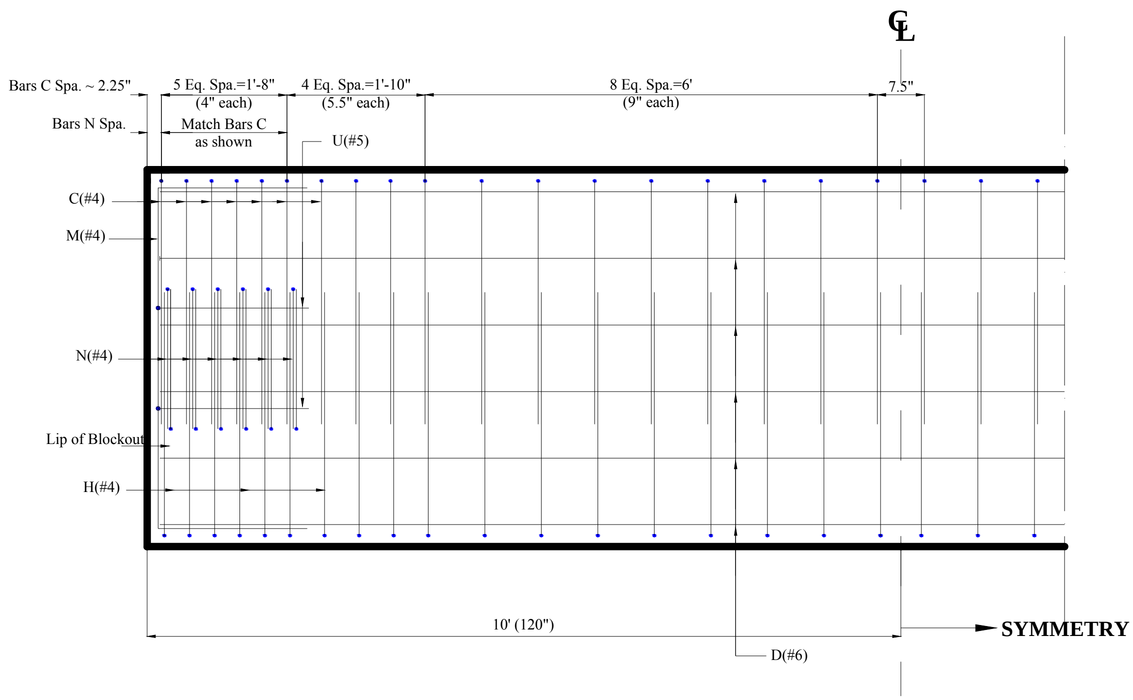


(b) Top View of 15-in. TPSBs with TxDOT Detailing

Figure 3.1 Cross-section and Top View of 5SB15T-1.2-14-D and 5SB15T-2.0-14-D

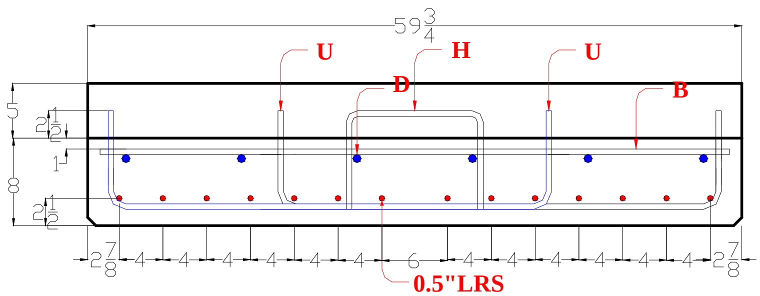


(a) Typical Cross-section of 12-in. TPSBs

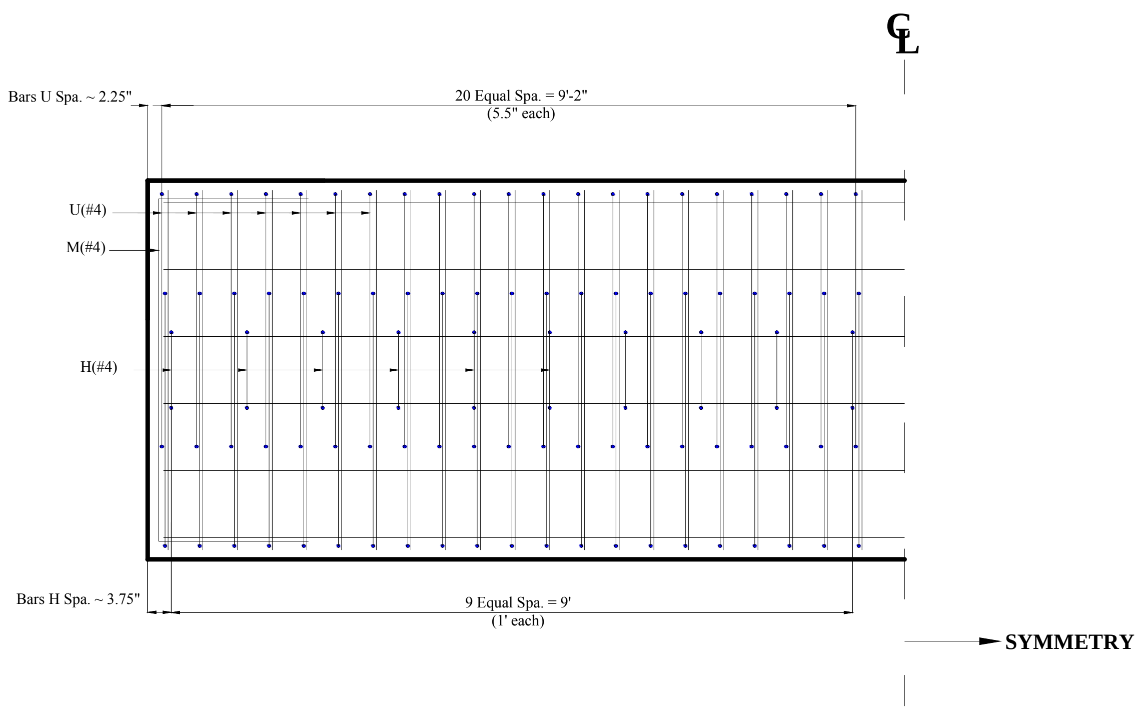


(b) Top View of 12-in. TPSBs with TxDOT Detailing

Figure 3.2 Cross-section and Top View of 5SB12T-1.2-14-D and 5SB12T-2.0-14-D

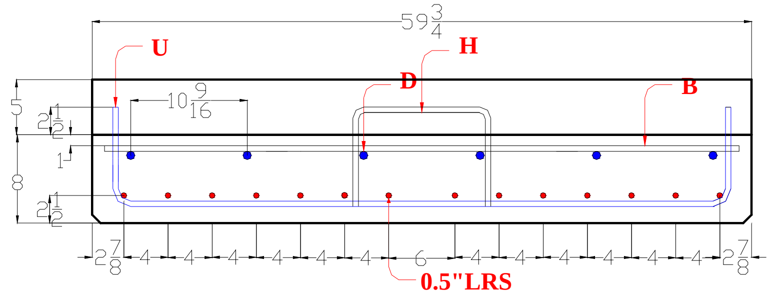


(a) Typical Cross-section of 8-in. TPSBs with Four Legs of Stirrups

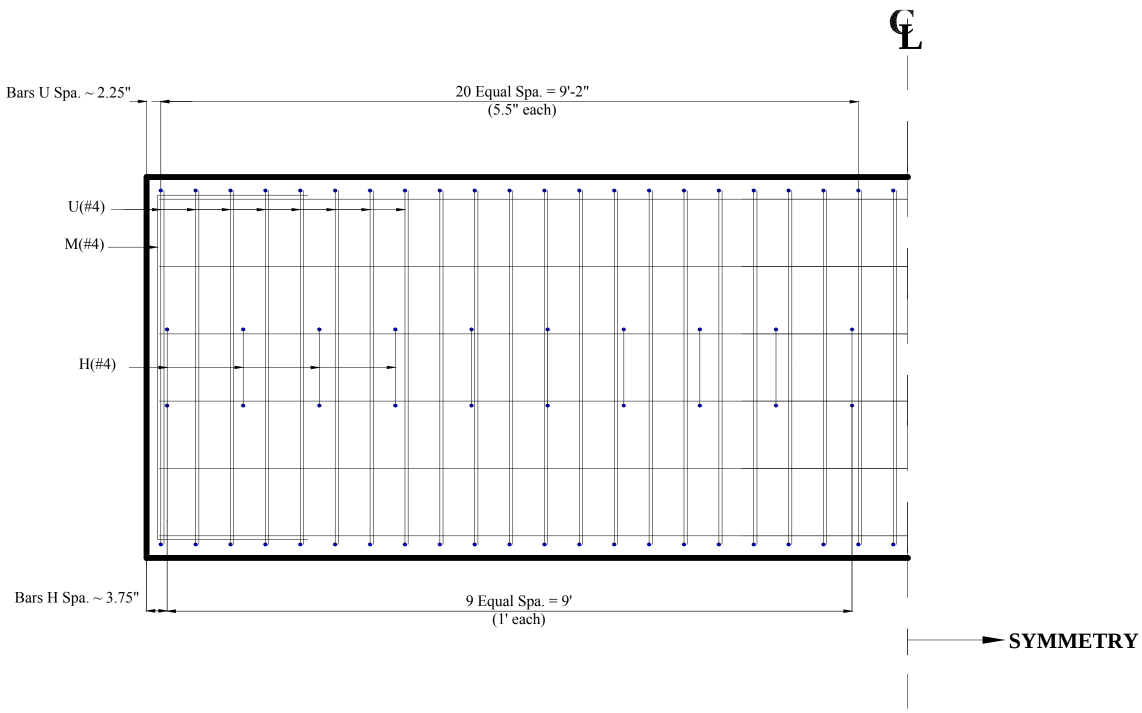


(b) Top View of 8-in. TPSBs with Four Legs of Stirrups

Figure 3.3 Cross-section and Top View of 5SB8T-1.2-14-D & 5SB8T-2.0-14-D



(a) Typical Cross-section of 8-in. TPSBs with Two Legs of Stirrups



(b) Top View of 8-in. TPSBs with Two Legs of Stirrups

Figure 3.4 Cross-section and Top View of 5SB8M-1.2-14-D and 5SB8M-2.0-14-D

3.3 Fabrication of Thin Prestressed Slab Beams (TPSBs)

3.3.1 Material Properties

Deformed mild steel bars of Grade 60 ksi (per ASTM A615) were used as stirrups and top longitudinal reinforcement. Low relaxation 7-wire strands of Grade 270 ksi (per ASTM A416) were used for longitudinal prestressing steel.

High Performance Concrete (HPC or class-H concrete) with minimum compression strength of 5 ksi at 28 days and 4 ksi at release time (practically 12 to 16 hours after pouring concrete) was prepared by TxDOT certified precast concrete plant, Flexicore of Texas. Table 3.2 shows the concrete mix proportions used for casting TPSBs.

Table 3.2 Concrete Mix Proportions Used for Casting TPSBs.

Materials	Weight for Full Size Batch (lbs.)
Cement Type III (Alamo Type III)	716
Fly Ash Type F (Headwater Jewitt Class F)	255
Fine Aggregate (Hanson Arena)	1,326
Coarse Aggregate (Hanson Arena/Eagle Lake)	1,691
Water	229
Coarse Aggregate/Fine Aggregate Ratio	1.28
Water/Cement Ratio	0.32
Superplasticizer (Sika 2110) (oz./100 lbs.)	4.5 (11.2 lbs.)
Retarder (Sika Plastiment) (oz./100 lbs.)	2.5 (6.21 lbs.)
Designed Slump (inches)	8.75

3.3.2 Manufacturing of TPSBs

All 14 TPSBs were manufactured at Flexicore of Texas (six TPSBs in July 2012, six TPSBs in July 2013, and two TPSBs in August 2013). The strands were initially pretensioned by hydraulic jacks that were placed at the end of a long prestressing steel platform/bed. Then, the end-zone and transverse reinforcements were installed in their proper locations. The reinforcing cage of typical TPSBs is shown in Figure 3.5.

Figure 3.5 Reinforcement Cage for a Typical TPSB

In the first phase of TPSBs (six TPSBs), 3/8 in.-diameter threaded rods and coupling nuts were embedded in the concrete for mounting the LVDT (Linear Variable Differential Transformer) rosettes during testing. The coupling nuts were fixed by screwing them through the side plywood, as shown in Figure 3.6.

After all reinforcement had been placed into proper location, the formwork was cleaned using air pressure, and form-released oil was sprayed onto the formwork; the concrete mix was then ready to be poured. The concrete mix was prepared in a plant mixer, transported to the casting bed, and deposited into the formwork using a mobile hopper, as depicted in Figure 3.7. During the pouring of concrete, spud vibrators were used to compact the concrete. Standard concrete cylinders (6-in. by 12-in.) were also cast, using the same concrete, so that the concrete strength during the tests could be determined by testing the concrete cylinders. Approximately 12 to 16 hours after casting TPSBs, the prestressing strands were slowly released, and the formwork was removed. The TPSBs were then transported to the storage yard and kept there for about seven days before they were delivered to the UH Thomas T.C. Hsu Structural Research Laboratory.

Figure 3.6 3/8 in.-Diameter Threaded Rod and Coupling Nuts Fixed on the Side Formwork

Figure 3.7 Concrete Pouring Using a Mobile Hopper

3.4 Test Setup

The TPSBs were subjected to vertical loading up to their maximum shear capacity in a custom-built loading frame, as shown in Figure 3.8. Two actuators were used to apply the force at the two ends of the TPSBs. Each actuator was attached to a vertical steel frame and each of them could apply up to 600 kips in compression. These actuator frames were sitting on top of two WF30x173 girders, bolted securely to a strong floor. The two WF30x173 girders were 25-ft. long and spaced at 118.5-in. center-to-center. A TPSB was positioned in the middle of the space on the three load cells placed at the north (one load cell) and south ends (two load cells).

Each actuator shown in Figure 3.8 has only one pin that allows the bottom head to rotate compensating the curvature, which corresponds to the specimen's deflection. This rotation activates the horizontal force at the top surface of the TPSBs. To minimize the horizontal force, a roller assembly was placed between the actuator and the TPSB. The assembly was a high-strength rod 2⅜-in. in diameter inserted between steel plates. Several steel plates were used as a spacer for preserving the stroke capacity of the actuator. The area of the contact surface was meant to simulate one wheel of HL93 live loading.

As the vertical load was applied, it was thought that the TPSB would deflect such that the bottom fiber would expand toward the support, introducing another horizontal force. Allowing the support to move along the bottom fiber's expansion would minimize this horizontal force, otherwise the force might cause an instability issue and the TPSB to slide over the load cell(s).

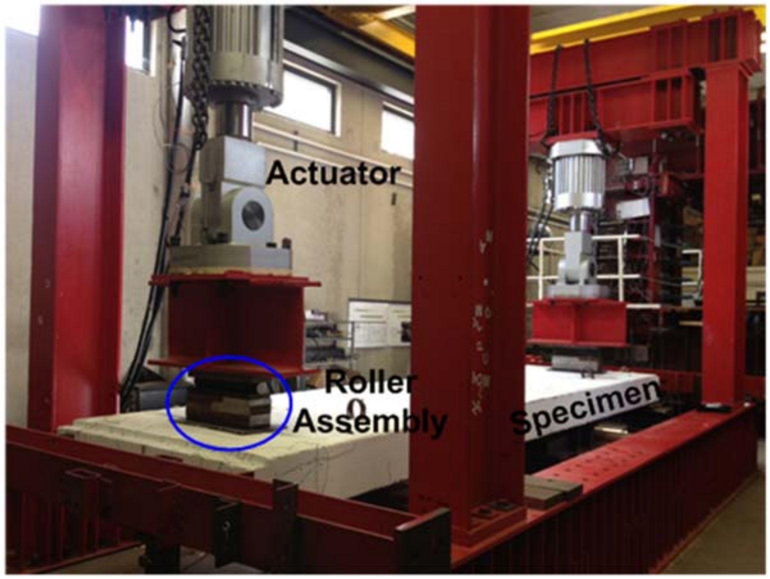


Figure 3.8 Test Setup for TPSBs

To allow the support to move, the load cell was placed on top of a square steel plate, 18-in. by 18-in. This steel plate was resting on eight high-strength, pre-heat-treated rods with a diameter of 2-in. These rods were connected with a clear spacing around ⅛-in. to prevent locking to one another. The top plate, therefore, could roll smoothly over another long steel plate, which was fixed to the strong floor, as shown in Figure 3.9. Bearing plates to support a TPSB were placed with hinge(s) at both ends of the TPSB on top of load cells. Thus, the TPSB was permitted to rotate freely at both supports and to expand along its length. A steel beam was secured at each end of the TPSBs to prevent any unexpected stability issue that might happen under high loading, as shown in Figure 3.8.

The bearing plate just under the TPSB had the dimensions typically used by TxDOT. One 14-in. by 7-in. by 2-in. steel plate and two 7-in. by 7-in. by 2-in. steel plates were used as the bearing plate at the north end and south end, respectively. The schematic top view of supports is depicted in Figure 3.10; also seen in this figure, is that, for the south end (with two load cells), the shear span-to-depth-ratio was kept at 1.2. The north end (with one load cell), had a shear span-to-depth ratio of either 1.6 or 2.0. Thus, the south end of the TPSBs is more critical than the north end.

Figure 3.9 Details of Support

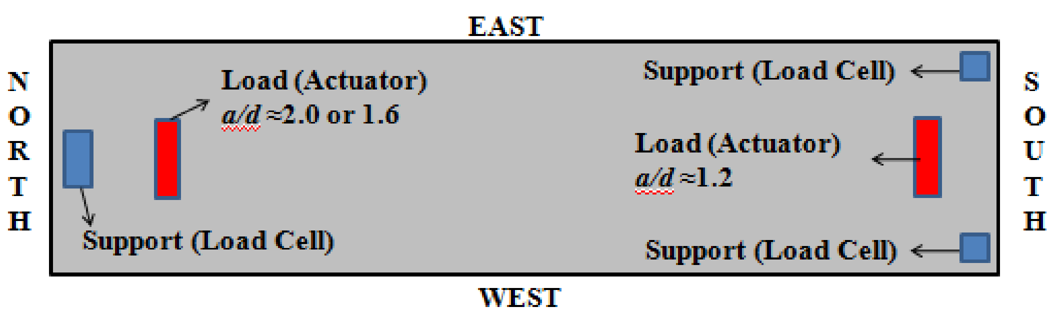


Figure 3.10 Schematic Top View of Supports

3.5 Instrumentation

The instrumentation used in Phase I and Phase II of the experimental work differed slightly. In Phase I, the strain in the transverse steel was continuously recorded as the load was applied to the TPSBs. Electrical-resistance foil-type strain gauges were installed on the transverse steel bars to obtain the local strain at predetermined critical locations in the

TPSBs. Because each transverse steel bar had two legs, the strain gauges were pasted in place in a staggered pattern so an average strain on the re-bars could be obtained. The strain gauge data obtained during the test could identify the effectiveness of transverse steel bars in the TPSBs subjected to shear load. Table 3.3 shows the name and locations of the strain gauges in each TPSB in Phase I.

Six LVDTs were installed in a rosette formation, as shown in Figure 3.11, to measure the smeared (or average) strain in concrete within the expected shear failure region of the TPSBs on both sides (west and east) and at both ends of the TPSBs (north and south). D1 is the diagonal LVDT (pointing from the support to loading point) measuring at a diagonal 45 degree concrete smeared compressive strain, D2 is the diagonal LVDT (opposite D1) measuring a diagonal 45 degree concrete smeared tensile strain, V1 is the vertical LVDT (closest to the support) measuring concrete smeared vertical strain, V2 is the vertical LVDT (closest to the loading point) also measuring concrete smeared vertical strain, H1 is the horizontal LVDT (the top one) measuring concrete smeared horizontal strain at the top fiber, and H2 is the horizontal LVDT (the bottom one) measuring concrete smeared horizontal strain at the bottom fiber. The detail of the LVDT Rosette labelling can be found in the Appendix.

During the test of the second TPSB, 5SB12T-1.2-10-D and 5SB12T-1.2-10-D, strands slipped as the applied load increased. LVDTs were attached, therefore, on all protruding portions of the strands to measure total slippage of the strands with respect to the end face of the TPSBs. The LVDTs were positioned parallel to the strand, and they were tied mechanically so that, when slippage occurred, the LVDT could move freely toward the TPSBs, as shown in Figure 3.12. The detail of the LVDTs configuration can be found in the Appendix.

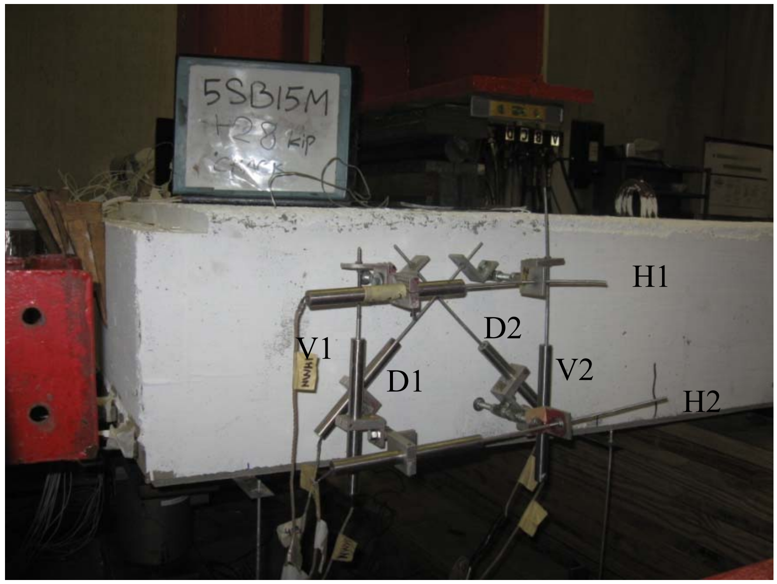


Figure 3.11 Typical LVDT Rosette Installed on the Web of TPSBs

Four LVDTs were placed under the TPSBs of each end to measure the vertical deflection during the tests as depicted schematically in Figure 3.13. Two LVDTs (LVDT nos. 2 and 4) were placed on the edges of the support(s) to measure their settlement, and two LVDTs (LVDT nos. 1 and 3) were positioned on the edges of the centerline loading section. As the height of the TPSBs became thinner, i.e., 12-in. thick without 5-in. CIP deck, an additional LVDT (LVDT no. 5) was installed under the TPSBs at the mid-cross-section of the applied loading section. The fifth LVDT was required to measure the deflection under the load in a direct manner because the two-way bending behavior became dominant, which could have affected the measurement of other LVDTs (LVDT nos. 1-4).

Table 3.3 Strain Gauges ID and Locations for Phase I TPSBs

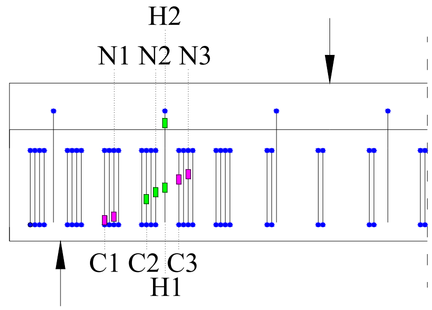
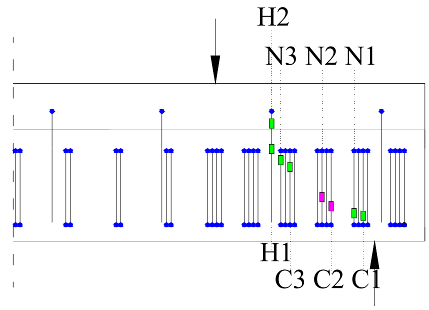
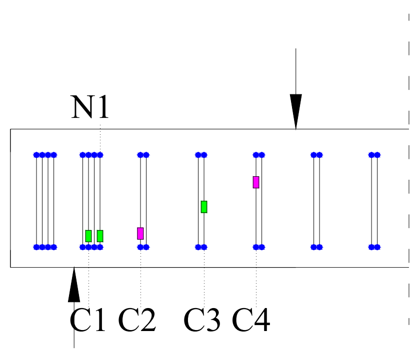
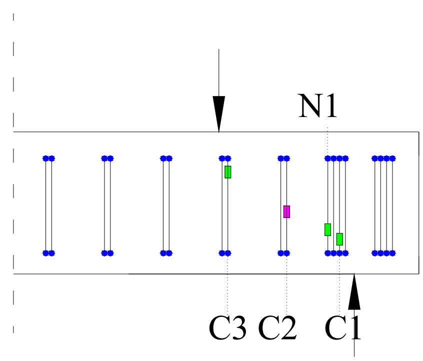
	North		South
5SB12T-2.0-10-D		**5SB12T-1.2-10-D**	
5SB12M-1.6-10-ND		**5SB12M-1.2-10-ND**	
5SB12N-1.6-10-ND	No transverse reinforcement	**5SB12N-1.2-10-ND**	No transverse reinforcement

Table 3.3-Cont. Strain Gauges ID and Locations for Phase I TPSBs

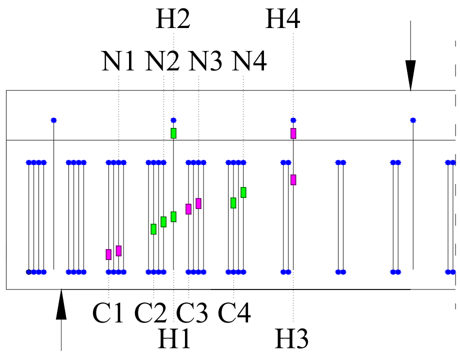
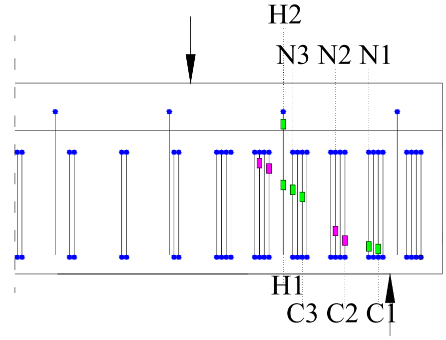
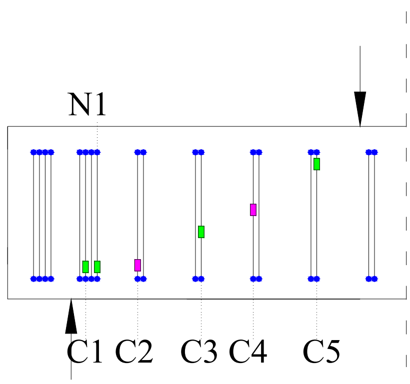
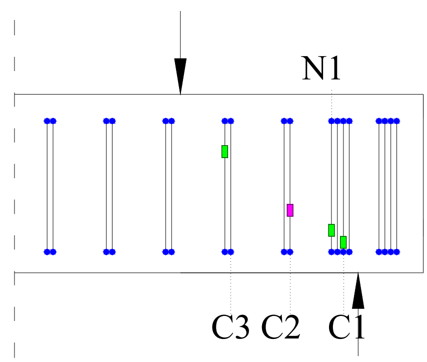
	North		South
5SB15T-2.0-8-D		**5SB15T-1.2-8-D**	
5SB15M-2.0-8-ND		**5SB15M-1.2-8-ND**	
5SB15N-2.0-8-ND	No transverse reinforcement	**5SB15N-1.2-8-ND**	No transverse reinforcement

Figure 3.12 LVDTs to Measure End Slip

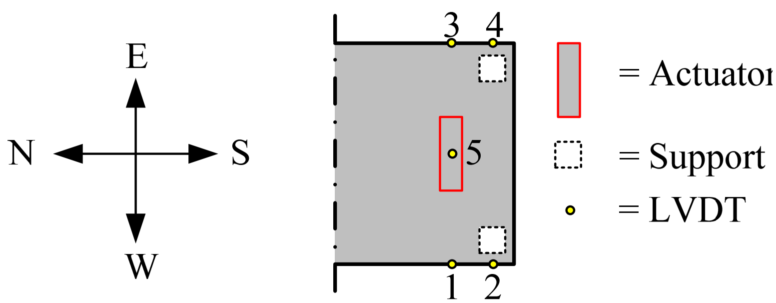


Figure 3.13 Schematic Plan of LVDT Under TPSBs at South End

After testing six TPSBs in Phase I, the general behavior of the TPSBs was revealed; in general, their behavior was not governed by shear behavior. For Phase II TPSBs, therefore, LVDT rosettes were not used, and the strain gauges were pasted on strands instead of transverse steel bars. The strain gauges were pasted on one of the twisted wires of seven low-lax strands after they were stressed, as shown in Figure 3.14. The strain gauges were attached on the two strands, four or five strain gauges on each strand. The predetermined location of strain gauges was based on the tendency of largest slippage that occurred in Phase I: in the case of the north end with one support, the slippage of strands near the edges of the section was larger than that in the mid-cross-section, and for the south end with two supports, the slippage of strands in the mid-cross-section was larger than that for nearby supports.

The measured data (from LVDTs and strain gauges) was continuously monitored and recorded by the HBM “Spider 8” Data Acquisition System. The crack widths were also measured at various loading stages using a standard crack-width gauge. The detail of the instrumentation’s labelling and reading can be found in the Appendix.

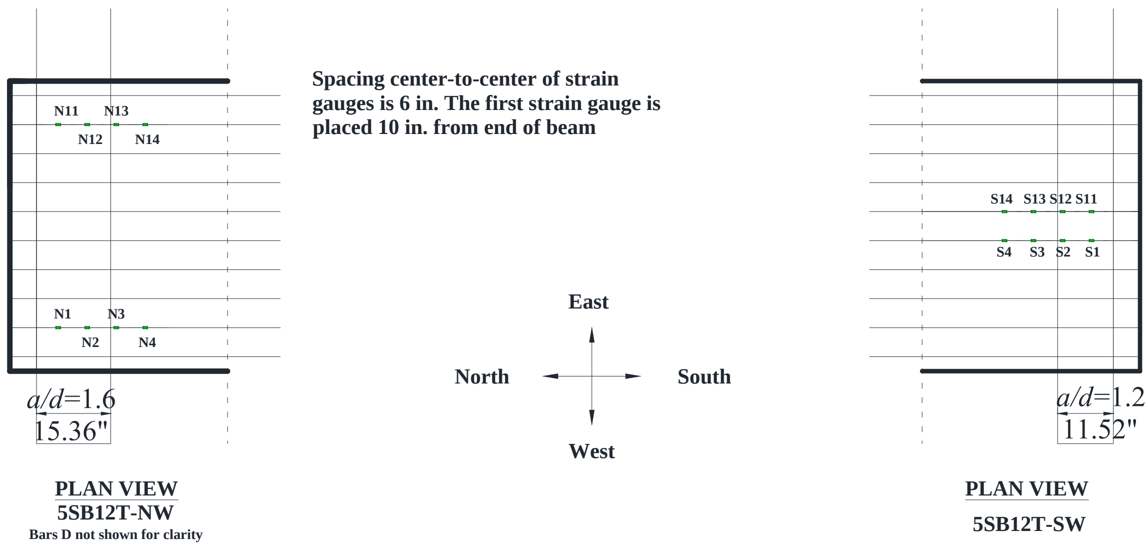


Figure 3.14 Strain Gauges on the Stands of Phase 2 TPSBs

CHAPTER 4 EXPERIMENTAL RESULTS AND ANALYSIS

4.1 Introduction

Experimental results and analysis of the test results are presented in this chapter. Analysis includes comparisons of reaction force vs. net deflection relationships, reaction force vs. relationships of LVDT measurements, and reaction force vs. relationships of readings of strain gauges. Test observations of crack patterns, crack width, and instrumentation readings together determined the failure mode of Thin Prestressed Slab Beams (TPSBs).

4.2 Group A (5SB8)

Group A consisted of four TPSBs with a height of 8-in. The concrete strength of these TPSBs varied from 9,800 to 10,300 psi. The behavior of 8-in. high TPSBs in this group was investigated, and several parameters were studied, including amount of stirrups, shear span-to-effective depth (*a/d*) ratio, and effect of the longitudinal bar at the end zone next to each strand.

Table 4.1 summarizes the test results of Group A TPSBs and the failure mode based on the test observations. All of the 8-in.-high TPSBs failed owing to anchorage bond. The minimum measured cracking shear force in Group A was 125 kips. This cracking strength is a useful parameter for checking the serviceability of TPSBs. The maximum measured crack width at the ultimate stage of Group A TPSBs varied from 7.87 x10^{-3}-in. to greater than 78.7 x10^{-3}-in. Detailed test observations are explained next.

Table 4.1 Test Summary and Failure Modes of Group A TPSBs

Specimen ID	*a/d*	f_c' (ksi)	Cracking Shear Force (kips)	Ultimate Reaction Force (kips)	Failure Mode	Crack Width ($\times 10^{-3}$in.)
5SB8T-1.2-14-D	1.24	10.3	199	259	Anchorage Bond	23.6
5SB8T-2.0-14-D	1.95	10.3	202	215	Anchorage Bond	11.8
5SB8M-1.2-14-D	1.24	9.9	191	249	Anchorage Bond	31.5
5SB8M-2.0-14-D	1.95	9.9	179	227	Anchorage Bond	7.87
5SB8T-1.2-14-D^L	1.26	10.2	232	268	Anchorage Bond	59.1
5SB8T-2.0-14-D^L	1.98	10.2	125	240	Anchorage Bond	59.1
5SB8M-1.2-14-D^L	1.24	9.8	172	222	Anchorage Bond	>78.7*
5SB8M-2.0-14-D^L	1.98	9.8	162	193	Anchorage Bond	19.7

* 78.7 x 10^{-3} is the limit of standard crack-width gauge

4.2.1 5SB8T-1.2-14-D and 5SB8T-2.0-14-D

5SB8T-1.2-14-D was tested at *a/d* = 1.24. The first crack occurred at a total shear load (recorded by two load cells) of 199 kips, and the total reaction force at the ultimate load stage was 259 kips. The maximum measured crack width at the ultimate load stage was 0.0236-in. Figure 4.1(b) shows that the first crack occurred at the end face, and no crack was observed on the side faces, as seen in Figures 4.1(a) and (c). At ultimate load stage, the crack patterns are shown in Figures 4.1(d) to (f). Figure 4.1(f) shows that no crack was observed on the east side of 5SB8T-1.2-14-D at the ultimate load stage, which might have been caused by an imperfection of the test-setup, concrete surface, and/or non-uniformity of concrete materials during compaction. In addition, the diagonal cracks shown in Figure 4.1(d) occurred beyond the testing span in the longitudinal direction because bending in the transverse direction was dominant over bending in the longitudinal direction, as shown in Figure 4.1(e).

At Cracking Loading

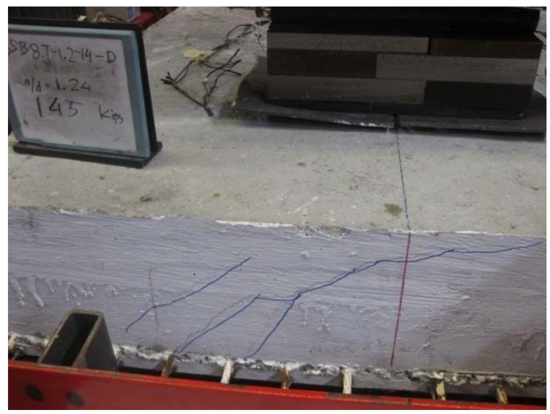
(a) West Side of 5SB8T-1.2-14-D

(b) End Face of 5SB8T-1.2-14-D

(c) East Side of 5SB8T-1.2-14-D

At Ultimate Loading

(d) West Side of 5SB8T-1.2-14-D



(e) End Face of 5SB8T-1.2-14-D

(f) East Side of 5SB8T-1.2-14-D

Figure 4.1 Crack Patterns of 5SB8T-1.2-14-D at Cracking Load and Ultimate Load

The noise owing to the slippage of tendons was heard during the test in a random sequence. The reaction force was reduced as the tendons slipped, and it increased again as the tendons gained the bond; this process continued until the tendons completely lost their bond. Figure 4.2 shows the total slippage of tendons vs. location of the distance, from the side face of the TPSB of 5SB8T-1.2-14-D; a maximum limit of horizontal axis, 60-in. represents the width of the TPSBs (5-ft.); each symbol represents the existence of each LVDT. Figure 4.2 clearly shows that the slippage existed at the cracking load stage. As the load increased, the slippage increased as well. The slippage of the interior tendons was relatively greater than that of the exterior tendons because the TPSBs were placed on two supports at this end. The complete set of the measurement is provided in the Appendix A, Table A.3. From Table A.3, the test data plotted in Figure 4.2 can be traced easily, i.e. it is known that the ultimate reaction force was 259 kips, therefore, the corresponding tendon slippage in Table A.3 is the magnitude of slippage at peak load (as plotted in red line, see Figure 4.2).

Figure 4.3 shows the strain measured by the strain gauges installed on the interior strands. Figure 4.3 shows that the maximum strain was about 0.003. By adding this number to the decompression strain (0.005~0.007), one sees that the maximum strain of tendons at that ultimate loading stage was about one percent (about yielding stress, $f_y \approx 0.7 f_{pu}$), which meant that the stress of tendons could not reach f_{ps} (stress in prestressing steel at nominal flexural strength, $f_{ps} \approx 0.9 - 0.95 f_{pu}$). The complete set of the measurement is provided in the Appendix A, Table A.4.

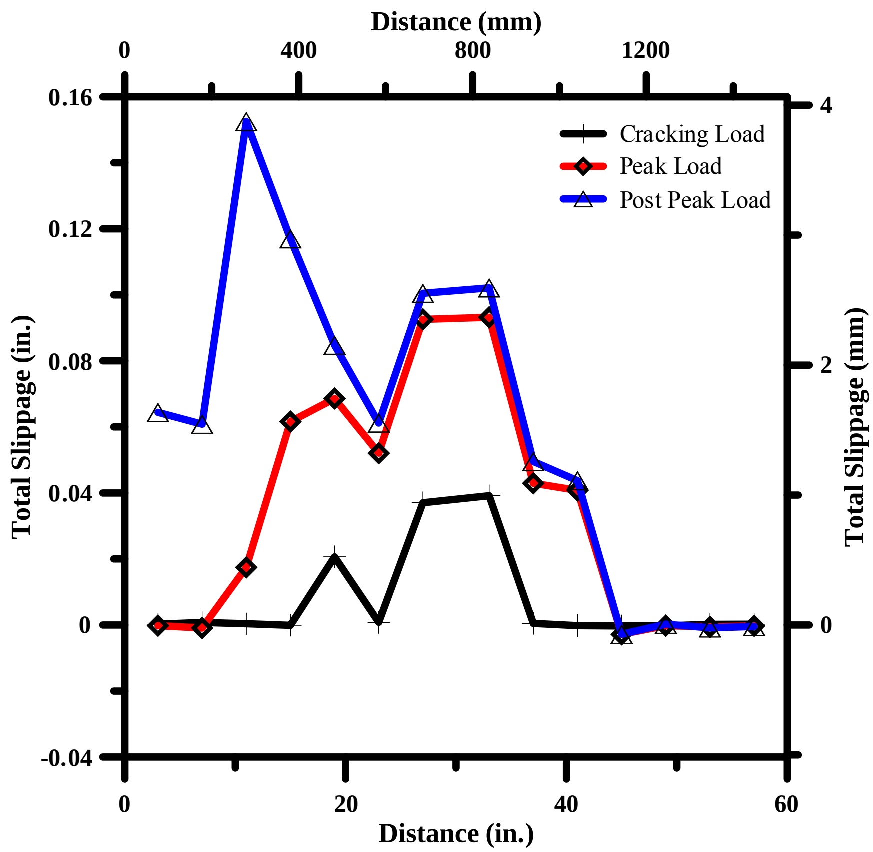
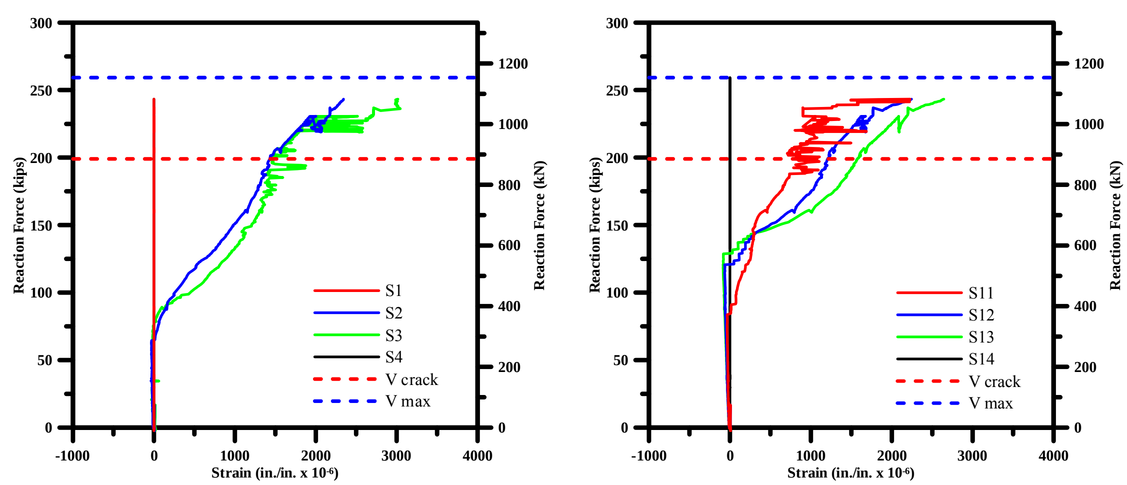


Figure 4.2 Total Slippage vs. Distance of 5SB8T-1.2-14-D



(a) Strain Of Interior Tendon 1

(b) Strain Of Interior Tendon 2

Figure 4.3 Strain of Interior Tendon of 5SB8T-1.2-14-D

After the south end (5SB8-T-1.2-14-D) failed, the TPSB was unloaded, and the north end (5SB8T-2.0-14-D) was tested at *a/d* = 1.95. The first crack occurred when the reaction force was 202 kips, and the TPSB was loaded to its ultimate reaction force, 215 kips. The maximum measured crack width at its ultimate load stage was 0.0118-in. The crack patterns at cracking load stage and ultimate load stage are depicted in Figures 4.4(a) to (c) and (d) to (f), respectively. The first crack formed at the end face, as shown in Figure 4.4(b); this crack occurred because the boundary induced a tensile stress at the top end face in the transverse direction. During the entire test, no vertical or flexural crack was observed on the west and east sides of 5SB8T-2.0-14-D, to be seen in Figures 4.4(d) and (f). The same condition can be seen in the south end; the major cracks formed at the end face, seen in Figure 4.4(e).

During the test, the slippage of tendons was also observed at north end, as shown in Figure 4.5. The slippage at cracking and ultimate load stage was negligible. This is understandable because until ultimate loading stage, the tendons were still perfectly bonded; however, right after they reached bond capacity, the tendons slipped, reaction force dropped, and slippage kept increasing. The complete set of the measurement is provided in the Appendix A, Table A.6.

Figure 4.6 shows the measured strain on the exterior tendons. The strain reading was relatively small; it showed that the exterior tendon was ineffective in resisting the external force as the loading zone was at mid-cross-section. This measurement also confirms that the stress of the strand could not reach f_{ps}. The complete set of the measurement is provided in the Appendix A, Table A.7.

At Cracking Loading

At Ultimate Loading

(a) West Side of 5SB8T-2.0-14-D

(d) West Side of 5SB8T-2.0-14-D

(b) End Face of 5SB8T-2.0-14-D

(e) End Face of 5SB8T-2.0-14-D

(c) East Side of 5SB8T-2.0-14-D

(f) East Side of 5SB8T-2.0-14-D

Figure 4.4 Crack Patterns of 5SB8T-2.0-14-D at Cracking Load and Ultimate Load

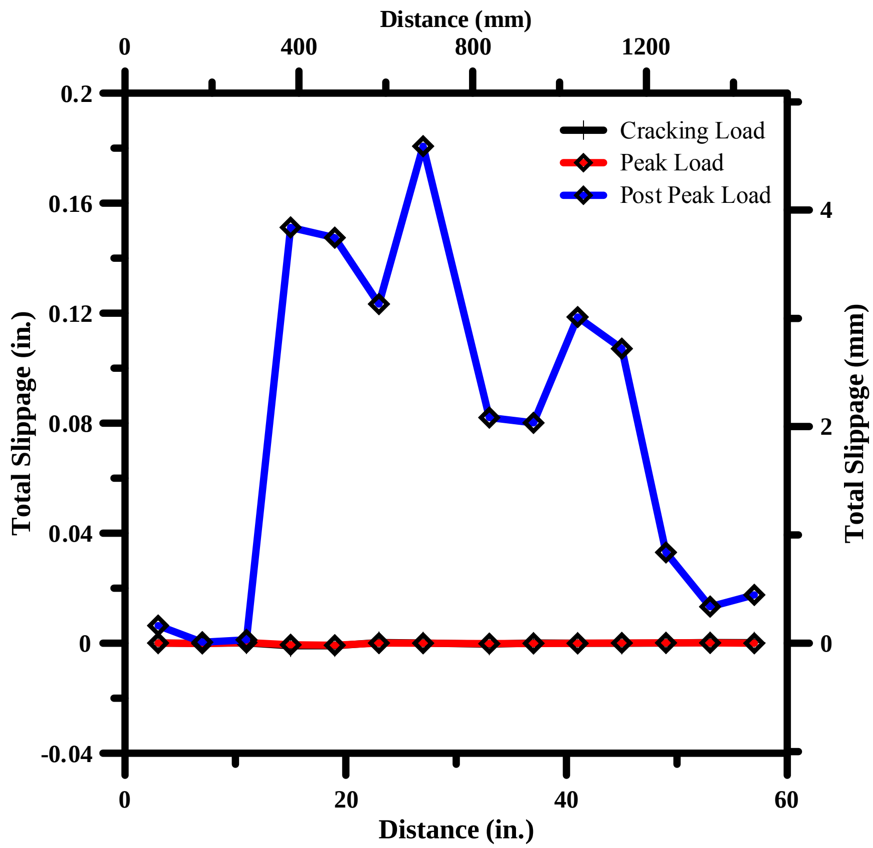
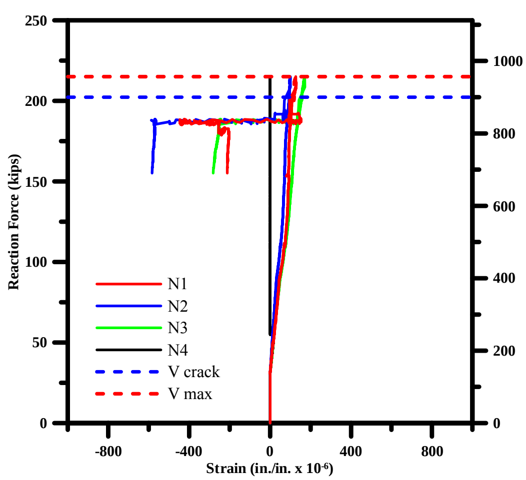
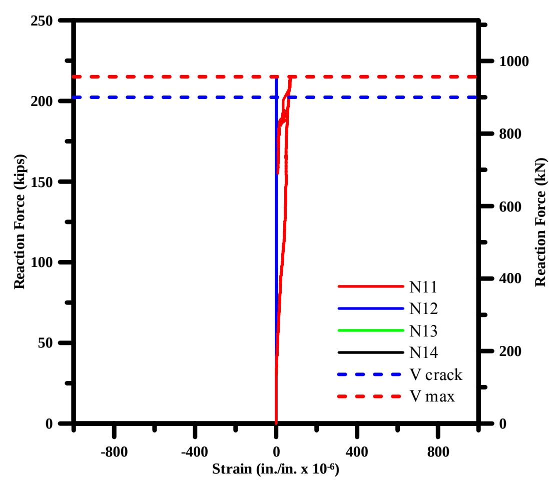


Figure 4.5 Total Slippage vs. Distance of 5SB8T-2.0-14-D



(a) Strain Of Exterior Tendon 1



(b) Strain Of Exterior Tendon 2

Figure 4.6 Strain of Exterior Tendon of 5SB8T-2.0-14-D

Figure 4.7 shows the comparison of reaction force vs. net deflection relationship between 5SB8T-1.2-14-D and 5SB8T-2.0-14-D. The vertical axis shows the reaction force recorded by load cell(s), and the horizontal axis shows the net deflection recorded by LVDTs under the loading section subtracted by the settlement of support(s) recorded by LVDTs under the support section. Figure 4.7 shows that the reaction force increases as the *a/d* decreases. The deformability of these two ends is relatively the same, and both ends fail in brittle behavior. Figure 4.7 also shows that once the tendons slipped (true for both ends), the reaction force is unlikely to recover. The test data of 5SB8T-1.2-14-D and 5SB8T-2.0-14-D can be found in the Appendix A, Table A.2 and A.5, respectively.

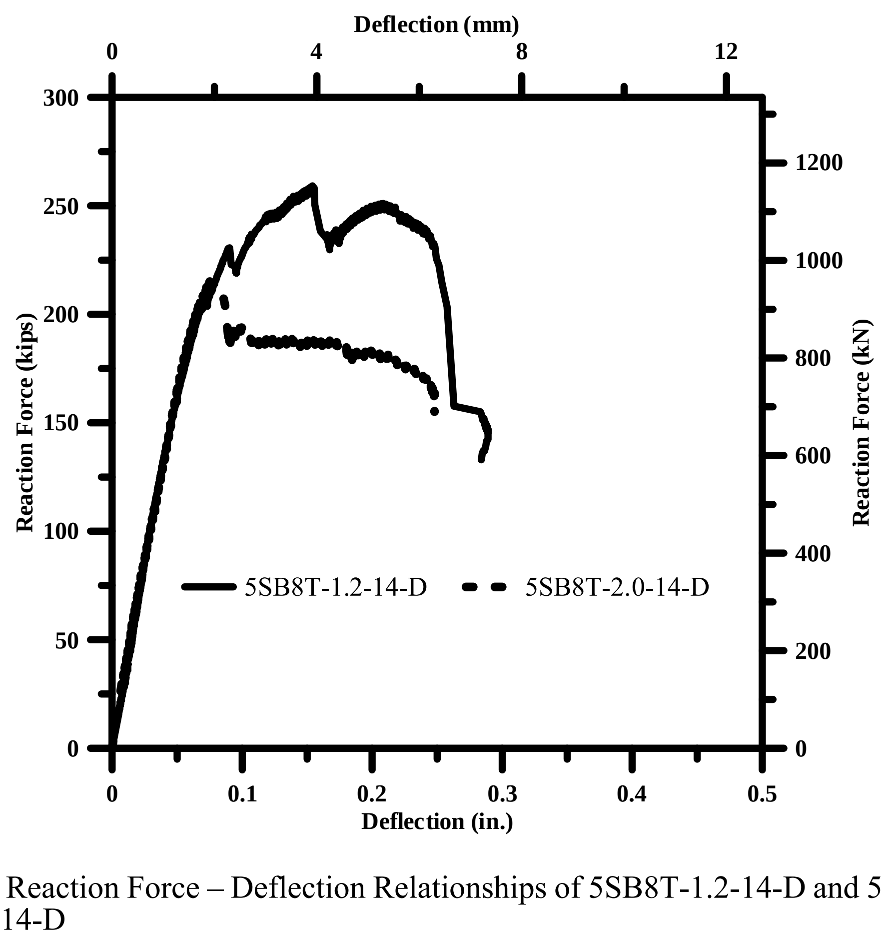


Figure 4.7 Reaction Force – Deflection Relationships of 5SB8T-1.2-14-D and 5SB8T-2.0-14-D

4.2.2 5SB8M-1.2-14-D and 5SB8M-2.0-14-D

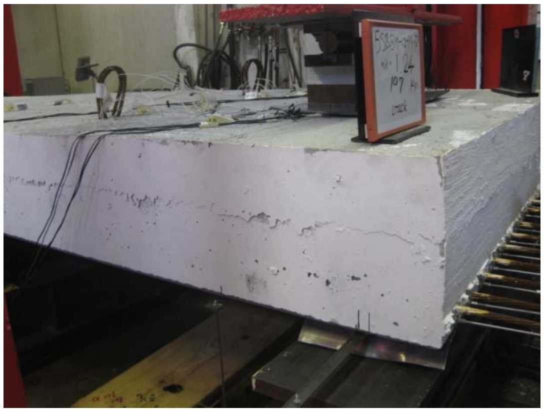
The second TPSB of Group A has half the number of stirrups compared to the first TPSB of Group A. Under the same loading protocol, the south end, 5SB8M-1.2-14-D, was tested first at *a/d* = 1.24. The first crack occurred at the end face, as shown in Figure 4.8(b) at the total recorded reaction force of 191 kips. No crack was observed on either west or east sides of 5SB8M-1.2-14-D, as shown in Figures 4.8(a) and (c), respectively. At the ultimate load stage, the crack patterns are shown in Figures 4.8(d) to (f). The major cracks occurred at the end face; the cracks that formed on the west and east sides of 5SB8M-1.2-14-D were the result of bending in a transverse direction. The maximum recorded reaction force was 249 kips, with the maximum crack width at 0.0315-in.

The slippage of tendons was significant, as shown in Figure 4.9. The slippage of tendons increased as more cracks were formed at the end face of 5SB8M-1.2-14-D, and the interior tendon had greater slippage than the exterior tendons. The complete set of the measurement can be found in the Appendix A, Table A.9.

The strain in the interior prestressing steel is shown in Figure 4.10. The strain gauges S1 to S4 were broken during construction, so no data was recorded during the test. Strain gauges S11 to S14 were damaged when the total recorded reaction force was about 50 kips, owing to strain-gauge wires protruding from the concrete so close to the loading area that they were severed as the applied load increased. The complete set of the measurement is provided in the Appendix A, Table A.10.

At Cracking Loading

At Ultimate Loading



(a) West Side of 5SB8M-1.2-14-D

(d) West Side of 5SB8M-1.2-14-D

(b) End Face of 5SB8M-1.2-14-D

(e) End Face of 5SB8M-1.2-14-D

(c) East Side of 5SB8M-1.2-14-D

(f) East Side of 5SB8M-1.2-14-D

Figure 4.8 Crack Patterns of 5SB8M-1.2-14-D at Cracking Load and Ultimate Load

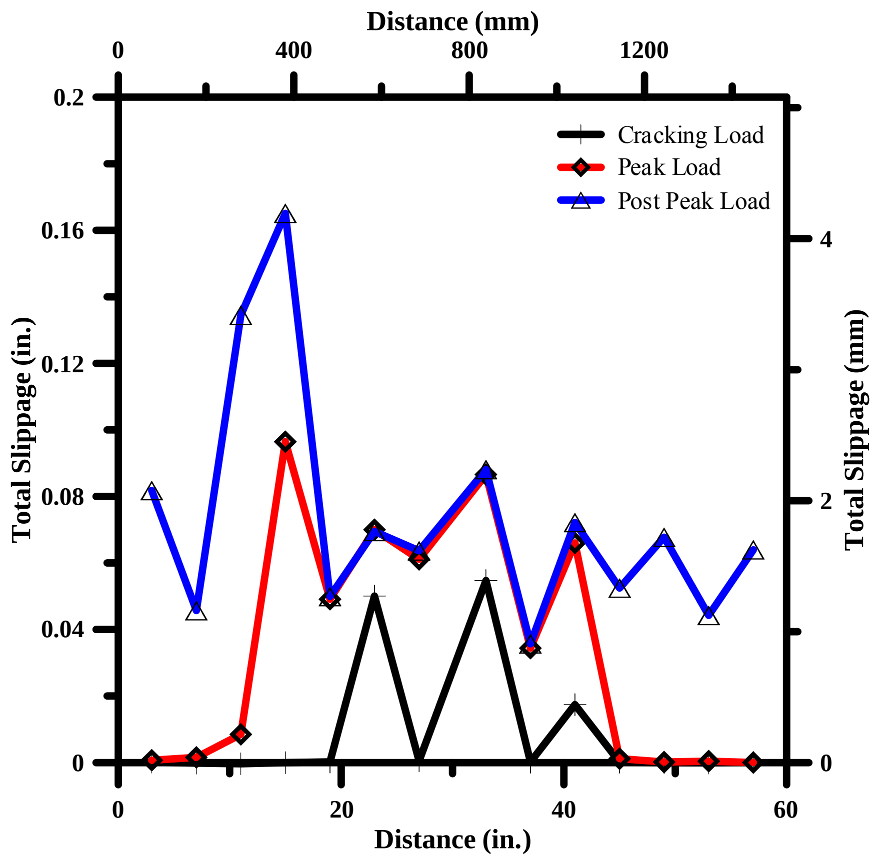
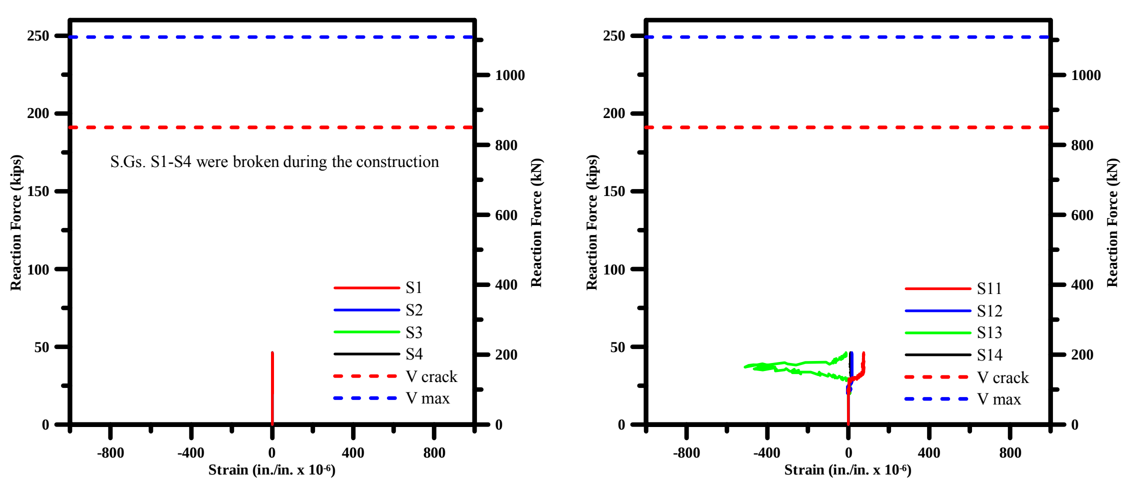


Figure 4.9 Total Slippage vs. Distance of 5SB8M-1.2-14-D



(a) Strain Of Interior Tendon 1

(b) Strain of Interior Tendon 2

Figure 4.10 Strain of Interior Tendon of 5SB8M-1.2-14-D

5SB8M-2.0-14-D was tested at *a/d* = 1.95. The first crack formed at the end face, as shown in Figure 4.11(b); this crack occurred because the boundary induced a tensile stress at the top end face in the transverse direction. It was formed when the reaction force was at 179 kips. 5SB8M-2.0-14-D continued resisting additional load and reached its capacity at 227 kips, and the measured crack width was 0.00787-in. At the ultimate load stage, the cracks formed mainly at the end face, as seen in Figure 4.11(e), and only a few cracks formed on the west and east sides of 5SB8M-2.0-14-D, Figures 4.11(d) and (f), respectively.

The noise owing to the slippage of tendons was observed in a random sequence, as seen in Figure 4.12. Both at cracking and ultimate load stage, slippage of tendons was negligible, which signified that the tendons were still perfectly bonded. As the applied load reached its bond capacity, the tendons slipped, and the recorded reaction force dropped. These slippages caused 5SB8M-2.0-14-D failed to develop to its nominal capacity. At post peak load stage, the slippage increased significantly. The complete set of the measurement is provided in the Appendix A, Table A.12.

Strain in the exterior tendons is illustrated in Figure 4.13. Up to the ultimate stage, no significant strain was measured; in other words, the exterior tendon was ineffective in resisting the external force as the loading zone was at mid-cross-section. The maximum strain was about 0.001. By adding this number to the decompression strain (0.005~0.007), one sees that the stress of the tendons could not reach f_{ps}. The complete set of the measurement is provided in the Appendix A, Table A.13.

At Cracking Loading

At Ultimate Loading

(a) West Side of 5SB8M-2.0-14-D

(d) West Side of 5SB8M-2.0-14-D

(b) End Face of 5SB8M-2.0-14-D

(e) End Face of 5SB8M-2.0-14-D

(c) East Side of 5SB8M-2.0-14-D

(f) East Side of 5SB8M-2.0-14-D

Figure 4.11 Crack Patterns of 5SB8M-2.0-14-D at Cracking Load and Ultimate Load

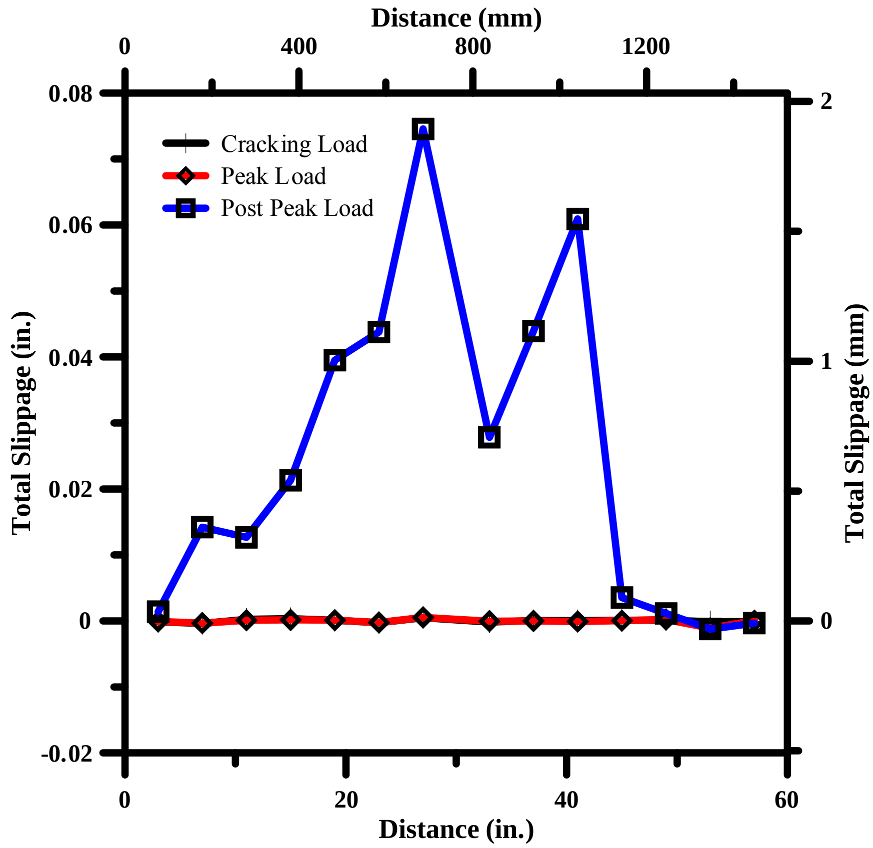
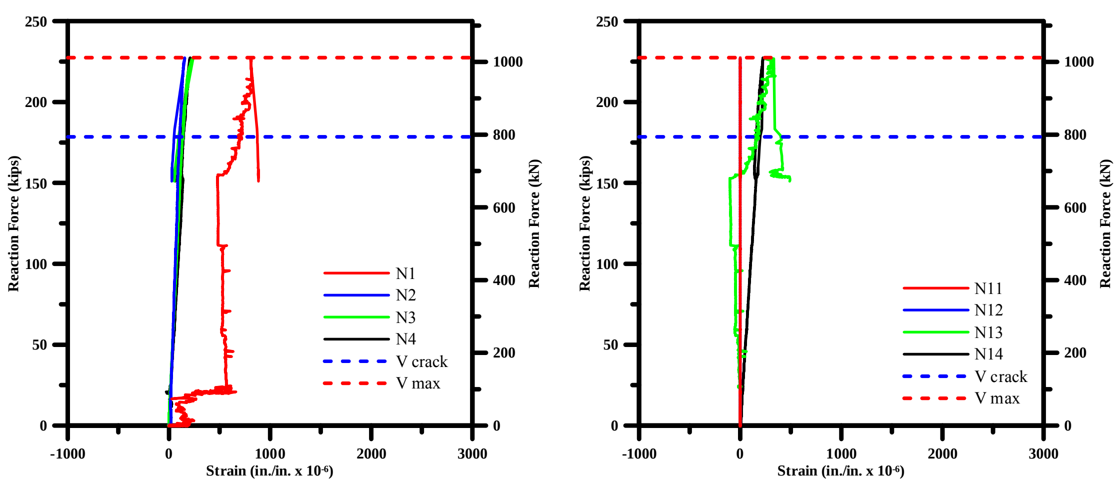


Figure 4.12 Total Slippage vs. Distance of 5SB8M-2.0-14-D



(a) Strain of Exterior Tendon 1 (b) Strain of Exterior Tendon 2

Figure 4.13 Strain of Exterior Tendon of 5SB8M-2.0-14-D

Figure 4.14 shows a comparison of reaction force vs. net deflection relationship between 5SB8M-1.2-14-D and 5SB8M-2.0-14-D. Figure 4.14 shows 5SB8M-2.0-14-D to be less than the deflection of 5SB8M-1.2-14-D, which was unlikely to happen. This condition might have happened because 5SB8M-1.2-14-D was tested before 5SB8M-2.0-14-D, so the damaged index at the end of 5SB8M-1.2-14-D affected the behavior at the end of 5SB8M-2.0-14-D. The reaction force of both ends was relatively the same, and it dropped as the slippage of tendons occurred. No ductility, therefore, was preserved at both ends. The test data of 5SB8M-1.2-14-D and 5SB8M-2.0-14-D can be found in the Appendix A, Table A.8 and A.11, respectively.

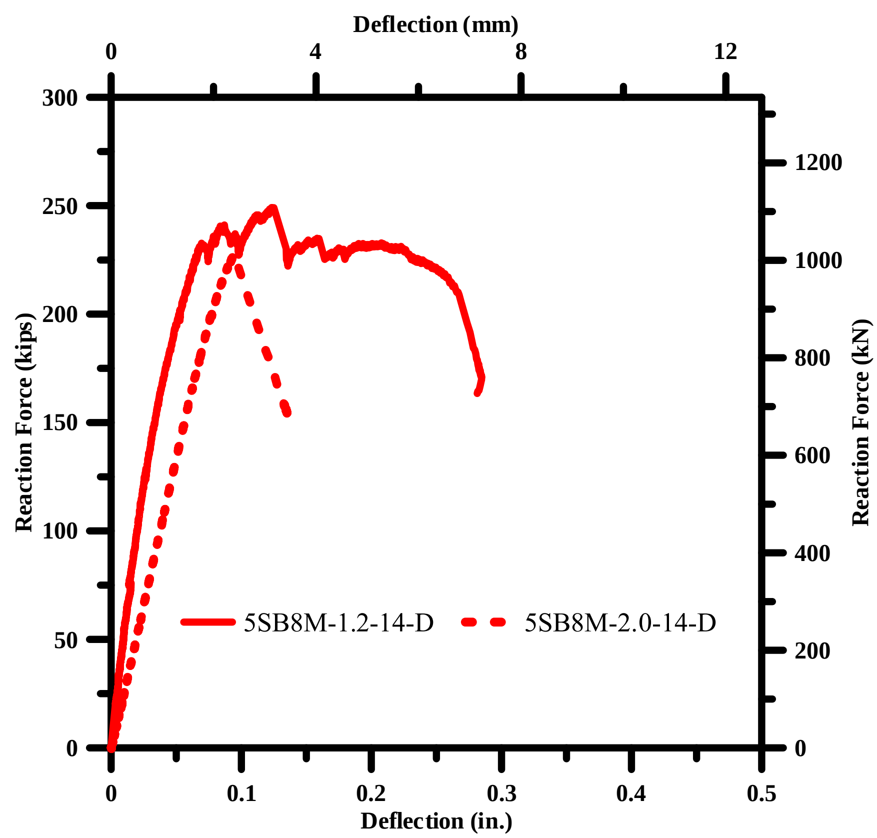


Figure 4.14 Reaction Force – Deflection Relationships of 5SB8M-1.2-14-D and 5SB8M-2.0-14-D

4.2.3 5SB8T-1.2-14-D^L and 5SB8T-2.0-14-D^L

The third TPSB of Group A was proposed by the TxDOT research monitoring committee to study the effect of longitudinal mild steel (4-ft. in length) at the end zone (next to each tendon at both ends). 5SB8T-1.2-14-D^L was tested at *a/d* = 1.26. The first crack was observed when the total reaction force was 232 kips. The first crack was formed both at the end face and the east side simultaneously, as shown in Figures 4.15(b) and (c), respectively. 5SB8T-1.2-14-D^L failed when the total reaction force was 268 kips. At this stage, the major cracks formed at the end face, seen in Figure 4.15(e), and some cracks formed on the west and east sides of 5SB8T-1.2-14-D^L, seen in Figures 4.15(d) and (f), respectively. The maximum measured width of the crack at this stage was 0.0591-in.

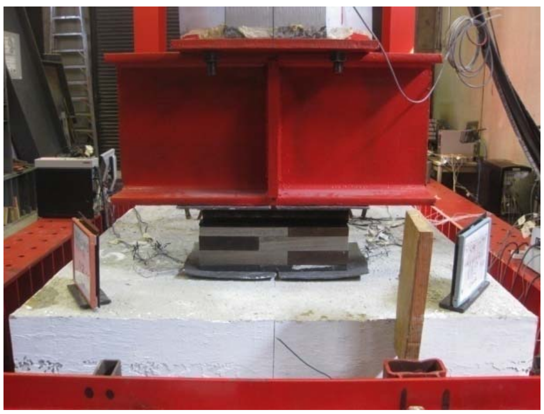
The slippage of the tendons was measured as seen in Figure 4.16. At cracking-load stage, the interior tendon showed a relatively significant slippage. As the load increased to its bond capacity, the slippage increased, and finally at the post peak stage, all the tendons slipped. The complete set of the measurement can be seen in the Appendix A, Table A.15.

Figure 4.17 shows the reading of the strain gauges of the interior tendons. The maximum recorded strain observed was about 0.004~0.008; if this number is added to the decompression strain, 0.005~0.007, then the maximum strain of the tendons is about 0.009~0.015. If this strain is then converted to stress based on the constitutive law of materials, the stress of tendons is still smaller than f_{ps}. Hence, it agrees that 5SB8T-1.2-14-D^L failed due to anchorage bond failure. The complete set of the measurement can be seen in the Appendix A, Table A.16.

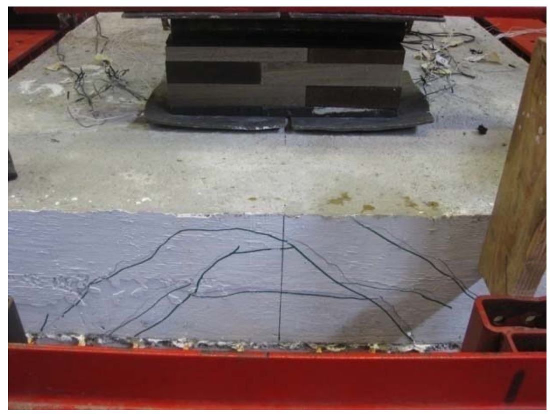
At Cracking Loading | At Ultimate Loading

(a) West Side of 5SB8T-1.2-14-D^L

(d) West Side of 5SB8T-1.2-14-D^L



(b) End Face of 5SB8T-1.2-14-D^L



(e) End Face of 5SB8T-1.2-14-D^L

(c) East Side of 5SB8T-1.2-14-D^L

(f) East Side of 5SB8T-1.2-14-D^L

Figure 4.15 Crack Patterns of 5SB8T-1.2-14-D^L at Cracking Load and Ultimate Load

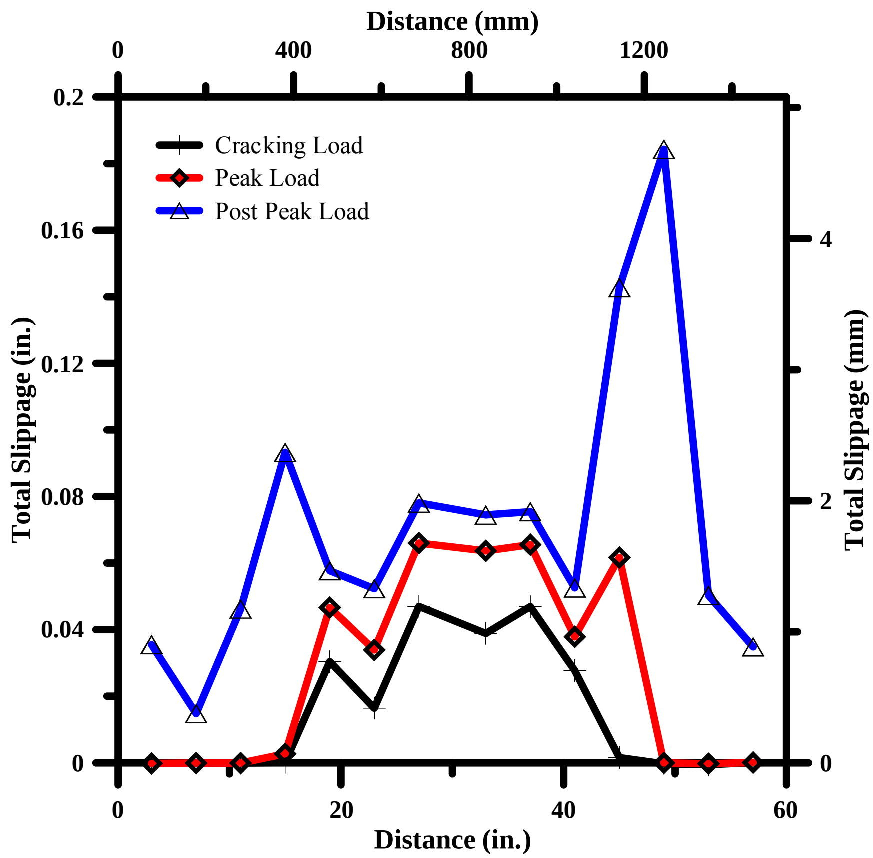
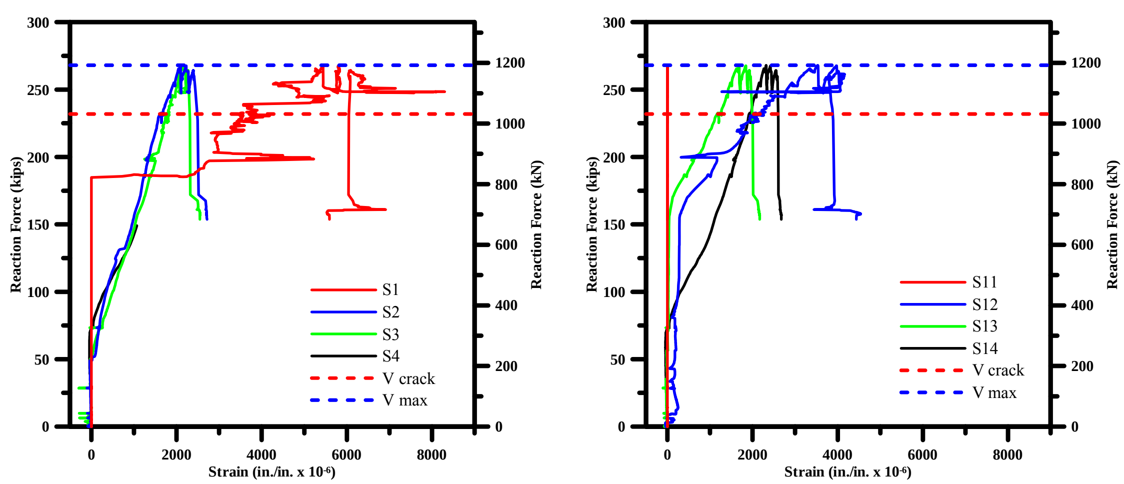


Figure 4.16 Total Slippage vs. Distance of 5SB8T-1.2-14-D^{L}



(a) Strain of Interior Tendon 1

(b) Strain of Interior Tendon 2

Figure 4.17 Strain of Interior Tendon of 5SB8T-1.2-14-D^{L}

5SB8T-2.0-14-D^L was tested at a/d = 1.98. The first crack was observed when the reaction force was 125 kips. A vertical crack formed at the top of mid-cross-section at the end face, as shown in Figure 4.18(b). This crack occurred because the boundary induced a tensile stress at the top end face in the transverse direction. No crack was formed on either west or east sides of 5SB8T-2.0-14-D^L, as shown in Figures 4.18(a) and (c). At the ultimate stage, more cracks were formed, as depicted in Figures 4.18(d) to (f); no flexural crack was observed on either west or east sides of 5SB8T-2.0-14-D^L as well. The maximum recorded reaction was 240 kips, and the maximum measured crack width at the ultimate stage was 0.0591-in.

Figure 4.19 shows the slippage of tendons at cracking load, peak load, and post peak load stages. From this figure, it is obvious that the tendons started to show a slippage at cracking load stage. At ultimate load stage, eight of 14 tendons showed considerable slippage, and at post peak load stage, all of the tendons slipped. At this end, 5SB8T-2.0-14-D^L was sat on two supports and they provided clamping forces; therefore, the slippage of exterior tendons is smaller than the slippage of interior tendons. The complete set of the measurement can be seen in the Appendix A, Table A.18.

Figure 4.20 shows strain-gauge readings of the exterior tendons. No significant reading was measured by the strain gauges. The maximum measured strain was less than 0.002. After this measured strain is added to the decompression strain (0.005~0.007), the result shows that the stress of the tendons was less than f_{ps}. Thus, this measurement supports that 5SB8T-2.0-14-D^L in anchorage bond failure. The complete set of the measurement can be found in the Appendix A, Table A.19.

At Cracking Loading

(a) West Side of 5SB8T-2.0-14-D^{L}

(b) End Face of 5SB8T-2.0-14-D^{L}

(c) East Side of 5SB8T-2.0-14-D^{L}

At Ultimate Loading

(d) West Side of 5SB8T-2.0-14-D^{L}

(e) End Face of 5SB8T-2.0-14-D^{L}

(f) East Side of 5SB8T-2.0-14-D^{L}

Figure 4.18 Crack Patterns of 5SB8T-2.0-14-D^{L} at Cracking Load and Ultimate Load

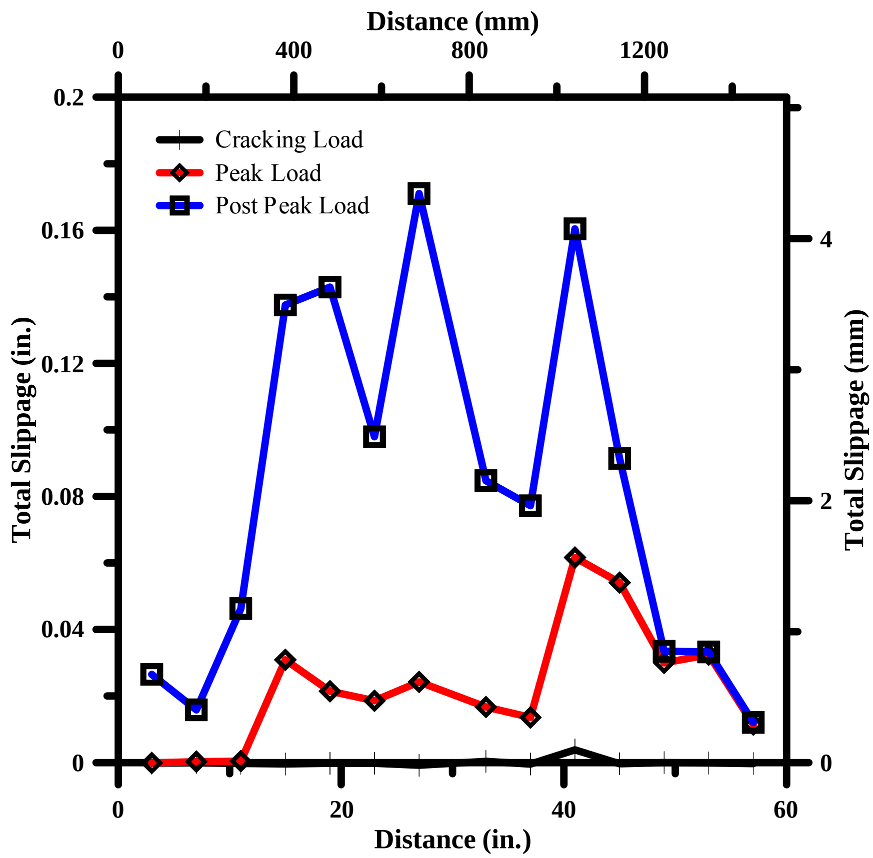
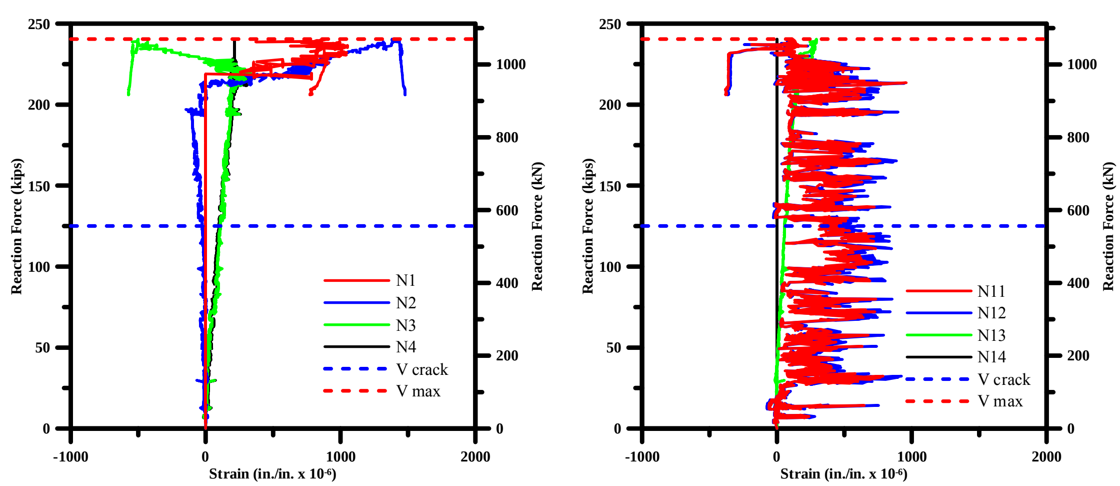


Figure 4.19 Total Slippage vs. Distance of 5SB8T-2.0-14-D^{L}



(a) Strain of Exterior Tendon 1

(b) Strain of Exterior Tendon 2

Figure 4.20 Strain of Exterior Tendon of 5SB8T-2.0-14-D^{L}

Figure 4.21 shows the comparison of reaction force vs. the deflection between 5SB8T-1.2-14-D^L and 5SB8T-2.0-14-D^L. In general, in the case of perfectly bonded prestressed concrete members, the capacity increases significantly as the *a/d* decreases. Where an anchorage bond exists, however, the capacity of these two ends is relatively close. The reaction force drops as the slippage occurs, and the reaction force increases again as the tendons regain their bond capacity. This process continues until the anchorage bond completely fails. The deflection of 5SB8T-2.0-14-D^L is greater than 5SB8T-1.2-14-D^L because 5SB8T-2.0-14-D^L has a greater *a/d*, so the flexure behavior of 5SB8T-2.0-14-D^L is dominant over 5SB8T-1.2-14-D^L. The test data of 5SB8T-1.2-14-D^L and 5SB8T-2.0-14-D^L can be found in the Appendix A, Table A.14 and A.17, respectively.

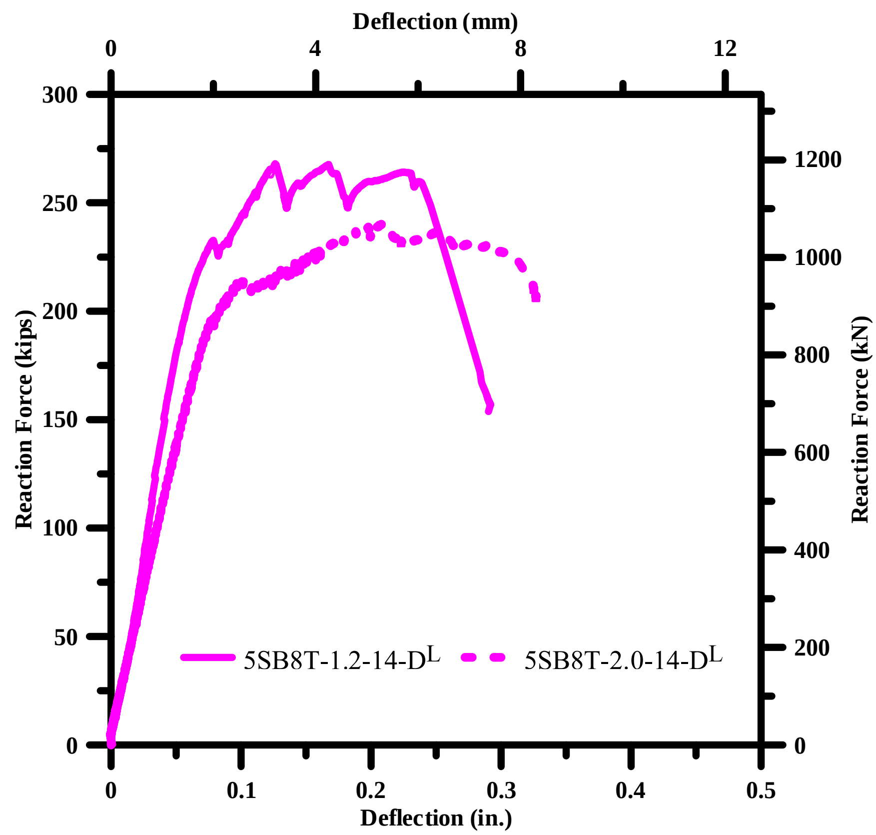


Figure 4.21 Reaction Force – Deflection Relationships of 5SB8T-1.2-14-D^L and 5SB8T-2.0-14-D^L

4.2.4 5SB8M-1.2-14-D^L and 5SB8M-2.0-14-D^L

5SB8M-1.2-14-D^L was tested at *a/d* = 1.24. The first crack occurred at the end face when the total reaction force was 172 kips, as shown in Figure 4.22(b). At this stage, no crack was observed on either west or east sides of 5SB8M-1.2-14-D^L, as depicted in Figures 4.22(a) and (c), respectively; 5SB8M-1.2-14-D^L reached its capacity when the total reaction force was 222 kips. The major cracks formed at the end face, as seen in Figure 4.22(e), and some cracks formed on the west and east sides of 5SB8M-1.2-14-D^L, as seen in Figures 4.22(d) and (f), respectively. The maximum measured crack width at this stage was larger than 0.0787-in.

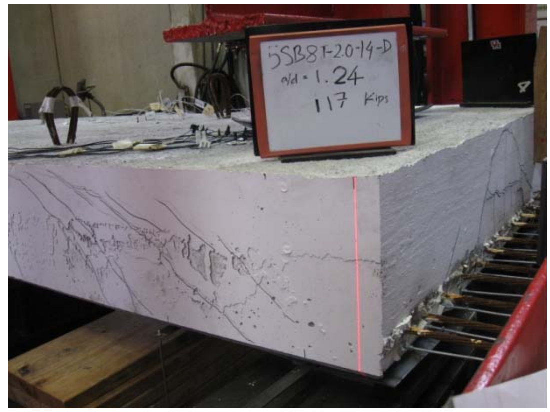
Figure 4.23 shows the slippage of tendons measured during the test. At cracking load stage, the interior tendon showed a significant slippage. At peak load stage, 11 of 14 tendons showed large slippage, and this slippage rendered the TPSBs unable to take additional load. At this end, 5SB8M-1.2-14-D^L was sat on two supports, which provided compression force to concrete area. The slippage of exterior tendons, therefore, was smaller than the slippage of interior tendons. At post peak load stage, all tendons slipped. The complete set of the measurement can be seen in the Appendix A, Table A.21.

Figure 4.24 shows the measured strain of interior tendons. The maximum recorded strain was about 0.003. If this number is added to the decompression strain (0.005~0.007), the maximum strain of the tendons is about 0.008~0.010, which proves the stress of tendons was smaller than f_{ps}. This measurement support that 5SB8M-1.2-14-D^L failed in anchorage bond failure. The complete set of the measurement can be found in the Appendix A, Table A.22.

At Cracking Loading

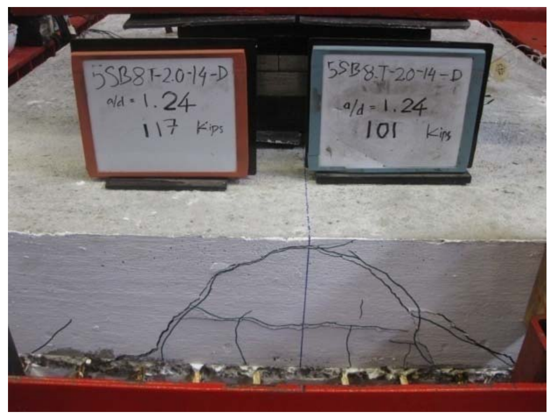
At Ultimate Loading

(a) West Side of 5SB8M-1.2-14-D^L



(d) West Side of 5SB8M-1.2-14-D^L

(b) End Face of 5SB8M-1.2-14-D^L



(e) End Face of 5SB8M-1.2-14-D^L

(c) East Side of 5SB8M-1.2-14-D^L

(f) East Side of 5SB8M-1.2-14-D^L

Figure 4.22 Crack Patterns of 5SB8M-1.2-14-D^L at Cracking Load and Ultimate Load

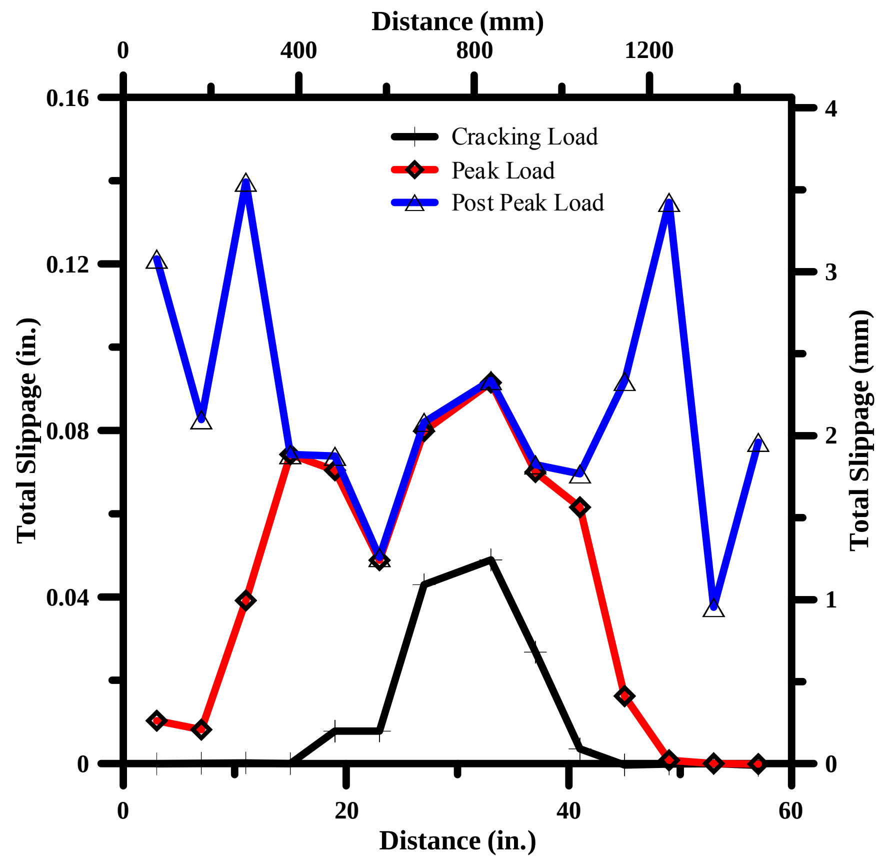
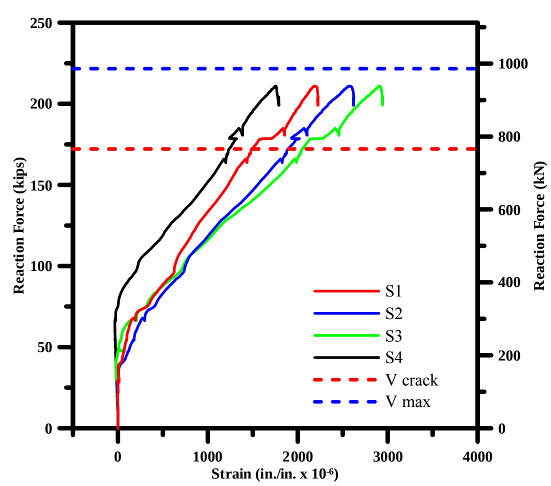
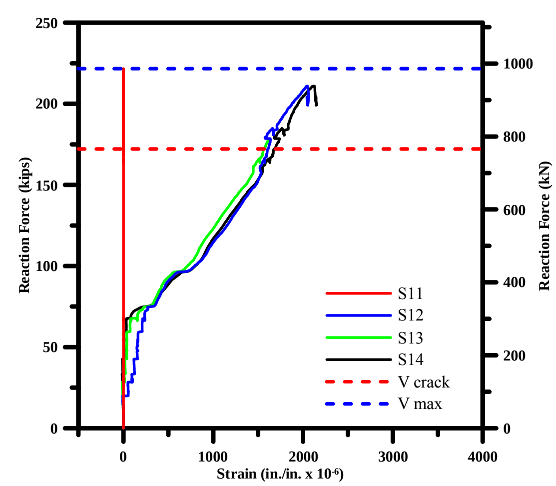


Figure 4.23 Total Slippage vs. Distance of 5SB8M-1.2-14-D^L



(a) Strain of Interior Tendon 1



(b) Strain of Interior Tendon 2

Figure 4.24 Strain of Interior Tendon of 5SB8M-1.2-14-D^L

5SB8M-2.0-14-D^{L} was tested at *a/d* = 1.98. The first crack was found when the reaction force was 162 kips. A vertical crack formed at the top of mid-cross-section at the end face; this occurred because the boundary condition induced a tensile stress at top end face in transverse direction, as shown in Figure 4.25(b). No crack was formed on either side of 5SB8M-2.0-14-D^{L}, as portrayed in Figures 4.25(a) and (c). At the ultimate stage, more cracks were formed, as depicted in Figures 4.25(d) to (f). The maximum recorded reaction was 193 kips, and the maximum measured crack width at the ultimate stage was 0.0197-in.

Figure 4.26 shows the slippage of tendons at cracking load, peak load, and post peak load stage. Both at cracking load and ultimate load stage, the slippage of tendons was negligible, meaning both concrete and tendons were still perfectly bonded. This phenomenon can be understood because up to ultimate load stage, there was no crack intersected the tendons, see Figure 4.25(d) to (f). After the tendons reached their ultimate capacity, more cracks were formed, and they slipped; therefore, the reaction force decreased. 5SB8M-2.0-14-D^{L} was sat on two supports. The tendon slippage of exterior tendons, therefore, is smaller than the tendon slippage of interior tendon. The complete set of the measurement can be found in the Appendix A, Table A.24.

Figure 4.27 shows the reading of the exterior tendon strain gauges, which show that the maximum measured strain was relatively small, less than 0.0005. They show, too, that the exterior tendon was not effective, and the stress of the tendons was less than f_{ps}. The complete set of the measurement can be found in the Appendix A, Table A.25.

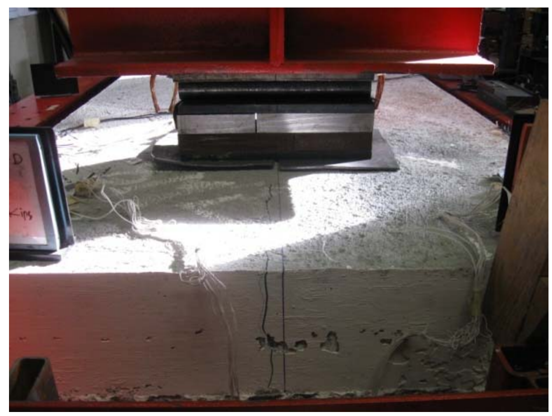
At Cracking Loading

At Ultimate Loading

(a)West Side of 5SB8M-2.0-14-D^{L}

(d) West Side of 5SB8M-2.0-14-D^{L}

(b) End Face of 5SB8M-2.0-14-D^{L}



(e) End Face of 5SB8M-2.0-14-D^{L}

(c) East Side of 5SB8M-2.0-14-D^{L}

(f) East Side of 5SB8M-2.0-14-D^{L}

Figure 4.25 Crack Patterns of 5SB8M-2.0-14-D^{L} at Cracking Load and Ultimate Load

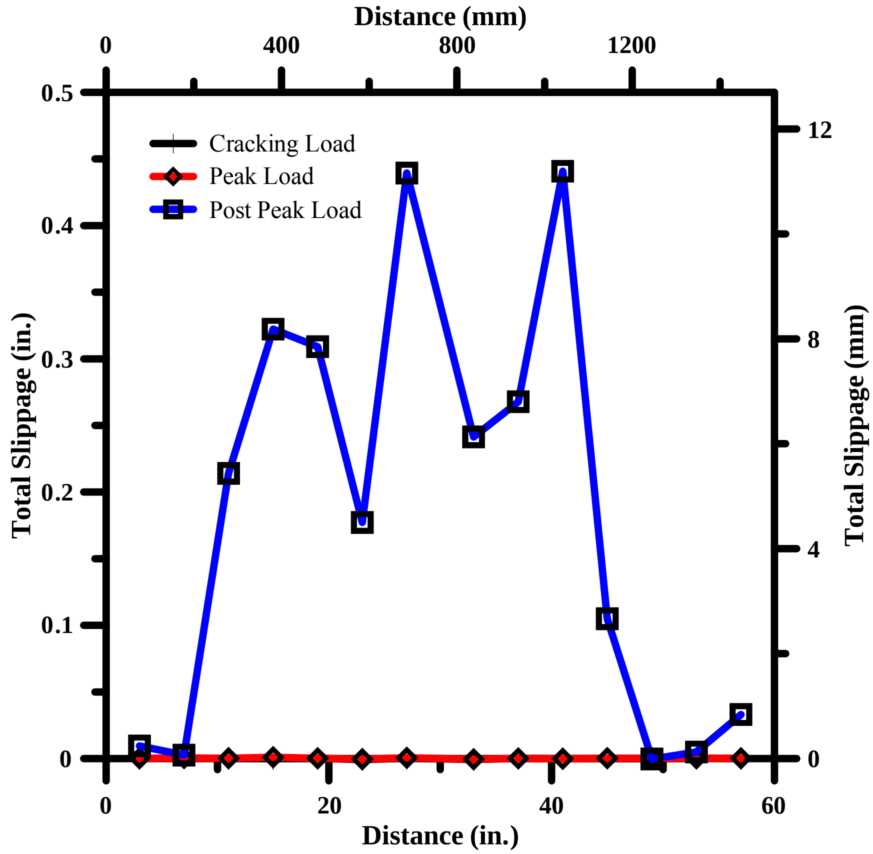
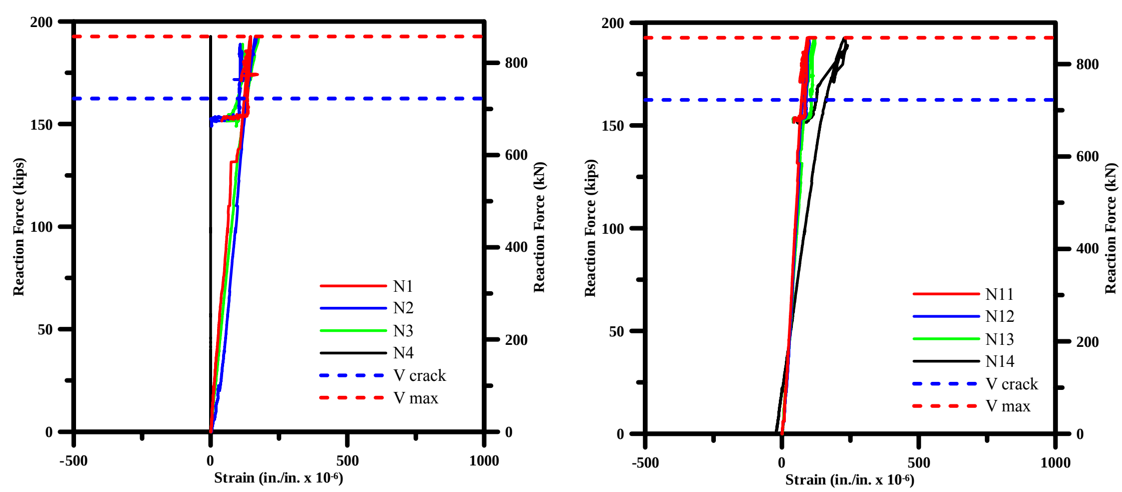


Figure 4.26 Total Slippage vs. Distance of 5SB8M-2.0-14-D[L]



(a) Strain of Exterior Tendon 1 (b) Strain of Exterior Tendon 2

Figure 4.27 Strain of Exterior Tendon of 5SB8M-2.0-14-D[L]

Figure 4.28 shows the comparison of reaction force vs. deflection between 5SB8M-1.2-14-D^L and 5SB8M-2.0-14-D^L. Perfectly bonded prestressed concrete members generally saw their capacity increase significantly as their *a/d* decreased. Where the anchorage bond exists, however, the capacity of these ends was relatively close: the reaction force dropped as the slippage occurred, and the reaction force increased again as the tendons regained their bond capacity. This process continued until the anchorage bond failed completely. Deflection of 5SB8M-2.0-14-D^L is larger than 5SB8M-1.2-14-D^L because 5SB8M-2.0-14-D^L has greater *a/d*, so flexure behavior is more dominant than 5SB8M-1.2-14-D^L. The test data of 5SB8T-1.2-14-D^L and 5SB8T-2.0-14-D^L can be found in the Appendix A, Table A.20 and A.23, respectively.

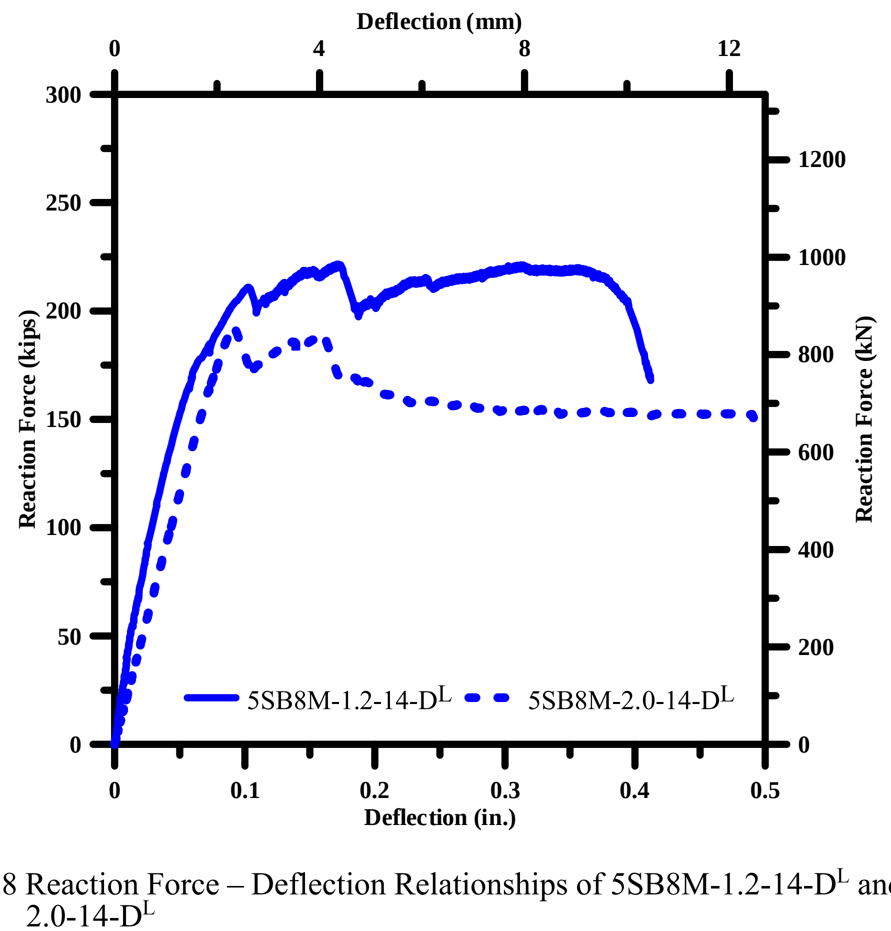
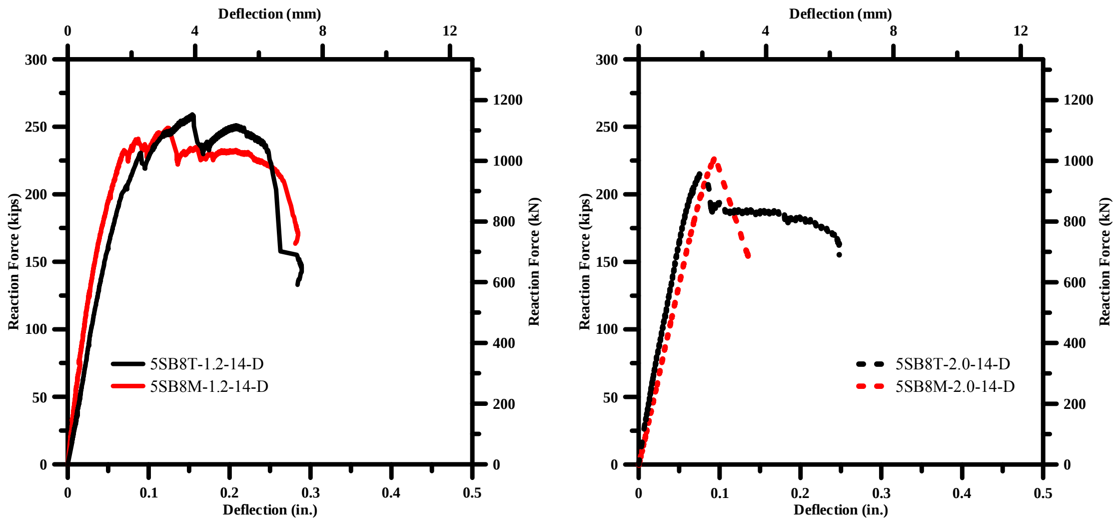


Figure 4.28 Reaction Force – Deflection Relationships of 5SB8M-1.2-14-D^L and 5SB8M-2.0-14-D^L

4.2.5 The Effect of Amount of Stirrups

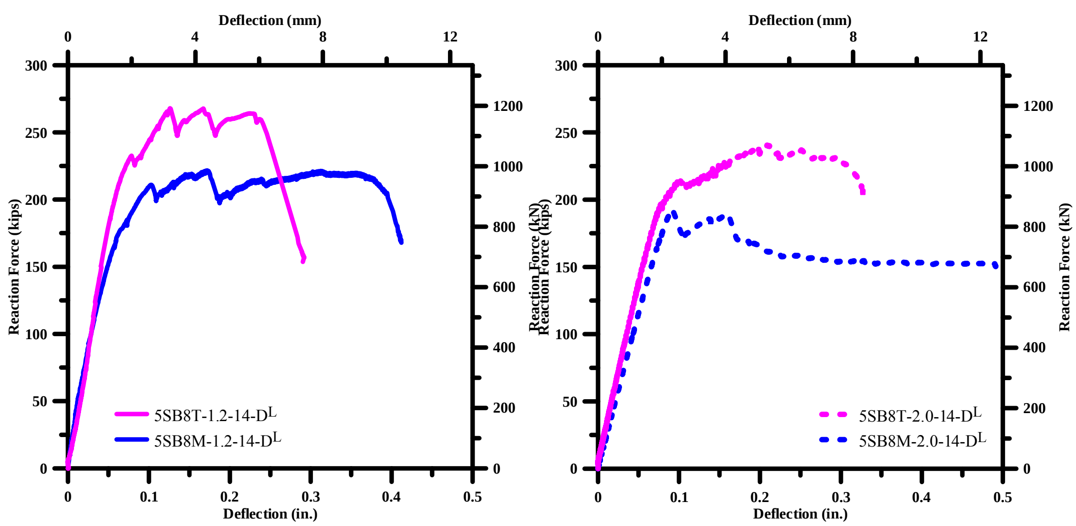
The comparison of reaction force vs. deflection of 5SB8T-1.2-14-D and 5SB8T-2.0-14-D can be compared with reaction force vs. deflection of 5SB8M-1.2-14-D and 5SB8M-2.0-14-D, as shown in Figures 4.29(a) and (b), respectively. As Figure 4.29(a) shows, since the *a/d* is very small, and the failure mode is governed by anchorage bond, adding more stirrups by as much as 100 percent does not improve their behavior and performance; the behavior of 5SB8T-1.2-14-D and 5SB8M-1.2-14-D is almost identical. As *a/d* increases, as shown in Figure 4.29(b), a 100 percent increase in stirrups slightly improves their deformability. This increase does not, however, prevent brittle failure (anchorage bond failure). From Figure 4.29, it can be seen that adding stirrups does not increase the capacity of TPSBs.

The comparison of reaction force vs. deflection of 5SB8T-1.2-14-D^L and 5SB8T-2.0-14-D^L can be compared to reaction force vs. deflection of 5SB8M-1.2-14-D^L and 5SB8M-2.0-14-D^L; as shown in Figures 4.30(a) and (b), respectively. Figures 4.30(a) and (b) show that 5SB8M-1.2-14-D^L and 5SB8M-2.0-14-D^L have less capacity but higher deflection than 5SB8T-1.2-14-D^L and 5SB8T-2.0-14-D^L, it is understandable because the tendons of 5SB8M-1.2-14-D^L and 5SB8M-2.0-14-D^L slipped before 5SB8T-1.2-14-D^L and 5SB8T-2.0-14-D^L; therefore, 5SB8M-1.2-14-D^L and 5SB8M-2.0-14-D^L could hardly have taken additional load. With the existence of mild longitudinal bars, 5SB8M-1.2-14-D^L and 5SB8M-2.0-14-D^L could have preserved certain "bond ductility". From Figure 4.30, it can be seen that adding stirrups slightly increase the capacity of TPSBs. This trend is different from one observed in Figure 4.29 because of the existence of 4-ft. longitudinal reinforcement next to each tendon at the end zone.



(a) $a/d = 1.2$ (b) $a/d = 2.0$

Figure 4.29 Comparison of Reaction Force vs. Deflection Between 5SB8T-1.2-14-D and 5SB8T-2.0-14-D and 5SB8M-1.2-14-D and 5SB8M-2.0-14-D



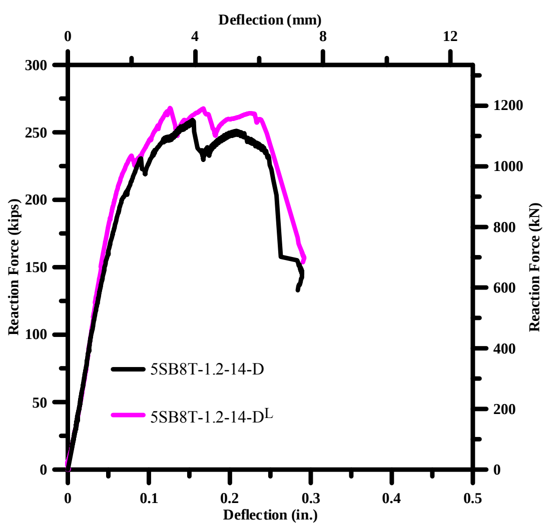
(a) $a/d = 1.2$ (b) $a/d = 2.0$

Figure 4.30 Comparison of Reaction Force vs. Deflection Between 5SB8T-1.2-14-D^L and 5SB8T-2.0-14-D^L and 5SB8M-1.2-14-D^L and 5SB8M-2.0-14-D^L

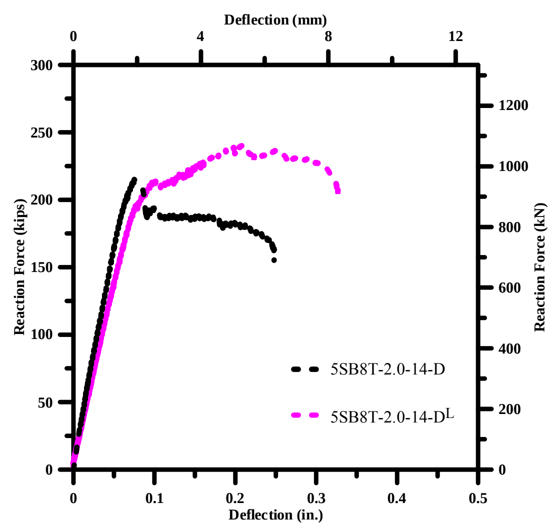
4.2.6 The Effect of Longitudinal Bar at End Zone

The comparison of the reaction force vs. deflection of 5SB8T-1.2-14-D and 5SB8T-2.0-14-D can be compared to the reaction force vs. deflection of 5SB8T-1.2-14-D^L and 5SB8T-2.0-14-D^L, as shown in Figures 4.31(a) and (b), respectively. Figure 4.31(a) shows that, since the *a/d* is very small (≈1.2), and since the failure mode is governed by anchorage bond, adding longitudinal prestressing steel next to each tendon does not improve behavior and performance. As *a/d* increases (≈2.0), as shown in Figure 4.31(b), adding longitudinal steel next to each tendon slightly improves capacity and deformability, which could be expected because TPSBs tend to behave in flexure as *a/d* increases. Brittle failure (anchorage bond failure), however, is not prevented.

The comparison of reaction force vs. deflection of 5SB8M-1.2-14-D and 5SB8M-2.0-14-D can be similarly compared to reaction force vs. deflection of 5SB8M-1.2-14-D^{L} and 5SB8M-2.0-14-D^{L}, as shown in Figures 4.32(a) and (b), respectively. Figures 4.32(a) and (b), show that adding longitudinal steel at the end zone does not increase the capacity but improves its deformability; it does not, however, help in preventing anchorage bond failure.

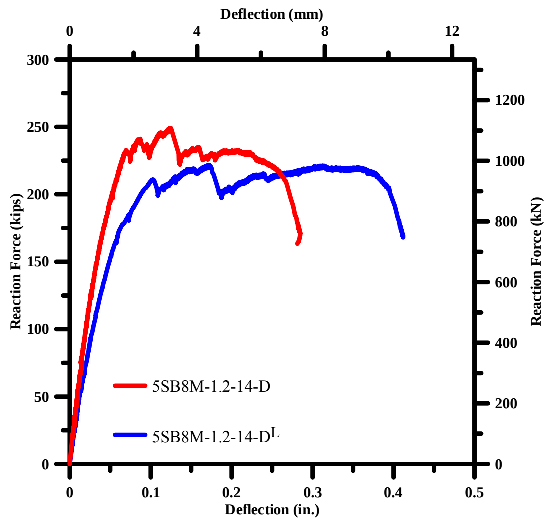


(a) *a/d* = 1.2

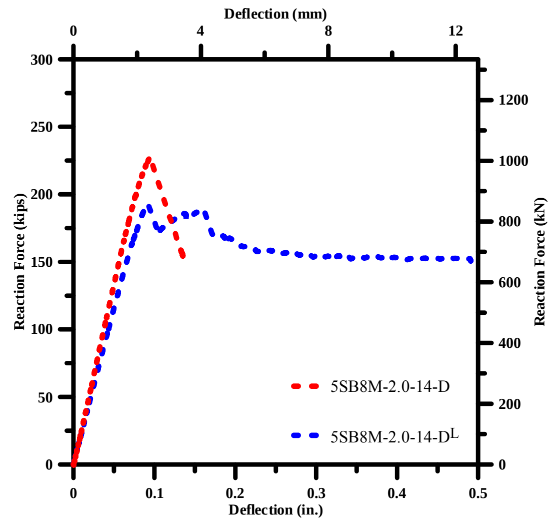


(b) *a/d* = 2.0

Figure 4.31 Comparison of Reaction Force vs. Deflection Between 5SB8T-1.2-14-D and 5SB8T-2.0-14-D and 5SB8T-1.2-14-D^{L} and 5SB8T-2.0-14-D^{L}



(a) *a/d* = 1.2



(b) *a/d* = 2.0

Figure 4.32 Comparison of Reaction Force vs. Deflection Between 5SB8M-1.2-14-D and 5SB8M-2.0-14-D and 5SB8M-1.2-14-D^L and 5SB8M-2.0-14-D^L

4.3 Group B (5SB12)

Group B consists of five TPSBs with a height of 12-in.; three TPSBs were tested in Phase 1, and two were tested in Phase 2. The concrete strength of these TPSBs varies from 9,600 to 11,100 psi. The behavior of 12-in. high TPSBs is studied in this group, including the current TxDOT products. Several parameters were studied, such as: amount of stirrups, shear span-to-depth (*a/d*) ratio, effect of 5-in. cast-in-place (CIP) deck, and number of tendons.

Table 4.2 summarizes the test results of Group B TPSBs and the failure mode based on test observations. All of the 12-in.-high TPSBs failed owing to anchorage bond. The minimum cracking shear forces for 12-in.-high TPSBs with 10 tendons and 14 tendons were 136 kips and 275 kips, respectively. This cracking strength is a useful parameter for checking the serviceability of TPSBs. The maximum measured crack width at the ultimate stage of Group B TPSBs varied from 3.94 x 10^{-3}in. to greater than 78.7 x 10^{-3}in.

Table 4.2 Test Summary and Failure Modes of Group B TPSBs

Specimen ID	*a/d*	f_c' (ksi)	Cracking Shear Force (kips)	Ultimate Reaction Force (kips)	Failure Mode	Crack Width (x10^{-3}in)
5SB12T-1.2-10-D	1.23	10.7	235	266	Anchorage Bond	35.4
5SB12T-2.0-10-D	1.94	10.7	153	249	Anchorage Bond	59.1
5SB12T-1.2-10-ND	1.25	9.6	137	175	Anchorage Bond	19.7
5SB12T-1.6-10-ND	1.62	9.6	171	187	Anchorage Bond	59.1
5SB12M-1.2-10-ND	1.16	11.1	146	196	Anchorage Bond	78.7
5SB12M-1.6-10-ND	1.63	11.1	187	191	Anchorage Bond	15.7
5SB12N-1.2-10-ND	1.2	10.9	120	136	Anchorage Bond	39.4
5SB12N-1.6-10-ND	1.63	10.9	200	204	Anchorage Bond	3.94
5SB12T-1.2-14-D	1.23	9.6	254	275	Anchorage Bond	>78.7*
5SB12T-2.0-14-D	2.00	9.6	214	319	Anchorage Bond	39.4

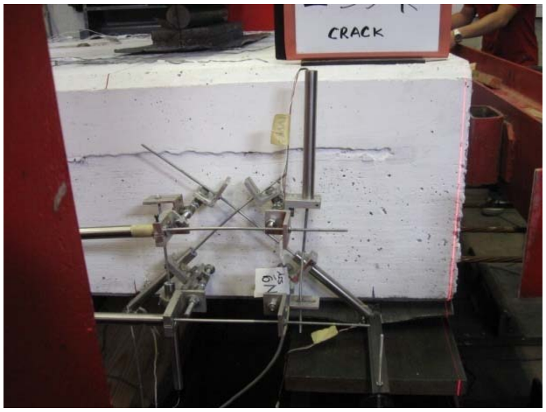
* 78.7 x 10^{-3} is the limit of standard crack width gauge

4.3.1 5SB12T-1.2-10-D and 5SB12T-2.0-10-D

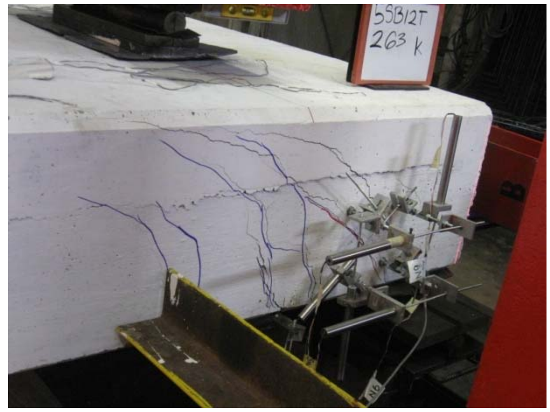
The first TPSB of Group B is the current TxDOT product for bridges with a span of up to 25-ft. 5SB12T-1.2-10-D was tested at *a/d* = 1.23. The first crack occurred on the east side of 5SB12T-1.2-10-D when the total reaction force was 235 kips, as shown in Figure 4.33(b). At this stage, no crack was observed on either west side of 5SB12T-1.2-10-D, as depicted in Figure 4.33(a), or at end face (no photo was taken). 5SB12T-1.2-10-D reached its capacity when the total reaction force was 266 kips. The major cracks developed at end face because the bending in the transverse direction is more dominant than the bending in the longitudinal direction, see Figure 4.33(d), and some cracks formed on west and east sides of 5SB12T-1.2-10-D, see Figures 4.33(c) and (e), respectively. The maximum measured crack width at this stage was 0.0354-in.

At Cracking Loading

At Ultimate Loading

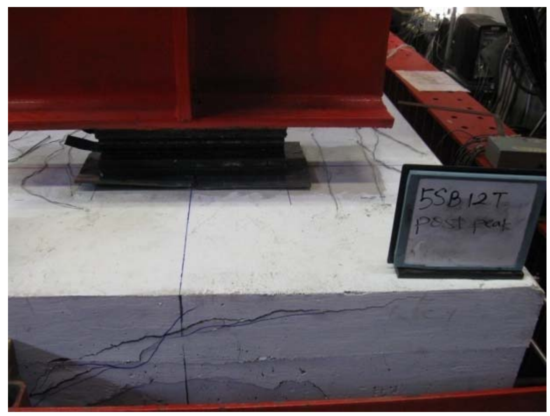


(a) West Side of 5SB12T-1.2-10-D



(c) West Side of 5SB12T-1.2-10-D

No crack observed at end face;
no photo was taken



(d) End Face of 5SB12T-1.2-10-D

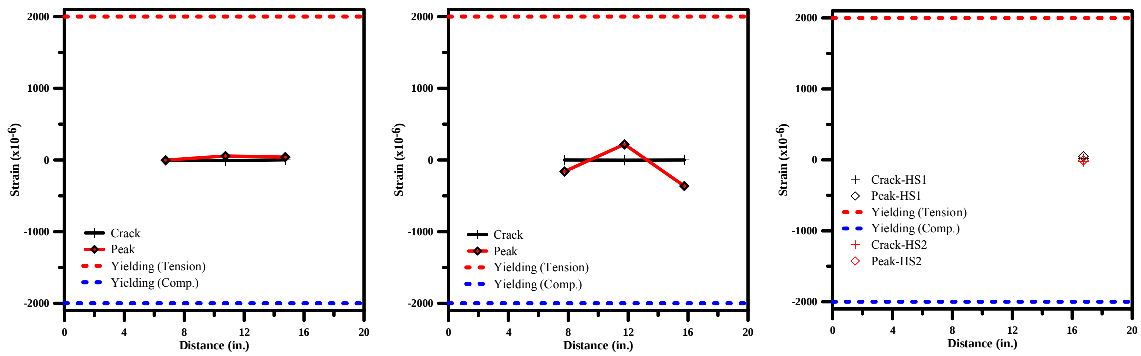
(b) East Side of 5SB12T-1.2-10-D

(e) East Side of 5SB12T-1.2-10-D

Figure 4.33 Crack Patterns of 5SB12T-1.2-10-D at Cracking Load and Ultimate Load

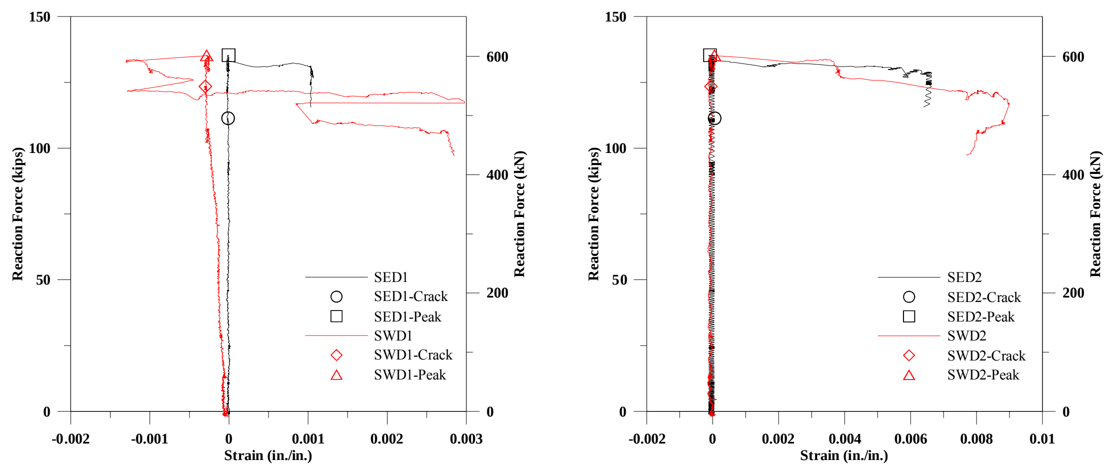
5SB12T-1.2-10-D was the first tested TPSB of Group B. Before the test, tendon slippage was never expected. Test results, however, revealed the total reaction force turned out to be smaller than flexural capacity. By this time, the anchorage bond failure was the main suspect. Unfortunately, no LVDT was attached (to this TPSB) to measure tendon slippage owing to a lack of knowledge from the experiment and literature about this issue.

Figure 4.34 shows the strain of bars C, N, and H. The horizontal axis represents distance in the longitudinal direction from the end of the TPSBs, i.e., 0-in. represents end of TPSBs, and each symbol represents existence of strain gauges. The vertical axis represents magnitude of strain. Figure 4.34 shows that all re-bars (bars C, N, and H) were ineffective in resisting the external load, which is understandable, because the height is very thin as compared to the width; therefore, in-plane shear (arch action) cannot develop. One may also think of the problem as an element subjected to out-of-plane shear. This argument can be proven by looking at the in-plane concrete smeared strain, which was negligible up to ultimate load, see Figure 4.35. The complete set of the strain gauges measurement is provided in the Appendix A, Table A.28. From Table A.28, the test data plotted in Figure 4.34 can be traced easily, i.e. it is known that the ultimate reaction force was 266 kips, therefore, the corresponding strain gauges reading in Table A.28 is the magnitude of stirrups' strain at peak load (as plotted in red line, see Figure 4.34). Similarly, the complete set of the in-plane concrete smeared strain measurement is provided in the Appendix A, Table A.27.

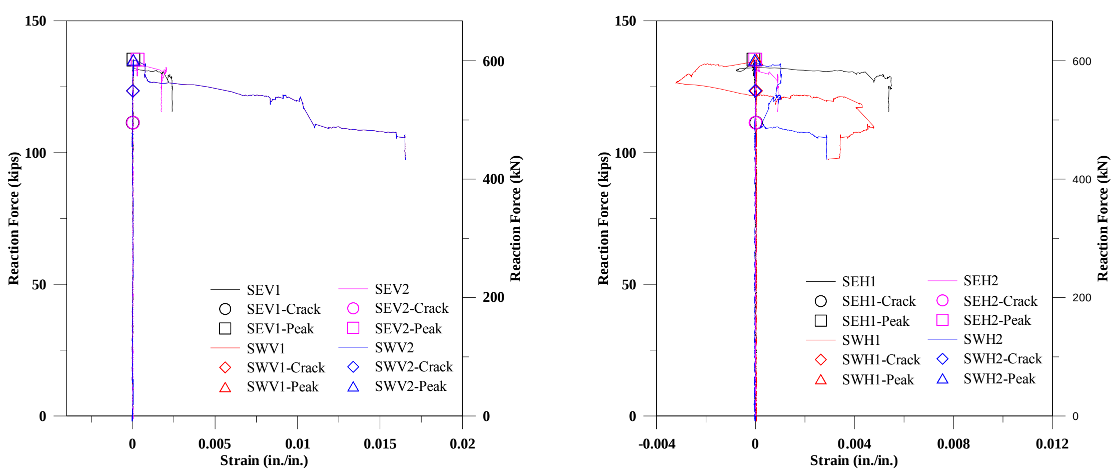


(a) Bars C (b) Bars N (c) Bars H

Figure 4.34 Strain in Stirrups of 5SB12T-1.2-10-D



(a) 45^0 Smeared Tensile Strain – D1 (b) 45^0 Smeared Compressive Strain – D2



(c) Smeared Vertical Strain – V1 and V2 (d) Smeared Horizontal Strain – H1 and H2

Figure 4.35 Reaction Force vs. Concrete Smeared Strain of 5SB12T-1.2-10-D

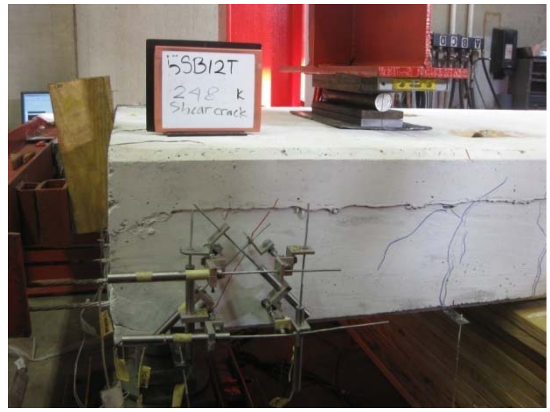
5SB12T-2.0-10-D was tested at *a/d* = 1.94. The first crack occurred on the west and east sides of 5SB12T-2.0-10-D simultaneously when the reaction force was 153 kips, as shown in Figures 4.36(a) and (b), respectively. At this stage, no crack was observed at end face (no photo was taken). As the load increased, more cracks formed, and 5SB12T-2.0-10-D reached its capacity when the reaction force was 249 kips. The major cracks formed at end face, see Figure 4.36(d), and some cracks formed on west and east sides of 5SB12T-2.0-10-D, see Figures 4.36(c) and (e), respectively. The maximum measured crack width at this stage was 0.0591-in.

Figure 4.37 shows the strain of bars C, N, and H. All re-bars (bars C, N, and H) were ineffective in resisting the external load, which can be explained by looking at this particular case as different from the in-plane shear; it can be considered an element subjected to out-of-plane shear because the height is very thin as compared to the width; therefore, in-plane shear (arch action) cannot develop. By looking at the concrete in-plane smeared strain, which was negligible up to the ultimate load, this argument can be viewed as proven, seen in Figure 4.38. From Figure 4.38, it can be seen that no significant strain was recorded; the recorded strain was basically the noise of strain, which may occur from vibration during the test and delicate sensitivity of LVDTs. The complete set of the strain gauges measurement is provided in the Appendix A, Table A.31. In addition, the complete set of concrete the in-plane smeared strain measurement is provided in the Appendix A, Table A.30.

At Cracking Loading

At Ultimate Loading

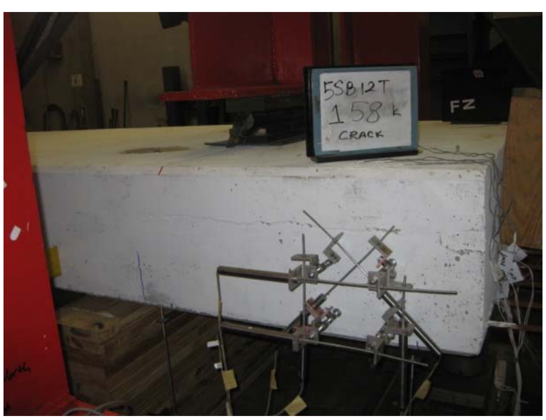
(a) West Side of 5SB12T-2.0-10-D



(c) West Side of 5SB12T-2.0-10-D

No crack observed at end face;
no photo was taken

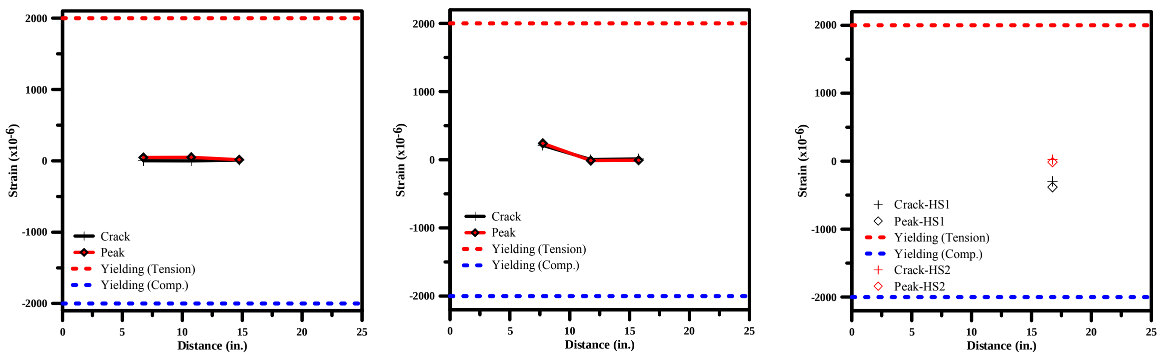
(d) End Face of 5SB12T-2.0-10-D



(b) East Side of 5SB12T-2.0-10-D

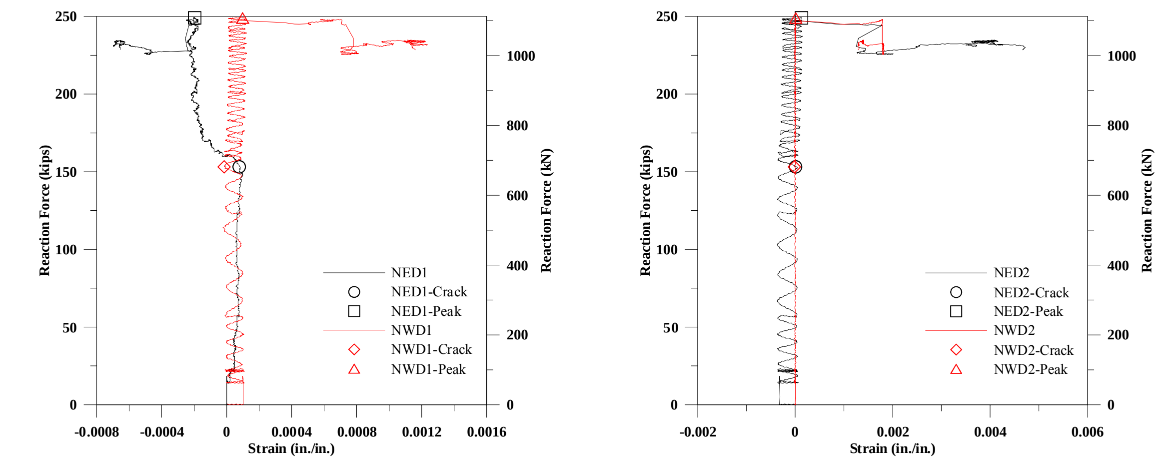
(e) East Side of 5SB12T-2.0-10-D

Figure 4.36 Crack Patterns of 5SB12T-2.0-10-D at Cracking Load and Ultimate Load

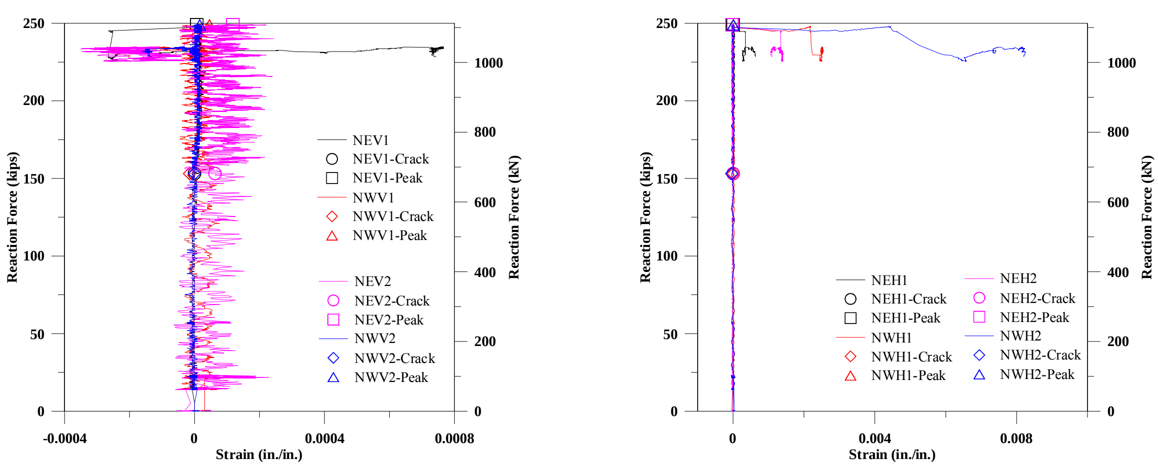


(a) Bars C
(b) Bars N
(c) Bars H

Figure 4.37 Strain in Stirrups of 5SB12T-2.0-10-D



(a) 45^0 Smeared Tensile Strain – D1
(b) 45^0 Smeared Compressive Strain – D2



(c) Smeared Vertical Strain – V1 and V2
(d) Smeared Horizontal Strain – H1 and H2

Figure 4.38 Reaction Force vs. Concrete Smeared Strain of 5SB12T-2.0-10-D

Figure 4.39 shows the comparison of reaction force vs. net deflection relationship between 5SB12T-1.2-10-D and 5SB12T-2.0-10-D. The vertical axis is the reaction force recorded by load cell(s), and the horizontal axis is the net deflection recorded by LVDTs under the loading section subtracted by settlement of support(s) recorded by LVDTs under the support section. Figure 4.39, shows that strength does not increase significantly as the *a/d* decreases. This behavior explains that there is no dominant in-plane shear (in this case arch action) acting on TPSBs. As the *a/d* increases, the 5SB12T-2.0-10-D end tries to demonstrate flexural behavior, and it exhibits part of ductile behavior. The bond slip occurs; then 5SB12T-2.0-10-D end fails. The test data of 5SB12T-1.2-10-D and 5SB12T-2.0-10-D can be found in the Appendix A, Table A.26 and A.29, respectively.

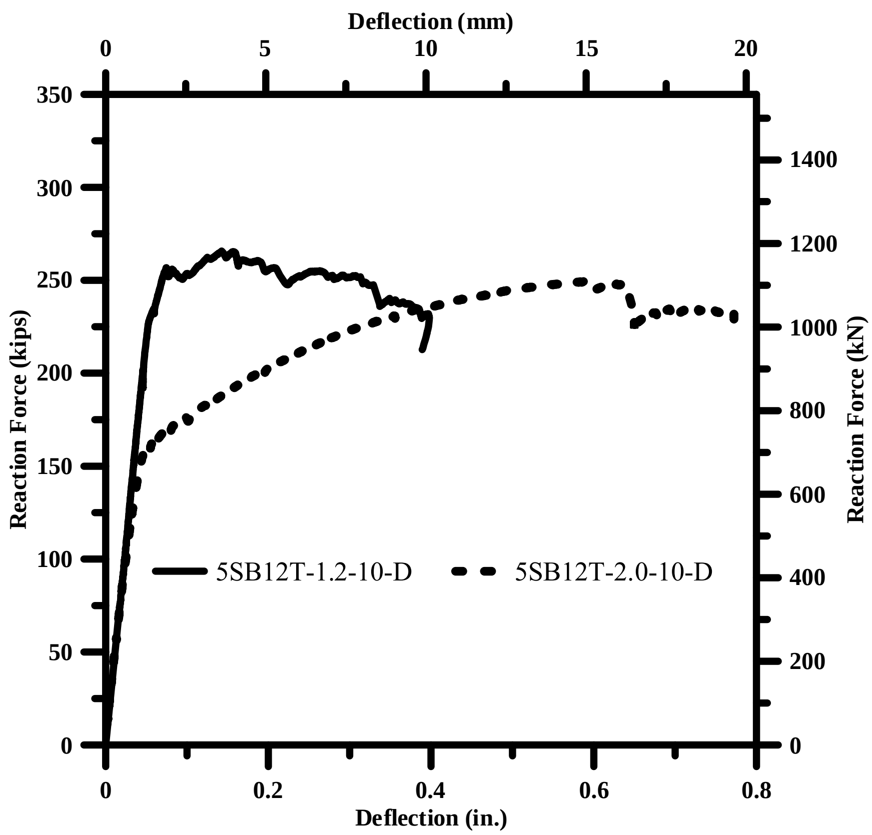


Figure 4.39 Reaction Force – Deflection Relationships of 5SB12T-1.2-10-D and 5SB12T-2.0-10-D

4.3.2 5SB12T-1.2-10-ND and 5SB12T-1.6-10-ND

The second TPSB of Group B was done in the Phase 2 experimental work. The TPSB has the detailing typical of the TxDOT product except that it does not have the 5-in. CIP deck. 5SB12T-1.2-10-ND was tested at *a/d* = 1.25. The first crack occurred at a total shear force (recorded by two load cells) of 137 kips, and the total ultimate reaction force was 175 kips. The maximum measured crack width at ultimate load stage was 0.0197-in. Figure 4.40(b) shows that the first crack occurred at the end face of 5SB12T-1.2-10-ND, and no crack was observed on the side faces of 5SB12T-1.2-10-ND, as seen in Figures 4.40(a) and (c). The crack patterns at ultimate load stage are shown in Figures 4.40(d) to (f). The diagonal cracks shown in Figures 4.40(d) and (f) occurred beyond the testing span in the longitudinal direction because bending in the transverse direction was dominant over bending in the longitudinal direction, as shown in Figure 4.40(e).

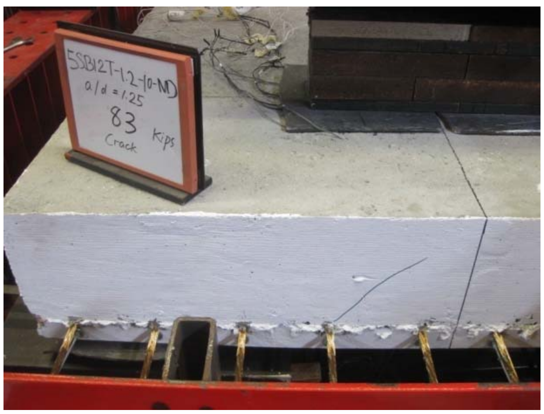
The noise due to the slippage of tendons was heard during the test in a random sequence. The reaction force attenuated as the tendons slipped and increased again as the tendons gained the bond; this process continued until the tendons completely lost their bond. Figure 4.41 shows total slippage of tendons vs. distance (location from side face of TPSB) of 5SB12T-1.2-10-ND; a maximum limit of the horizontal axis (60-in.) represents the width of TPSBs (5 ft.), and each symbol represents the existence of each LVDT. Figure 4.41 clearly shows that slippage existed at the cracking load stage; as the load increased, the slippage increased. Also, the slippage of the interior tendons was relatively greater than that of the exterior tendons because there were two supports at this end. The complete set of the measurement can be found in the Appendix A, Table A.33.

At Cracking Loading

At Ultimate Loading

(a) West Side of 5SB12T-1.2-10-ND

(d) West Side of 5SB12T-1.2-10-ND



(b) End Face of 5SB12T-1.2-10-ND

(e) End Face of 5SB12T-1.2-10-ND

(c) East Side of 5SB12T-1.2-10-ND

(f) East Side of 5SB12T-1.2-10-ND

Figure 4.40 Crack Patterns of 5SB12T-1.2-10-ND at Cracking Load and Ultimate Load

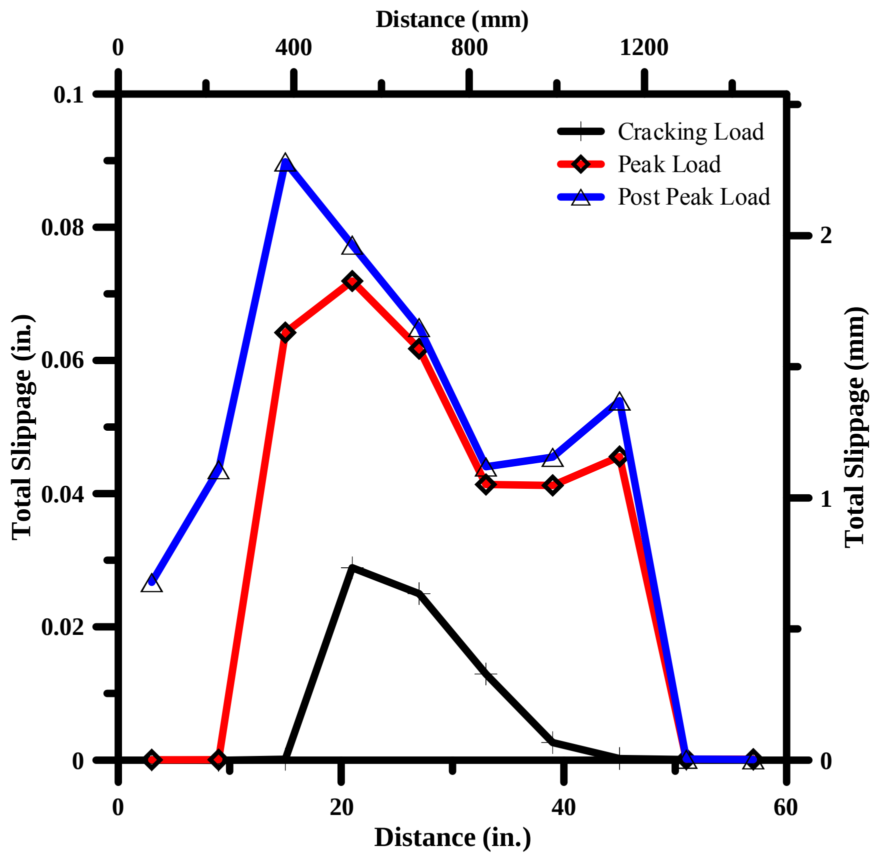
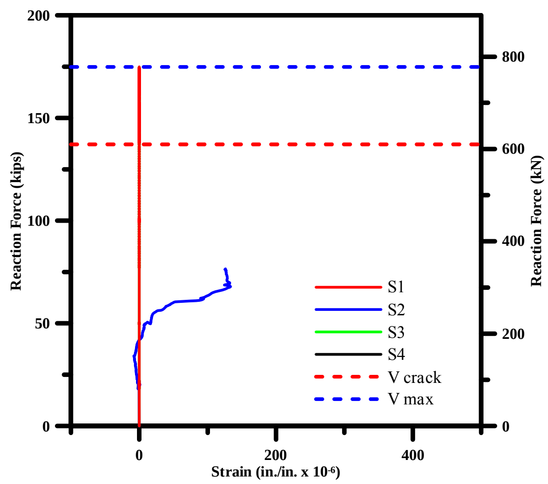
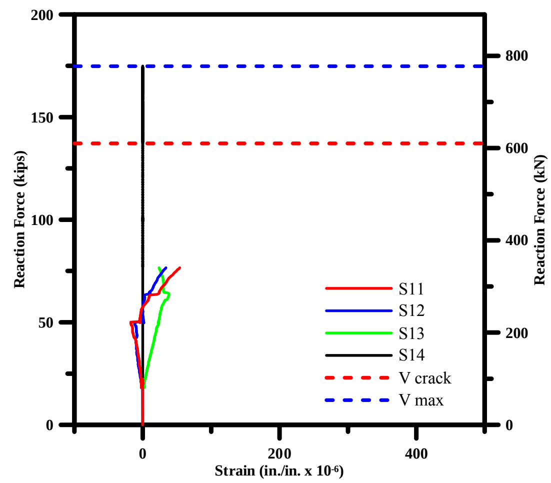


Figure 4.41 Total Slippage vs. Distance of 5SB12T-1.2-10-ND

The strain in the interior prestressing steel is shown in Figure 4.42. Few strain gauges were broken during construction, so there was no data recorded during the test. Other strain gauges broke during the test, when the total recorded reaction force was about 75 kips, because the strain-gauge wires coming out of the concrete were very close to the loading area and were severed as the applied load increased. No significant reading was recorded prior to the damage of the strain gauges. The strain in the interior prestressing steel, however, can be expected to be insignificant due to the anchorage bond failure. The complete set of the measurement can be found in the Appendix A, Table A.34.



(a) Strain of Interior Tendon 1



(b) Strain of Interior Tendon 2

Figure 4.42 Strain of Interior Tendon of 5SB12T-1.2-10-ND

The north end, 5SB12T-1.6-10-ND, was tested at a/d = 1.62. A vertical crack at the mid-top of the end face was formed when the reaction force was 171 kips, as shown in Figure 4.43(b); this crack occurred because the boundary induced a tensile stress at the top end face in the transverse direction. At this stage, no crack was observed on the west and east sides of 5SB12T-1.6-10-ND, as seen in Figures 4.43(a) and (c), respectively. 5SB12T-1.6-10-ND continued to resist additional loads and reached its capacity at 187 kips. At the ultimate load stage, the cracks formed mainly at the end face, as seen in Figure 4.43(e), and a few minor cracks formed on the west and east sides of 5SB12T-1.6-10-ND, as seen in Figures 4.43(d) and (f), respectively. At this stage, the maximum measured crack width was 0.0591-in. From the crack patterns, as shown in Figure 4.43, it is obvious that 5SB12T-1.6-10-ND did not fail due to shear or flexural failure.

At Cracking Loading | At Ultimate Loading

(a) West Side of 5SB12T-1.6-10-ND

(d) West Side of 5SB12T-1.6-10-ND

(b) End Face of 5SB12T-1.6-10-ND

(e) End Face of 5SB12T-1.6-10-ND

(c) East Side of 5SB12T-1.6-10-ND

(f) East Side of 5SB12T-1.6-10-ND

Figure 4.43 Crack Patterns of 5SB12T-1.6-10-ND at Cracking Load and Ultimate Load

The slippage of tendons was observed in a random sequence and recorded during the test, as shown in Figure 4.44. At cracking load stage, the slippage of tendons was negligible, which meant the tendons were still perfectly bonded. This can be understood because the first crack occurred at the mid top section of end face, where was relatively far away from the tendons. At ultimate load stage, however, all the tendons slipped; as more cracks formed passing through the tendons, slippage of tendons increased. The complete set of the measurement can be found in the Appendix A, Table A.36.

Figure 4.45 shows the strain measured by the strain gauges installed on the exterior strands; this figure shows that some of the strain gauges were broken during construction, and the maximum strain at ultimate load stage was about 0.001. When this number was added to the decompression strain (0.005~0.007), the maximum strain of tendon at ultimate loading stage was less than 1 percent, which meant that the stress of tendons could not reach f_{ps} (stress in prestressing steel at nominal flexural strength, $f_{ps} \approx 0.9 - 0.95 f_{pu}$). The complete set of the measurement can be found in the Appendix A, Table A.37.

Figure 4.46 shows the comparison of the reaction force vs. the deflection between 5SB12T-1.2-10-ND and 5SB12T-1.6-10-ND. In the case where the anchorage bond exists, the capacity of two ends is relatively close. The reaction force drops as the slippage occurs, and the reaction force increases as the tendons regain their bond capacity; this process continues until complete failure. The deflection of 5SB12T-1.6-10-ND is larger than 5SB12T-1.2-10-ND because 5SB12T-1.6-10-ND has greater *a/d*, so the flexure behavior is more dominant than that of 5SB12T-1.2-10-ND. The test data of 5SB12T-1.2-10-ND and 5SB12T-1.6-10-ND can be found in the Appendix A, Table A.32 and A.35, respectively.

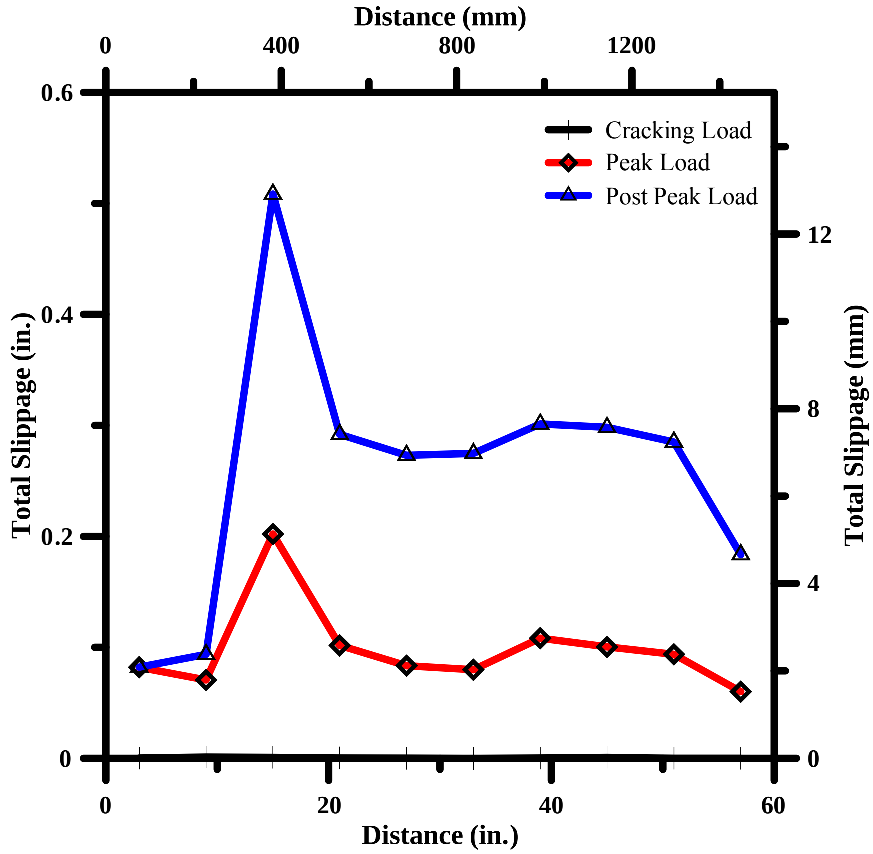
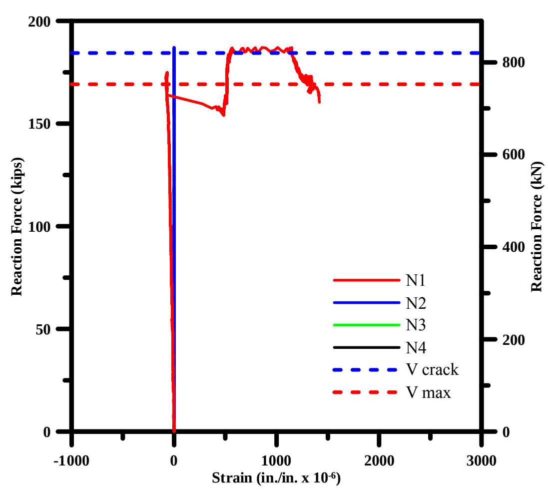
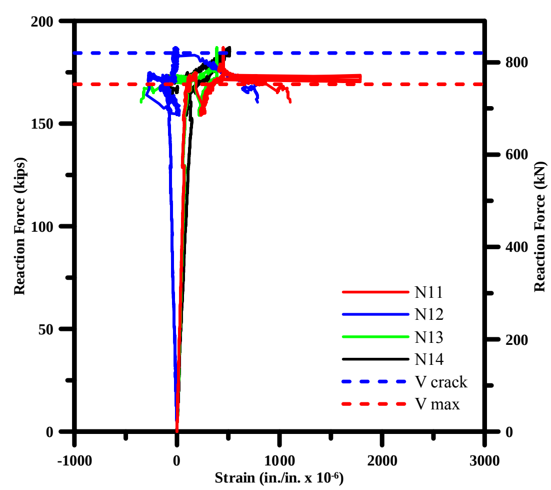


Figure 4.44 Total Slippage vs. Distance of 5SB12T-1.6-10-ND



(a) Strain of Exterior Tendon 1



(b) Strain of Exterior Tendon 2

Figure 4.45 Strain of Exterior Tendon of 5SB12T-1.6-10-ND

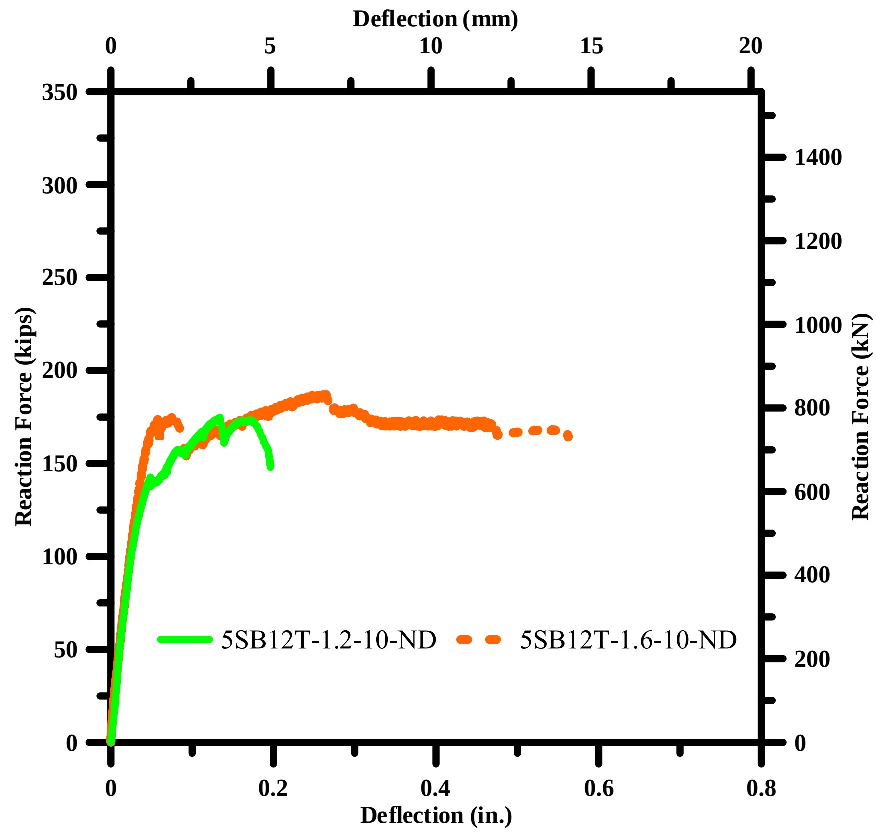


Figure 4.46 Reaction Force – Deflection Relationships of 5SB12T-1.2-10-ND and 5SB12T-1.6-10-ND

4.3.3 5SB12M-1.2-10-ND and 5SB12M-1.6-10-ND

5SB12M-1.2-10-ND was tested at *a/d* = 1.16. The first crack occurred simultaneously on the west and east sides of 5SB12M-1.2-10-ND when the total reaction force was 146 kips, as shown in Figures 4.47(a) and (c), respectively. No crack was observed at this stage at the end face of 5SB12M-1.2-10-D, seen in Figure 4.47(b). 5SB12M-1.2-10-ND reached its capacity when the total reaction force was 196 kips. The major cracks formed at end face, see Figure 4.47(e), and some cracks formed on west and east sides of 5SB12M-1.2-10-D, seen in Figures 4.47(d) and (f), respectively. The cracks that formed on the west and east sides of 5SB12M-1.2-10-ND were beyond the testing span in the longitudinal direction because the bending in the transverse direction was dominant over the longitudinal direction. The maximum measured crack width at this stage was 0.0787-in.

After the previous test results were observed (5SB12T-1.2-10-D), additional LVDTs were installed to measure tendon slippage. Figure 4.48 shows the slippage recorded during the test. At cracking load stage, the slippage of interior tendons was observed. The tendons continued to slip, and at ultimate load stage, the tendon slippage was significantly high. As more cracks formed, slippage of all tendons increased. From Figure 4.48, it can be seen that the slippage of exterior tendons is smaller than the slippage of interior tendons because the supports provide compression force which artificially confines the concrete. The complete set of the measurement can be found in the Appendix A, Table A.40.

Figure 4.49 shows the strain of bars C and N. The strain in bars C shows that they were ineffective in resisting the load: bars C were the outer stirrups, which was relatively farther away from the applied load at mid-cross-section. Bar N, in this TPSB, originally designed for end-zone reinforcement, showed a significant reading both at cracking and ultimate loading stage. This condition occurred because the loading area was relatively close to bar N, and bending in the transverse direction was dominant. As cracks formed at end face of 5SB12M-1.2-10-ND, bar N resisted the applied force to maintain equilibrium. The complete set of the measurement can be found in the Appendix A, Table A.41.

Figure 4.50 shows the in-plane smeared strain measured by the rosette LVDT. The measured strain was negligible because the 5SB12M-1.2-10-ND was not subjected to in-plane shear. This measurement also confirms that bars C were ineffective in this particular case. The complete set of the measurement can be found in the Appendix A, Table A.39.

At Cracking Loading | At Ultimate Loading

(a) West Side of 5SB12M-1.2-10-ND

(d) West Side of 5SB12M-1.2-10-ND

(b) End Face of 5SB12M-1.2-10-ND

(e) End Face of 5SB12M-1.2-10-ND

(c) East Side of 5SB12M-1.2-10-ND

(f) East Side of 5SB12M-1.2-10-ND

Figure 4.47 Crack Patterns of 5SB12M-1.2-10-ND at Cracking Load and Ultimate Load

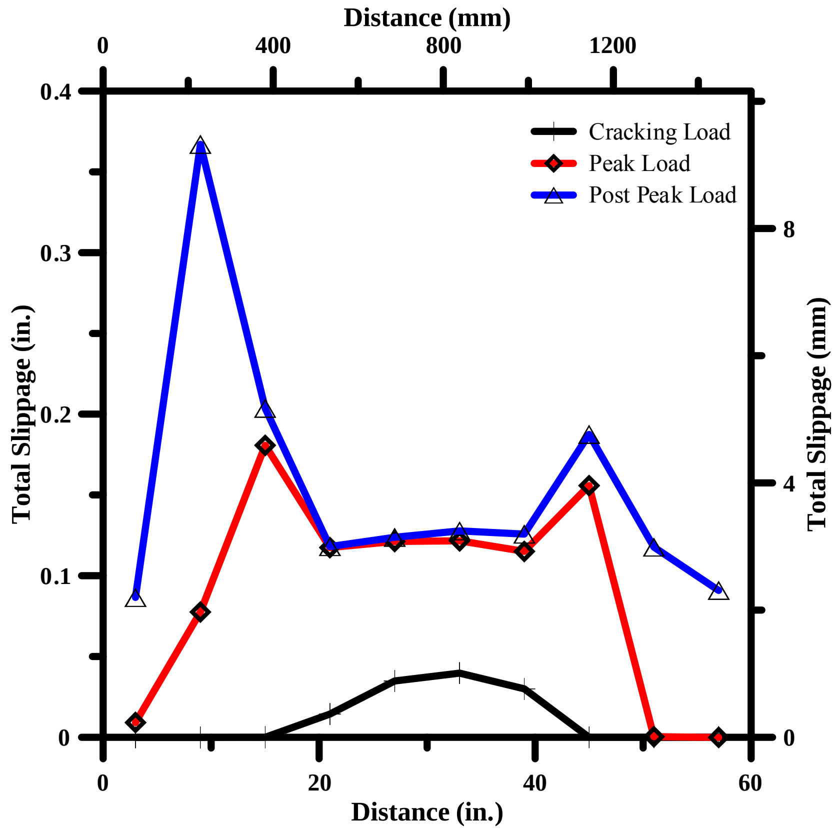


Figure 4.48 Total Slippage vs. Distance of 5SB12M-1.2-10-ND

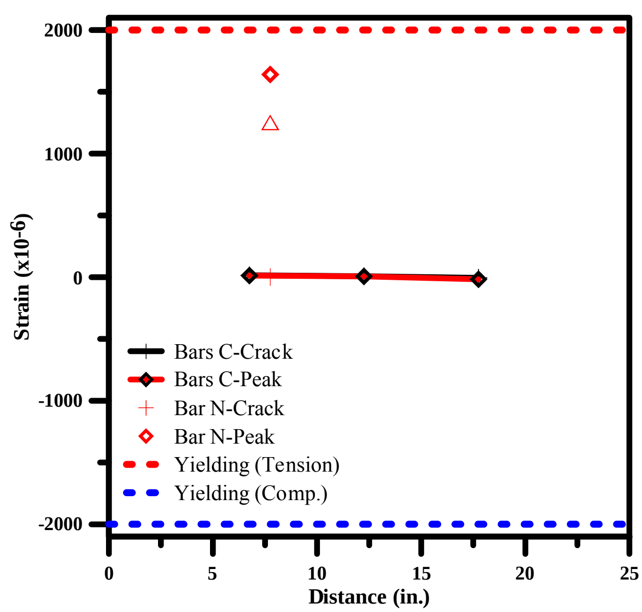
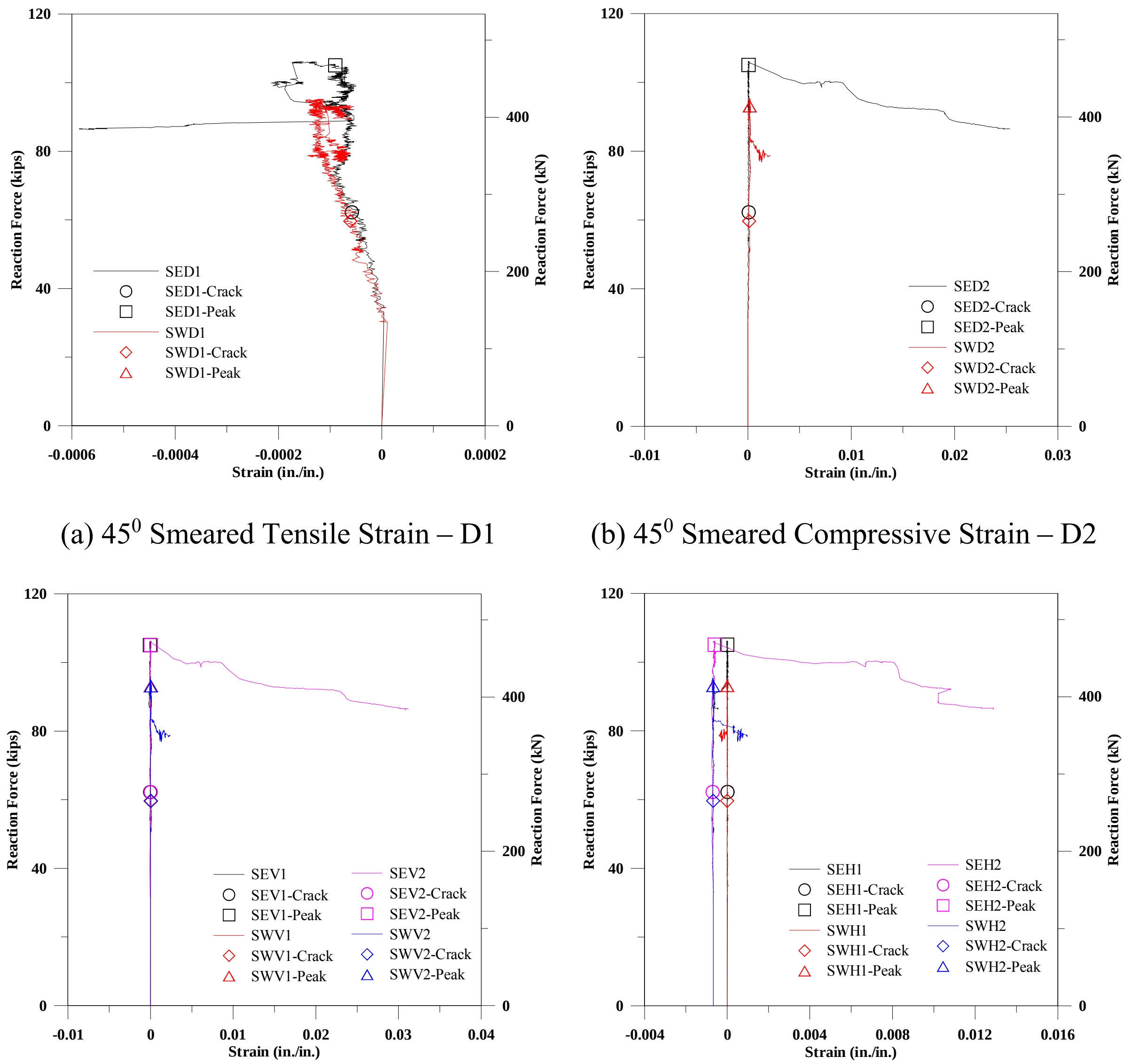


Figure 4.49 Strain in Stirrups of 5SB12M-1.2-10-ND



(a) 45^0 Smeared Tensile Strain – D1 (b) 45^0 Smeared Compressive Strain – D2

(c) Smeared Vertical Strain – V1 and V2 (d) Smeared Horizontal Strain – H1 and H2

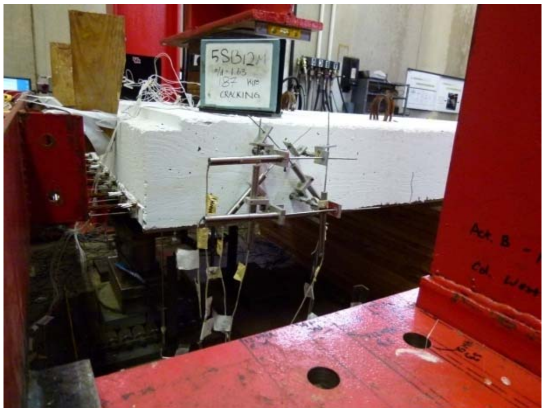
Figure 4.50 Reaction Force vs. Concrete Smeared Strain of 5SB12M-1.2-10-ND

5SB12M-1.6-10-ND was tested at *a/d* = 1.63. The first crack occurred simultaneously on all sides (end face, both west and east sides) of 5SB12M-1.6-10-D when the reaction force was 187 kips, as shown in Figures 4.51(a) to (c). As the load increased, more cracks were formed, and 5SB12M-1.6-10-ND reached its capacity when the reaction force was 191 kips. The major cracks formed at end face, see Figure 4.51(e), and some cracks formed on west and east sides of 5SB12M-1.6-10-ND, see Figures 4.51(d) and (f), respectively. The maximum measured crack width at this stage was 0.0158-in. From the crack patterns, as shown in Figure 4.51, it is obvious that 5SB12M-1.6-10-ND did not fail due to shear or flexural failure.

The noise owing to the slippage of tendons was heard during the test in a random sequence. The reaction force was reduced as the tendons slipped, and it increased again as the tendons gained the bond; this process continued until the tendons completely lost their bond. Figure 4.52 shows the tendon slippage recorded during the test. The slippage of tendons started to occur at cracking load stage. The tendon slippage increased as the applied load increased. At the ultimate load stage, the tendon slippage was almost symmetric and the interior tendon slippage is relatively smaller than the exterior tendon slippage due to the compression force from the reaction. At post-peak load, the slippage increased significantly. The complete set of the measurement can be found in the Appendix A, Table A.44.

Figure 4.53 shows that the strain of bars C and N was minor at both cracking and ultimate load stages, owing mostly to the fact that 5SB12M-1.6-10-ND was not subjected to in-plane stress. This argument can also be proven by looking at the in-plane smeared strain, which was negligible up to the ultimate load stage, as shown in Figure 4.54. The recorded noise of strain may occur owing to vibration during the test and the delicate sensitivity of LVDTs. The complete set of the strain gauges measurement can be found in the Appendix A, Table A.45. And the complete set of the in-plane smeared strain measurement can be found in the Appendix A, Table A.43.

At Cracking Loading | At Ultimate Loading



(a) West Side of 5SB12M-1.6-10-ND

(d) West Side of 5SB12M-1.6-10-ND

(b) End Face of 5SB12M-1.6-10-ND

(e) End Face of 5SB12M-1.6-10-ND

(c) East Side of 5SB12M-1.6-10-ND

(f) East Side of 5SB12M-1.6-10-ND

Figure 4.51 Crack Patterns of 5SB12M-1.6-10-ND at Cracking Load and Ultimate Load

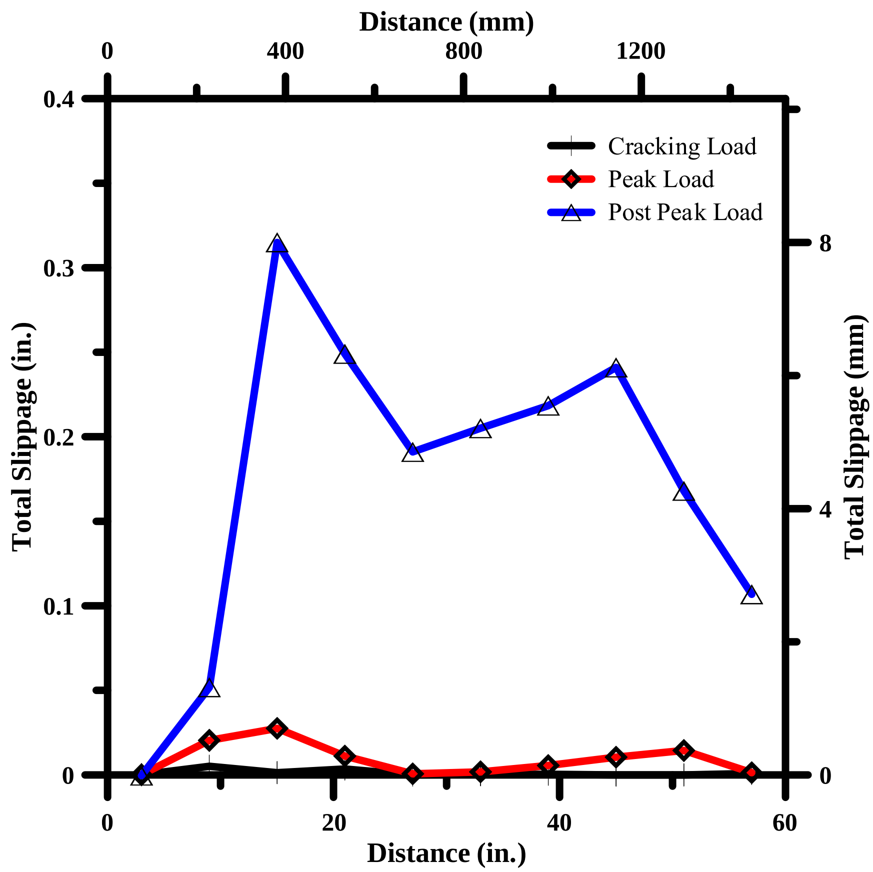


Figure 4.52 Total Slippage vs. Distance of 5SB12M-1.6-10-ND

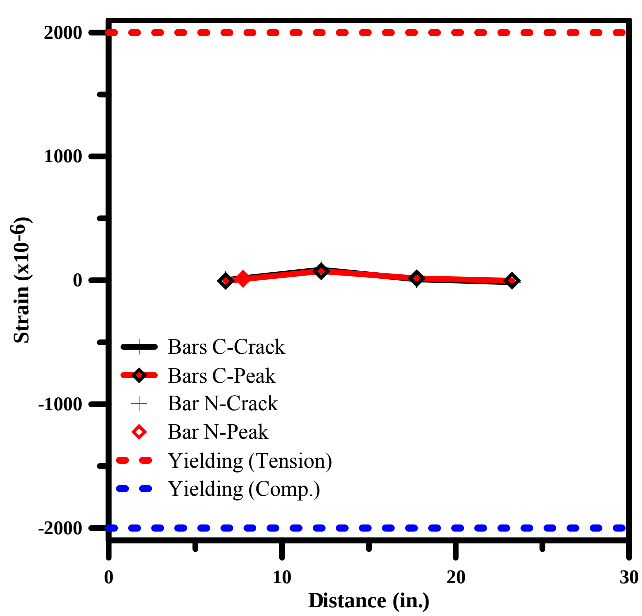
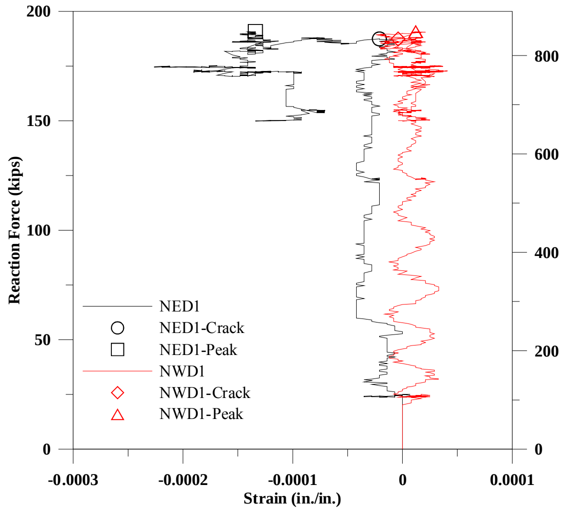
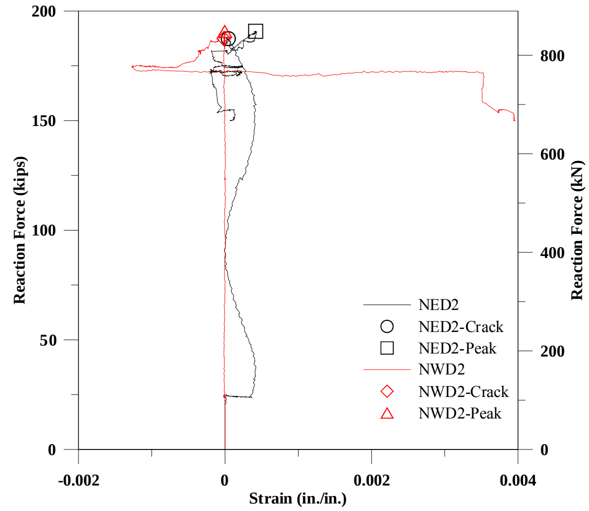


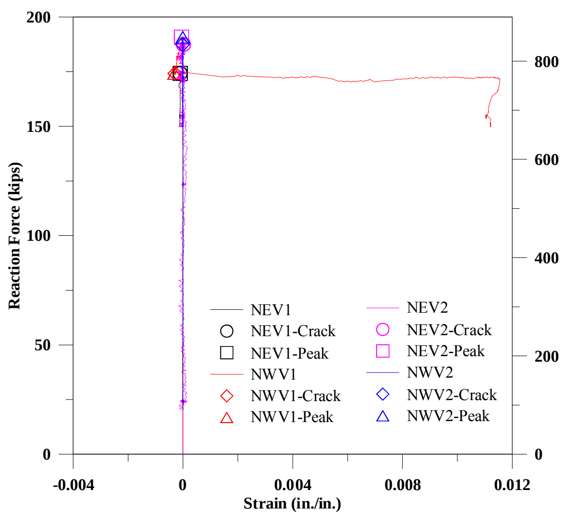
Figure 4.53 Strain in Stirrups of 5SB12M-1.6-10-ND



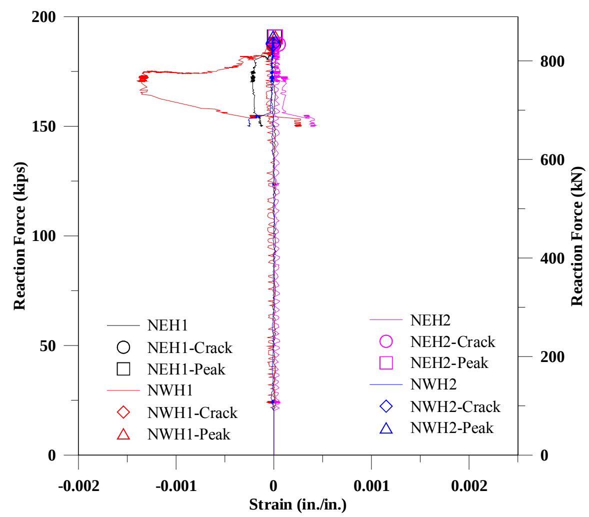
(a) 45^0 Smeared Tensile Strain – D1



(b) 45^0 Smeared Compressive Strain – D2



(c) Smeared Vertical Strain – V1 and V2



(d) Smeared Horizontal Strain – H1 and H2

Figure 4.54 Reaction Force vs. Concrete Smeared Strain of 5SB12M-1.6-10-ND

Figure 4.55 shows a comparison of the reaction force vs. the net deflection relationship between 5SB12M-1.2-10-ND and 5SB12M-1.6-10-ND; it shows that both ends have the same relative capacity (in terms of strength). This condition can be understood because the *a/d* of both ends does not differ much, and both ends have the same failure mode. The irregular sawtooth curves represent the existence of the bond slip. 5SB12M-1.2-10-ND has a smaller cracking strength than 5SB12M-1.6-10-ND because 5SB12M-1.2-10-ND has two supports; therefore, there is a two-way action on 5SB12M-1.2-10-ND. 5SB12M-1.6-10-ND has only one support; therefore, the two-way action causes 5SB12M-1.2-10-ND to crack earlier than 5SB12M-1.6-10-ND. The test data of 5SB12M-1.2-10-ND and 5SB12M-1.6-10-ND can be found in the Appendix A, Table A.38 and A.42, respectively.

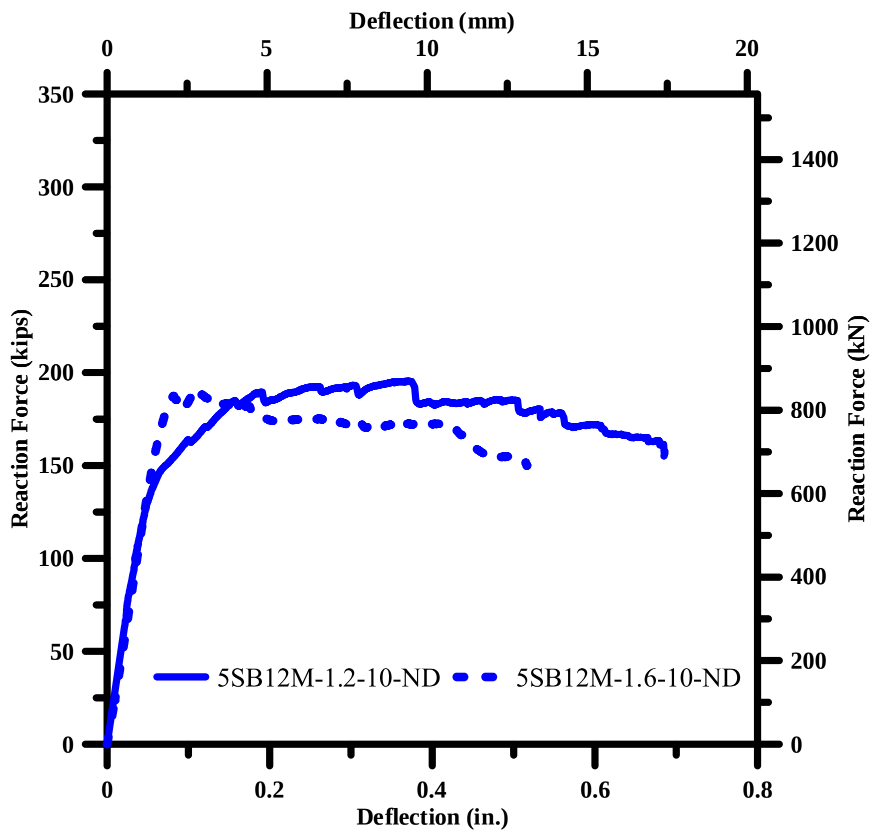


Figure 4.55 Reaction Force – Deflection Relationships of 5SB12M-1.2-10-ND and 5SB12M-1.6-10-ND

4.3.4 5SB12N-1.2-10-ND and 5SB12N-1.6-10-ND

5SB12N-1.2-10-ND was tested twice before it failed completely, on the third attempt. The reaction force in the first two attempts, vs. the deflection curve of 5SB12N-

1.2-10-ND was unusual, which might have been because the height of this particular beam was very thin, so the two-way action was more obvious than with any of the other TPSBs. To capture the deflection under the load more accurately, an additional LVDT was added below the beam where the load was applied.

On the third attempt, 5SB12N-1.2-10-ND was tested at *a/d* = 1.20. The first crack occurred when the total reaction force was 120 kips; the crack patterns at this stage are shown in Figures 4.56(a) and (b). Soon after the crack, 5SB12N-1.2-10-ND reached its capacity, at 136 kips. Major cracks formed at the end face, see Figure 4.56(d), and some cracks formed on west and east sides of 5SB12N-1.2-10-D, see Figures 4.56(c) and (e), respectively. Cracks that formed on the west and east sides of 5SB12N-1.2-10-ND were beyond the testing span in the longitudinal direction because the bending in the transverse direction is dominate over the bending in the longitudinal direction. The maximum measured crack width at this stage was 0.0394-in.

Figure 4.57 shows the slippage of tendons recorded during the test. At cracking load stage, the slippage of tendons was significant. Since 5SB12N-1.2-10-ND did not contain any stirrup, therefore, the ultimate load and the cracking load of 5SB12N-1.2-10-ND were very close and the slippage of tendons at ultimate load stage was slightly greater than the slippage of tendons at cracking load. After achieving ultimate capacity, deflection and cracks caused the slippage of tendon to increase dramatically. In addition, the exterior tendon slippage is smaller than the interior tendon slippage due to the compression force from the supports. The complete set of the measurement can be found in the Appendix A, Table A.47.

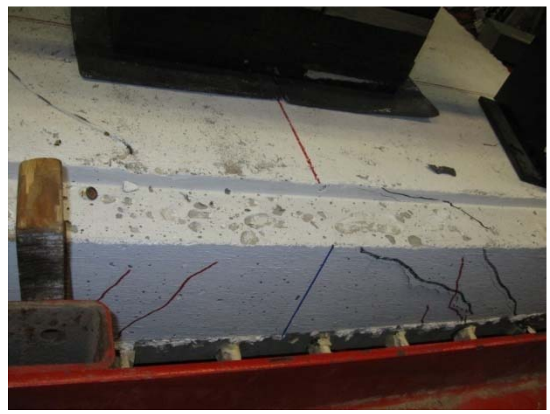
At Cracking Loading

At Ultimate Loading

(a) West Side of 5SB12N-1.2-10-ND

(c) West Side of 5SB12N-1.2-10-ND

No crack was observed at end face;
no photo was taken



(d) End Face of 5SB12N-1.2-10-ND

(b) East Side of 5SB12N-1.2-10-ND

(e) East Side of 5SB12N-1.2-10-ND

Figure 4.56 Crack Patterns of 5SB12N-1.2-10-ND at Cracking Load and Ultimate Load

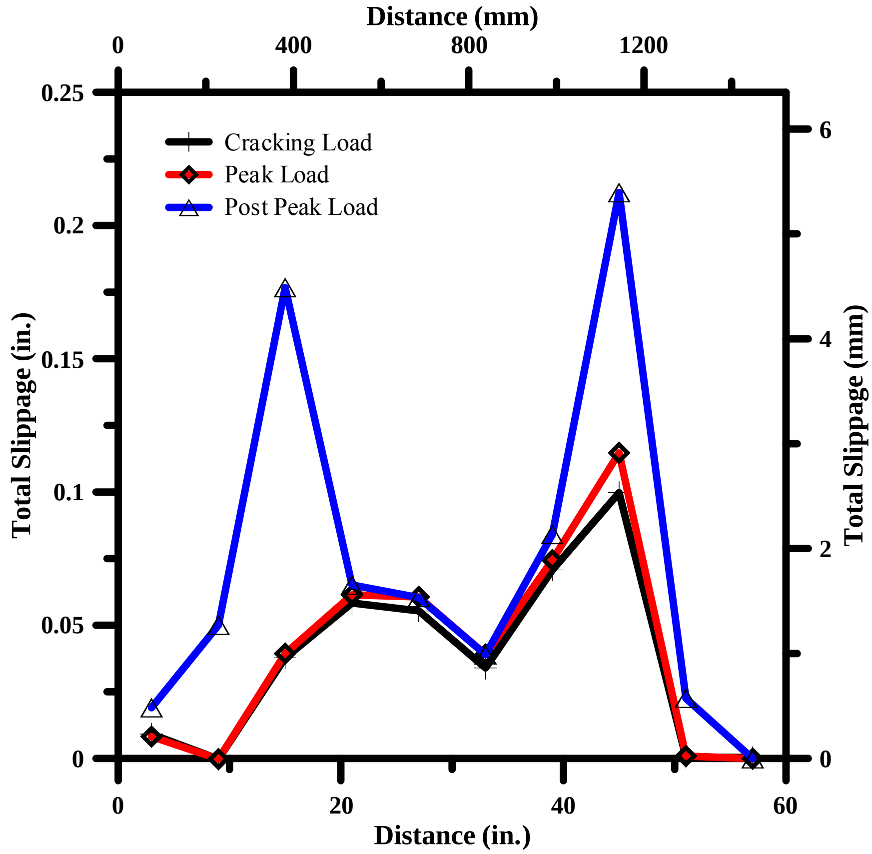
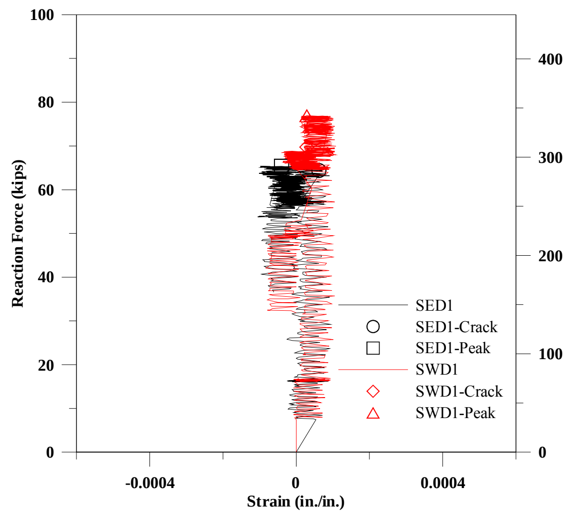
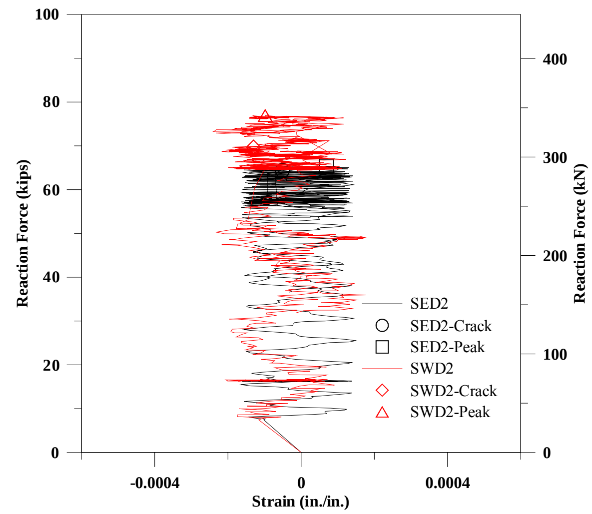


Figure 4.57 Total Slippage vs. Distance of 5SB12N-1.2-10-ND

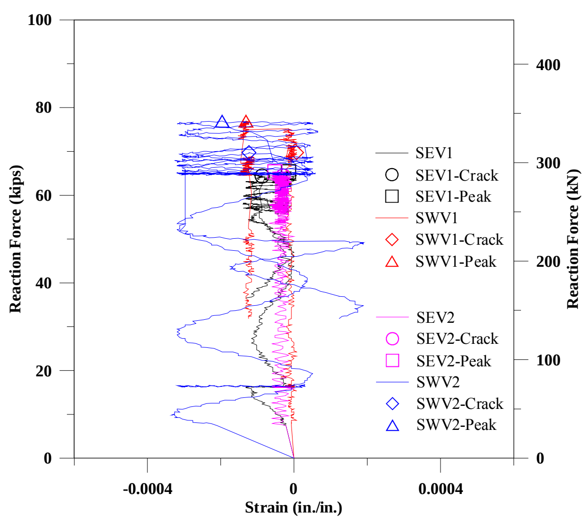
Figure 4.58 shows the in-plane concrete smeared strain measured by the rosette LVDT. From Figure 4.58, it can be seen that no significant strain was recorded; the recorded strain was basically the noise of strain, which may occur from vibration during the test and delicate sensitivity of LVDTs. It can be explained by looking at this particular case as different from the in-plane shear; it can be considered an element subjected to out-of-plane shear because the height is very thin as compared to the width; therefore, in-plane shear (arch action) cannot develop.



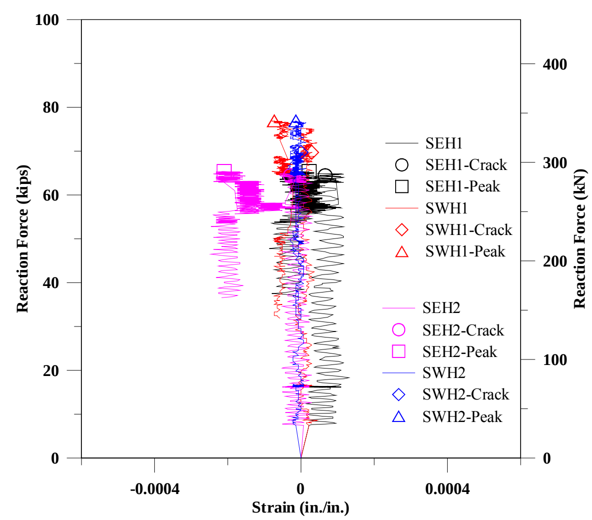
(a) 45^0 Smeared Tensile Strain – D1



(b) 45^0 Smeared Compressive Strain – D2



(c) Smeared Vertical Strain – V1 and V2



(d) Smeared Horizontal Strain – H1 and H2

Figure 4.58 Reaction Force vs. Concrete Smeared Strain of 5SB12N-1.2-10-ND

5SB12N-1.6-10-ND was tested at a/d = 1.63. The first crack occurred on west and east sides of 5SB12N-2.0-10-D simultaneously when the reaction force was 200 kips, as shown in Figures 4.59(a) and (b), respectively. Right after the first crack was observed, the ultimate reaction force only increased to 204 kips and TPSB failed. This failure was due mainly to the cracks at the end face, which caused the slippage of the tendon. Major cracks formed at the end face, see Figure 4.59(d), and some cracks formed on west and east sides of 5SB12N-1.6-10-ND, see Figures 4.59(c), and (e), respectively. The maximum measured crack width at this stage was 0.00394-in.

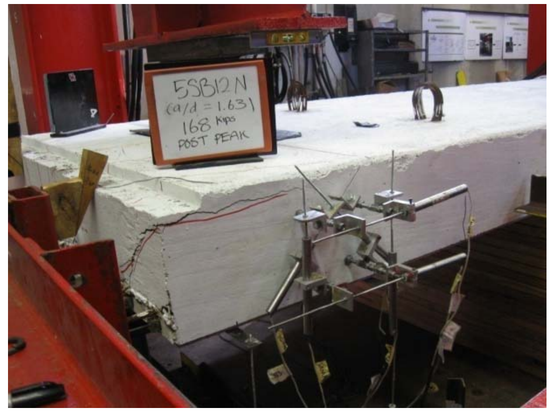
The noise owing to the slippage of tendons was heard during the test in a random sequence. The reaction force was reduced as the tendons slipped, and it increased again as the tendons gained the bond; this process continued until the tendons completely lost their bond. Figure 4.60 shows the slippage of tendons recorded during the test. Similar to the other end of this beam, the slippage of the tendon at cracking load and ultimate load stages are relatively the same. This condition is understandable because 5SB12N-1.6-10-ND had no shear reinforcement, so it reached its capacity soon after it cracked. Right after peak, the tendons slipped, rendering 5SB12N-1.6-10-ND unable to take on additional load. By the end of the test (at post-peak stage), the slippage of tendons increased tremendously. The complete set of the measurement can be found in the Appendix A, Table A.50.

Figure 4.61 shows the in-plane concrete smeared strain of 5SB12N-1.6-10-ND measured by the rosette LVDT. From Figure 4.61, it can be seen that no significant strain was recorded; the recorded strain was basically the noise of strain, which may occur from vibration during the test and delicate sensitivity of LVDTs. It can be explained by looking at this particular case as different from the in-plane shear; it can be considered an element subjected to out-of-plane shear because the height is very thin as compared to the width; therefore, in-plane shear (arch action) cannot develop. The complete set of the measurement can be found in the Appendix A, Table A.49.

At Cracking Loading

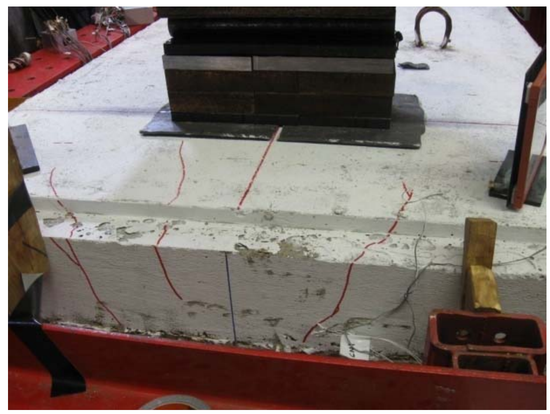
At Ultimate Loading

(a) West Side of 5SB12N-1.6-10-ND

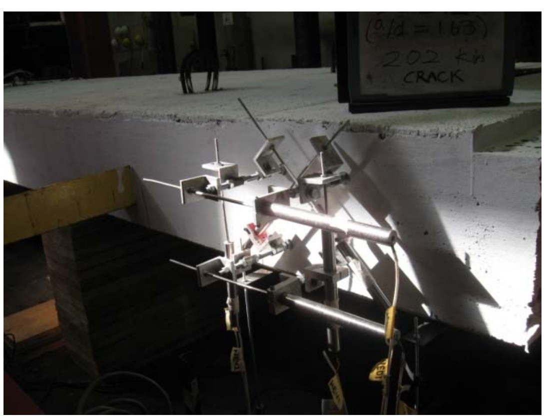


(c) West Side of 5SB12N-1.6-10-ND

No crack was observed at end face;
no photo was taken



(d) End Face of 5SB12N-1.6-10-ND



(b) East Side of 5SB12N-1.6-10-ND

(e) East Side of 5SB12N-1.6-10-ND

Figure 4.59 Crack Patterns of 5SB12N-1.6-10-ND at Cracking Load and Ultimate Load

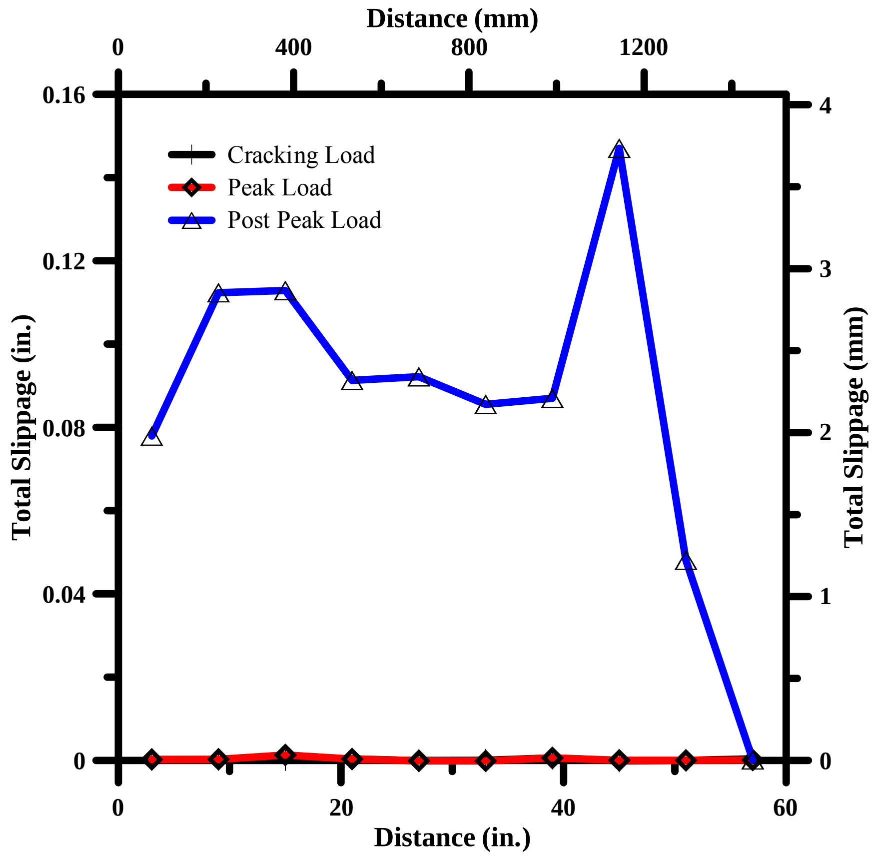
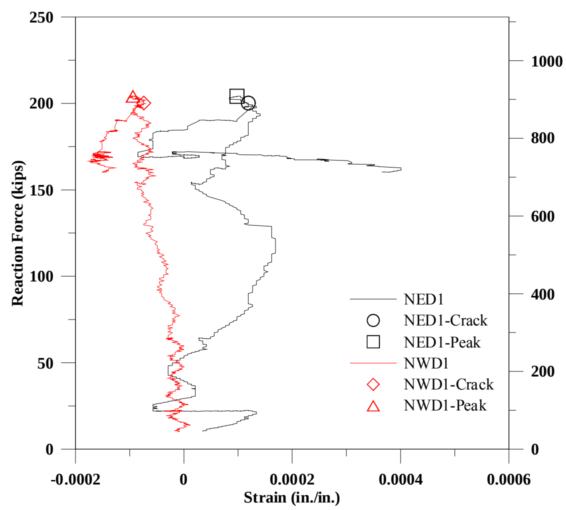


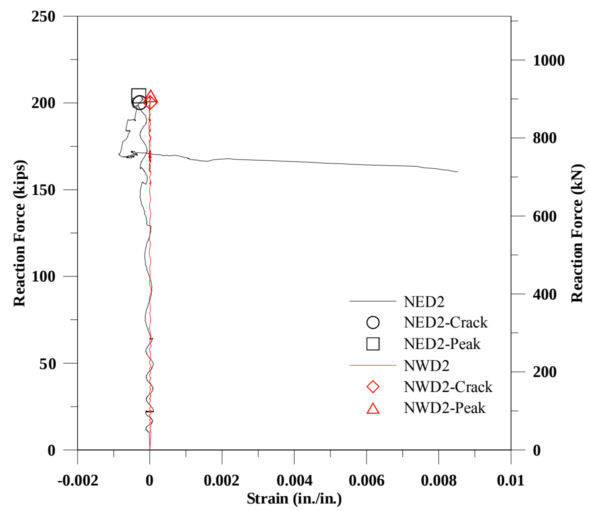
Figure 4.60 Total Slippage vs. Distance of 5SB12N-1.6-10-ND

Figure 4.62 shows a comparison of the reaction force vs. the net deflection relationship between 5SB12N-1.2-10-ND and 5SB12N-1.6-10-ND. Figure 4.62 shows that 5SB12N-1.2-10-ND failed prematurely, which means it was expected to have higher capacity than the test result yielded. This condition can be explained because the height of the TPSB was thin, and the boundary condition of 5SB12N-1.2-10-ND caused bending in the transverse direction, which induced cracks at the end face and on west and east sides of 5SB12N-1.2-10-ND. The cracks at the end face related significantly to the anchorage bond failure. The cracks on west and east sides of 5SB12N-1.2-10-ND were formed beyond the testing span where there was no stirrup. 5SB12N-1.2-10-ND, therefore, could barely take additional load once the concrete cracked. Similarly, at the other end of 5SB12N-1.6-

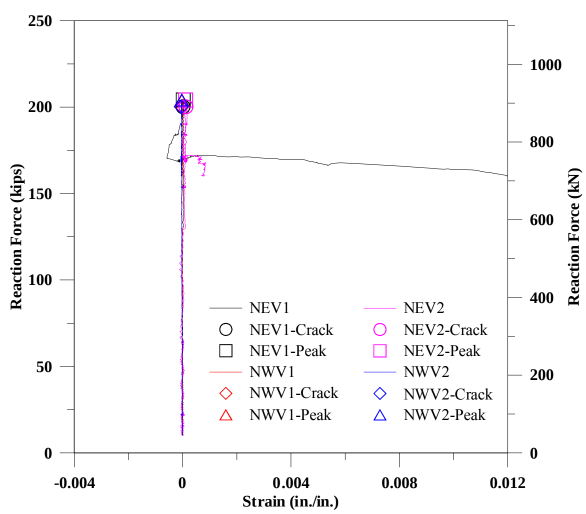
10-ND, the boundary condition induced the crack at the end face of 5SB12N-1.6-10-ND, so once it cracked, the tendons slipped, and the reaction force dropped. The test data of 5SB12N-1.2-10-ND and 5SB12N-1.6-10-ND can be found in the Appendix A, Table A.46 and A.48, respectively.



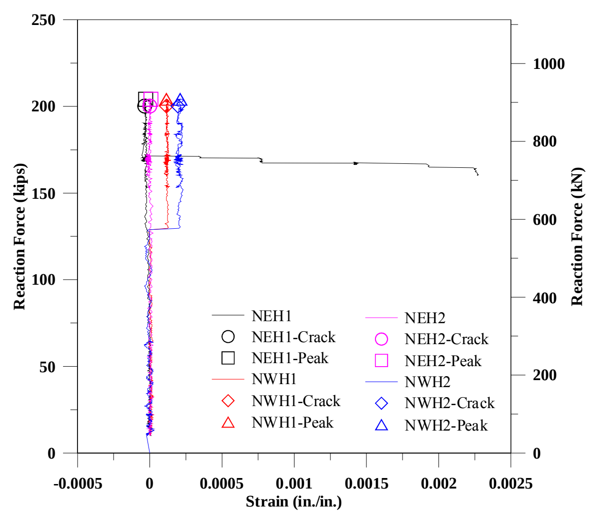
(a) 45^0 Smeared Tensile Strain – D1



(b) 45^0 Smeared Compressive Strain – D2



(c) Smeared Vertical Strain – V1 and V2



(d) Smeared Horizontal Strain – H1 and H2

Figure 4.61 Reaction Force vs. Concrete Smeared Strain of 5SB12N-1.6-10-ND

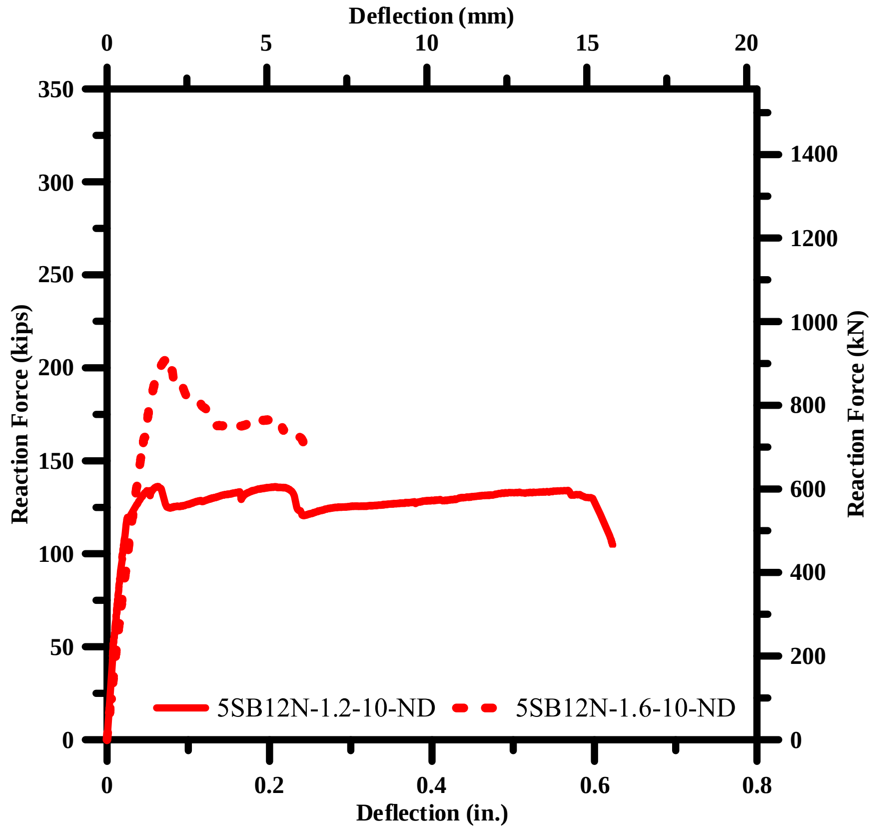


Figure 4.62 Reaction Force – Deflection Relationships of 5SB12N-1.2-10-ND and 5SB12N-1.6-10-ND

4.3.5 5SB12T-1.2-14-D and 5SB12N-2.0-14-D

5SB12T-1.2-14-D was tested at *a/d* = 1.23. The first crack occurred at a total shear force (recorded by two load cells) of 254 kips, and the total reaction force at the ultimate stage was 275 kips. The maximum measured crack width at ultimate load stage was 0.0787-in. Figure 4.63(b) shows that the first crack occurred at the end face of 5SB12T-1.2-14-D, and no crack was observed on the side faces of 5SB12T-1.2-14-D, as seen in Figures 4.63(a) and (c). At ultimate load stage, the crack patterns are shown in Figures 4.63(d) to (f). Figure 4.63(f) shows that no crack was observed on the east side of 5SB12T-1.2-14-D at the ultimate load stage, which might be explained by imperfections of test setup, concrete surface, and/or non-uniformity of concrete materials during compaction. In addition, the diagonal cracks shown in Figure 4.63(d) occurred beyond the testing span in the longitudinal direction because bending in the transverse direction was dominant over bending in the longitudinal direction, as shown in Figure 4.63(e).

The noise owing to the slippage of tendons was heard during the test in a random sequence. The reaction force was reduced as the tendons slipped, and it increased again as the tendons gained the bond; this process continued until the tendons completely lost their bond. Figure 4.64 shows the total slippage of tendons vs. the distance (location from the side face of TPSB) of 5SB12T-1.2-14-D. Figure 4.64, shows clearly that slippage occurred at cracking load stage. As the load increased, the slippage increased significantly. Since the cracks developed more dominant at west-end face than east-end face, therefore, the slippage of first few tendons (from west side) was greater than the slippage of other tendons. At post-peak stage, all the tendons slipped. The complete set of the measurement can be found in the Appendix A, Table A.52.

The strain in the interior prestressing steel is shown in Figure 4.65. Few strain gauges were broken during construction, so there was no data recorded during the test, and the maximum recorded strain was less than 0.002. By adding this number to the decompression strain (0.005~0.007), the maximum strain of tendon at ultimate loading stage was found to be less than 1% ($f_s < f_y \approx 0.7 f_{pu}$), which meant the stress of tendons could not reach f_{ps} (f_{ps} = stress in prestressing steel at nominal flexural strength, $f_{ps} \approx 0.9 - 0.95 f_{pu}$). The complete set of the measurement can be found in the Appendix A, Table A.53.

At Cracking Loading

(a) West Side of 5SB12T-1.2-14-D

(b) End Face of 5SB12T-1.2-14-D

(c) East Side of 5SB12T-1.2-14-D

At Ultimate Loading

(d) West Side of 5SB12T-1.2-14-D

(e) End Face of 5SB12T-1.2-14-D

(f) East Side of 5SB12T-1.2-14-D

Figure 4.63 Crack Patterns of 5SB12T-1.2-14-D at Cracking Load and Ultimate Load

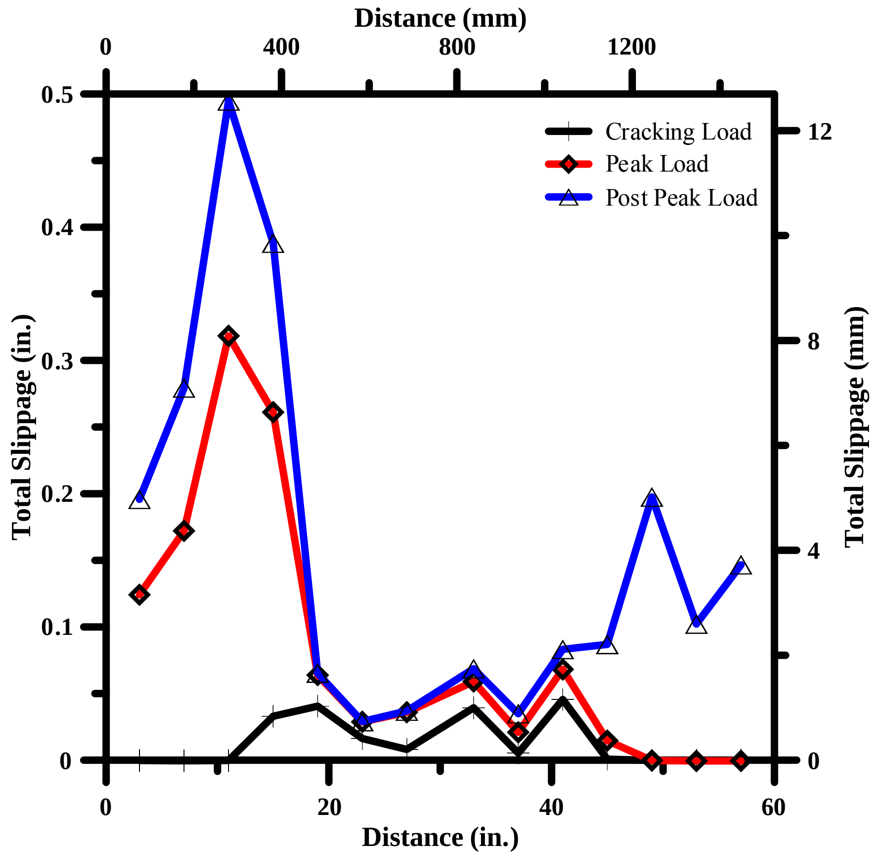
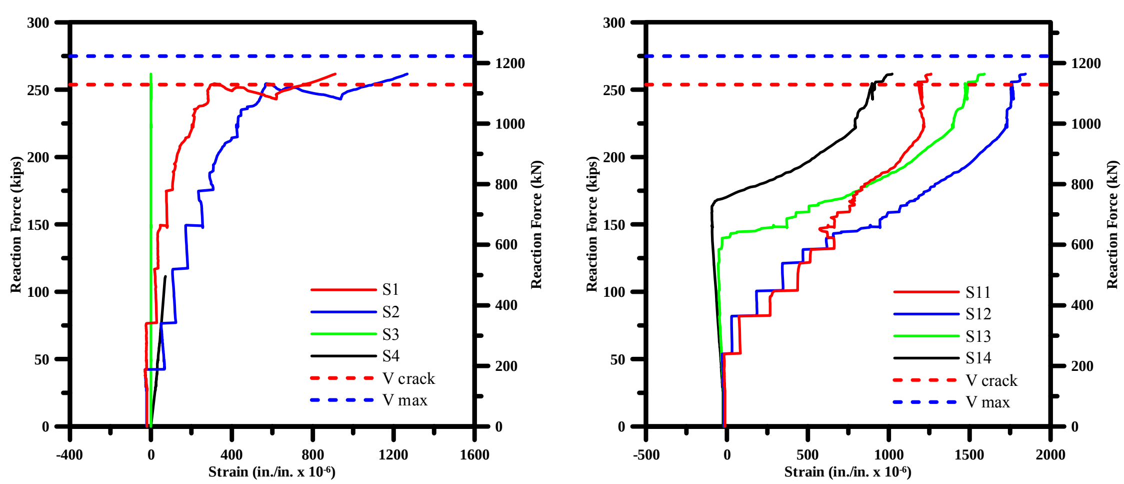


Figure 4.64 Total Slippage vs. Distance of 5SB12T-1.2-14-D



(a) Strain of Interior Tendon 1 (b) Strain of Interior Tendon 2

Figure 4.65 Strain of Interior Tendon of 5SB12T-1.2-14-D

The north end, 5SB12T-2.0-14-D, was tested at *a/d* = 2.00. The first crack occurred simultaneously on the west and east sides of 5SB12T-2.0-14-D when the reaction force was 214 kips, as shown in Figures 4.66(a) and (c), respectively. No crack was observed at the end face, as shown in Figure 4.66(b). As the load increased, more cracks were formed, and 5SB12T-2.0-14-D reached its capacity when the reaction force was 319 kips. At this stage, major cracks formed at the end face, see Figure 4.66(e), and some cracks formed on west and east sides of 5SB12T-2.0-14-D, see Figures 4.66(d) and (f), respectively. The maximum measured crack width at this stage was 0.0394-in.

Figure 4.67 shows the slippage of tendons observed and recorded during the test. At cracking load stage, the slippage of tendons was negligible, which showed the tendons were still perfectly bonded. At ultimate load stage, only two tendons slipped, causing the force to decrease. As more cracks formed, the slippage of tendons increased. The complete set of the measurement can be found in the Appendix A, Table A.55.

Figure 4.68 shows the strain measured by the strain gauges installed on the exterior strands; this figure shows that some of the strain gauges were broken during construction, and the maximum measured strain at ultimate load stage was about 0.002. Adding this number to the decompression strain (0.005~0.007), yielded a maximum strain of tendon at ultimate loading stage of less than one percent, which meant the stress of tendons could not reach f_{ps} (stress in prestressing steel at nominal flexural strength, $f_{ps} \approx 0.9 - 0.95 f_{pu}$). The complete set of the measurement can be found in the Appendix A, Table A.56.

At Cracking Loading | At Ultimate Loading

(a) West Side of 5SB12T-2.0-14-D

(d) West Side of 5SB12T-2.0-14-D

(b) End Face of 5SB12T-2.0-14-D

(e) End Face of 5SB12T-2.0-14-D

(c) East Side of 5SB12T-2.0-14-D

(f) East Side of 5SB12T-2.0-14-D

Figure 4.66 Crack Patterns of 5SB12T-2.0-14-D at Cracking Load and Ultimate Load

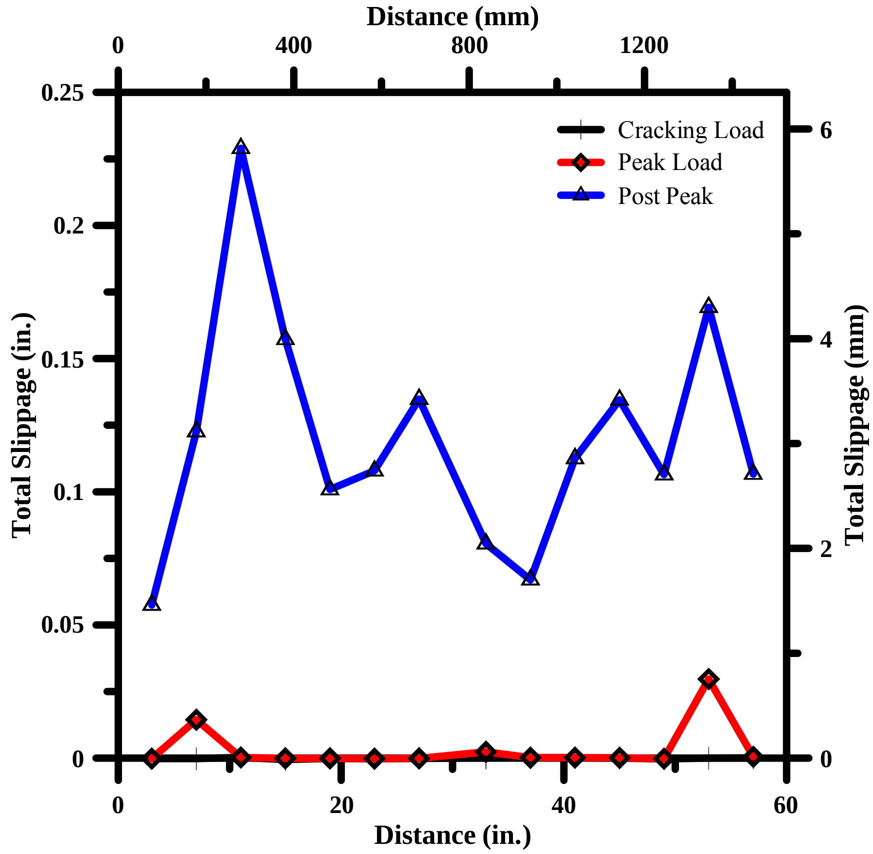
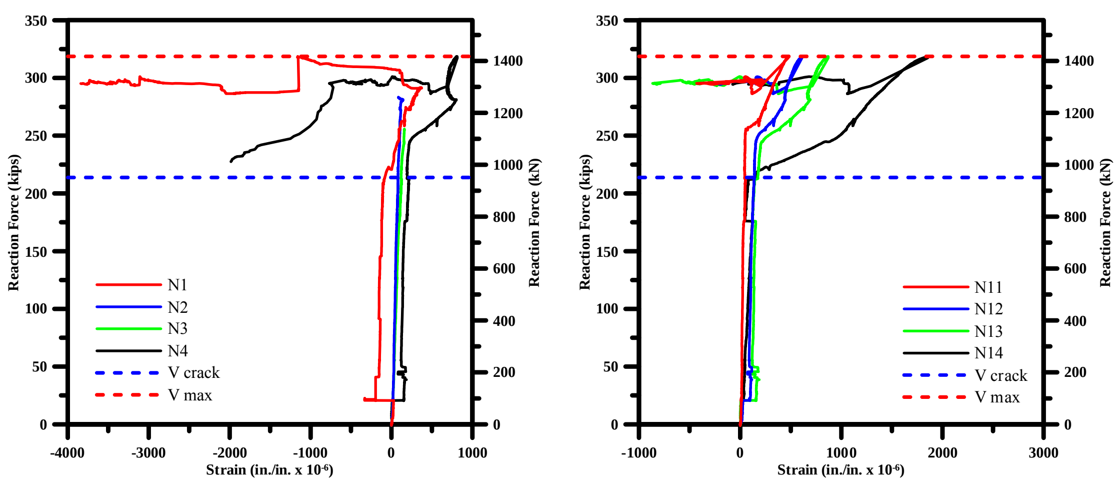


Figure 4.67 Total Slippage vs. Distance of 5SB12T-2.0-14-D



(a) train of Exterior Tendon 1 (b) Strain of Exterior Tendon 2

Figure 4.68 Strain of Exterior Tendon of 5SB12T-2.0-14-D

Figure 4.69 shows a comparison of reaction force vs. deflection between 5SB12T-1.2-14-D and 5SB12T-2.0-14-D. The strength of 5SB12T-1.2-14-D is less than the strength of 5SB12T-2.0-14-D. This trend is the reverse of perfectly bonded prestressed concrete members, where capacity increases significantly as *a/d* decreases. 5SB12T-1.2-14-D failed prematurely owing to the bond-capacity governs. At the other end, 5SB12T-2.0-14-D had a longer provided development length so 5SB12T-2.0-14-D behaved as a flexural member initially; however, as the applied load increased and concrete cracked, the tendons lost their bond, and the load dropped before the tendons reached their flexural capacity. The test data of 5SB12T-1.2-14-D and 5SB12T-2.0-14-D can be found in the Appendix A, Table A.51 and A.54, respectively.

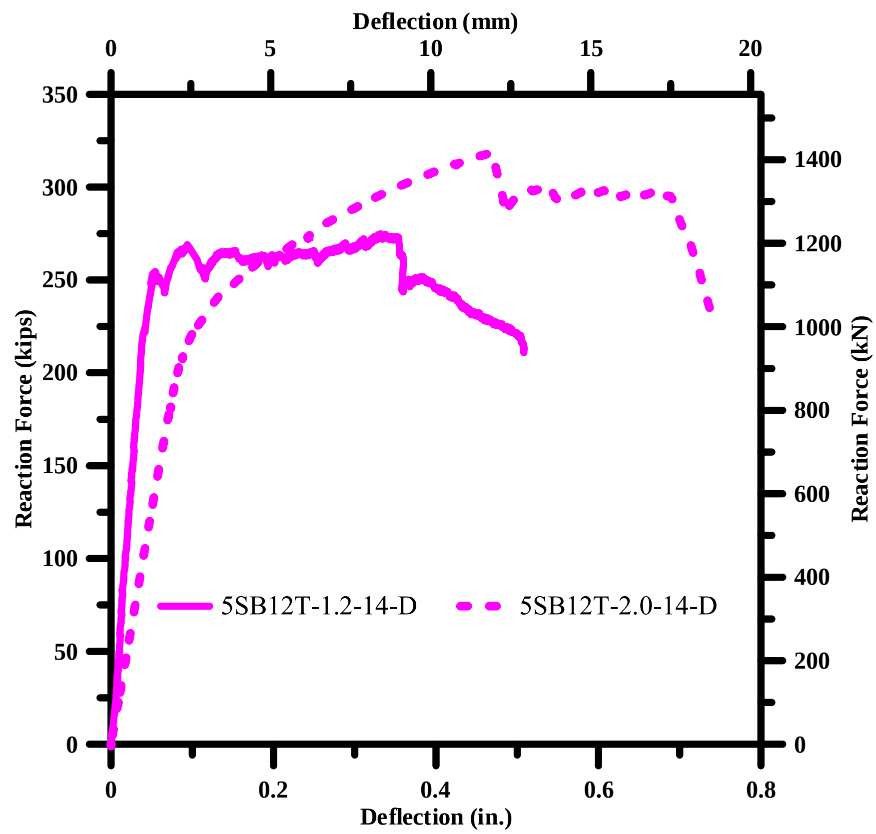
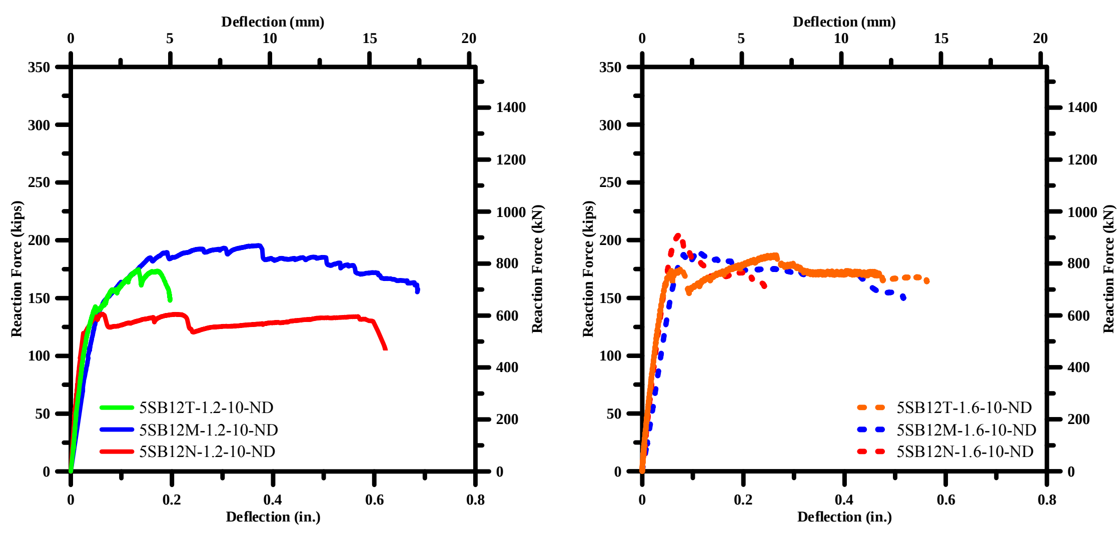


Figure 4.69 Reaction Force – Deflection Relationships of 5SB12T-1.2-14-D and 5SB12T-2.0-14-D

4.3.6 The Effect of Amount of Stirrups

The comparison of the reaction force vs. deflection curves of 5SB12T-1.2-10-ND, 5SB12M-1.2-10-ND, and 5SB12N-1.2-10-ND is shown in Figure 4.70(a). These curves are all governed by anchorage bond failure; 5SB12N-1.2-10-ND shows the least strength. Adding more than double the minimum amount of stirrup per AASHTO (5SB12M-1.2-10-ND), the strength of 5SB12T-1.2-10-ND and 5SB12M-1.2-10-ND remained relatively the same. This type of failure mode, i.e., anchorage bond failure, is brittle and undesirable.

The comparison of reaction force vs. deflection curves of 5SB12T-1.6-10-ND, 5SB12M-1.6-10-ND, and 5SB12N-1.6-10-ND is shown in Figure 4.70(b). These curves also are all governed by anchorage bond failure. As the *a/d* increases, a clearer trend can be observed: Adding more stirrups can preserve the larger deformability., Adding more stirrups, however, does not increase the capacity of these TPSBs.



(a) *a/d* = 1.2 (b) *a/d* = 1.6

Figure 4.70 Comparison of Reaction Force vs. Deflection Among 5SB12T, 5SB12M, and 5SB12N

4.3.7 The Effect of 5-in. CIP Deck

The comparison of reaction force vs. deflection curves of 5SB12T-1.2-10-D and 5SB12T-1.2-10-ND is shown in Figure 4.71. Adding 5-in. CIP deck does not prevent anchorage bond failure; however, it is obvious that adding 5-in. CIP deck increases the capacity of anchorage bond because the effective depth is greater, and the development length provided is longer than one without a deck under the same *a/d*. Both 5SB12T-1.2-10-D and 5SB12T-1.2-10-ND exhibit brittle behavior owing to the anchorage bond.

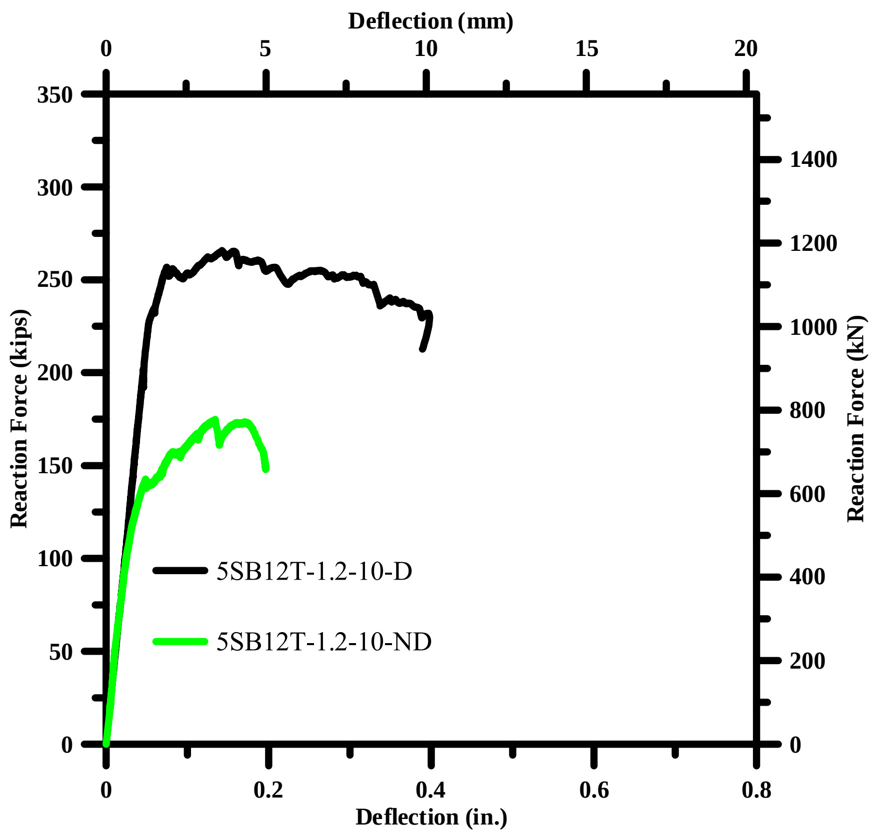
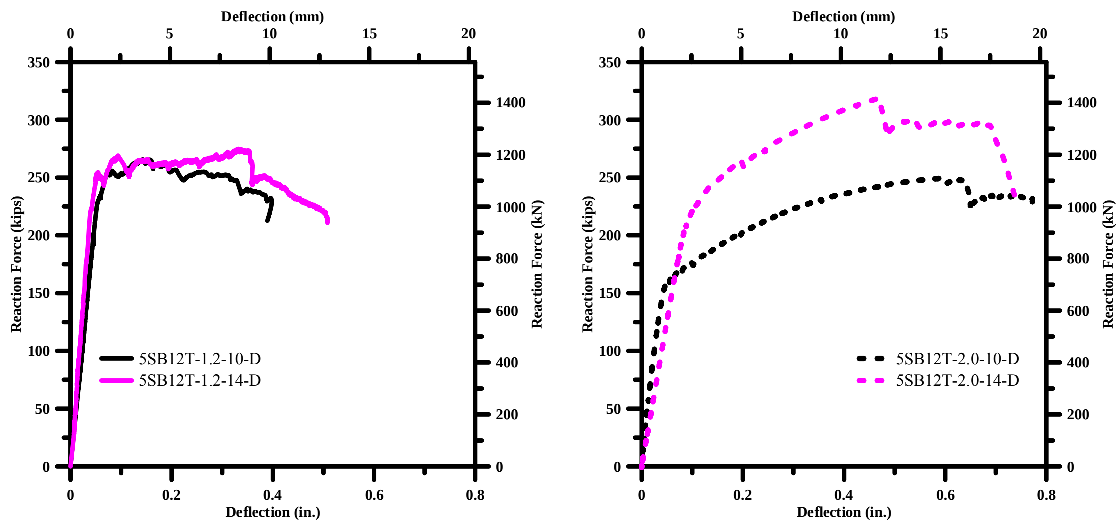


Figure 4.71 Comparison of Reaction Force vs. Deflection Between 5SB12T-1.2-10-D and 5SB12T-1.2-10-ND

4.3.8 The Effect of Number of Strands

The comparison of reaction force vs. deflection curves of 5SB12T-1.2-10-D and 5SB12T-1.2-14-D is shown in Figure 4.72(a). Adding to the number of strands does not have a significant effect, because both 5SB12T-1.2-10-D and 5SB12T-1.2-14-D fail owing to anchorage bond.

The comparison of the reaction force vs. deflection curves of 5SB12T-2.0-10-D and 5SB12T-2.0-14-D is shown in Figure 4.72(b). Although both 5SB12T-2.0-10-D and 5SB12T-2.0-14-D failed in brittle manner owing to anchorage bond, they initially exhibit flexure behavior. Adding strands, therefore, does increase capacity.



(a) $a/d = 1.2$ (b) $a/d = 2.0$

Figure 4.72 Comparison of Reaction Force vs. Deflection Between 5SB12T-1.2-10-D and 5SB12T-2.0-10-D, 5SB12T-1.2-14-D and 5SB12T-2.0-14-D

4.4 Group C (5SB15)

Group C consists of five TPSBs with a height of 15-in.; three TPSBs were tested in Phase 1, and two were tested in Phase 2. The concrete strength of these TPSBs varies from 8,500 to 10,500 psi. The behavior, in this group, of 15-in.-high TPSBs was studied, including current TxDOT products. Various parameters were studied: amount of stirrups, shear span-to-depth (*a/d*) ratio, effect of 5-in. cast-in-place (CIP) deck, and number of tendons.

Table 4.3 summarizes the test results of Group C TPSBs and the failure mode based on the test observations. Two distinct failure modes were observed: All 15-in.-high TPSBs with *a/d* ratio close to 1.2 failed owing to anchorage bond and the remaining 15-in.-high TPSBs (with *a/d* ratio close to 2.0) failed owing to flexure. The minimum cracking shear forces for 15-in.-high TPSBs with eight tendons and 14 tendons were 121 kips and 192 kips, respectively. This cracking strength is a useful parameter for checking the serviceability of TPSBs. The maximum measured crack width at ultimate stage of Group C TPSBs varied from 19.7 x10^{-3}-in. to greater than 78.7 x 10^{-3}-in.

Table 4.3 Test Summary and Failure Modes of Group C TPSBs

Specimen ID	*a/d*	$f_c^{'}$ (ksi)	Cracking Shear Force (kips)	Ultimate Reaction Force (kips)	Failure Mode	Crack Width (x10^{-3}in)
5SB15T-1.2-08-D	1.15	9.7	249	298	Anchorage Bond	78.7
5SB15T-2.0-08-D	2.2	9.7	136	196	Flexure	>78.7*
5SB15T-1.2-08-ND	1.23	8.5	184	185	Anchorage Bond	39.4
5SB15T-2.0-08-ND	2.02	8.5	121	172	Flexure	>78.7*
5SB15M-1.2-08-ND	1.25	10.5	174	199	Anchorage Bond	>78.7*
5SB15M-2.0-08-ND	1.99	10.5	128	177	Flexure	>78.7*
5SB15N-1.2-08-ND	1.23	9.9	165	189	Anchorage Bond	19.7
5SB15N-2.0-08-ND	1.96	9.9	130	176	Flexure	>78.7*
5SB15T-1.2-14-D	1.21	9.1	320	347	Anchorage Bond	23.6
5SB15T-2.0-14-D	2.17	9.3	192	303	Flexure	>78.7*

* 78.7 x 10^{-3} is the limit of standard crack width gauge

4.4.1 5SB15T-1.2-8-D and 5SB15T-2.0-8-D

The first TPSB of Group C is the current TxDOT product for bridges with spans of up to 30-ft. 5SB15T-1.2-8-D was tested at *a/d* = 1.15. The first crack occurred on the west and east sides of 5SB15T-1.2-8-D simultaneously when the total reaction force was 249 kips, as shown in Figures 4.73(a) and (b), respectively. At this stage, no crack was observed at the end face of 5SB15T-1.2-8-D (no photo was taken). 5SB15T-1.2-8-D reached its capacity when the total reaction force was 298 kips. The major cracks formed at end face, see Figure 4.73(d), and some cracks formed on west and east sides of 5SB15T-1.2-8-D, see Figures 4.73(c) and (e), respectively. The maximum measured crack width at this stage was 0.0787-in.

5SB15T-1.2-8-D was the first TPSB of Group C tested. Before the test, the slippage of tendon was never expected, because the total reaction force from the test was higher than its flexural capacity. Reaction force vs. deflection curve, however, did not show that 5SB15T-1.2-8-D had a ductile behavior. By this time, the anchorage bond failure was the main suspect. Unfortunately, no LVDT was attached to this TPSB to measure the slippage of tendons owing to insufficient knowledge from the experiment and from literature.

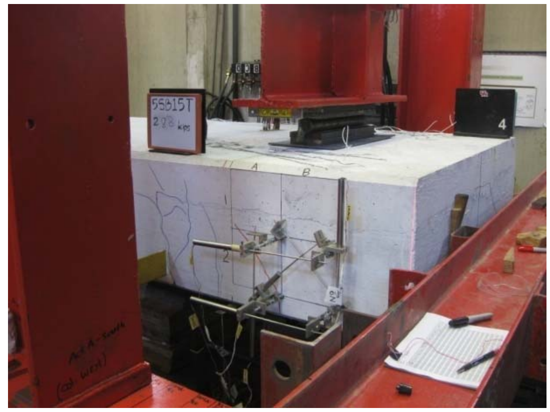
Figure 4.74 shows the strain of bars C, N, and H. The horizontal axis represents the longitudinal distance from the end of the TPSB, i.e., 0-in. represents the end of the TPSB, and each symbol represents the existence of strain gauges. The vertical axis represents the magnitude of strain. Figure 4.74 shows that all re-bars (bars C, N, and H) were ineffective in resisting the external load, which is understandable, because the height is thin relative to the width; therefore, the in-plane shear (arch action) cannot be developed. The complete set of the measurement can be found in the Appendix A, Table A.59.

Figure 4.75 shows the in-plane concrete smeared strain of 5SB15T-1.2-8-D. Until ultimate load stage, the in-plane concrete smeared strain was negligible. These measurements verified that the 5SB15T-1.2-8-D was not subjected to in-plane shear. The complete set of the measurement can be found in the Appendix A, Table A.58.

At Cracking Loading

At Ultimate Loading

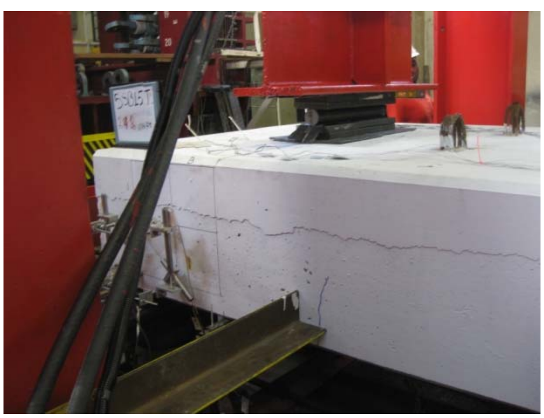
(a) West Side of 5SB15T-1.2-08-D



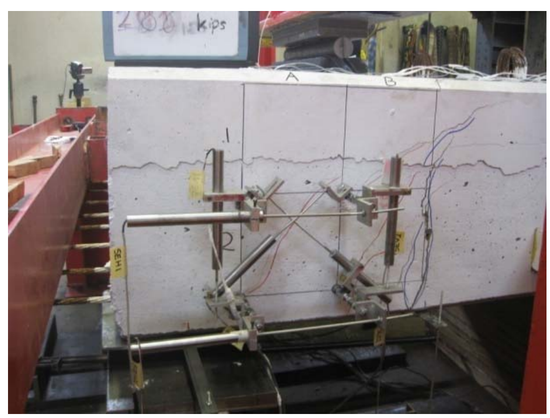
(c) West Side of 5SB15T-1.2-08-D

No crack was observed at end face; no photo was taken

(d) End Face of 5SB15T-1.2-08-D

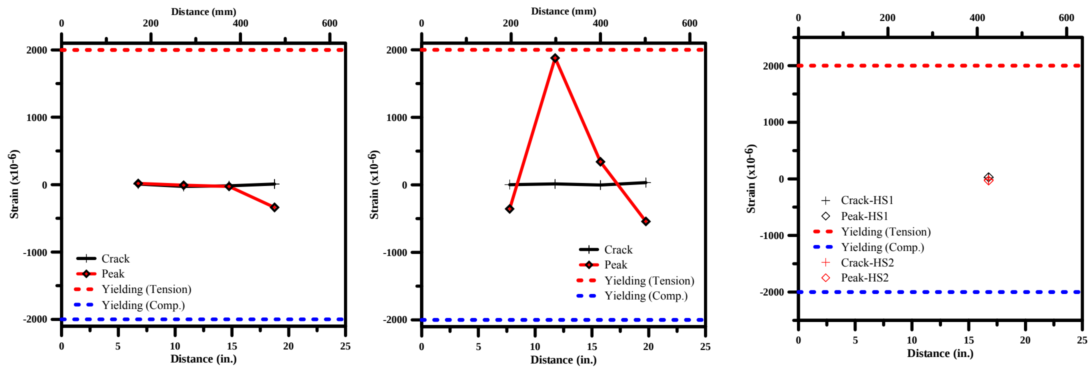


(b) East Side of 5SB15T-1.2-08-D



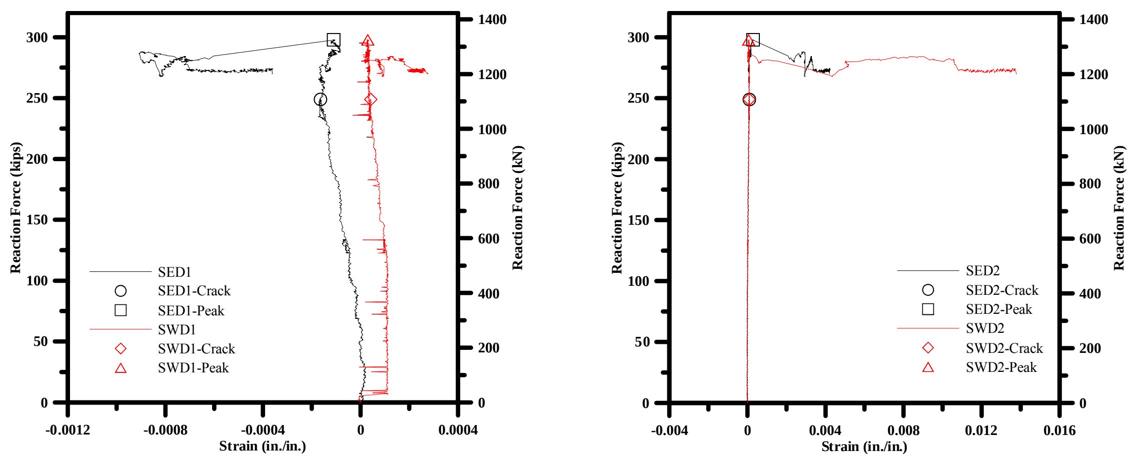
(e) East Side of 5SB15T-1.2-08-D

Figure 4.73 Crack Patterns of 5SB15T-1.2-08-D at Cracking Load and Ultimate Load

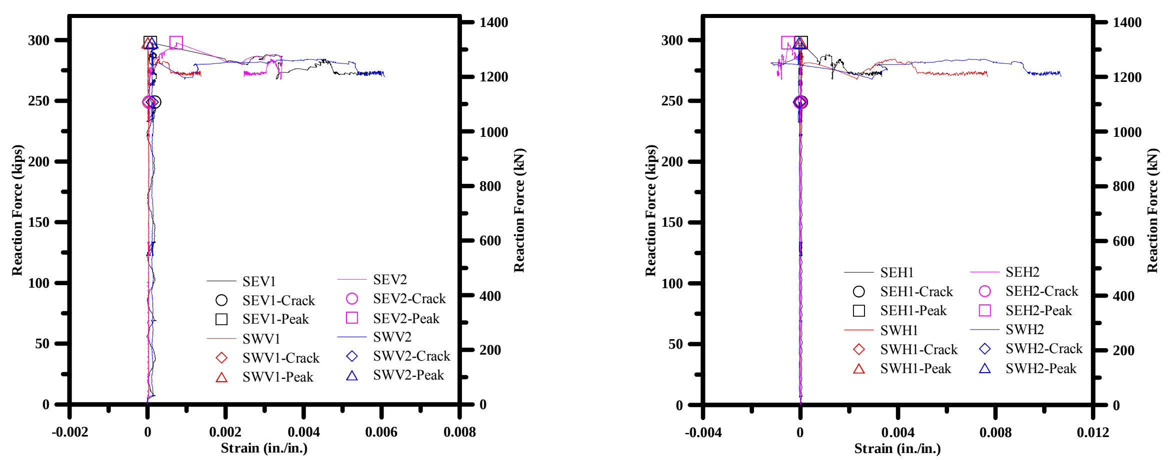


(a) Bars C (b) Bars N (c) Bars H

Figure 4.74 Strain in Stirrups of 5SB15T-1.2-8-D



(a) 45^0 Smeared Tensile Strain – D1 (b) 45^0 Smeared Compressive Strain – D2



(c) Smeared Vertical Strain – V1 and V2 (d) Smeared Horizontal Strain – H1 and H2

Figure 4.75 Reaction Force vs. Concrete Smeared Strain of 5SB15T-1.2-8-D

5SB15T-2.0-8-D was tested at *a/d* = 2.20. The first crack occurred on west and east sides of 5SB15T-2.0-8-D simultaneously when the reaction force was 136 kips, as shown in Figures 4.76(a) and (b), respectively. No crack was observed at the end face (no photo was taken). After 5SB15T-2.0-8-D cracked, the stiffness of 5SB15T-2.0-8-D decreased, and 5SB15T-2.0-8-D behaved in ductile manner. 5SB15T-2.0-8-D reached its capacity at 196 kips, and unlike other TPSBs, the cracks on the west and east of 5SB15T-2.0-8-D propagated toward the top fiber, as shown in Figures 4.76(c) and (e), respectively. No crack was observed at the end face of 5SB15T-2.0-8-D, as shown in Figure 4.76(d), and the maximum measured crack width at ultimate load stage was 0.0787-in. The crushing of concrete at the top fiber was observed at ultimate load stage. Moreover, no significant noise (due to anchorage bond) was heard throughout the test.

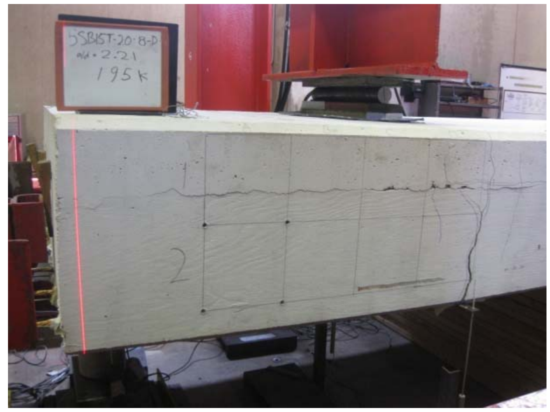
Figure 4.77 shows the strain of bars C, N, and H. Figure 4.77 shows that all re-bars (bars C, N, and H) were ineffective in resisting the external load. The explanation for this result is that this particular case is different from in-plane shear; it can be considered an element subjected to out-of-plane shear.

Figure 4.78 shows the in-plane concrete smeared strain of 5SB15T-2.0-8-D. Until the ultimate load stage, the in-plane concrete smeared strain was negligible. These measurements verified that the 5SB15T-2.0-8-D was not subjected to in-plane shear. The recorded noise of strain may occur owing to vibration during the test and the delicate sensitivity of LVDTs. The irregular strain of D1, as shown in Figure 4.78(a), may be caused by a bad channel in one of the data acquisition systems.

At Cracking Loading

At Ultimate Loading

(a) West Side of 5SB15T-2.0-08-D

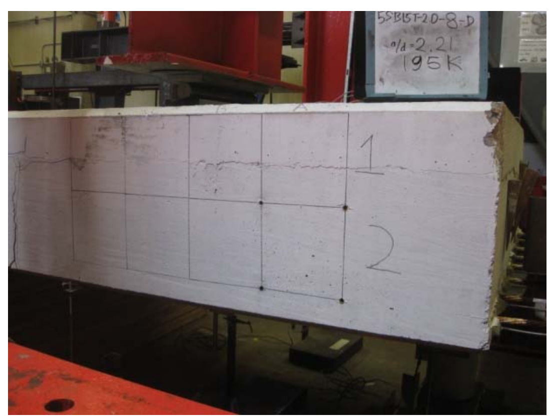


(c) West Side of 5SB15T-2.0-08-D

No crack was observed at end face;
no photo was taken

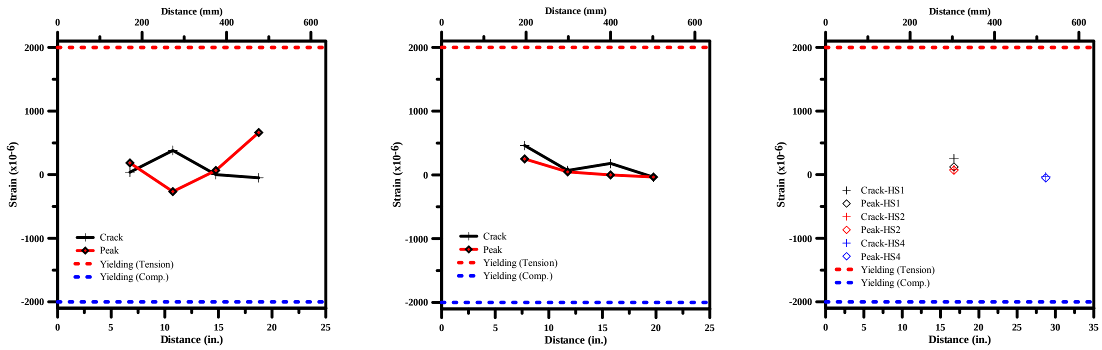
(d) End Face of 5SB15T-2.0-08-D

(b) East Side of 5SB15T-2.0-08-D



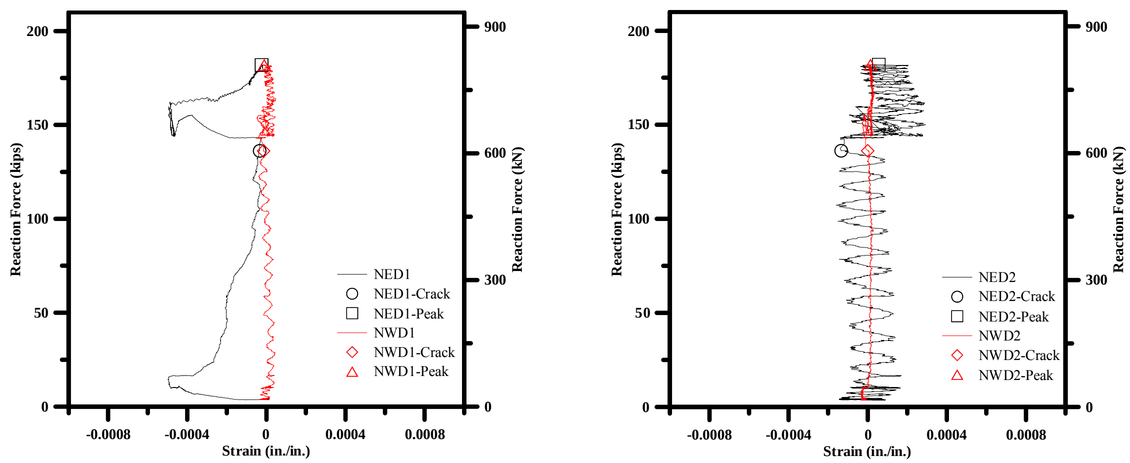
(e) East Side of 5SB15T-2.0-08-D

Figure 4.76 Crack Patterns of 5SB15T-2.0-08-D at Cracking Load and Ultimate Load

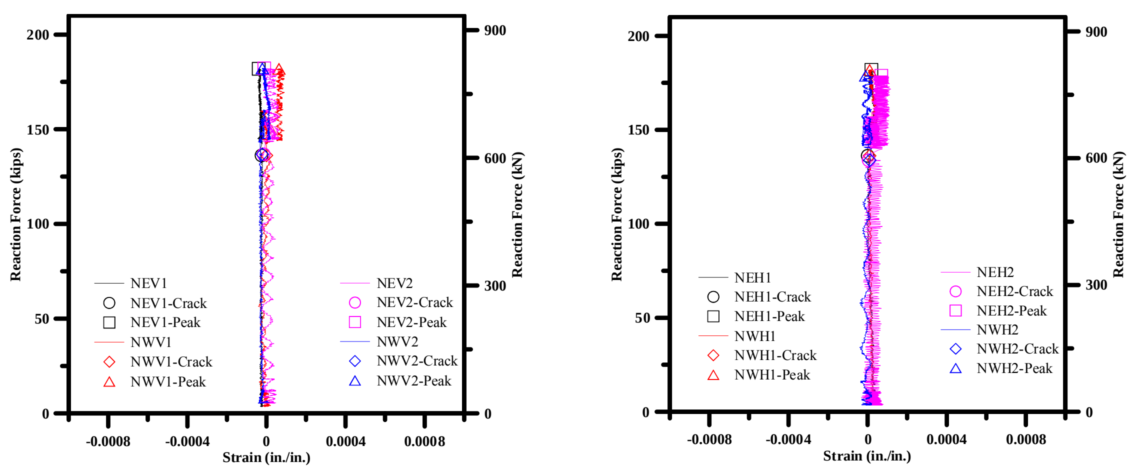


(a) Bars C (b) Bars N (c) Bars H

Figure 4.77 Strain in Stirrups of 5SB15T-2.0-08-D



(a) 45^0 Smeared Tensile Strain – D1 (b) 45^0 Smeared Compressive Strain – D2



(c) Smeared Vertical Strain – V1 and V2 (d) Smeared Horizontal Strain – H1 and H2

Figure 4.78 Reaction Force vs. Concrete Smeared Strain of 5SB15T-2.0-08-D

Figure 4.79 shows a comparison of reaction force vs. net deflection relationship between 5SB15T-1.2-08-D and 5SB15T-2.0-08-D. The vertical axis is the reaction force recorded by load cell(s), and the horizontal axis is the net deflection recorded by LVDTs under the loading section subtracted by the settlement of support(s) recorded by LVDTs under the support section. Figure 4.79 shows that two different failure modes exist: 5SB15T-1.2-08-D behaves in brittle manner owing to anchorage bond failure; 5SB15T-2.0-08-D, however, behaves in ductile manner owing to flexure failure. Strength increases significantly as the *a/d* decreases, and 5SB15T-2.0-08-D has a larger deflection than 5SB15T-1.2-08-D. The test data of 5SB15T-1.2-08-D and 5SB15T-2.0-08-D can be found in the Appendix A, Table A.57 and A.60, respectively.

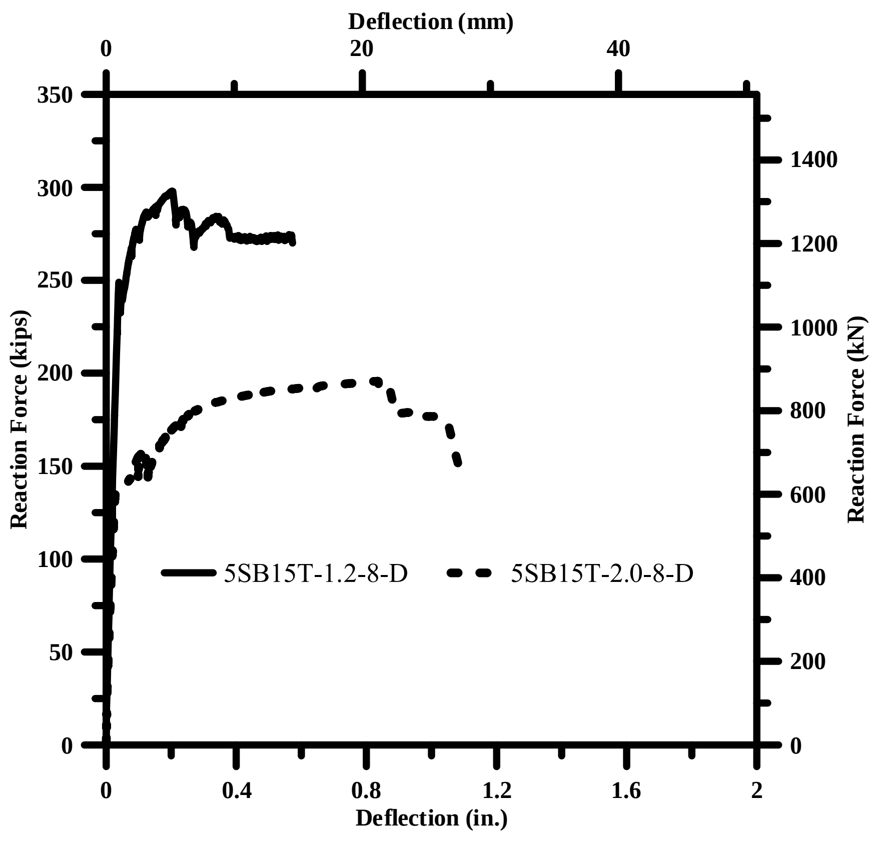


Figure 4.79 Reaction Force – Deflection Relationships of 5SB15T-1.2-08-D and 5SB15T-2.0-08-D

4.4.2 5SB15T-1.2-8-ND and 5SB15T-2.0-8-ND

The second TPSB of Group C was done in Phase 2 experimental work. The TPSB has the typical detailing of the TxDOT product, with the exception of 5-in. CIP deck. 5SB15T-1.2-8-ND was tested at a/d = 1.23. The first crack occurred at a total shear force (recorded by two load cells) of 184 kips, and the total ultimate reaction force was 185 kips. The maximum measured crack width at ultimate load stage was 0.0394-in. Figures 4.80(a) and (b) show that the first crack occurred on the west and at the end face of 5SB15T-1.2-8-ND, and no crack was observed on the east side of 5SB15T-1.2-8-ND, as seen in Figure 4.80(c). The crack patterns are shown in Figures 4.80(d) to (f) at ultimate load stage. The diagonal cracks shown in Figures 4.80(d) and (f) occurred beyond the testing span in the longitudinal direction, because the bending in the transverse direction was dominant over the bending in the longitudinal direction, as shown in Figure 4.80(e).

The noise owing to slippage of tendons was heard during the test in a random sequence. The reaction force attenuated as the tendons slipped, and as the tendons gained the bond, the reaction force increased again; this process continued until the tendons lost their bond completely. The slippage was measured by LVDTs installed on the protruding portion of each tendon. Figure 4.81 shows total slippage of tendons vs. distance (location from side face of TPSB) of 5SB15T-1.2-8-ND; a maximum limit of horizontal axis (60-in.) represents the width of TPSBs (5 ft.), and each symbol represents the existence of each LVDT. Figure 4.81 shows that slippage was measured at cracking load stage. As the load increased, the slippage increased as well. The slippage of the interior tendons was greater relative to the exterior tendons because there were two supports at this end. The complete set of the measurement can be found in the Appendix A, Table A.63.

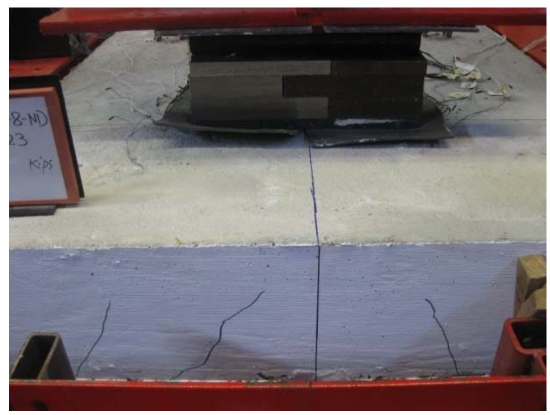
At Cracking Loading

At Ultimate Loading

(a) West Side of 5SB15T-1.2-08-ND

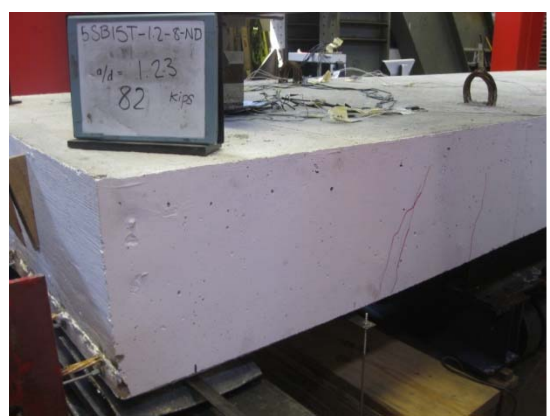
(d) West Side of 5SB15T-1.2-08-ND

(b) End Face of 5SB15T-1.2-08-ND



(e) End Face of 5SB15T-1.2-08-ND

(c) East Side of 5SB15T-1.2-08-ND



(f) East Side of 5SB15T-1.2-08-ND

Figure 4.80 Crack Patterns of 5SB15T-1.2-8-ND at Cracking Load and Ultimate Load

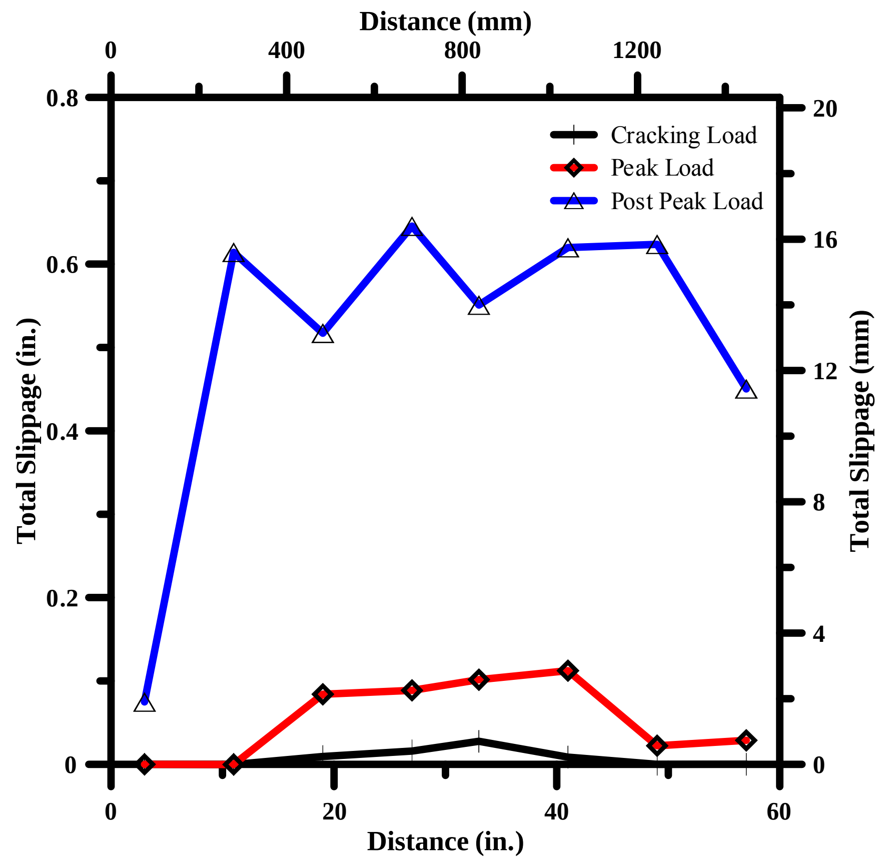
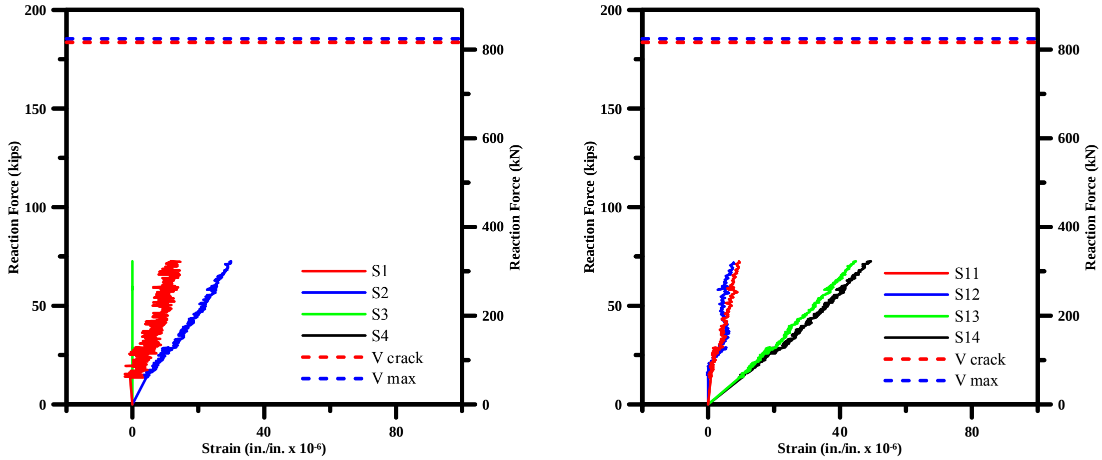


Figure 4.81 Total Slippage vs. Distance of 5SB15T-1.2-8-ND

The strain in the interior prestressing steel is shown in Figure 4.82. Few strain gauges were broken during construction, so there was no data recorded during the test. Other strain gauges broke when the total recorded reaction force was about 75 kips, because the strain-gauge wires protruding from the concrete were very close to the loading area, so they were severed as the applied load increased. The complete set of the measurement can be found in the Appendix A, Table A.64.



(a) Strain of Interior Tendon 1 (b) Strain of Interior Tendon 2

Figure 4.82 Strain of Interior Tendon of 5SB15T-1.2-8-ND

The north end, 5SB15T-2.0-8-ND, was tested at *a/d* = 2.02. A vertical flexural crack near the loading section was formed on west and east sides of 5SB15T-2.0-8-ND simultaneously when the reaction force was 121 kips, as shown in Figures 4.83(a) and (c), respectively. No crack was observed at the end face of 5SB15T-2.0-8-ND, shown in Figure 4.83(b). 5SB15T-2.0-8-ND reached its capacity at 172 kips. At this stage, the flexural cracks propagated toward the top fiber, and they were getting wider at the bottom fiber, shown in Figures 4.83(d) and (f). No crack occurred at the end face of 5SB15T-2.0-8-ND, shown in Figure 4.83e). At ultimate load stage, the maximum measured crack width was 0.0787-in., and the concrete at the top fiber was crushing.

Tendon slippage was recorded during the test, as shown in Figure 4.84. At cracking load stage, tendon slippage was negligible, which meant the tendons were still perfectly bonded. At ultimate load stage, a few tendons slipped. Tendon slippage barely increased, however, as the applied load increased. The complete set of the measurement can be found in the Appendix A, Table A.66.

At Cracking Loading

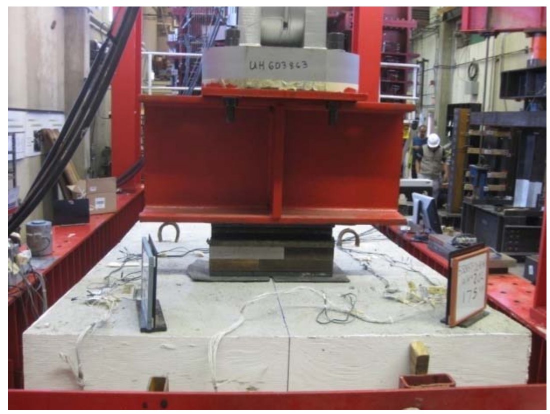
(a) West Side of 5SB15T-2.0-08-ND

(b) End Face of 5SB15T-2.0-08-ND

(c) East Side of 5SB15T-2.0-08-ND

At Ultimate Loading

(d) West Side of 5SB15T-2.0-08-ND



(e) End Face of 5SB15T-2.0-08-ND

(f) East Side of 5SB15T-2.0-08-ND

Figure 4.83 Crack Patterns of 5SB15T-2.0-8-ND at Cracking Load and Ultimate Load

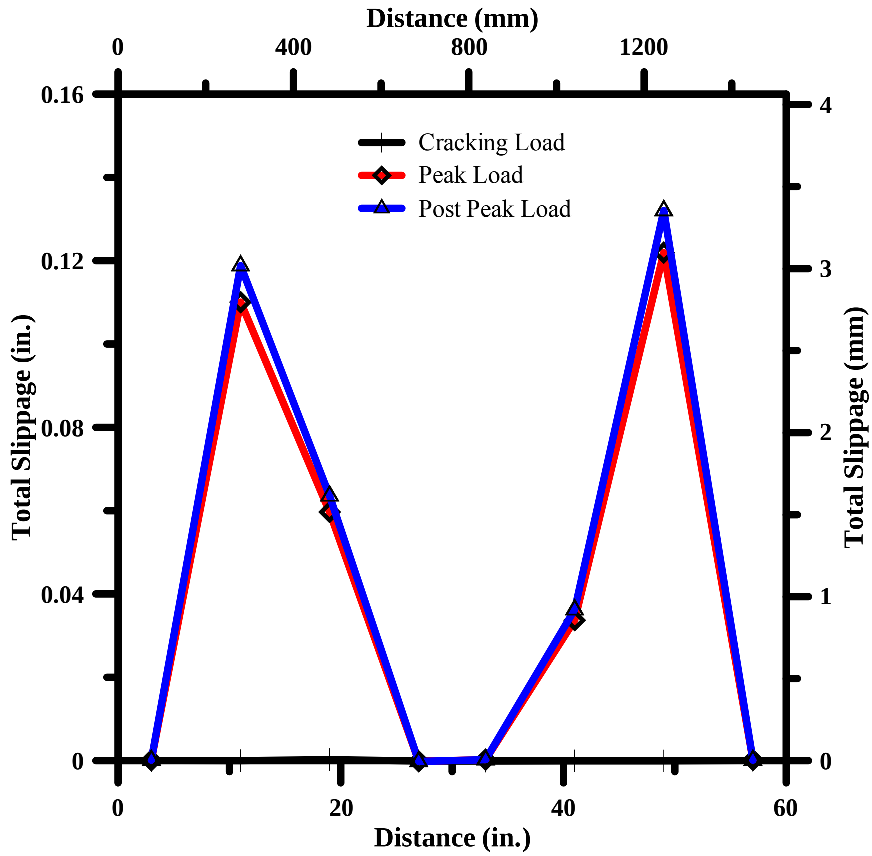
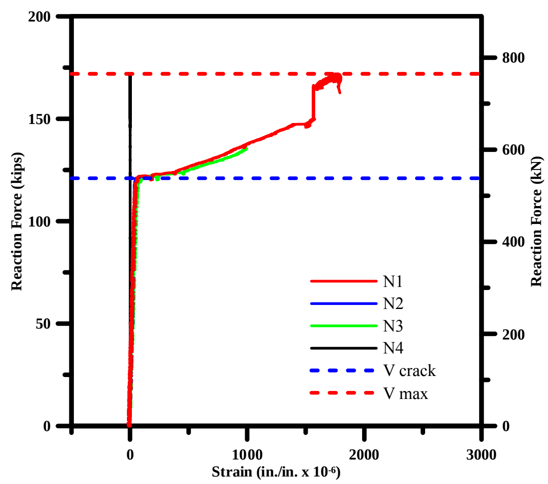
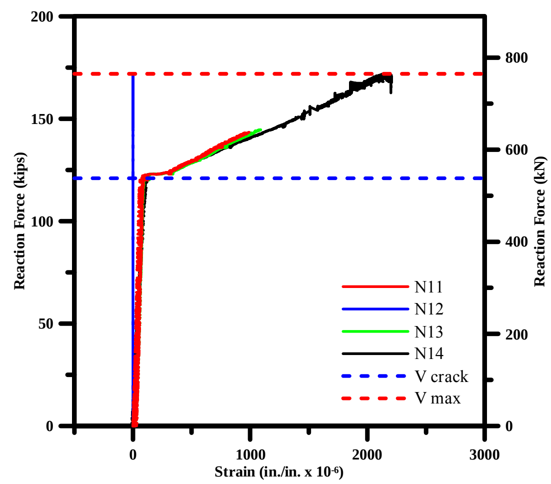


Figure 4.84 Total Slippage vs. Distance of 5SB15T-2.0-8-ND

Figure 4.85 shows the strain measured by the strain gauges installed on the exterior strands. This figure shows that some of the strain gauges were broken during construction, and the maximum recorded strain at ultimate load stage was about 0.0025. Adding this number to the decompression strain (0.005~0.007), a result at maximum strain of the exterior tendons at ultimate loading stage of less than one percent, which means the stress of exterior tendons could not reach f_{ps} (stress in prestressing steel at nominal flexural strength, $f_{ps} \approx 0.9 - 0.95 f_{pu}$). The complete set of the measurement can be found in the Appendix A, Table A.67.



(a) Strain of Exterior Tendon 1



(b) Strain of Exterior Tendon 2

Figure 4.85 Strain of Exterior Tendon of 5SB15T-2.0-8-ND

Figure 4.86 shows the comparison of reaction force vs. deflection between 5SB15T-1.2-8-ND and 5SB15T-2.0-8-ND. These curves show two extinct failure modes: 5SB15T-2.0-8-ND has ductile behavior owing to flexure failure, and 5SB15T-1.2-8-ND has brittle failure owing to anchorage bond failure. In the case of perfectly bonded prestressed concrete members, the capacity increases significantly as the *a/d* decreases. Where anchorage bond exists, however, the capacity of these ends is relatively close. The reaction force drops as slippage occurs, and as the tendons regain their bond capacity, the reaction force increases. This process continues until the beam fails completely. The test data of 5SB15T-1.2-08-D and 5SB15T-2.0-08-D can be found in the Appendix A, Table A.62 and A.65, respectively.

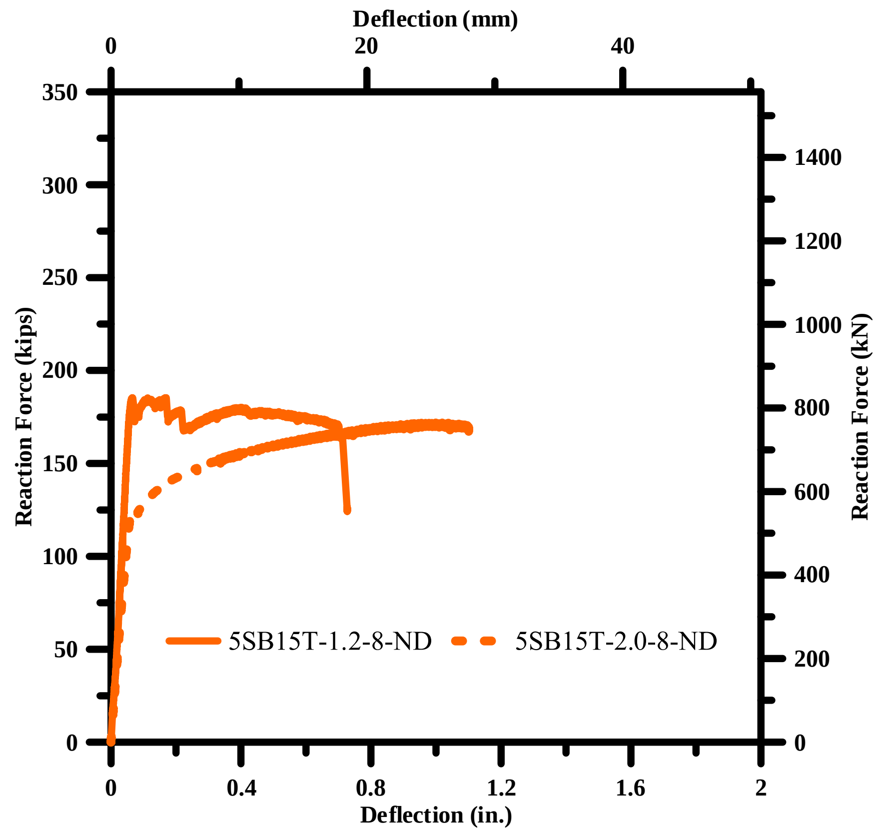


Figure 4.86 Reaction Force – Deflection Relationships of 5SB15T-1.2-8-ND and 5SB15T-2.0-8-ND

4.4.3 5SB15M-1.2-8-ND and 5SB15M-2.0-8-ND

5SB15M-1.2-8-ND was tested at *a/d* = 1.25. The first crack occurred on west and east sides of 5SB15M-1.2-8-ND simultaneously when the total reaction force was 174 kips, as shown in Figures 4.87(a) and (b), respectively. At this stage, no crack was observed at the end face of 5SB15M-1.2-8-ND. 5SB15M-1.2-8-ND reached its capacity when the total reaction force was 199 kips. The major cracks formed at end face, see Figure 4.87(d), and some cracks formed on west and east sides of 5SB15M-1.2-8-ND, see Figures 4.87(c) and (e), respectively. The cracks that formed on west and east sides of 5SB15M-1.2-8-ND were beyond the testing span in the longitudinal direction because the bending in the transverse direction is dominant over the bending in the longitudinal direction. The maximum measured crack width at this stage was 0.0787-in.

Figure 4.88 shows the tendon slippage recorded during the test. Interior tendon slippage occurred at cracking load stage. The tendons continued to slip, and at ultimate load stage, the tendon slippage was significantly high. As more cracks formed, slippage of all tendons increased. The complete set of the measurement can be found in the Appendix A, Table A.70.

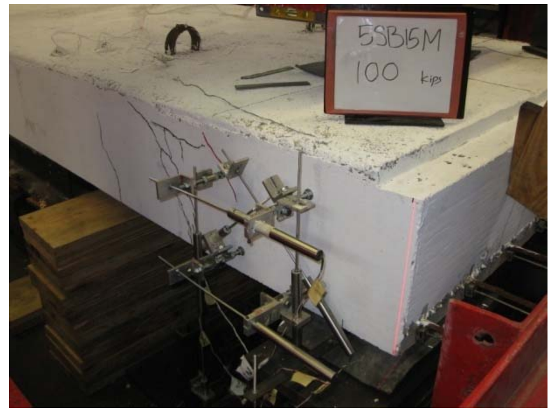
Figure 4.89 shows strain on bars C and N; the strain shows that bars C were ineffective in resisting the load. Bars C, the outer stirrups, were relatively farther from the applied load at mid-cross-section. Bar N in this TPSB, which was originally designed for end-zone reinforcement, showed a higher reading at ultimate load. This condition can occur because the loading area was relatively close to bar N; since bending in the transverse direction was dominant, cracks formed at the end face of 5SB15M-1.2-08-ND, and bar N resisted the applied force to maintain equilibrium. The complete set of the measurement can be found in the Appendix A, Table A.71.

Figure 4.90 shows in-plane smeared strain measured by the rosette LVDT. One can expect that the measured strain was negligible because the 5SB15M-1.2-08-ND was not subjected to in-plane shear. The measured strain was noise owing to vibration and/or delicate sensitivity of LVDTs until the ultimate load stage. This measurement confirms that bars C were ineffective in this case. The complete set of the measurement can be found in the Appendix A, Table A.69.

At Cracking Loading

At Ultimate Loading

(a) West Side of 5SB15M-1.2-08-ND



(c) West Side of 5SB15M-1.2-08-ND

No crack was observed at end face;
no photo was taken

(d) End Face of 5SB15M-1.2-08-ND

(b) East Side of 5SB15M-1.2-08-ND

(e) East Side of 5SB15M-1.2-08-ND

Figure 4.87 Crack Patterns of 5SB15M-1.2-08-ND at Cracking Load and Ultimate Load

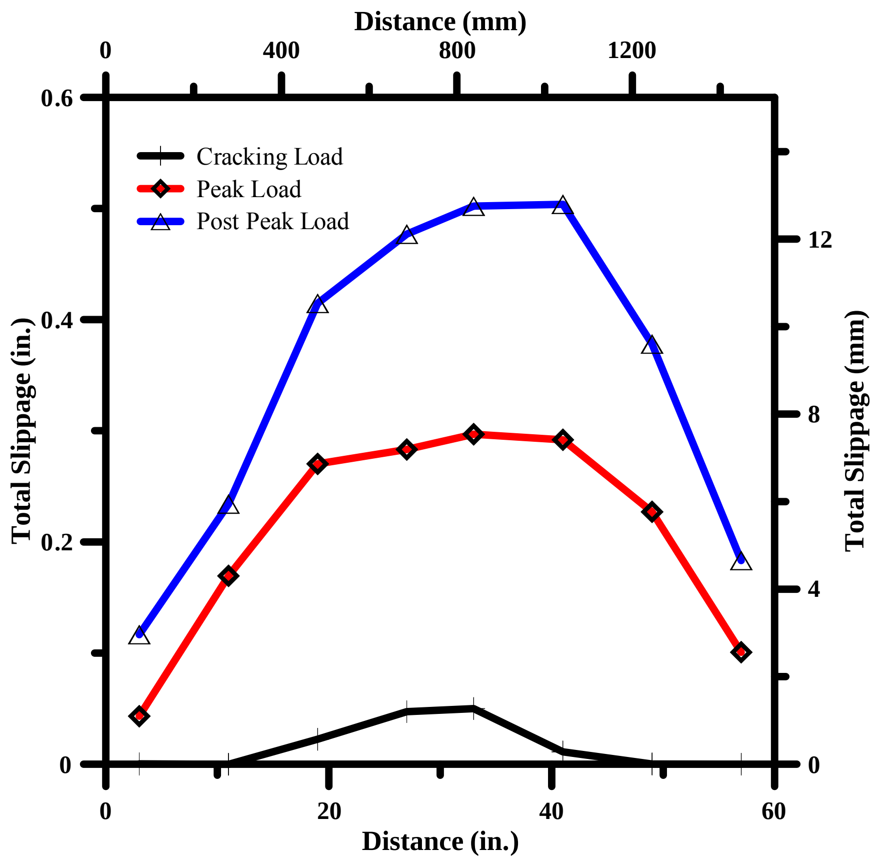


Figure 4.88 Total Slippage vs. Distance of 5SB15M-1.2-08-ND

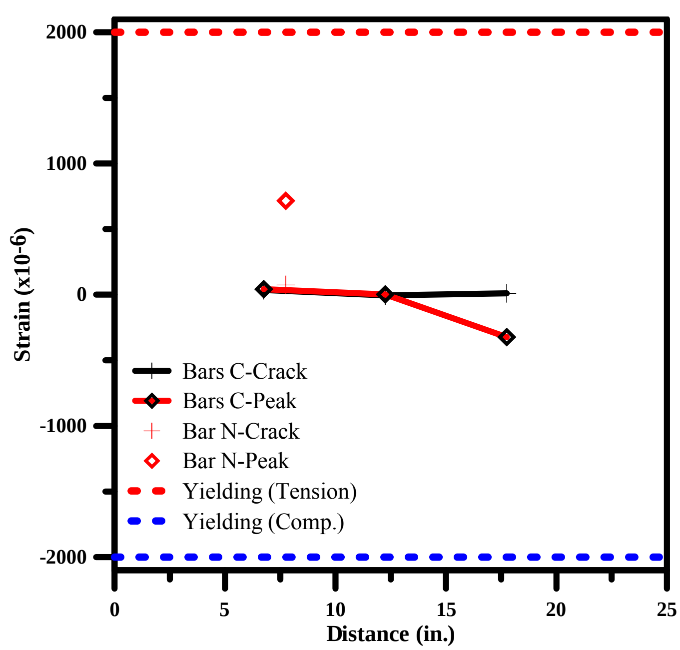
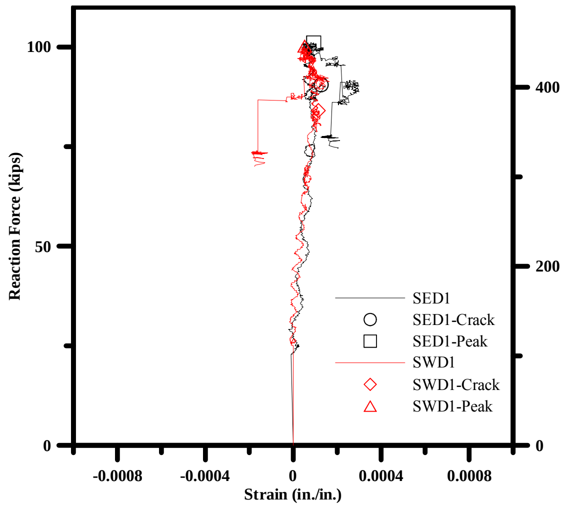
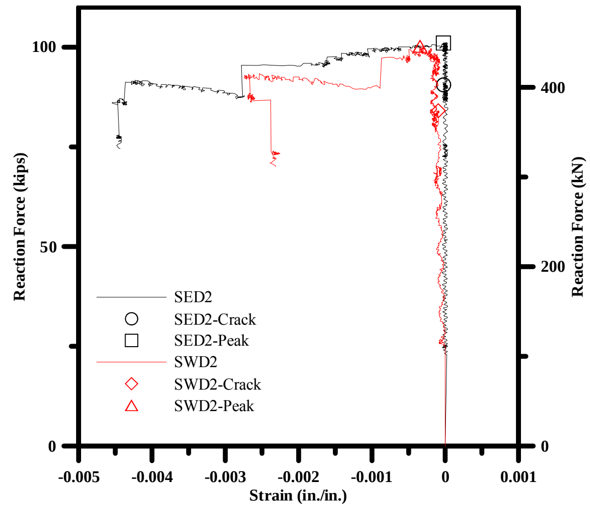


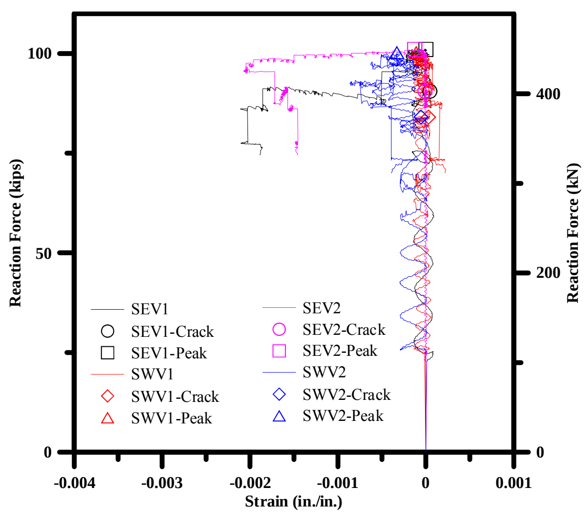
Figure 4.89 Strain in Stirrups of 5SB15M-1.2-08-ND



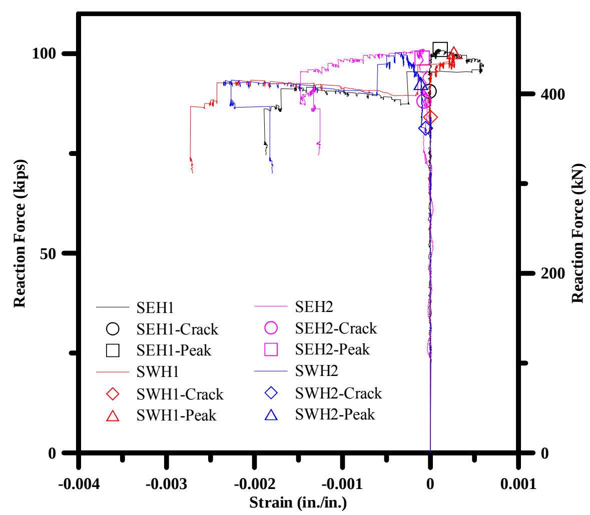
(a) 45^0 Smeared Tensile Strain – D1



(b) 45^0 Smeared Compressive Strain – D2



(c) Smeared Vertical Strain – V1 and V2



(d) Smeared Horizontal Strain – H1 and H2

Figure 4.90 Reaction Force vs. Concrete Smeared Strain of 5SB15M-1.2-08-ND

5SB15M-2.0-8-ND was tested at *a/d* = 1.99. The first crack occurred on west and east sides of 5SB15M-2.0-8-ND simultaneously when the reaction force was 128 kips, as shown in Figures 4.91(a) and (b), respectively, and no crack was observed at the end face. 5SB15M-2.0-8-ND reached its capacity at 177 kips. At this stage, the flexural cracks propagated toward the top fiber, and they got wider at the bottom fiber, as depicted in

Figures 4.91(c) and (d). No crack occurred at the end face of 5SB15M-2.0-8-ND. At ultimate load stage, the maximum measured crack width was 0.0787-in., and the crushing of concrete at the top fiber was observed.

At Cracking Loading At Ultimate Loading

(a) West Side of 5SB15M-2.0-08-ND

(c) West Side of 5SB15M-2.0-08-ND

(b) East Side of 5SB15M-2.0-08-ND

(d) East Side of 5SB15M-2.0-08-ND

Figure 4.91 Crack Patterns of 5SB15M-2.0-8-ND at Cracking Load and Ultimate Load

Tendon slippage was recorded during the test, as shown in Figure 4.92. Until the ultimate stage, tendon slippage was negligible, which meant tendons were still perfectly bonded. As the TPSB continued to deform, tendon slippage increased also, but it was still relatively little. The complete set of the measurement can be found in the Appendix A, Table A.74.

Figure 4.93 shows the strain of bars C and N was minor at both cracking and ultimate load stages. This condition existed mainly because 5SB15M-2.0-8-ND was not subjected to in-plane stress. The complete set of the measurement can be found in the Appendix A, Table A.75.

Figure 4.94 shows in-plane concrete smeared strain. Until ultimate load stage, strain measurements were negligible. The recorded noise of strain might occur owing to vibration during the test and the delicate sensitivity of LVDTs. These measurements confirmed that the behavior of 5SB15M-2.0-08-ND was not governed by in-plane (shear) stress. The complete set of the measurement can be found in the Appendix A, Table A.73.

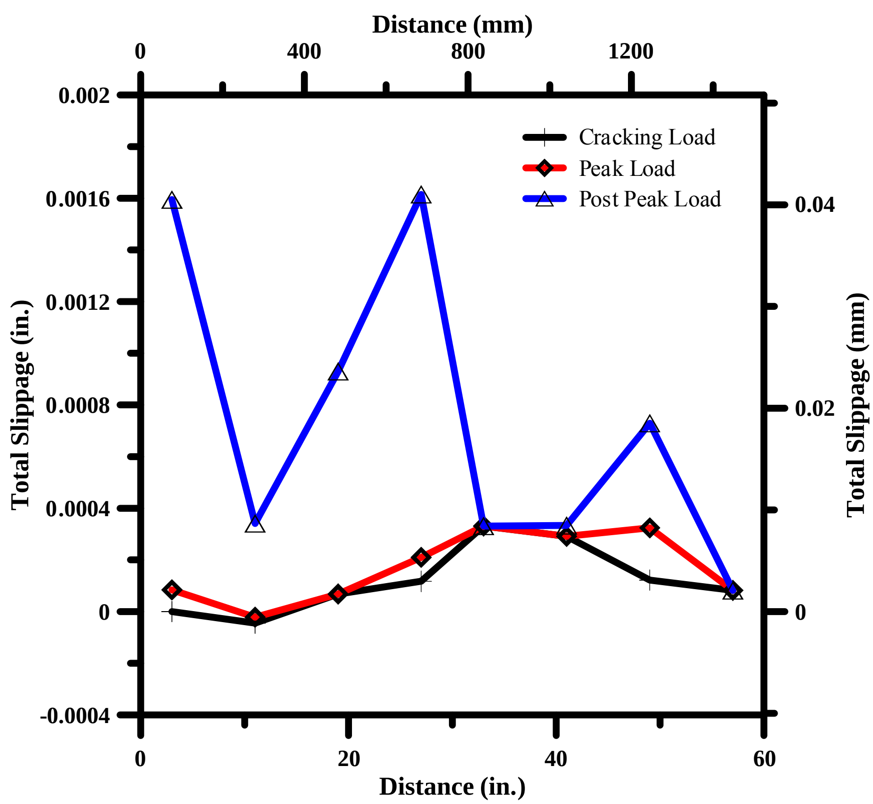


Figure 4.92 Total Slippage vs. Distance of 5SB15M-2.0-08-ND

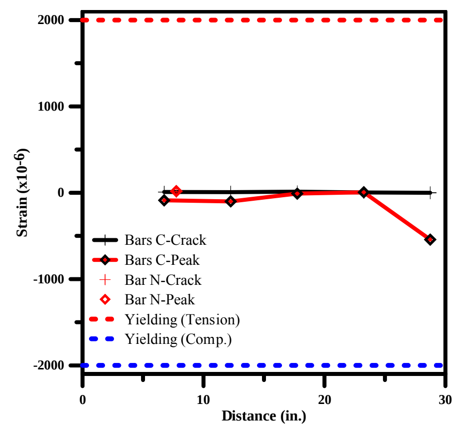
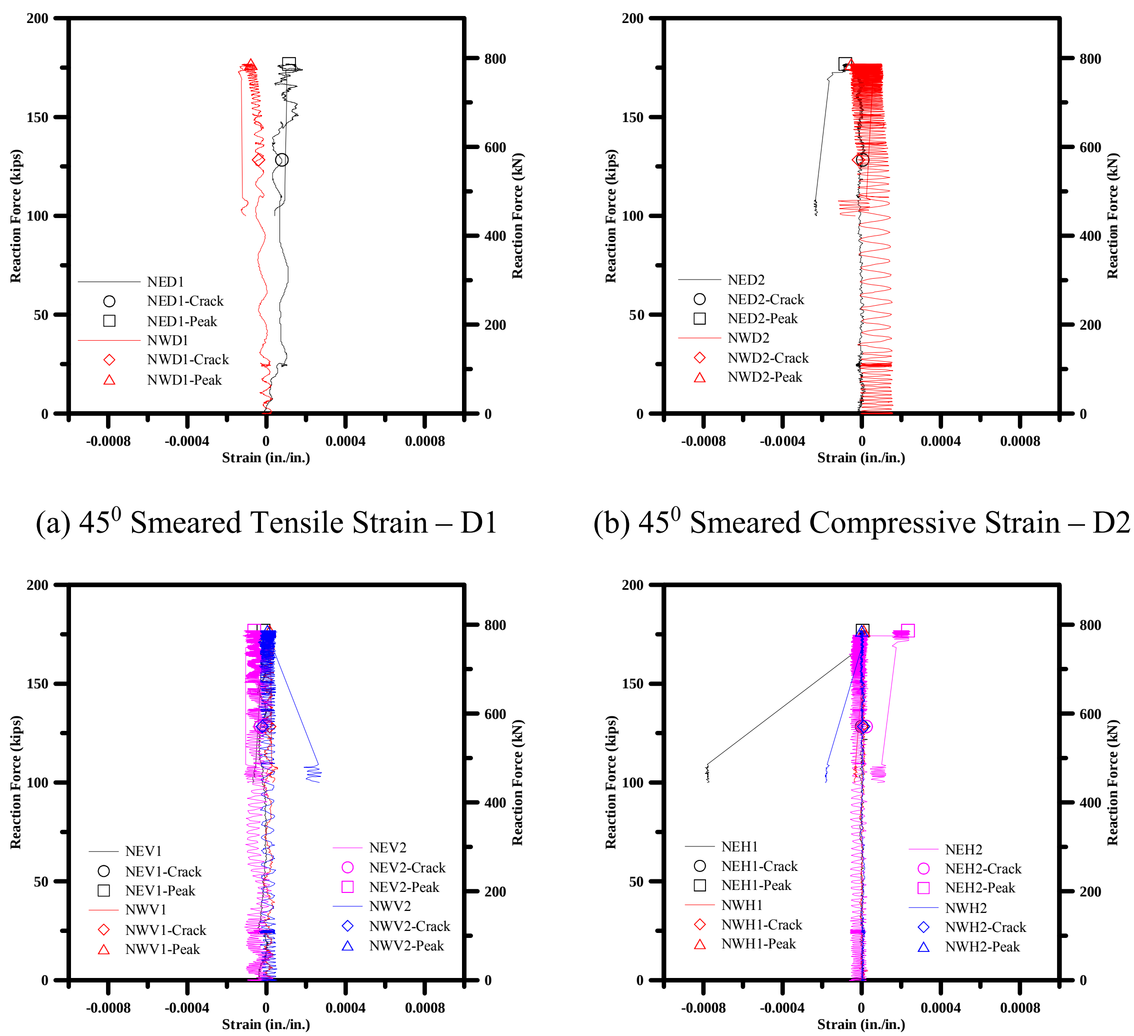


Figure 4.93 Strain in Stirrups of 5SB15M-2.0-08-ND



(a) 45^0 Smeared Tensile Strain – D1 (b) 45^0 Smeared Compressive Strain – D2

(c) Smeared Vertical Strain – V1 and V2 (d) Smeared Horizontal Strain – H1 and H2

Figure 4.94 Reaction Force vs. Concrete Smeared Strain of 5SB15M-2.0-08-ND

Figure 4.95 shows a comparison of reaction force vs. the deflection between 5SB15M-1.2-8-ND and 5SB15M-2.0-8-ND. These curves show two extinct failure modes: 5SB15M-2.0-8-ND has ductile behavior owing to flexure failure, and 5SB15M-1.2-8-ND has brittle failure owing to anchorage bond failure. The strength of both 5SB15M-1.2-8-ND and 5SB15M-2.0-8-ND is relatively the same owing to tendon slippage. The test data of 5SB15M-1.2-8-ND and 5SB15M-2.0-8-ND can be found in the Appendix A, Table A.68 and A.72, respectively.

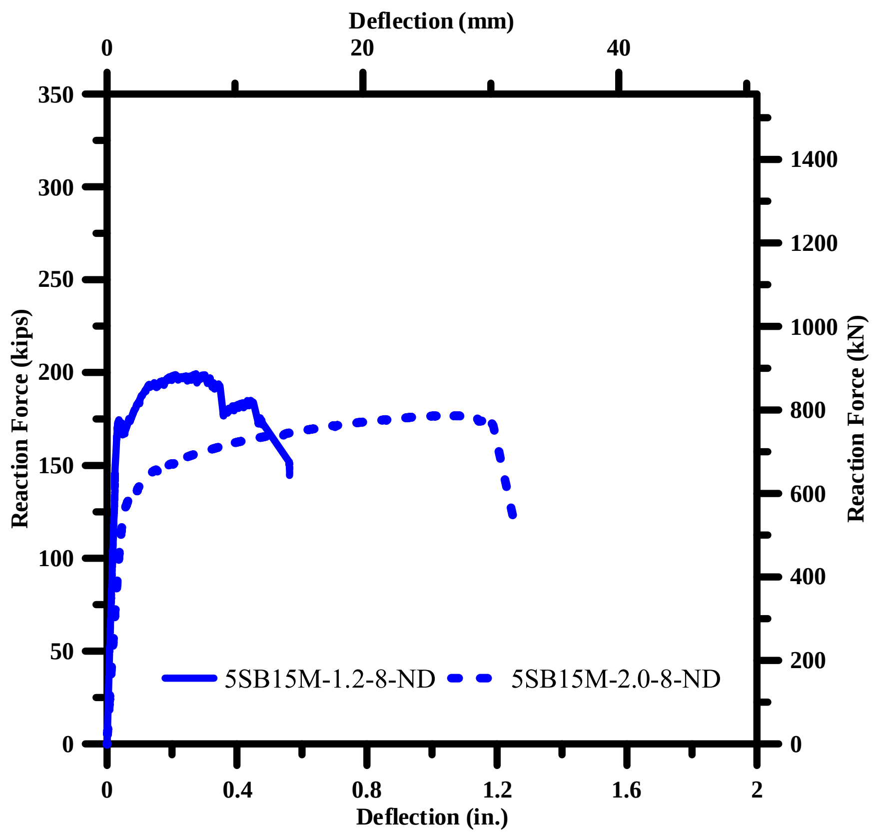


Figure 4.95 Reaction Force – Deflection Relationships of 5SB15M-1.2-8-ND and 5SB15M-2.0-8-ND

4.4.4 5SB15N-1.2-8-ND and 5SB15N-2.0-8-ND

5SB15N-1.2-8-ND was tested at *a/d* = 1.23. The first crack occurred when the total reaction force was 165 kips; the crack pattern at this stage is shown in Figures 4.96(a) and (b). 5SB15N-1.2-8-ND continued to take up additional load; it reached its capacity at 189 kips. The major cracks formed at the end face, seen in Figure 4.96(d), and some cracks formed on west and east sides of 5SB15N-1.2-8-ND, seen in Figures 4.96(c) and (e), respectively. The cracks that formed on west and east sides of 5SB15N-1.2-8-ND were beyond the testing span in the longitudinal direction because the bending in the transverse direction was dominant over the bending in the longitudinal direction. The maximum measured crack width at the ultimate load stage was 0.0197-in.

The noise owing to the slippage of tendons was heard during the test in a random sequence. The reaction force was reduced as the tendons slipped, and it increased again as the tendons gained the bond; this process continued until the tendons completely lost their bond. Figure 4.97 shows tendon slippage recorded during the test. At cracking load stage, tendon slippage was significant; it kept increasing as the load increased, and after it reached its ultimate capacity, the deflection of 5SB15N-1.2-8-ND, plus its cracking, caused tendon slippage to increase dramatically. The complete set of the measurement can be found in the Appendix A, Table A.78.

Figure 4.98 shows in-plane concrete smeared strain measured by the rosette LVDT. The strain shown in Figure 4.98 was basically noise recorded during the test, i.e., vibration or sensitivity of LVDTs. One can expect that the measured strain was negligible because the 5SB15N-1.2-8-ND was not subjected to in-plane shear. The complete set of the measurement can be found in the Appendix A, Table A.77.

At Cracking Loading | At Ultimate Loading

(a) West Side of 5SB15N-1.2-08-ND

(c) West Side of 5SB15N-1.2-08-ND

No crack was observed at end face;
no photo was taken

(d) End Face of 5SB15N-1.2-08-ND

(b) East Side of 5SB15N-1.2-08-ND

(e) East Side of 5SB15N-1.2-08-ND

Figure 4.96 Crack Patterns of 5SB15N-1.2-8-ND at Cracking Load and Ultimate Load.

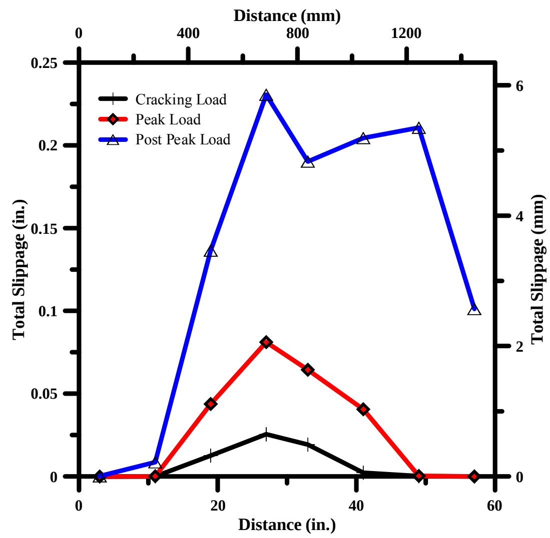
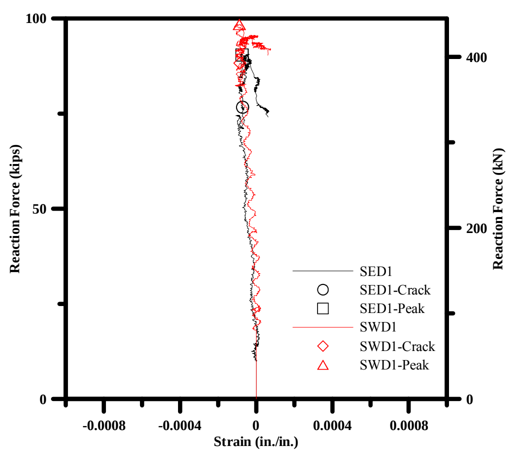
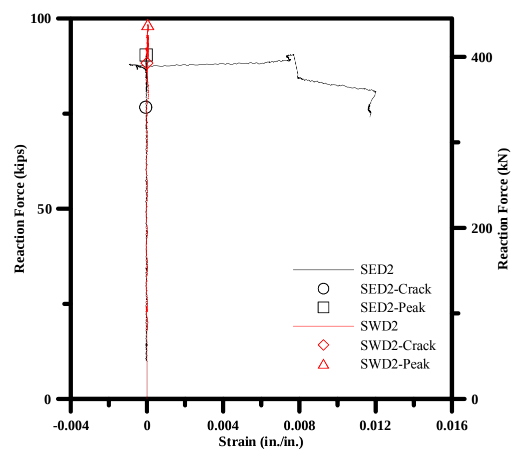


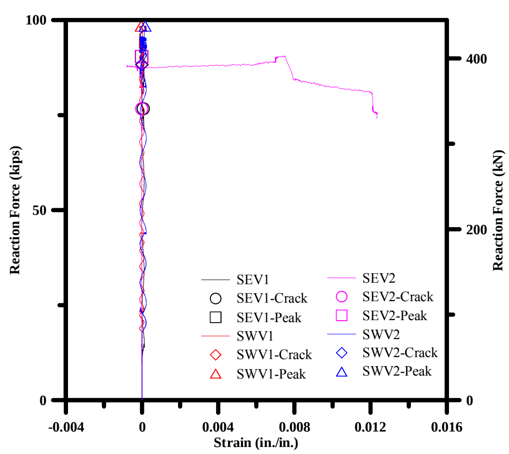
Figure 4.97 Total Slippage vs. Distance of 5SB15N-1.2-8-ND



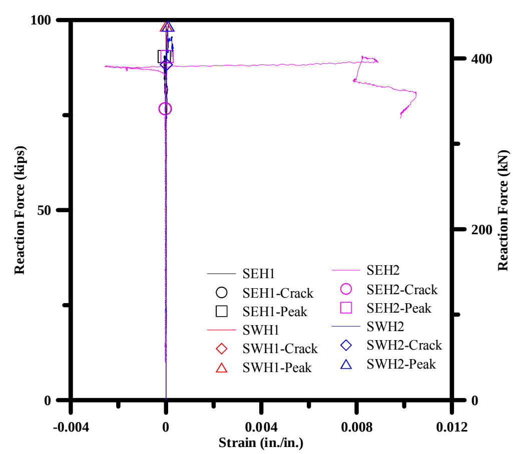
(a) 45^0 Smeared Tensile Strain – D1



(b) 45^0 Smeared Compressive Strain – D2



(c) Smeared Vertical Strain – V1 and V2



(d) Smeared Horizontal Strain – H1 and H2

Figure 4.98 Reaction Force vs. Concrete Smeared Strain of 5SB15N-1.2-8-ND

5SB15N-2.0-8-ND was tested at *a/d* = 1.96. The first crack occurred on west and east sides of 5SB15N-2.0-8-ND simultaneously when the reaction force was 130 kips, as shown in Figures 4.99(a) and (b), respectively. No crack was observed at the end face of 5SB15N-2.0-8-ND. The cracks propagated toward the top fiber and 5SB15N-2.0-8-ND reached its capacity at 176 kips. At the ultimate stage, the cracks formed on west and east sides of 5SB15N-2.0-8-ND and got wider at the bottom fiber, seen in Figures 4.99(c) and (d), respectively; no crack was formed at the end face of 5 SB15N-2.0-8-ND. At ultimate load stage, the maximum measured crack width was 0.0787-in., and concrete was crushed at the top fiber.

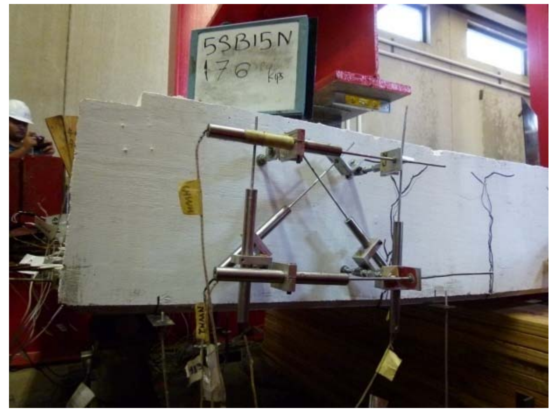
Figure 4.100 shows the measured slippage of tendons recorded during the test. The figure shows that tendon slippage at cracking load stage was relatively negligible. Three tendons slipped at ultimate stage, however, since the concrete crushed at the top fiber; therefore, tendon slippage did not increase significantly after the ultimate stage. Although three tendons showed relatively significant slippage, however, the behavior was governed by a ductile – flexural behavior. The complete set of the measurement can be found in the Appendix A, Table A.81.

Figure 4.101 shows in-plane concrete smeared strain measured by the rosette LVDT. The strain shown in Figure 4.101 was noise recorded during the test, i.e., vibration or sensitivity of LVDTs. One can expect that the measured strain was negligible because the 5SB15N-2.0-8-ND was not subjected to in-plane shear. The complete set of the measurement can be found in the Appendix A, Table A.80.

At Cracking Loading

At Ultimate Loading

(a) West Side of 5SB15N-2.0-08-ND



(c) West Side of 5SB15N-2.0-08-ND

(b) East Side of 5SB15N-2.0-08-ND

(d) East Side of 5SB15N-2.0-08-ND

Figure 4.99 Crack Patterns of 5SB15N-2.0-08-ND at Cracking Load and Ultimate Load

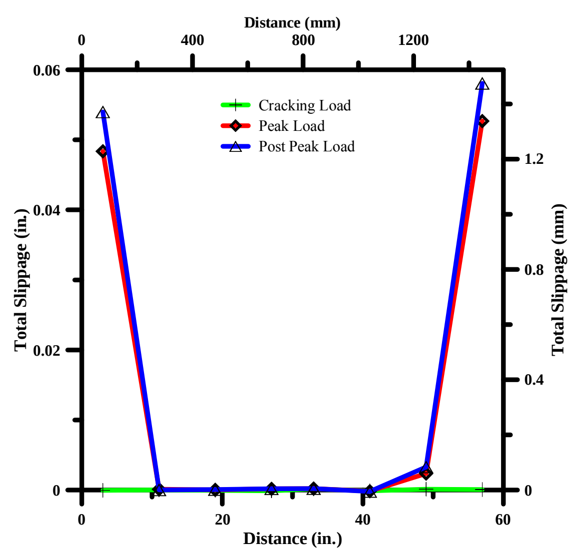
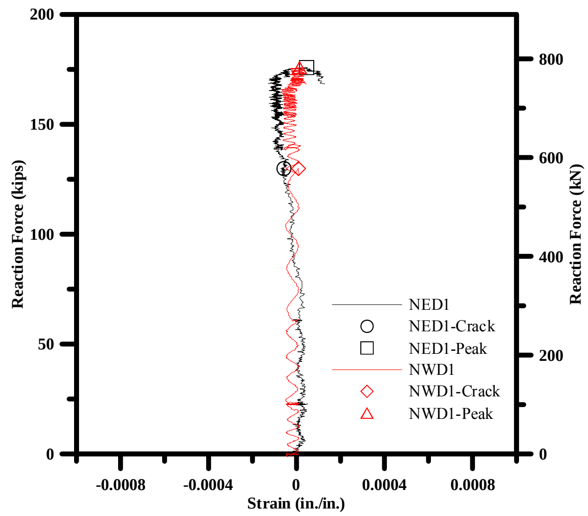
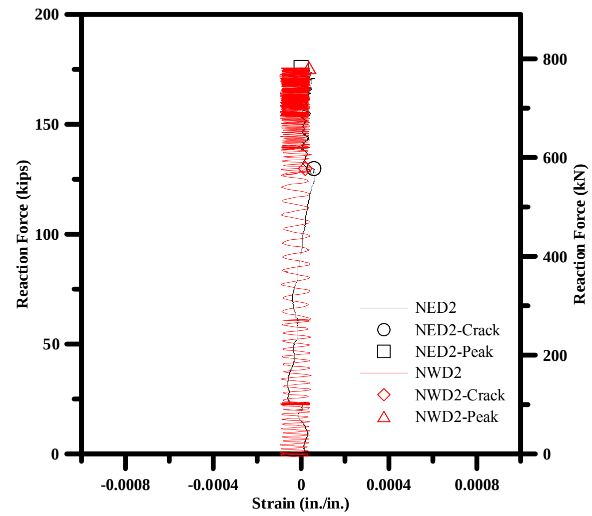


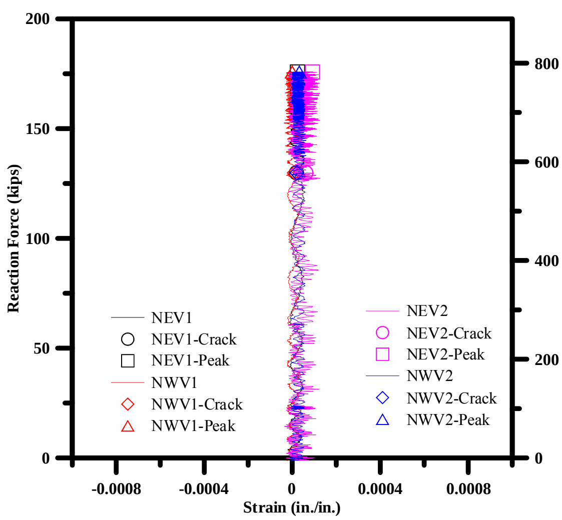
Figure 4.100 Total Slippage vs. Distance of 5SB15N-2.0-08-ND



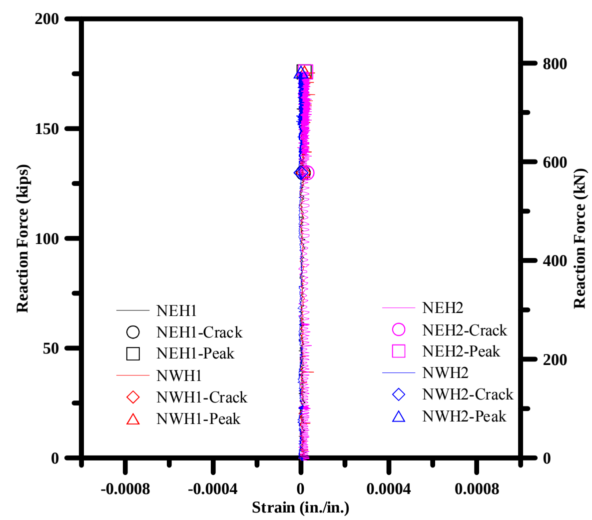
(a) 45^0 Smeared Tensile Strain – D1



(b) 45^0 Smeared Compressive Strain – D2



(c) Smeared Vertical Strain – V1 and V2



(d) Smeared Horizontal Strain – H1 and H2

Figure 4.101 Reaction Force vs. Concrete Smeared Strain of 5SB15N-2.0-8-ND

Figure 4.102 shows a comparison of reaction force vs. net deflection relationship between 5SB15N-1.2-8-ND and 5SB15N-2.0-8-ND. Figure 4.102 shows that 5SB15N-1.2-8-ND failed in brittle manner owing to anchorage bond failure; 5SB15N-2.0-8-ND failed in ductile behavior owing to flexure failure. The strength between 5SB15N-1.2-8-ND and 5SB15N-2.0-8-ND was relatively close, though the *a/d* was reduced from 2.0 to

1.2, when slippage occurred at the end of 5SB15N-1.2-8-ND. The test data of 5SB15N-1.2-8-ND and 5SB15N-2.0-8-ND can be found in the Appendix A, Table A.76 and A.79, respectively.

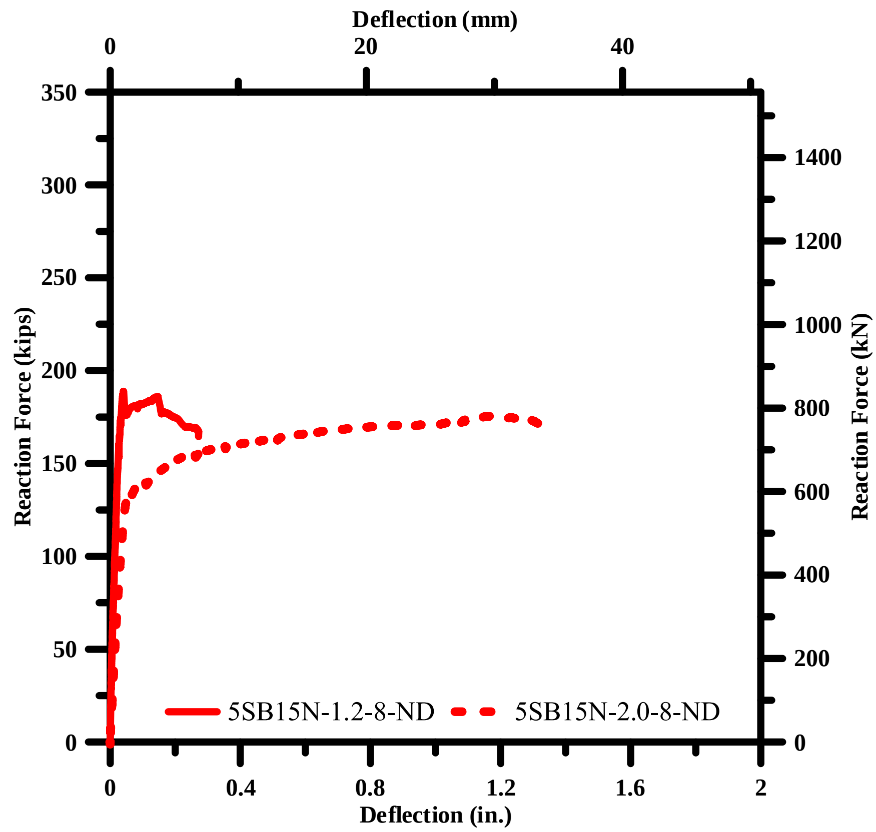


Figure 4.102 Reaction Force – Deflection Relationships of 5SB15N-1.2-8-ND and 5SB15N-2.0-8-ND

4.4.5 5SB15T-1.2-14-D and 5SB15T-2.0-14-D

5SB15T-1.2-14-D was tested at $a/d = 1.21$. The first crack occurred simultaneously on west and east sides of 5SB15T-1.2-14-D when the total reaction force was 320 kips, as shown in Figures 4.103(a) and (c), respectively. At this stage, no crack was observed at the end face of 5SB15T-1.2-14-D, as shown in Figure 4.103(b). 5SB15T-1.2-14-D reached its capacity when the total reaction force was 347 kips. The major cracks formed at the end face, seen in Figure 4.103(e), and some cracks formed on the west and east sides of

5SB15T-1.2-14-D, seen in Figures 4.103(d) and (f), respectively. The cracks that formed on west and east sides of 5SB15T-1.2-14-D were beyond the testing span in the longitudinal direction because the bending in the transverse direction was dominant over bending in the longitudinal direction. The maximum measured crack width at ultimate load stage was 0.0236-in.

Figure 4.104 shows total tendon slippage vs. distance (location from side face of TPSB) of 5SB15T-1.2-14-D. This figure shows clearly that slippage occurred at the cracking load stage. As the load increased, the slippage increased significantly, and at post peak stage, all the tendons slipped. Up to the ultimate stage, it can be seen that the slippage of exterior tendons is smaller than the slippage of the interior tendons. This can happen because the supports provided compression force to concrete. The complete set of the measurement can be found in the Appendix A, Table A.83.

The strain in the interior prestressing steel is shown in Figure 4.105. So few strain gauges were broken during construction that there was no data recorded during the test. Figure 4.105 shows that the maximum strain was less than 0.0035. This number added to the decompression strain (0.005~0.007) resulted in the maximum strain of tendons at an ultimate loading stage of about one percent ($f_s \approx f_y \approx 0.7 f_{pu}$), which meant that the stress of tendons could not reach f_{ps} (f_{ps} = stress in prestressing steel at nominal flexural strength, $f_{ps} \approx 0.9 - 0.95 f_{pu}$). The complete set of the measurement can be found in the Appendix A, Table A.84.

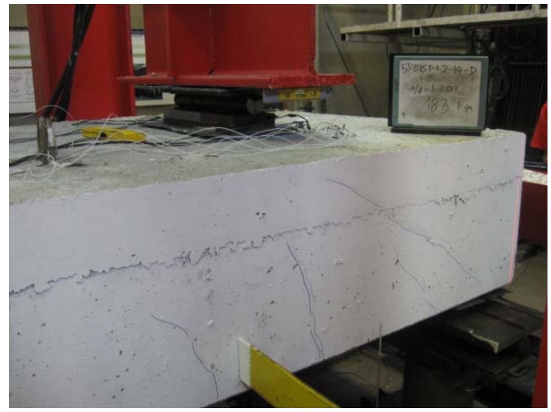
At Cracking Loading

(a) West Side of 5SB15T-1.2-14-D

(b) End Face of 5SB15T-1.2-14-D

(c) East Side of 5SB15T-1.2-14-D

At Ultimate Loading



(d) West Side of 5SB15T-1.2-14-D

(e) End Face of 5SB15T-1.2-14-D

(f) East Side of 5SB15T-1.2-14-D

Figure 4.103 Crack Patterns of 5SB15T-1.2-14-D at Cracking Load and Ultimate Load

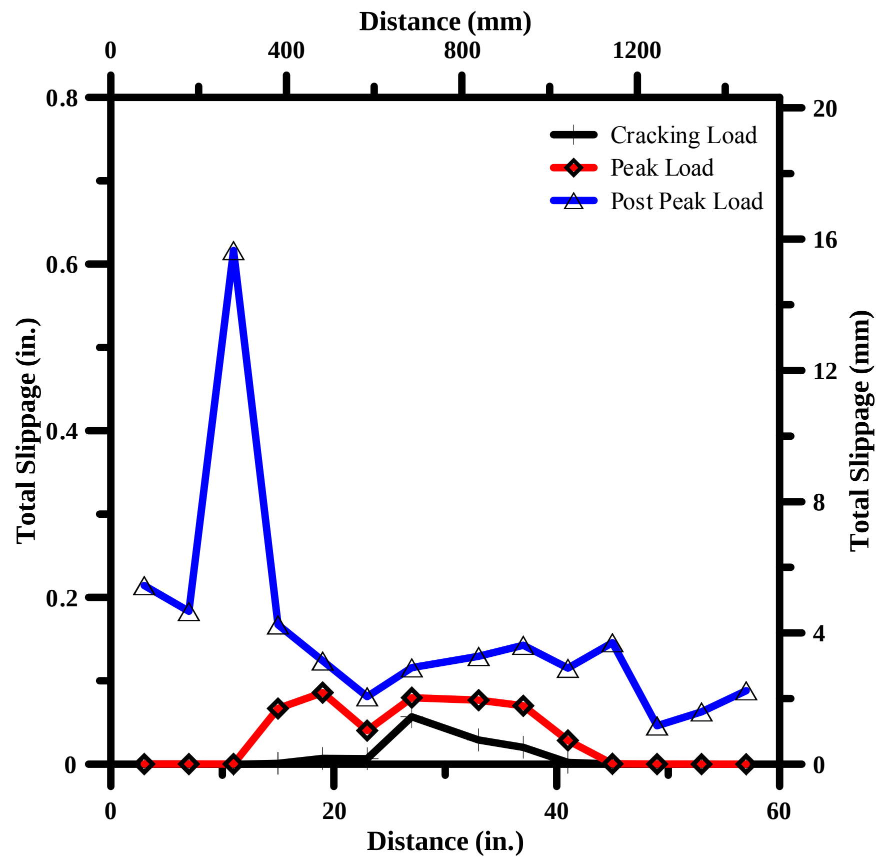
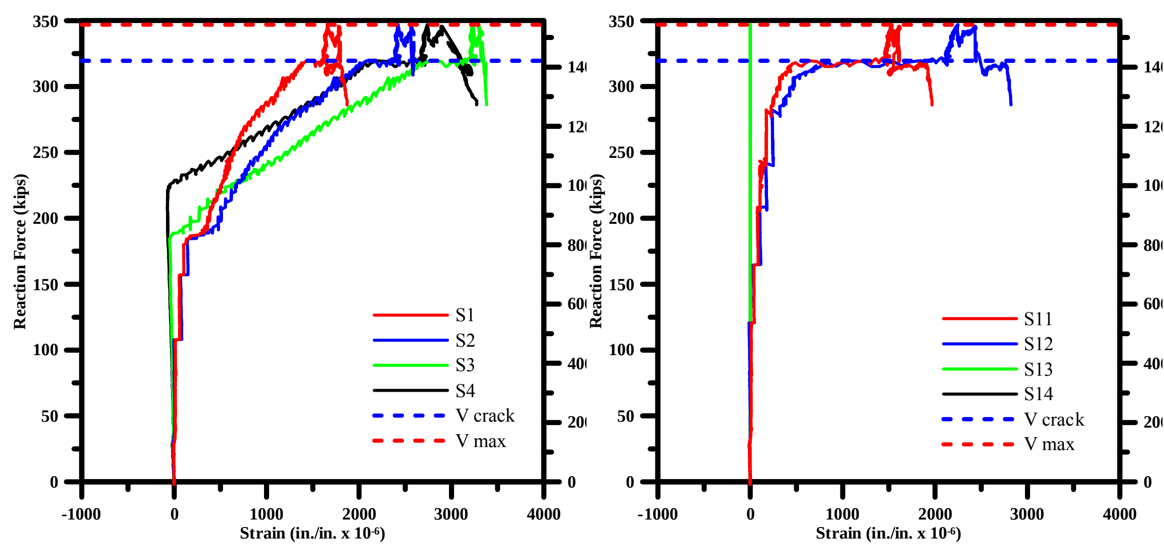


Figure 4.104 Total Slippage vs. Distance of 5SB15T-1.2-14-D



(a) Strain of Interior Tendon 1

(b) Strain of Interior Tendon 2

Figure 4.105 Strain of Interior Tendon of 5SB15T-1.2-14-D

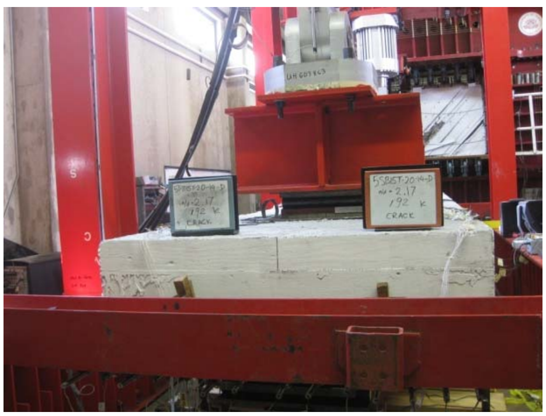
The north end, 5SB15T-2.0-14-D, was tested at *a/d* = 2.17. The first crack occurred simultaneously on west and east sides of 5SB15T-2.0-14-D when the reaction force was 192 kips, as shown in Figures 4.106(a) and (c), respectively. No crack was observed at the end face, as shown in Figure 4.106(b). The cracks developed toward the top fiber, and 5SB15T-2.0-14-D reached its capacity at 303 kips. The crack patterns on west and east sides of 5SB15T-2.0-14-D at ultimate stage can be seen in Figures 4.106(d) and (f), respectively; no crack was observed at the end face of 5SB15T-2.0-14-D, as shown in Figure 4.106(e). The maximum measured crack width at ultimate load stage was 0.0787-in. Concrete was crushed at the top fiber.

Tendon slippage was observed and recorded during the test, as shown in Figure 4.107; this slippage was negligible throughout the entire test. Only one tendon slipped during the test; however, this slippage was relatively small, and did not govern the failure of 5SB15T-2.0-14-D. The complete set of the measurement can be found in the Appendix A, Table A.86.

Figure 4.108 shows strain measured by the strain gauges installed on the exterior strands. The maximum strain at ultimate load stage was about 0.003. This number, added to the decompression strain (0.005~0.007), resulted in the maximum strain of exterior tendons at ultimate loading stage of about one percent, which meant that the stress of the exterior tendons could not reach f_{ps} (stress in prestressing steel at nominal flexural strength, $f_{ps} \approx 0.9 - 0.95 f_{pu}$). The complete set of the measurement can be found in the Appendix A, Table A.87.

At Cracking Loading

(a) West Side of 5SB15T-2.0-14-D



(b) End Face of 5SB15T-2.0-14-D

(c) East Side of 5SB15T-2.0-14-D

At Ultimate Loading

(d) West Side of 5SB15T-2.0-14-D

(e) End Face of 5SB15T-2.0-14-D

(f) East Side of 5SB15T-2.0-14-D

Figure 4.106 Crack Patterns of 5SB15T-2.0-14-D at Cracking Load and Ultimate Load

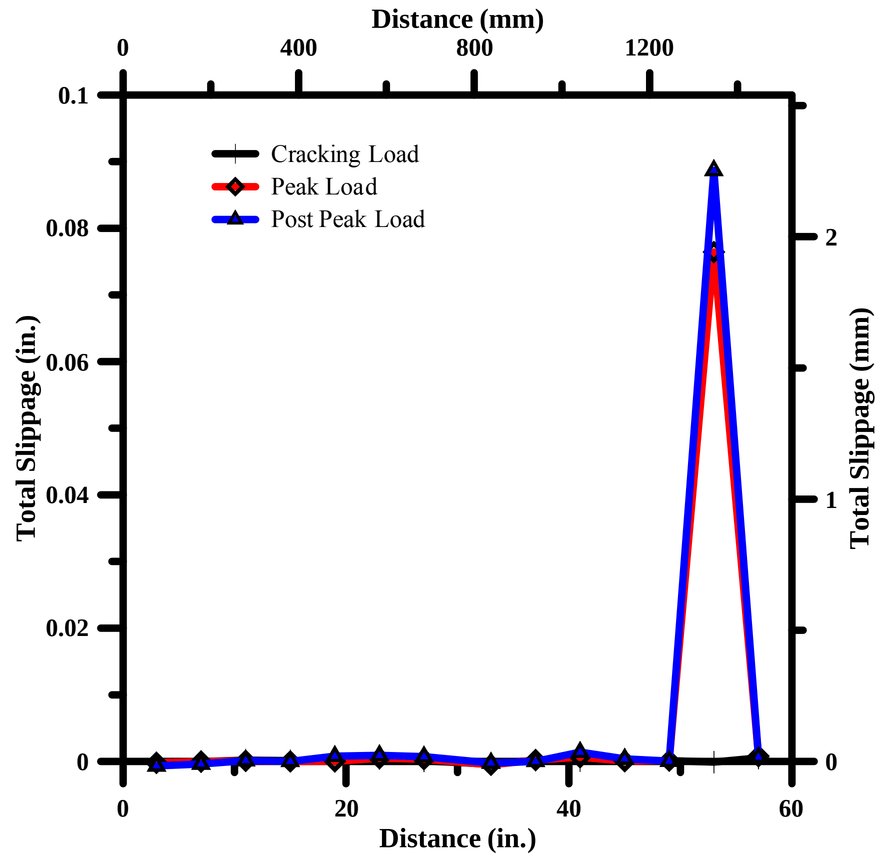
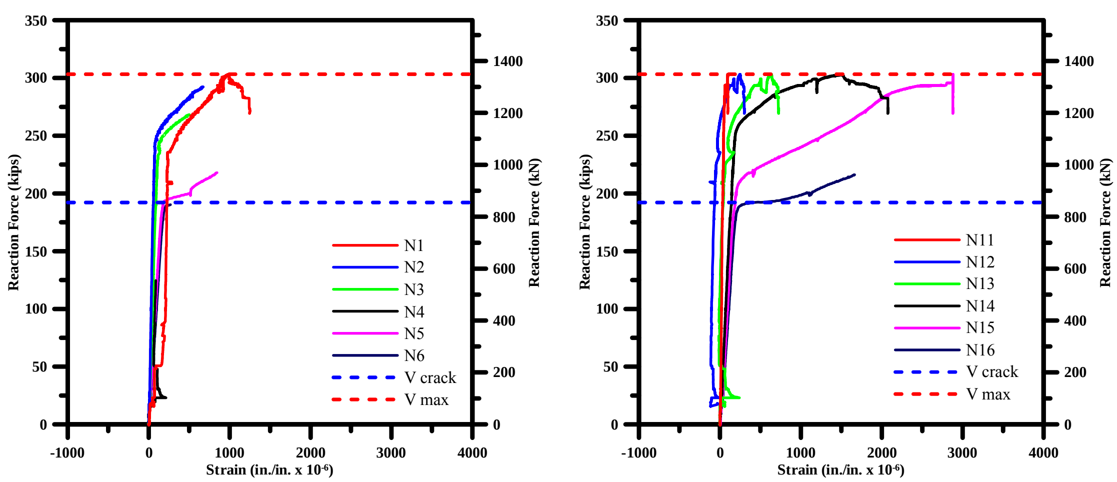


Figure 4.107 Total Slippage vs. Distance of 5SB15T-2.0-14-D



(a) Strain of Exterior Tendon 1 (b) Strain of Exterior Tendon 2

Figure 4.108 Strain of Exterior Tendon of 5SB15T-2.0-14-D

Figure 4.109 shows a comparison of reaction force vs. net deflection relationship between 5SB15T-1.2-14-D and 5SB15T-2.0-14-D. 5SB15T-1.2-14-D failed in a brittle manner owing to anchorage bond failure; 5SB15T-2.0-14-D failed in ductile behavior owing to flexure failure. The strength between 5SB15T-1.2-14-D and 5SB15T-2.0-14-D was relatively close, though the *a/d* decreased from 2.0 to 1.2, owing to tendon slippage, which occurred at the end of 5SB15T-1.2-14-D. The test data of 5SB15T-1.2-14-D and 5SB15T-2.0-14-D can be found in the Appendix A, Table A.82 and A.85, respectively.

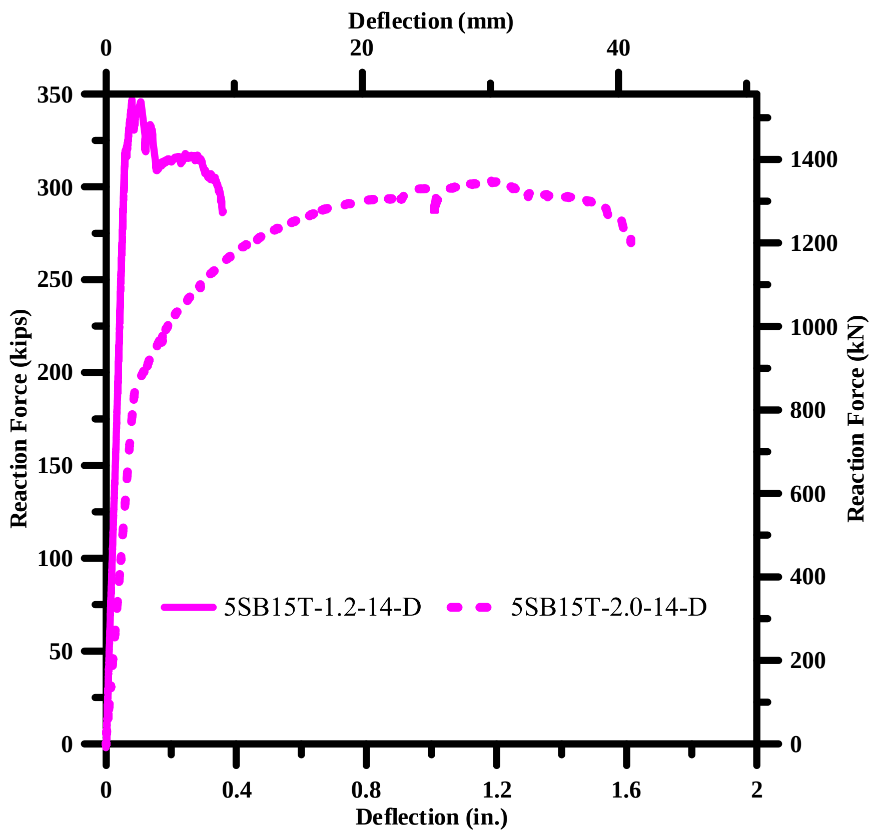
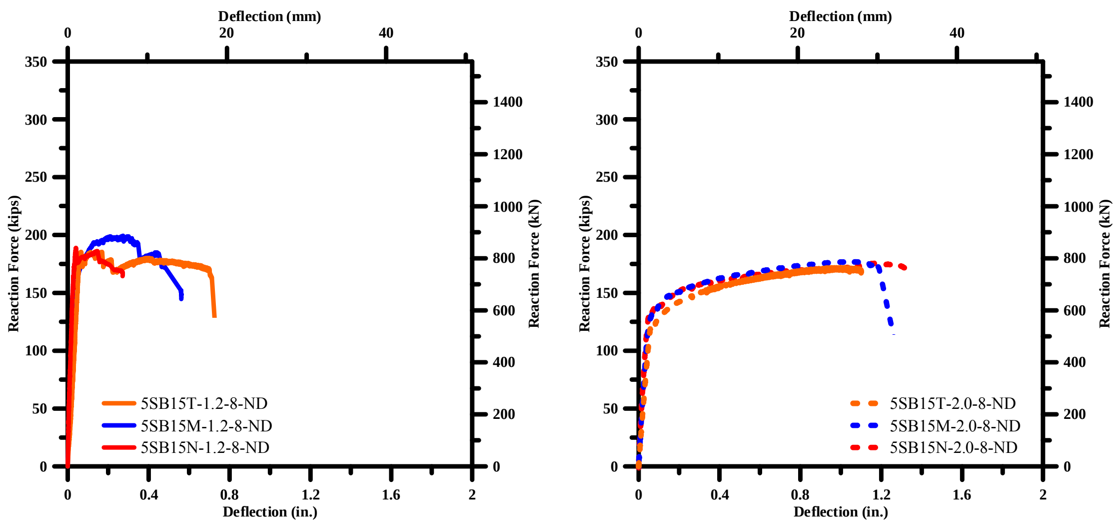


Figure 4.109 Reaction Force – Deflection Relationships of 5SB15T-1.2-14-D and 5SB15T-2.0-14-D

4.4.6 The Effect of Amount of Stirrups

The comparison of reaction force vs. deflection curves of 5SB15T-1.2-8-ND, 5SB15M-1.2-8-ND, and 5SB15N-1.2-8-ND is shown in Figure 4.110(a). These curves are all governed by anchorage-bond failure. Adding to the number of stirrups can create a larger deflection; however, it cannot prevent anchorage bond failure. This type of failure mode, anchorage bond failure, is brittle and undesirable.

The comparison of reaction force vs. deflection curves of 5SB15T-2.0-8-ND, SB15M-2.0-8-ND, and 5SB15N-2.0-8-ND is shown in Figure 4.110(b). The clear trend shown is that adding to the number of stirrups does not affect the performance of Group C TPSBs with *a/d* ≈ 2.0 because they are all governed by flexure.



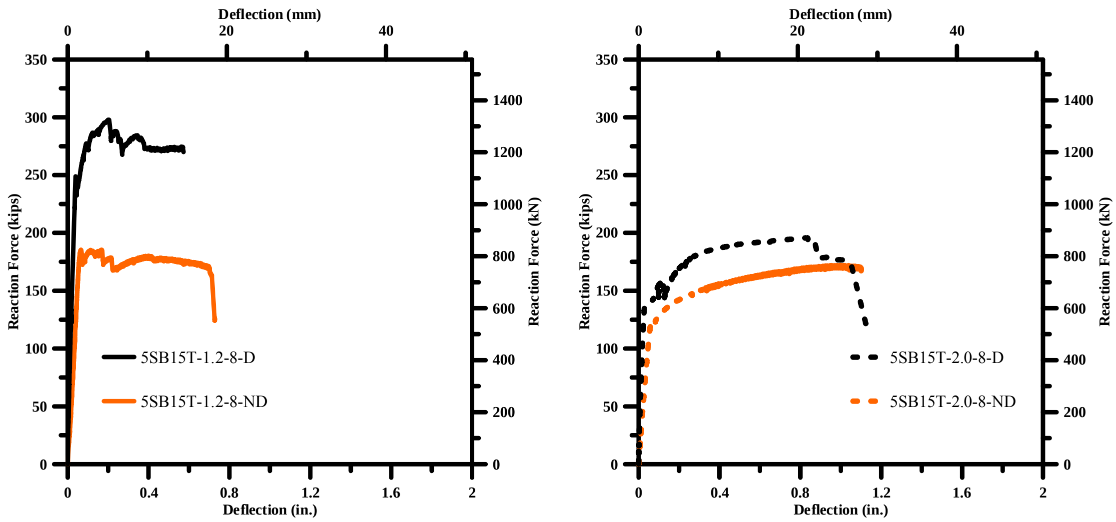
(a) *a/d* = 1.2 (b) *a/d* = 2.0

Figure 4.110 Comparison of Reaction Force vs. Deflection Among 5SB15T, 5SB15M, and 5SB15N

4.4.7 The Effect of 5 in. CIP Deck

The comparison of reaction force vs. deflection curves of 5SB15T-1.2-8-D and 5SB15T-1.2-8-ND is shown in Figure 4.111(a). Adding 5-in. CIP deck does not prevent anchorage bond failure; however, by adding 5-in. CIP deck, the capacity of the anchorage bond increases, owing to the increase of the development length provided.

The comparison of reaction force vs. deflection curves of 5SB15T-2.0-8-D and 5SB15T-2.0-8-ND is shown in Figure 4.111(b). The addition of 5-in. deck did not affect the failure mode, but it increased the strength, because the effective depth increased.



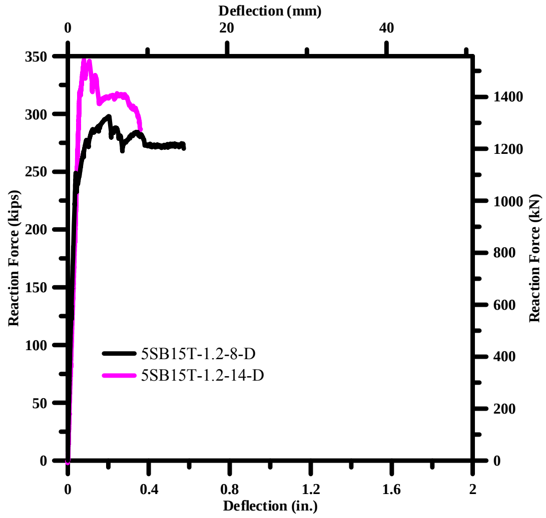
(a) $a/d = 1.2$ (b) $a/d = 2.0$

Figure 4.111 Comparison of Reaction Force vs. Deflection Between 5SB15T-1.2-8-D and 5SB15T-1.2-8-D and 5SB15T-1.2-8-ND and 5SB15T-1.2-8-ND

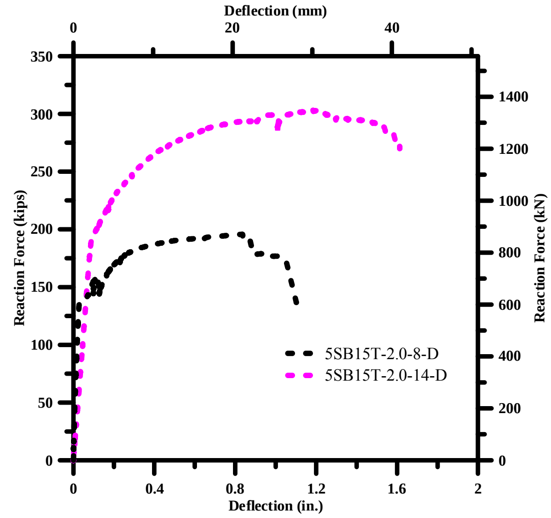
4.4.8 The Effect of Number of Strands

Figure 4.112(a) shows the comparison of reaction force vs. deflection curves of 5SB15T-1.2-8-D and 5SB15T-1.2-14-D. Adding to the number of strands increased the strength; however, the failure mode for both 5SB15T-1.2-10-D and 5SB15T-1.2-14-D remained the same.

Figure 4.112(b) shows the comparison of reaction force vs. deflection curves of 5SB15T-2.0-8-D and 5SB15T-2.0-14-D. Both 5SB15T-2.0-8-D and 5SB15T-2.0-14-D exhibited ductile behavior. Since they are governed by flexure, adding to the number of strands can improve their flexural capacity.



(a) $a/d = 1.2$



(b) $a/d = 2.0$

Figure 4.112 Comparison of Reaction Force vs. Deflection between 5SB15T-1.2-8-D and 5SB15T-2.0-8-D and 5SB15T-1.2-14-D and 5SB15T-2.0-14-D

CHAPTER 5 FLEXURAL AND SERVICEABILITY ANALYSIS

5.1 Flexural Analysis

Chapter 4 shows that the two governing failure modes for Thin Prestressed Slab Beams (TPSBs) are anchorage bond and flexure failures. Anchorage bond strength is greatly influenced by the development length provided. When the development length is short, i.e., a short shear span, the stress in prestressing steel cannot develop to nominal stress f_{ps}. When the development length is sufficient, however, the prestressing steel can develop to nominal stress f_{ps}.

Since the main concern of this project was the study of shear behavior, the shear force at the support when the beam reaches its flexural capacity (moment nominal) V_f was used as a comparative to the reaction force. The test setup can be modeled as shown in Figure 5.1.

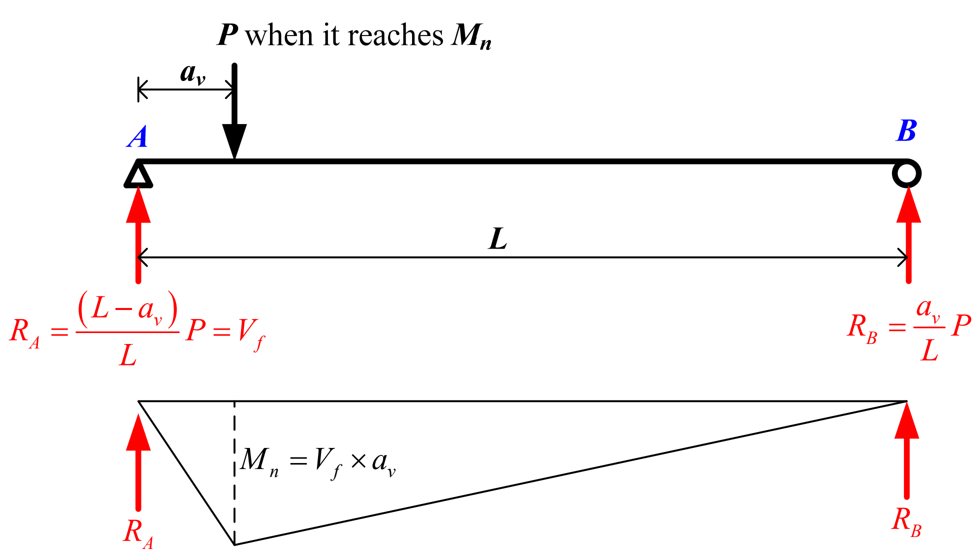


Figure 5.1 Structural Modeling and Moment Diagram of Test Setup

Table 5.1 shows the ultimate reaction force, flexural strength per AASHTO (2010), flexural strength ratio, and failure mode. There is no AASHTO (2010) provision or guideline to predict the strength of members loaded within the development length; therefore, the prediction in Table 5.1 is based on the assumption that the tendon stress could reach nominal stress, and the predicted strength serves as the upper-bound solution. Table 5.1 shows that AASHTO (2010) overestimates the strength of TPSBs failed in anchorage bond, and that AASHTO (2010) predicts well for TPSBs failed in flexure. The average flexural strength ratio per AASHTO (2010) is 0.84 with a coefficient of variance of 29 percent. These numbers represent an AASHTO (2010) flexural strength provision that is not conservative because it does not take anchorage bond failure into account.

5.2 Serviceability Analysis

In prestressed concrete members, it is important to check the performance of the members under service load. Bridges are expected to behave elastically under service load so that minimum or zero maintenance is required during their lifespan. Cracking and ultimate loads of the tests were compared with service and ultimate loads of design of TPSBs; two major aspects, shear and bending moment, were checked. To compare the most extreme case, the maximum span that could be provided by a given amount of tendons needed to be verified. Table 5.2 shows the maximum span corresponding to the number of tendons per software PSTR14 version 5.2.

Table 5.1 Reaction Force, Flexural Strength, Flexural Strength Ratio, and Failure Mode

Group	Specimen ID	d_p *(in)*	ρ_p	*a/d*	f_c' (*ksi*)	V_{test} [1] (kips)	V_f [2] (kips)	$\frac{V_{test}}{V_f}$ [3]	Failure Mode*
A	5SB8T-1.2-14-D	10.5	0.341%	1.24	10.3	259	424	0.61	AB
	5SB8T-2.0-14-D	10.5	0.341%	1.95	10.3	215	269	0.80	AB
	5SB8M-1.2-14-D	10.5	0.341%	1.24	9.9	249	422	0.59	AB
	5SB8M-2.0-14-D	10.5	0.341%	1.95	9.9	227	268	0.85	AB
	5SB8T-1.2-14-D^{L**}	10.5	0.341%	1.26	10.2	268	417	0.64	AB
	5SB8T-2.0-14-D^{L}	10.5	0.341%	1.98	10.2	240	265	0.91	AB
	5SB8M-1.2-14-D^{L}	10.5	0.341%	1.24	9.8	222	422	0.53	AB
	5SB8M-2.0-14-D^{L}	10.5	0.341%	1.98	9.8	193	264	0.73	AB
B	5SB12T-1.2-10-D	14.5	0.177%	1.23	10.7	266	320	0.83	AB
	5SB12T-2.0-10-D	14.5	0.177%	1.94	10.7	249	203	1.23	AB
	5SB12T-1.2-10-ND	9.6	0.267%	1.25	9.6	175	305	0.57	AB
	5SB12T-1.6-10-ND	9.6	0.267%	1.62	9.6	187	235	0.80	AB
	5SB12M-1.2-10-ND	9.6	0.267%	1.16	11.1	196	332	0.59	AB
	5SB12M-1.6-10-ND	9.6	0.267%	1.63	11.1	191	236	0.81	AB
	5SB12N-1.2-10-ND	9.6	0.267%	1.2	10.9	136	321	0.42	AB
	5SB12N-1.6-10-ND	9.6	0.267%	1.63	10.9	204	236	0.86	AB
	5SB12T-1.2-14-D	14.5	0.247%	1.23	9.6	275	436	0.63	AB
	5SB12T-2.0-14-D	14.5	0.247%	2.00	9.6	319	268	1.19	AB
C	5SB15T-1.2-08-D	17.5	0.117%	1.15	9.7	298	277	1.07	AB
	5SB15T-2.0-08-D	17.5	0.117%	2.2	9.7	196	145	1.35	F
	5SB15T-1.2-08-ND	12.5	0.164%	1.23	8.5	185	254	0.73	AB
	5SB15T-2.0-08-ND	12.5	0.164%	2.02	8.5	172	155	1.11	F
	5SB15M-1.2-08-ND	12.5	0.164%	1.25	10.5	199	253	0.79	AB
	5SB15M-2.0-08-ND	12.5	0.164%	1.99	10.5	177	159	1.12	F
	5SB15N-1.2-08-ND	12.5	0.164%	1.23	9.9	189	256	0.74	AB
	5SB15N-2.0-08-ND	12.5	0.164%	1.96	9.9	176	161	1.10	F
	5SB15T-1.2-14-D	17.5	0.205%	1.21	9.1	347	449	0.77	AB
	5SB15T-2.0-14-D	17.5	0.205%	2.17	9.3	303	250	1.21	F
							Ave	0.84	
							COV	0.29	

* AB = Anchorage Bond; F= Flexure
**L = 4-ft. longitudinal bar next to each tendon at end zone
[1] V_{test} = Reaction Force from the Tests
[2] V_f = Flexural Strength per AASHTO

Table 5.2 Maximum Span Corresponding to the Number of Tendons per PSTR14

Case	Height	Number of Tendons	Maximum Span (ft.)
I	15-in.+5-in. deck	8	26
II		14	35
III	15 in.	8	22
IV	12-in. +5-in. deck	10	27
V		14	31
VI	12 in.	10	21
VII*	8-in. +5-in. deck	14	24

* The detailed calculation for this case is provided in the next sections

Table 5.3 summarizes the strength ratios of test or analysis results vs. design outcomes. Table 5.3 shows a consistent trend: all strength ratios are greater than one, which means all cases (cases I to VII) of the TPSBs satisfy the design requirements for service and ultimate states. The shear and moment checks at the section closest to the support have great strength ratios because the loading analysis results are compared with the test results. The ratios indicate TPSBs will not crack under service state and will not fail under ultimate state. The moment check at mid-span has ratios close to 1.0, which confirms the design of TPSBs per PSTR14 is safe, appropriate, and cost-effective.

5.2.1 The Detail of Calculations

The detailed calculation of Case VII TPSBs in Table 5.3 (8-in. height with 5-in. deck, 14 strands, and 24 ft. span) is presented in this section. It includes the most extreme shear check, the moment check at the section close to the support, i.e., at the transfer length section, ≈ 60 d_b, and the moment check at mid-span.

Table 5.3 Strength Ratios of Test or Analysis Results to Design Outcomes

Case	Height	# of Tendons	Shear Check		Moment Check at Section Close to Support (Test Situation)		Moment Check at Mid-span	
			$\frac{P_{cr,test}}{P_{service,design}}$	$\frac{P_{n,test}}{P_{u,design}}$	$\frac{M_{cr,test}}{M_{service,design}}$	$\frac{M_{n,test}}{M_{u,design}}$	$\frac{M_{cr,AASHTO}}{M_{service,design}}$	$\frac{M_{n,AASHTO}}{M_{u,design}}$
I	15 in. +5 in. deck	8	3.00	2.75	5.90	5.42	1.36	1.10
II		14	3.44	3.50	6.50	6.61	1.03	1.16
III	15 in.	8	3.21	2.83	4.16	3.66	1.27	1.08
IV	12 in. +5 in. deck	10	3.47	3.55	4.96	5.10	1.15	1.10
V		14	4.42	3.60	6.46	5.27	1.10	1.20
VI	12 in.	10	3.41	2.36	2.03	1.41	1.16	1.11
VII	8 in. +5 in. deck	14	3.29	3.14	3.50	3.34	1.31	1.33

5.2.1.1 Shear Check

The HL93 vehicle load, in the case of shear, was placed on the beam such that it produced the largest shear (reaction) force, based on the influence line of the reaction force concept. Figure 5.2 shows a simply-supported beam with the configuration of the truckload, tandem load, and influence line of shear force. A uniform lane load of 0.64 klf was assumed to be uniformly distributed over the 10 ft. width and was added to the moving load as well. In this analysis, the distance between the last two wheels of HS20-44 truck in Figure 5.2(a) was assumed to be 14 ft. so it would produce the largest shear force.

a. Service State

- Net span $= 24\ ft - \dfrac{2\times 8.5\ in}{12\ in/ft} = 22.58\ ft.$
- Reaction force at B due to a truck, based on Figure 5.2(a):

Reaction at B $=32\ kips\left(1-\dfrac{14}{22.58}\right)+32\ kips=44.2\ kips\rightarrow governs.$

- Reaction force at B due to a tandem, based on Figure 5.2(b):

  Reaction at B $=24\ kips\left(1-\dfrac{4}{22.58}\right)+24\ kips=43.7\ kips.$

- Reaction force at B due to lane load:

  Reaction at B $\approx 0.64\ klf\times\left(\dfrac{5\,ft}{10\,ft}\right)\times\dfrac{22.58\ ft}{2}=3.61\ kips.$

- Total reaction force at B due to live load:

  Assume the impact factor of the truck load is 1.33, and take live load distribution factor (LLDF) = 0.441 (based on TxDOT specification), the reaction force at B:

  $V_{B,LL+IM}=0.441\left(1.33\times 44.2+3.61\right)=27.5\ kips.$

- Reaction force at B due to dead load (self-weight):

  $V_{B,DL}=0.15\ kcf\times 5\,ft\ width\times\left(\dfrac{8\ in\ \text{beam}+5\ in\ deck}{12\ in/ft}\right)\times 22.58\ ft/2=9.17\ kips.$

- Reaction at B due to future wearing surface, DW:

  Assume the thickness of future wearing surface is 2-in.

  Reaction at B $=0.14\ kcf\times 5\,ft\ width\times\left(\dfrac{2\ in}{12\ in/ft}\right)\times 22.58\ ft/2=1.32\ kips.$

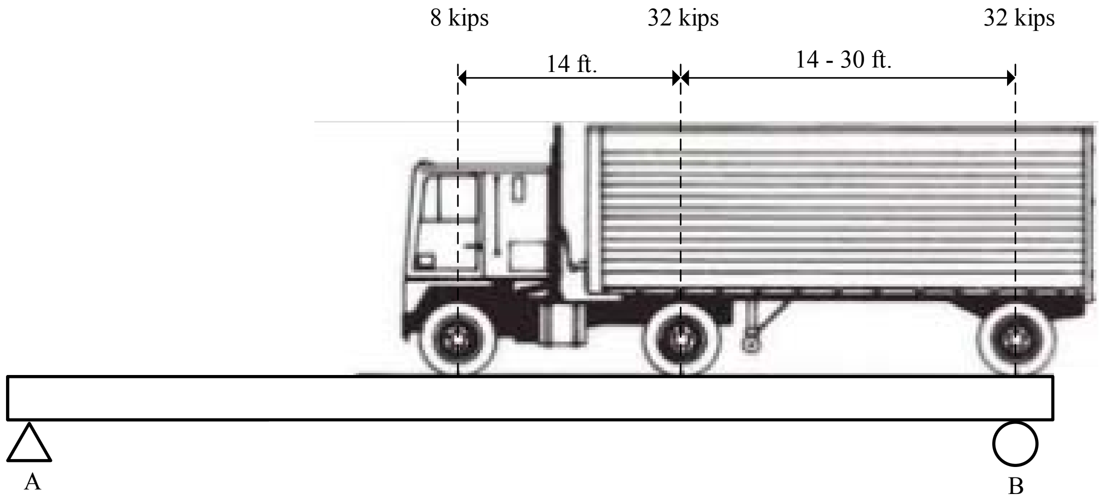
- Service load

  Total service load $=DL+DW+(LL+IM)=9.17+1.32+27.5=38.0\ kips.$

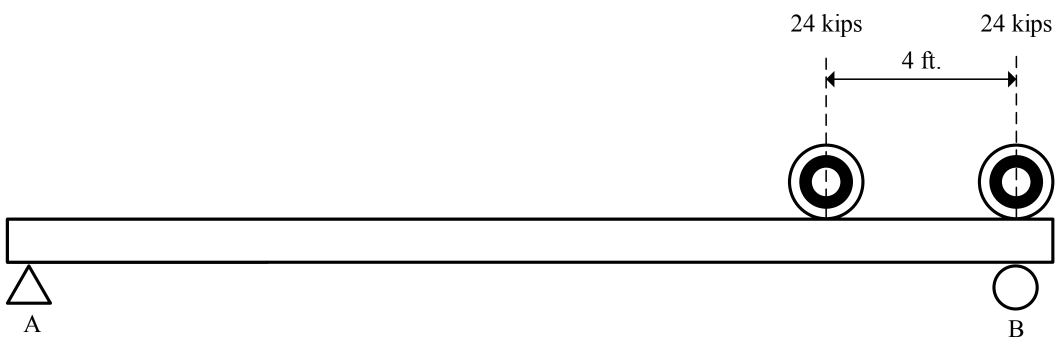
- Minimum cracking shear force from the test:

  $V_{cr.,test}=125\ kips>V_{total}=38.0\ kips\rightarrow ok!$

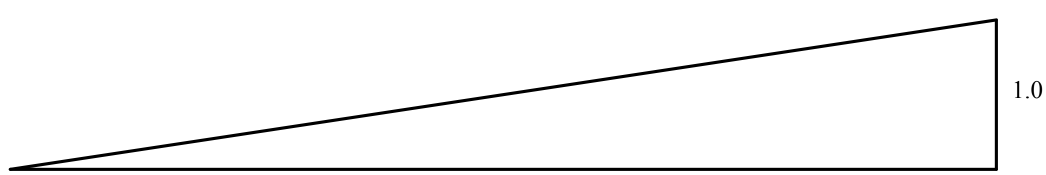
$$\frac{V_{cr.,test}}{V_{total}} = \frac{125}{38.0} = 3.29 \rightarrow ok!$$



(a) Simply Supported Slab Beam with HS20-44 Truck



(b) Simply Supported Slab Beam with Truck Axle loads in Tandem



(c) Influence Function of Shear Force

Figure 5.2 Simply Supported Beam with Live Load and Influence Function of Shear Force

b. Ultimate State

- Total ultimate load

$$V_u = 1.25DL + 1.5DW + 1.75(LL + IM) = 1.25 \times (9.17) + 1.5 \times (1.32) + 1.75 \times (27.5),$$

$$V_u = 11.5 + 1.98 + 48.1 = 61.6\,kips.$$

- Minimum ultimate shear force from the test:

$$V_{test} = 193\,kips > V_u = 61.6\,kips \rightarrow ok!$$

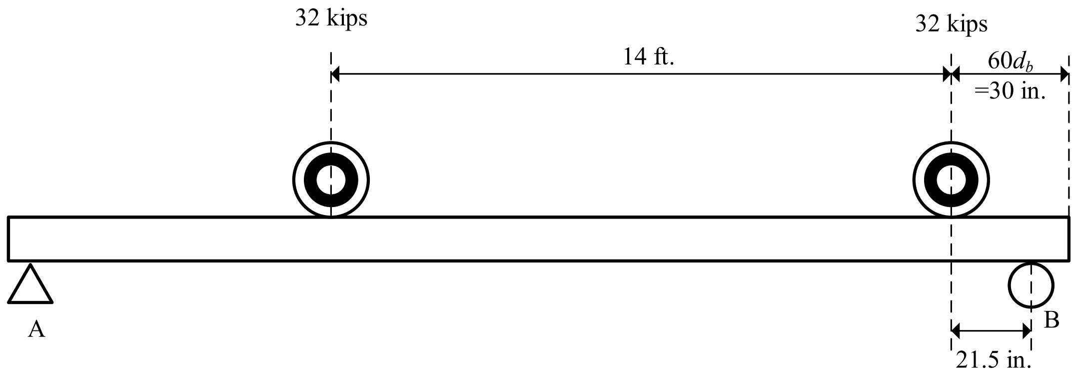
$$\frac{V_{test}}{V_u} = \frac{193}{61.6} = 3.14 \rightarrow ok!$$

c. Discussion

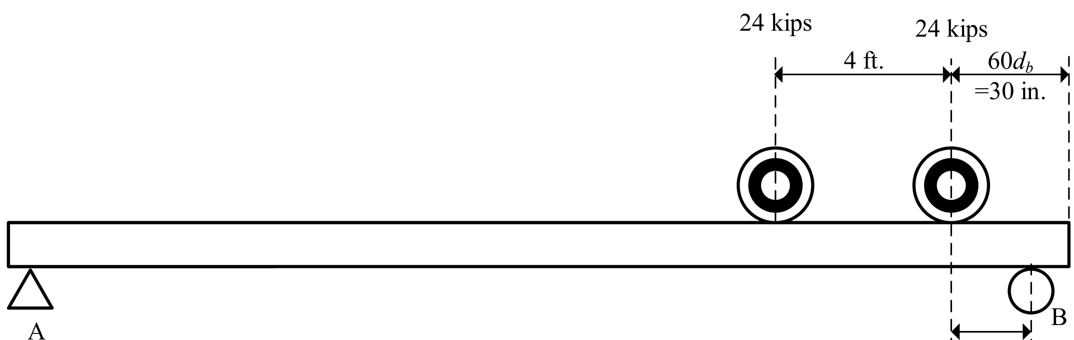
The analysis in points (a) and (b) shows that the 8-in. slab beam with 5 ft. width, 5-in. deck, and 14 strands will not crack under the service load, and anchorage bond failure will not occur under the ultimate state. The strength ratios of shear check, i.e., the tests to design load ratios, for these types of slab beams are 3.29 and 3.14 for service load state and ultimate load state, respectively.

5.2.1.2 Moment Check with Live Load at Section Close to Support (Transfer Length Section)

The HL93 live load, for the moment case, was placed on the beam such that it produced the largest moment, and the beam was designed based on the analyzed moment. The live load, truckload or tandem, generally, was placed close to the middle section, which was based on the influence line of the bending moment concept. Tests performed at UH, however, have a relatively short shear span-to-depth ratio; when the beams were loaded within the transfer length, the strand could not reach the nominal stage. To be comparable to the test results, one wheel of the truck or tandem was placed at the transfer length section, shown in Figure 5.3



(a) Simply Supported Slab Beam with HS20-44 Truck



(b) Simply Supported Slab Beam with Tandem

Figure 5.3 Configuration of Truck and Tandem With One Wheel at Transfer Length Section

a. Service State

- Net span $= 24\ ft - \dfrac{2 \times 8.5\, in}{12\, in/ft} = 22.58\ ft.$

- Due to truck load, see Figure 5.3(a):

  Reaction at B:

$$R_{B,truck} = \left(\frac{22.58 - 21.5/12}{22.58}\right)32 + \left(\frac{22.58 - 21.5/12 - 14}{22.58}\right)32 = 29.5 + 9.62 = 39.1\, kips.$$

  Moment at transfer length section due to a truck:

$$M_{\text{transfer},truck} = Reaction\ at\ B \times 21.5\, in = 39.1\, kips \times 21.5\, in = 841\, kip - in,$$

$$M_{\text{transfer},truck} = 70.1\, kip - ft.$$

- Due to tandem load, see Figure 5.3(b):

  Reaction at B:

$$R_{B,tandem} = \left(\frac{22.58 - 21.5/12}{22.58}\right)24 + \left(\frac{22.58 - 21.5/12 - 4}{22.58}\right)24 = 22.1 + 17.8 = 39.9\, kips.$$

  Moment at transfer length section due to a truck:

$$M_{\text{transfer},tandem} = Reaction\ at\ B \times 21.5\, in = 39.9\, kips \times 21.5\, in = 858\, kip - in,$$

$$M_{\text{transfer},tandem} = 71.5\, kip - ft \rightarrow governs!$$

- Moment due to lane load:

$$M_{transfer,lane} = 0.64\ klf \times \left(\frac{5\,ft}{10\,ft}\right) \times \left(\frac{22.58\,ft}{2}\right)\frac{21.5}{12} - 0.64\ klf \times \left(\frac{5\,ft}{10\,ft}\right)\frac{(21.5/12)^2}{2},$$

$$M_{transfer,lane} = 6.47 - 0.51 = 5.96\, kip - ft.$$

- Total Moment at mid-span due to live load:

  Assume an impact factor of the truck load is 1.33, and use live load distribution factor (LLDF) = 0.441 (based on TxDOT specification); the moment at mid-span:

$$M_{\text{transfer},LL+IM} = 0.441(1.33 \times 71.5 + 5.96) = 44.6\, kip - ft.$$

- Moment due to dead load (self-weight):

$$M_{\text{transfer},DL} = 0.15 \times 5 \times \left(\frac{13}{12}\right)\left(\frac{22.58}{2}\right)\frac{21.5}{12} - 0.15 \times 5 \times \left(\frac{13}{12}\right)\frac{(21.5/12)^2}{2},$$

$$M_{\text{transfer},DL} = 16.4 - 1.30 = 15.1\, kip - ft.$$

- Moment due to future wearing surface, DW:

  Assume the thickness of future wearing surface is 2-in.

$$M_{transfer,DW} = 0.14\times 5\times\left(\frac{2}{12}\right)\left(\frac{22.58}{2}\right)\frac{21.5}{12} - 0.14\times 5\times\left(\frac{2}{12}\right)\frac{\left(21.5/12\right)^2}{2},$$

$$M_{transfer,DW} = 2.36 - 0.19 = 2.17\,kip-ft.$$

- Service state:

  Total mid-span moment at service state

$$M_{transfer,service} = M_{transfer,DL} + M_{transfer,DW} + M_{transfer,(LL+IM)} = 15.1 + 2.17 + 44.6,$$

$$M_{transfer,service} = 61.9\,kip-ft.$$

- Minimum cracking moment from the test:

$$V_{cr.,test} = 125\,kips,$$

  shear span for this particular specimen, $a_v = 1.98\times 10.5 = 20.8\,in = 1.73\,ft,$ and

$$M_{cr.,test} = V_{cr.,test}\times a_v = 125\times 1.73 = 216\,kip-ft > M_{transfer,service} = 61.9\,kip-ft \rightarrow ok!$$

$$\frac{M_{cr.,test}}{M_{transfer,service}} = \frac{216}{61.9} = 3.50 \rightarrow ok!$$

b. Ultimate State

- Total ultimate moment at transfer length section:

$$M_{transfer,ult.} = 1.25M_{transfer,DL} + 1.5M_{transfer,DW} + 1.75M_{transfer,(LL+IM)},$$

$$M_{transfer,ult.} = 1.25\times(15.1) + 1.5\times(2.17) + 1.75\times(44.6),$$

$$M_{transfer,ult.} = 18.9 + 3.26 + 78.1 = 100\,kip-ft.$$

- Minimum ultimate shear force from the test:

$$V_{test} = 193\, kips,$$

$$M_{test} = V_{test} \times a_v = 193 \times 1.73 = 334\, kip - ft > M_{transfer,ult.} = 100\, kip - ft \rightarrow ok!$$

$$\frac{M_{test}}{M_{transfer,ult.}} = \frac{334}{100} = 3.34 \rightarrow ok!$$

c. Discussion

An 8-in. slab beam with 5 ft. width, 5-in. deck, and 14 strands will not crack under the service load, and anchorage bond failure will not occur under the ultimate state: this is the conclusion based on the moment analysis done in points (a) and (b). The flexural strength ratios for the section close to support, the test-to-design load ratios for these types of slab beams, are 3.50 and 3.34 for service load state and ultimate load state, respectively.

5.2.1.3 Moment Check with Live Load Close to Middle Span

In this case, one wheel of the live load, truck or tandem, was placed on the middle span to produce the maximum moment. The design of TPSBs typically is based on the middle span section and is compared with results of the analysis.

a. Service State

- Net span $= 24\, ft - \dfrac{2 \times 8.5\, in}{12\, in/ft} = 22.58\, ft.$
- Moment due to a truck, based on Figure 5.4(a):

  one wheel in the mid-span of the beam

  $$M_{mid,truck} = 32\left(\frac{L}{4}\right) = 32\left(\frac{22.58}{4}\right) = 181\, kip - ft,$$

  or two back wheels (with 14 ft. away) on the beam

$$M_{mid,truck} = 2\times 32\left(\frac{L}{4}\right)\left(\frac{L/2-7}{L/2}\right) = 2\times 32\left(\frac{22.58}{4}\right)\left(\frac{22.58/2-7}{22.58/2}\right) = 137\ kip-ft.$$

- Moment due to a tandem, based on Figure 5.4(b):

$$M_{mid,tandem} = 24\left(\frac{L}{4}\right)+24\left(\frac{L}{4}\right)\left(\frac{L/2-4}{L/2}\right) = 24\left(\frac{22.58}{4}\right)+24\left(\frac{22.58}{4}\right)\left(\frac{22.58/2-4}{22.58/2}\right),$$

$$M_{mid,tandem} = 135+87.5 = 223\ kip-ft \rightarrow governs!$$

- Moment due to lane load:

$$M_{mid,lane} \approx \frac{1}{8}0.64\ klf \times\left(\frac{5\,ft}{10\,ft}\right)\times\left(22.58\,ft\right)^2 = 20.4\ kip-ft.$$

- Total moment at mid-span due to live load:

  Assume the impact factor of the truck load is 1.33, and use live load distribution factor (LLDF) = 0.441 (based on TxDOT specification), the moment at mid-span:

$$M_{mid,LL+IM} = 0.441\left(1.33\times 223+20.4\right) = 140\ kip-ft.$$

- Moment due to uniform dead load on composite section (based on TxDOT specification):

$$M_{mid,composite} = \frac{1}{8}0.132klf \times\left(22.58\,ft\right)^2 = 8.41\ kip-ft.$$

- Moment due to self-weight:

- $$M_{mid,self} = \frac{1}{8}0.15\ kcf \times 5\,ft\ width\times\left(\frac{8\ in\ \text{beam} + 5\ in\ deck}{12\ in/ft}\right)\times\left(22.58\,ft\right)^2 = 51.8\ kip-ft.$$

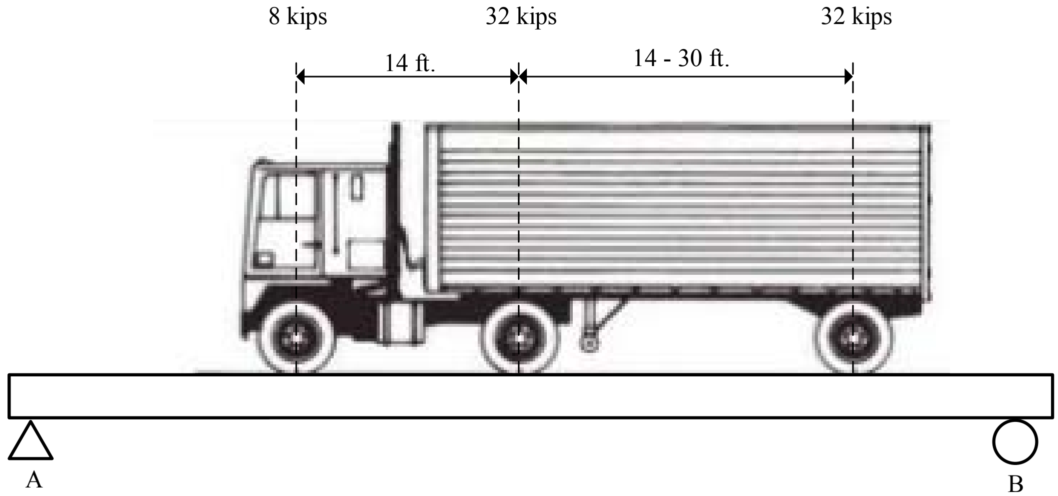
  Total moment at mid-span due to dead load:

$$M_{mid,DL} = 8.41+51.8 = 60.2\ kips.$$

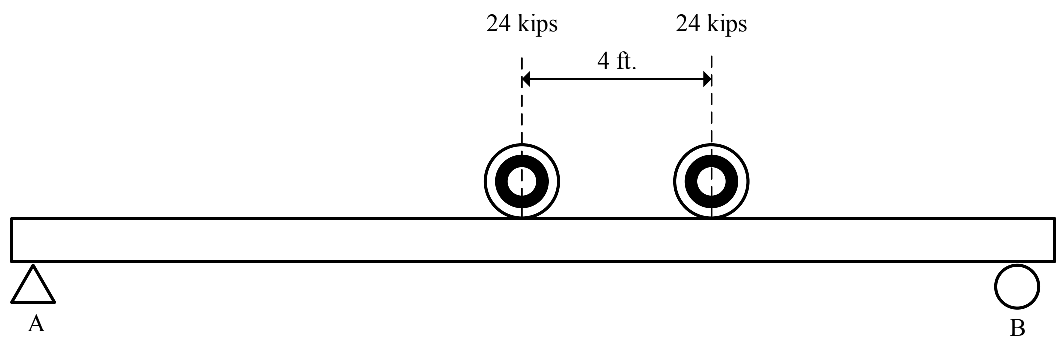
- Moment due to future wearing surface, DW:

  Assume the thickness of future wearing surface is 2-in.

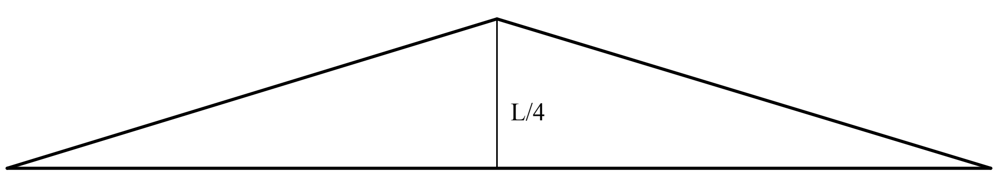
$$M_{DW} = \frac{1}{8} 0.14\ kcf \times 5\, ft\ width \times \left(\frac{2\ in}{12\ in/ft} \right) \times (22.58\ ft)^2 = 7.44\ kip - ft.$$



(a) Simply Supported Slab Beam with HS20-44 Truck



(b) Simply Supported Slab Beam with Tandem



(c) Influence Function of Moment

Figure 5.4 Simply Supported Beam with Live Load on Middle Span and Influence Function of Moment

- Service state:

Total mid-span moment at service state

$$M_{mid,service} = M_{DL} + M_{DW} + M_{(LL+IM)} = 60.2 + 7.44 + 140 = 207\,kip - ft.$$

- Cracking moment capacity per code:

$$f_r = f_{bottom} + \frac{M_{cr} y_b}{I} = 7.5\sqrt{f_c^{'}(psi)}\text{ ; take } f_c^{'} = 9{,}000\,psi,$$

$$f_r = 7.5\sqrt{f_c^{'}(psi)} = 7.5\sqrt{9{,}000} = 712\,psi = 0.71\,ksi,$$

$$y_b = 6.5\,in,$$

$$I = \frac{1}{12}bh^3 = \frac{1}{12}(59.75)(13)^3 = 10{,}939\,in^4,$$

$$f_{bottom} = -\frac{P}{A} - \frac{(P \times e)\,y_b}{I} + \frac{M_{girder}\,y_b}{I},$$

$$P = A_{ps} f_{pi} = (14 \times 0.153)(0.75 \times 270) = 434\,kips,$$

$$M_{girder,@mid} = \frac{1}{8}(0.15)\left(\frac{59.75 \times 13}{144}\right)(22.58)^2 = 51.6\,kip - ft,$$

$$f_{bottom} = -\frac{P}{A} - \frac{(P \times e)\,y_b}{I} + \frac{M_{girder}\,y_b}{I} = -\frac{434}{59.75 \times 13} - \frac{(434 \times 4)6.5}{10{,}939} + \frac{(51.6 \times 12)6.5}{10{,}939},$$

$$f_{bottom} = -0.56 - 1.03 + 0.37 = -1.22\,ksi,$$

$$f_r = f_{bottom} + \frac{M_{cr} y_b}{I},$$

$$M_{cr} = \frac{(f_r - f_{bottom})I}{y_b} = \frac{\left[0.71 - (-1.22)\right]10{,}939}{6.5} = 3248\,kip - in,$$

$$M_{cr} = 271\,kip - ft > M_{mid,service} = 207 kip - ft \rightarrow ok!$$

$$\frac{M_{cr.,analysis}}{M_{mid,service}} = \frac{271}{207} = 1.31 \rightarrow ok!$$

b. Ultimate State

- Total ultimate moment at mid-span:

$$M_{u,mid} = 1.25M_{DL} + 1.5M_{DW} + 1.75M_{(LL+IM)} = 1.25\times(60.2) + 1.5\times(7.44) + 1.75\times(140),$$

$$M_{u,mid} = 75.3 + 11.2 + 245 = 331\ kip - ft.$$

- Moment nominal capacity per code:

$$M_n = A_{ps} f_{ps}\left(d_p - \frac{a}{2}\right),$$

$$f_{ps} = f_{pu}\left(1 - k\frac{c}{d_p}\right), \text{ and}$$

$$a = \frac{A_{ps} f_{pu} + A_s f_s - A_s^{'} f_s^{'}}{0.85 f_c^{'} \beta_1 b + k A_{ps} \frac{f_{pu}}{d_p}}.$$

By conservatively neglecting the compression longitudinal reinforcement:

$$a = \frac{A_{ps} f_{pu} + A_s f_s - A_s^{'} f_s^{'}}{0.85 f_c^{'} \beta_1 b + k A_{ps} \frac{f_{pu}}{d_p}} = \frac{14\times0.153\times270 + 0 - 0}{0.85\times9\times0.65\times59.75 + 0.28\times14\times0.153\frac{270}{10.5}} = 1.85\ in,$$

$$f_{ps} = f_{pu}\left(1 - k\frac{c}{d_p}\right) = 270\left(1 - 0.28\frac{1.85}{10.5}\right) = 257\, ksi,$$

$$M_n = A_{ps} f_{ps}\left(d_p - \frac{a}{2}\right) = 14 \times 0.153 \times 257\left(10.5 - \frac{1.85}{2}\right) = 5271\ kip - in.$$

$$M_n = 439 kip - ft > M_{u,mid} = 331\ kip - ft \rightarrow ok!$$

$$\frac{M_n}{M_{u,mid}} = \frac{439}{331} = 1.33 \rightarrow ok!$$

c. Discussion

The flexural strength ratio is relatively close to 1.0 at both service and ultimate states because the number of 14 longitudinal strands for 8-in. slab beam with 24 ft. span is obtained from flexural strength analysis. In design, the resistance reduction factor for flexural analysis per AASHTO is 0.9; the strength ratio of 1.33 for the ultimate state, therefore, makes sense.

CHAPTER 6 SIMULATION OF THIN PRESTRESSED SLAB BEAMS USING PROGRAM SCS

6.1 Introduction

Over the decades, researchers at the University of Houston have shown great contributions toward understanding the behavior of reinforced concrete (RC) elements and members subjected to shear. Their valuable findings have been applied to the nonlinear finite element program called Simulation of Concrete Structures (SCS) (Zhong, 2005). A two-dimensional reinforced concrete membrane element has been developed based on the Cyclic Softened Membrane Model (CSMM) (Mansour, 2001; Mansour et al., 2001; M. Mansour & T. Hsu, 2002; M. Mansour & T. T. C. Hsu, 2002; Mansour & Hsu, 2005a, 2005b). A two-dimensional reinforced concrete plane stress material module and three uniaxial material modules of concrete and steel have been developed also and implemented into SCS using an object-oriented finite element framework: OpenSees (Fenves, 2005). SCS has successfully simulated the behavior of reinforced concrete elements/members/structures subjected to static, reversed cyclic, and dynamic loading.

The research at the University of Houston has been extended to study the behavior of Prestressed Concrete (PC) elements/members. Wang (2006) proposes the constitutive laws of PC membrane elements and implements them into Softened Membrane Model for Prestressed Concrete (SMM-PC). The model is further extended to Cyclic Softened Membrane Model for Prestressed Concrete (CSMM-PC) (Laskar, 2009). This model is applied to SCS, and SCS becomes powerful, and the most advanced, analytical tool in simulating many PC girders tested at the University of Houston (Laskar, 2009; Tadepalli et al., 2011; Labib et al., 2013).

In this research, instead of shear failure, 14 Thin Prestressed Slab Beams (TPSBs) failed either in flexure or anchorage bond. The program SCS, therefore, has been further developed and calibrated based on testing these 14 TPSBs.

6.2 Analytical Model

The anchorage bond failure (in the case of TPSBs) happens mainly owing to insufficient development length such that the stress in the tendons cannot develop to its nominal stress. On the other hand, the flexure failure governs if the development length provided is ample. Based on this behavior, the material properties of the prestressing steel need to account both for flexure and anchorage bond behavior. TPSBs can be simplified as a 1-D problem; the plan view of the model is shown in Figure 6.1. In the experimental work, TPSBs were loaded very close to their support; therefore the applied load in the finite element model was usually next to the support node.

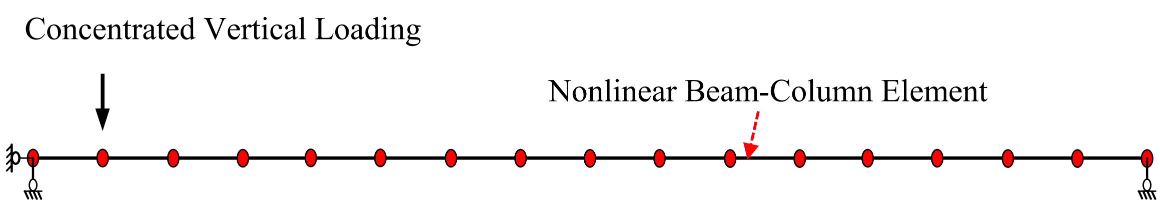


Figure 6.1 Finite Element Model of TPSBs

The element used in modeling TPSBs is “nonlinear beam-column element”, and the section used in the model is “fiber section”. The concrete section is discretized into numbers of fibers over the section, and longitudinal steel of TPSBs are generated by rows of fibers along a section. The sections of each of the 8-in., 12-in., and 15-in. high TPSBs are depicted in Figures 6.2 to 6.4, respectively.

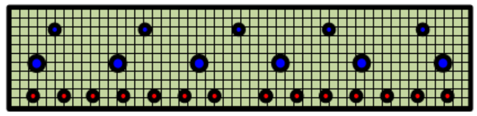
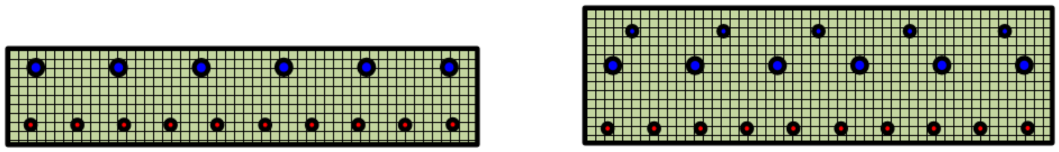
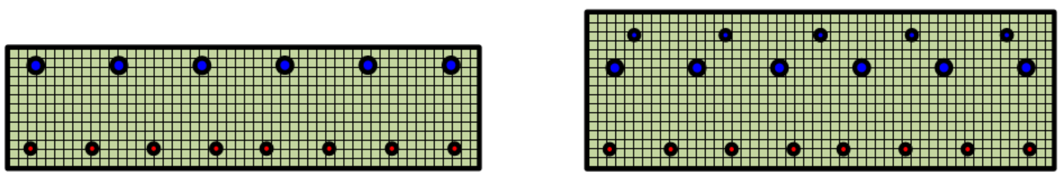


Figure 6.2 Section of Typical 8-in. High TPSBs With 14 Strands



(a) Without Deck (b) With Deck

Figure 6.3 Section of Typical 12-in. High TPSBs With 10 Strands



(a) Without Deck (b) With Deck

Figure 6.4 Section of Typical 15-in. High TPSBs With 8 Strands

In Group C TPSBs, all TPSBs that failed in flexure failure used ConcreteS01 material module, and all TPSBs that failed in anchorage bond failure used ConcreteS02 material module. Some of the TPSBs in Groups A and B, however, used ConcreteS01 material module, although they failed in anchorage bond. This condition is understandable because, as the height of TPSBs decreases, the anchorage bond failure becomes more pronounced, and failure becomes a localized failure (depending on many variables), thus, initial stiffness of the concrete varies. The effect of prestressing steel was modeled using Steel02 material module, which allows the user to define the initial stress of the steel. The initial stress of prestressing steel per TxDOT specifications is 75 percent of f_{pu}. In this simulation, 15 percent of total loss was assumed; in addition, the negative slope of prestressing steel was introduced to simulate the behavior of the anchorage bond. Figure 6.5 shows the physical meaning of the negative slope introduced in SCS. Theoretically, when anchorage bond slip takes place, the stress of prestressing steel drops and a residual strain exists. As the TPSBs take additional load, the stress of prestressing steel increases; however, this stiffness is smaller than initial stiffness. Then, when the stress reaches bond capacity, the stress of prestressing steel drops again. This phenomenon was observed during the test; therefore, to simplify the analysis in SCS, the negative slope was proposed.

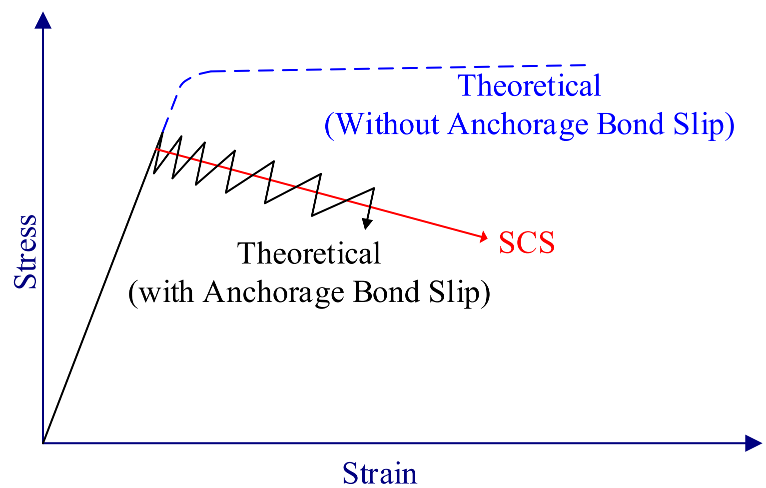
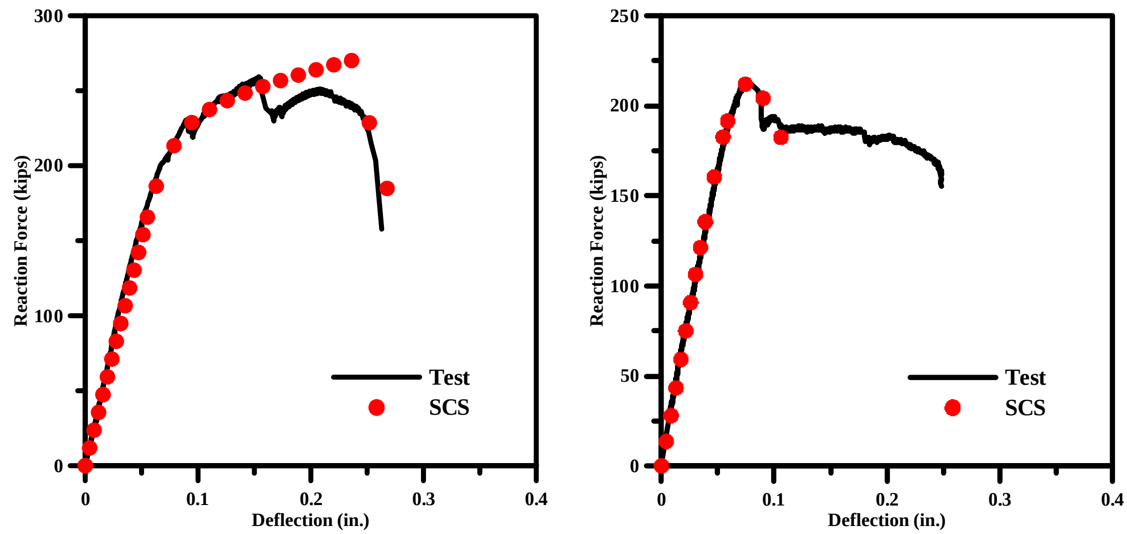


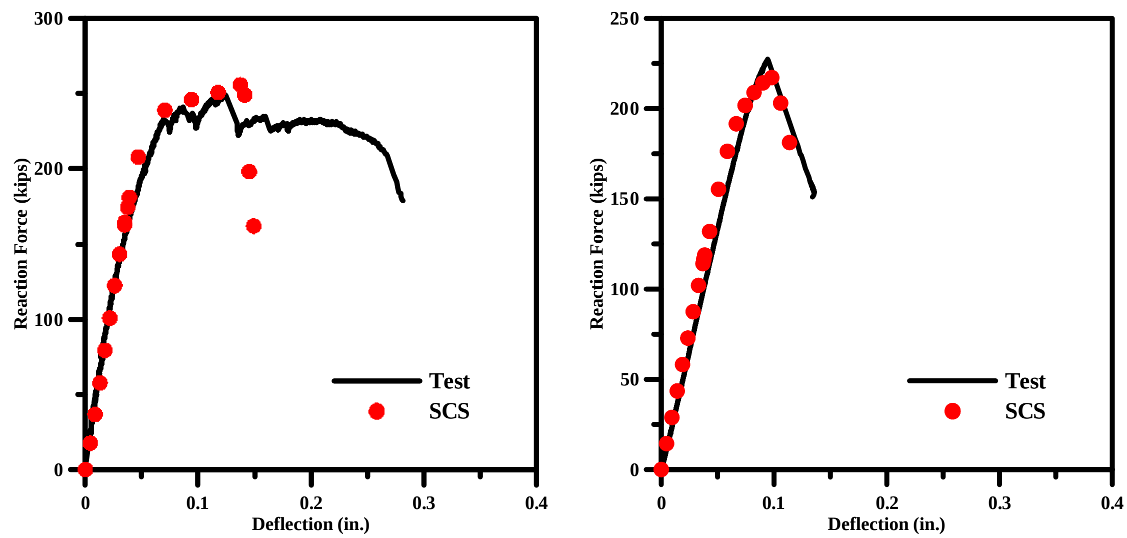
Figure 6.5 Physical Meaning of Constitutive Laws of Prestressing Steel Considering Anchorage Bond Slip in SCS

Figures 6.6 to 6.19 show the comparison of the reaction force vs. deflection curves of each TPSB between analytical results using the program SCS and experimental results. It is indisputable that the program SCS successfully predicts nonlinear behavior of TPSBs. And the anchorage bond failure can be accurately modeled by introducing the negative slope of post-peak stress of Steel02.



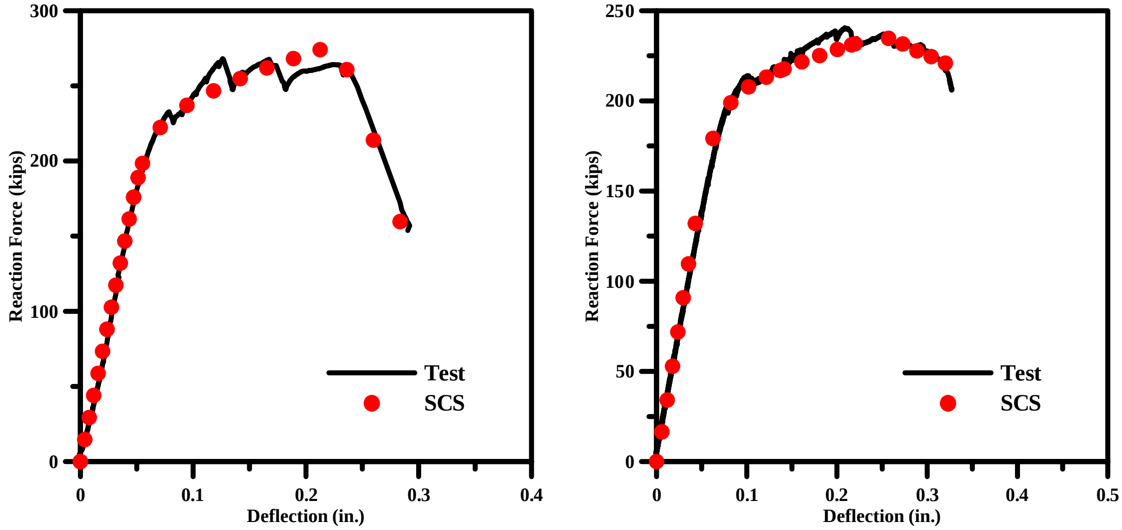
(a) 5SB8T-1.2-14-D (b) 5SB8T-2.0-14-D

Figure 6.6 Analytical and Experimental Reaction Force-Deflection Relationships of 5SB8T-1.2-14-D and 5SB8T-2.0-14-D



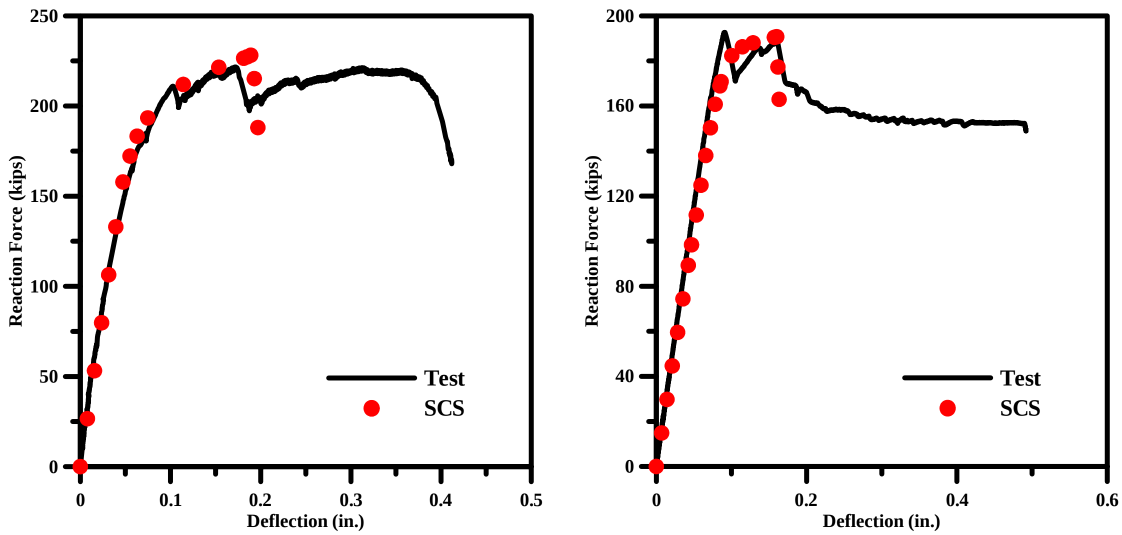
(a) 5SB8M-1.2-14-D (b) 5SB8M-2.0-14-D

Figure 6.7 Analytical and Experimental Reaction Force-Deflection Relationships of 5SB8M-1.2-14-D and 5SB8M-2.0-14-D



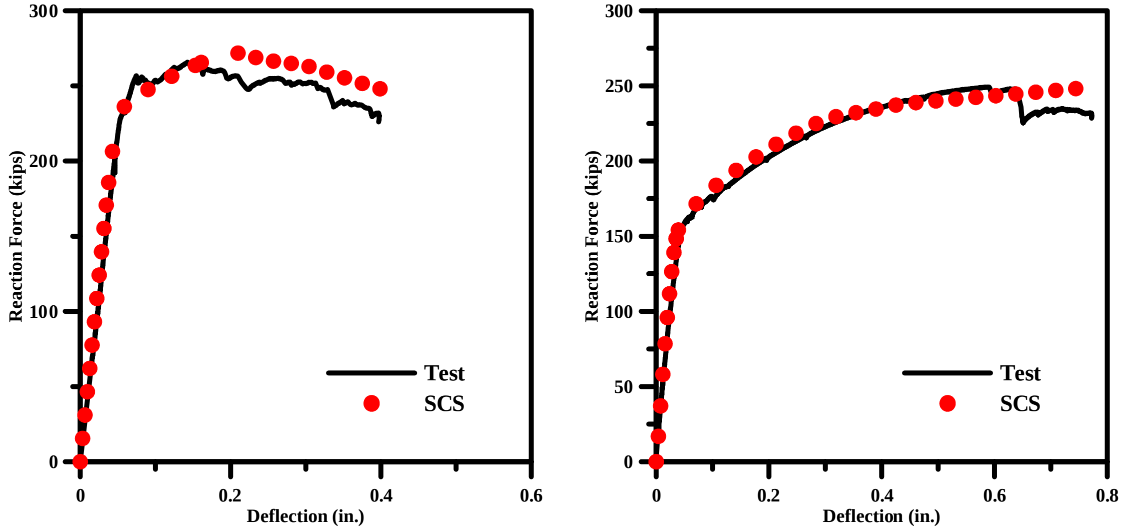
(a) 5SB8T-1.2-14-D^L (b) 5SB8T-2.0-14-D^L

Figure 6.8 Analytical and Experimental Reaction Force-Deflection Relationships of 5SB8T-1.2-14-D^L and 5SB8T-2.0-14-D^L



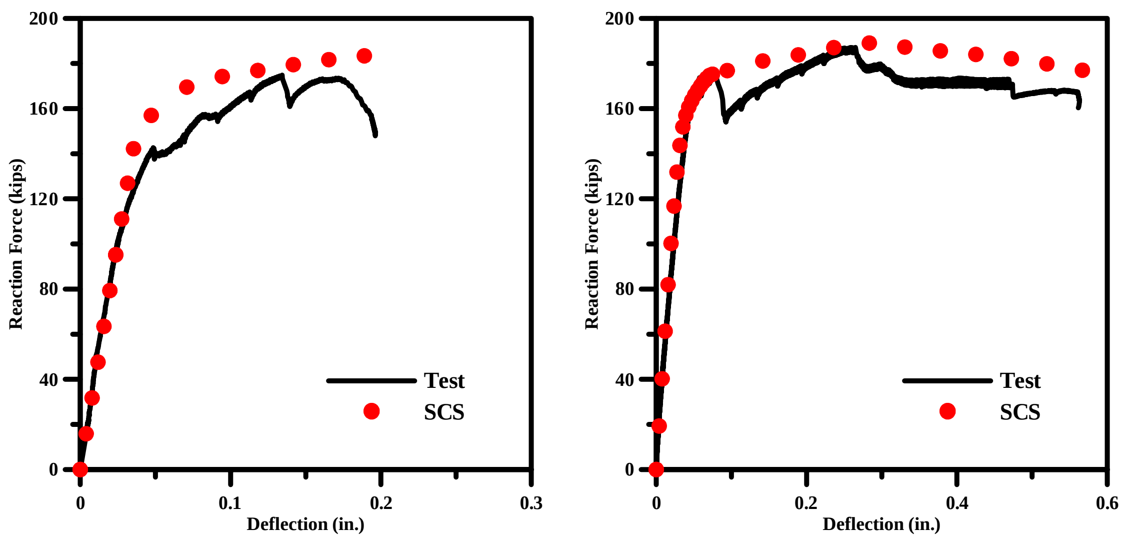
(a) 5SB8M-1.2-14-D^L (b) 5SB8M-2.0-14-D^L

Figure 6.9 Analytical and Experimental Reaction Force-Deflection Relationships of 5SB8M-1.2-14-D^L and 5SB8M-2.0-14-D^L



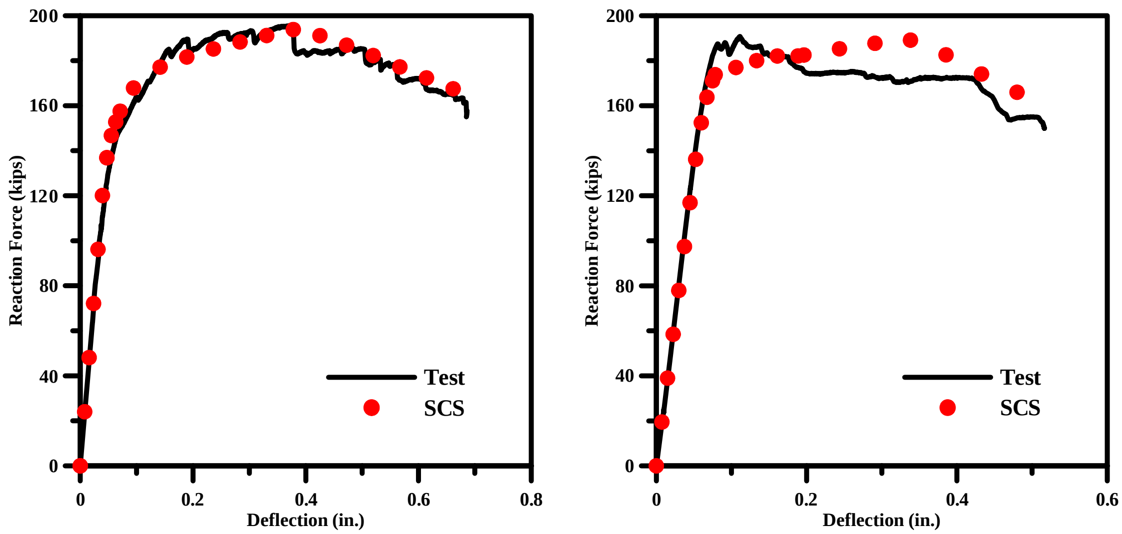
(a) 5SB12T-1.2-10-D (b) 5SB12T-2.0-10-D

Figure 6.10 Analytical and Experimental Reaction Force-Deflection Relationships of 5SB12T-1.2-10-D and 5SB12T-2.0-10-D



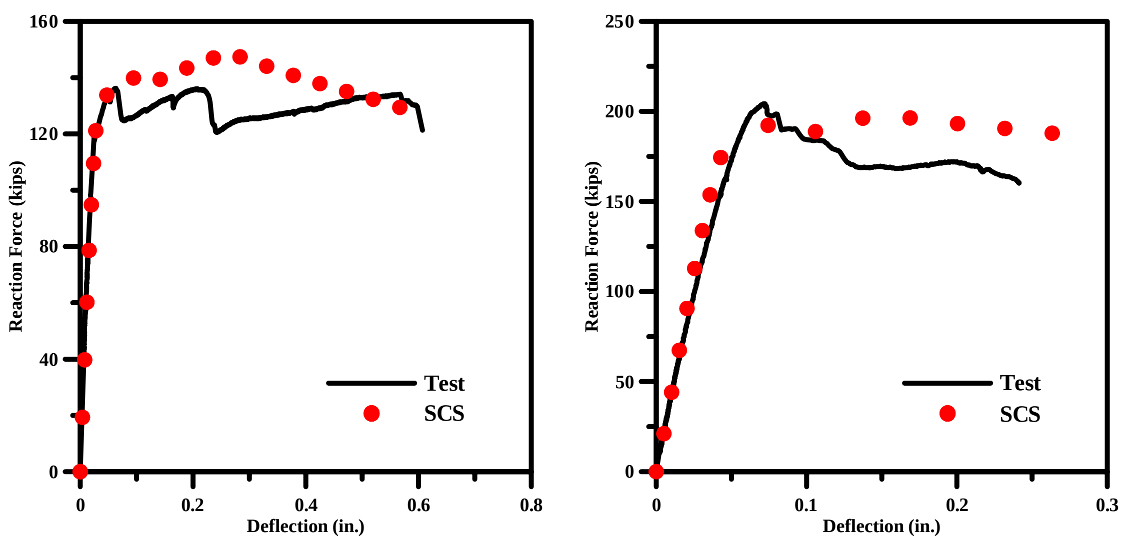
(a) 5SB12T-1.2-10-ND (b) 5SB12T-1.6-10-ND

Figure 6.11 Analytical and Experimental Reaction Force-Deflection Relationships of 5SB12T-1.2-10-ND and 5SB12T-1.6-10-ND



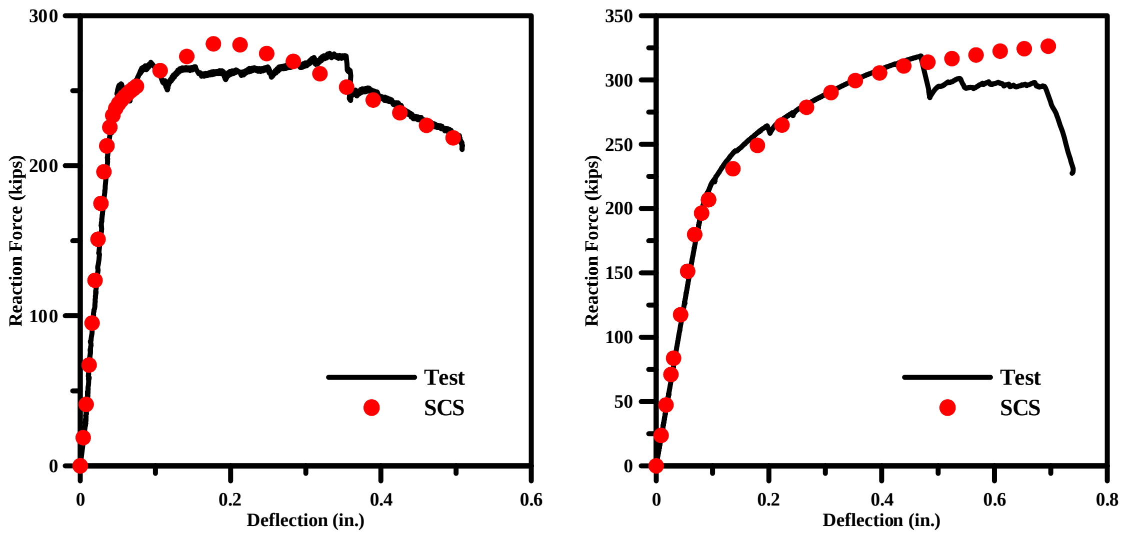
(a) 5SB12M-1.2-10-ND (b) 5SB12M-1.6-10-ND

Figure 6.12 Analytical and Experimental Reaction Force-Deflection Relationships of 5SB12M-1.2-10-ND and 5SB12M-1.6-10-ND



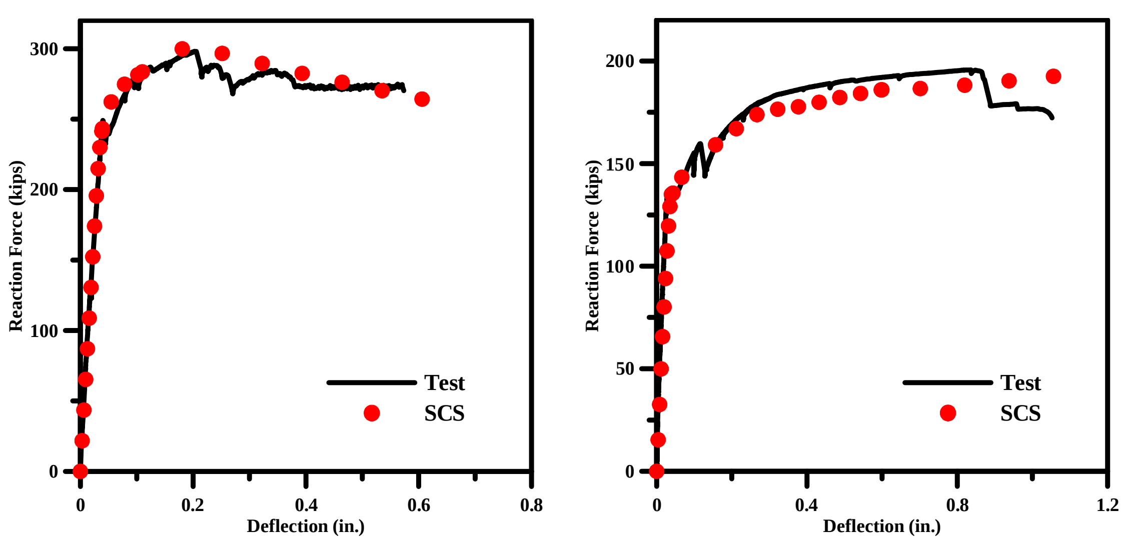
(a) 5SB12N-1.2-10-ND (b) 5SB12N-1.6-10-ND

Figure 6.13 Analytical and Experimental Reaction Force-Deflection Relationships of 5SB12N-1.2-10-ND and 5SB12N-1.6-10-ND



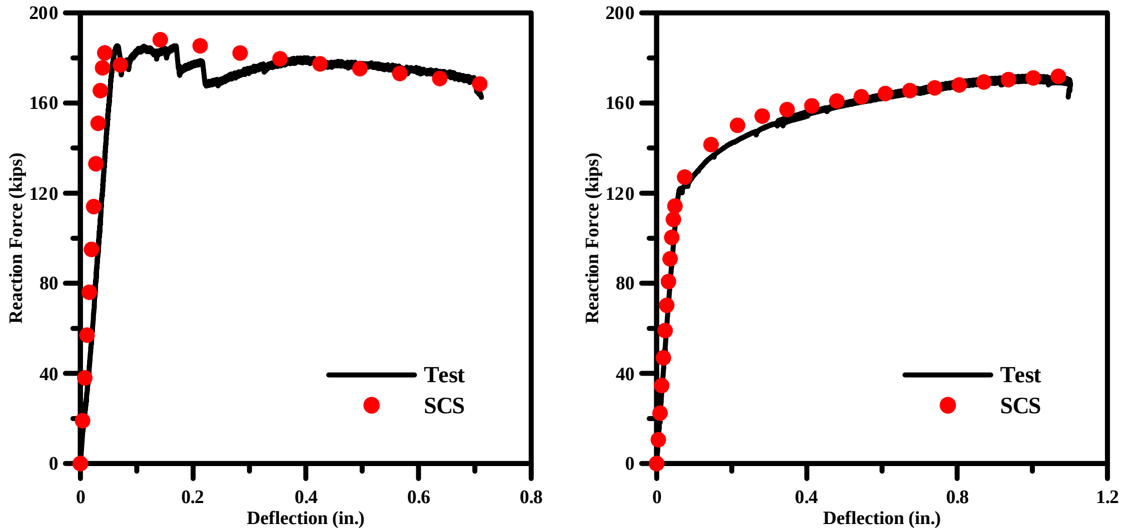
(a) 5SB12T-1.2-14-D (b) 5SB12T-2.0-14-D

Figure 6.14 Analytical and Experimental Reaction Force-Deflection Relationships of 5SB12T-1.2-14-D and 5SB12T-2.0-14-D



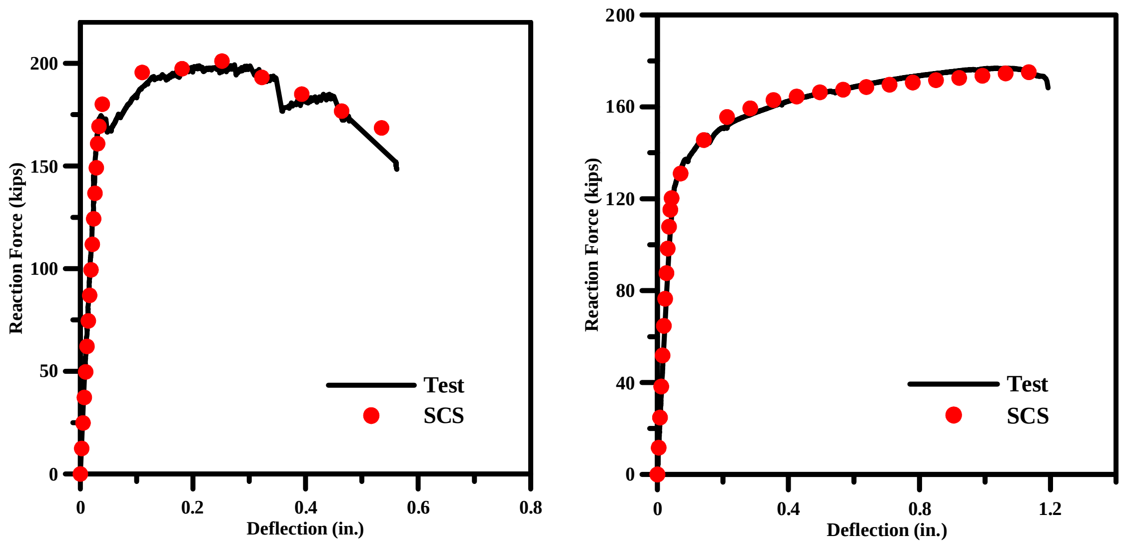
(a) 5SB15T-1.2-8-D (b) 5SB15T-2.0-8-D

Figure 6.15 Analytical and Experimental Reaction Force-Deflection Relationships of 5SB15T-1.2-8-D and 5SB15T-2.0-8-D



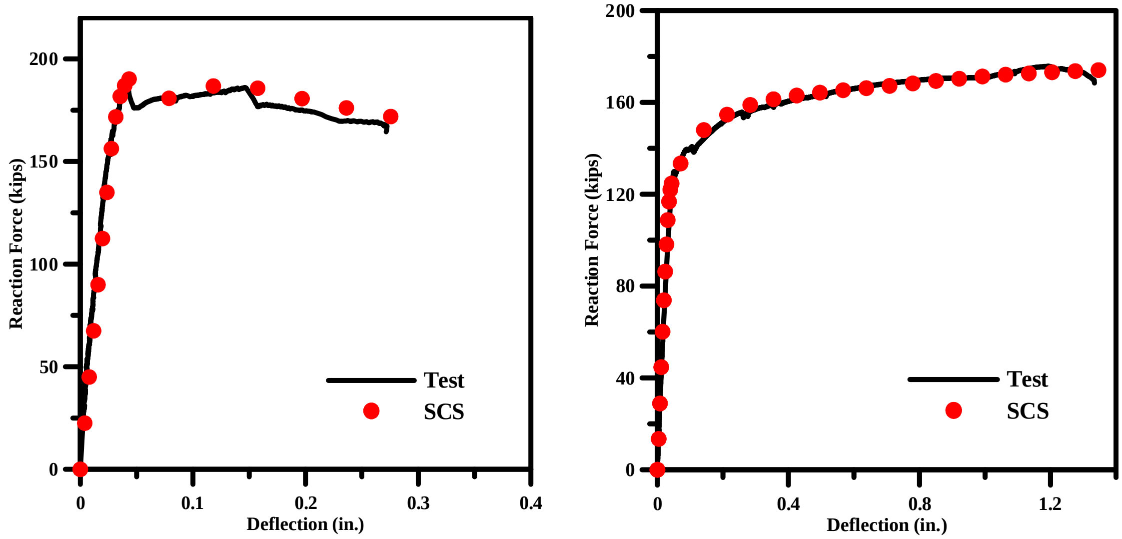
(a) 5SB15T-1.2-8-ND (b) 5SB15T-2.0-8-ND

Figure 6.16 Analytical and Experimental Reaction Force-Deflection Relationships of 5SB15T-1.2-8-ND and 5SB15T-2.0-8-ND



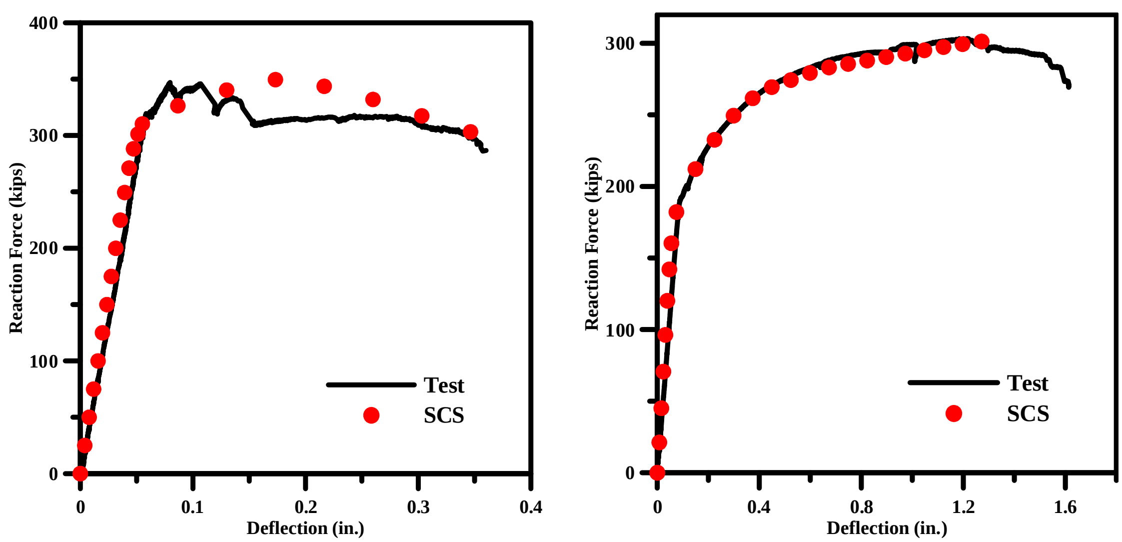
(a) 5SB15M-1.2-8-ND (b) 5SB15M-2.0-8-ND

Figure 6.17 Analytical and Experimental Reaction Force-Deflection Relationships of 5SB15M-1.2-8-ND and 5SB15M-2.0-8-ND



(a) 5SB15N-1.2-8-ND (b) 5SB15N-2.0-8-ND

Figure 6.18 Analytical and Experimental Reaction Force-Deflection Relationships of 5SB15N-1.2-8-ND and 5SB15N-2.0-8-ND



(a) 5SB15T-1.2-14-D (b) 5SB15T-2.0-14-D

Figure 6.19 Analytical and Experimental Reaction Force-Deflection Relationships of 5SB15T-1.2-14-D and 5SB15T-2.0-14-D

CHAPTER 7 BOND ANALYSIS OF THIN PRESTRESSED SLAB BEAMS

7.1 Introduction

Bond analysis, and a detailed derivation of the proposed analytical model to predict the ultimate strength of Thin Prestressed Slab Beams (TPSBs), are presented in this chapter. The proposed model is rational, which engages the concept of bond stress of prestressed concrete members into the flexural analysis, a useful tool for predicting prestressed concrete members with solid thin and wide sections.

7.2 Bond Analysis in TPSBs

A simply-supported beam with single-point load was used to model the test setup of TPSBs. The static determinate model and the corresponding moment diagram are shown in Figure 7.1.

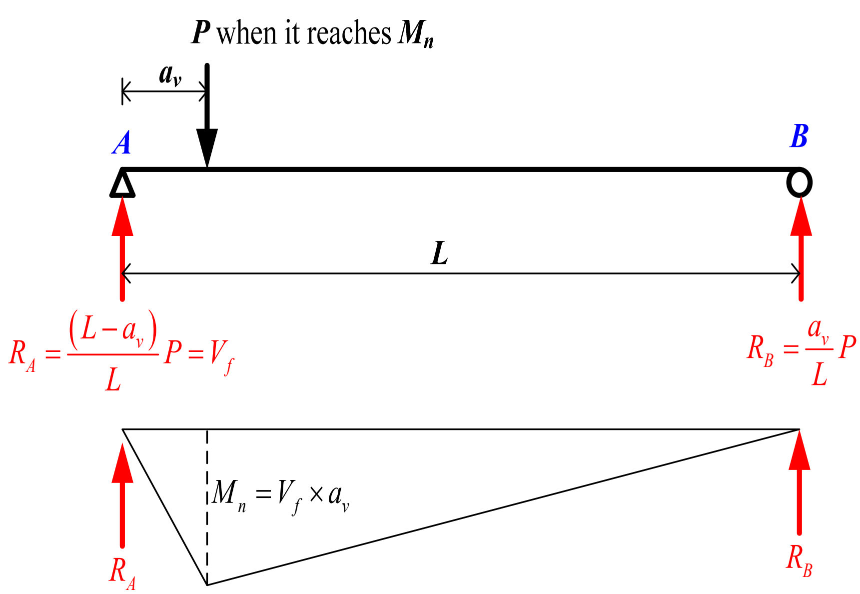


Figure 7.1 Statics Model of TPSBs and Corresponding Moment Diagram

Figure 7.1 shows that the moment nominal is equal to the product of reaction (shear) force multiplied by the shear span. It is understood from mechanics that moment nominal is proportional to the area of longitudinal steel, nominal stress of steel, and moment arm. AASHTO LRFD specifies that the moment arm shall be larger than 0.9 of effective depth. Equation 7-1, therefore, can be derived as follows:

$$M_n = A_{ps} f_{ps} jd ,$$

$$V_n = \frac{M_n}{a_v} = \frac{A_{ps} f_{ps} jd}{a_v} ,$$

$$\frac{V_n}{A_{ps} f_{ps}} = \frac{jd}{a_v} ,$$

$$\frac{V_n}{bd \rho_p f_{ps}} = \frac{jd}{a_v}; \quad take\ minimum\ jd = 0.9d\ (AASHTO) \text{, and}$$

$$\frac{V_n}{bd \rho_p f_{ps}} = 0.9 \frac{1}{a_v / d} . \tag{7-1}$$

Equation 7-1 shows that the non-dimensional shear force at the moment nominal stage is inversely proportional to shear-span-to-depth ratio. The ultimate reaction force from the experiment can be incorporated into Equation 7-1, and the test data can be compared with the flexural capacity as plotted in Figure 7.2.

Figure 7.2 shows that a majority of the test data are below the flexural capacity; only one half of the test data in Group C (15-in.), and a few in Group B (12-in.) are higher than flexural capacity. The majority of failure modes of experimental results are governed by anchorage bond failure, whereas the bond capacity is lower than flexure capacity. A theory of bond, therefore, is needed to predict the capacity of TPSBs.

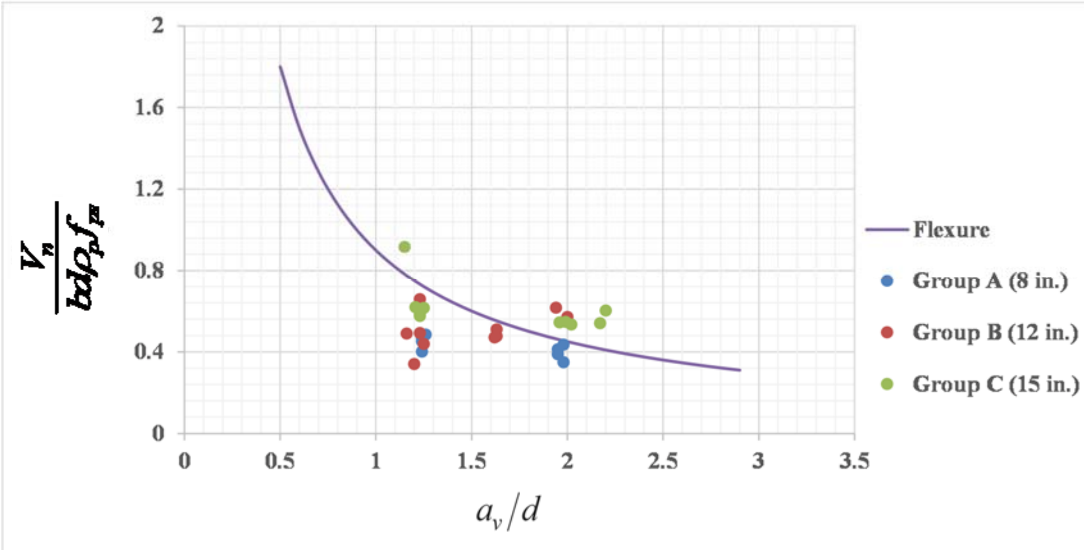


Figure 7.2 Normalized Shear Force and Shear-Span-to-Depth Ratio Relationship

Figure 7.3 shows the summary of bond theory in Prestressed Concrete (PC). Figure 7.3(a) shows the free body diagram of a PC beam subjected to a load within the transfer length. Figure 7.3(b) shows the relationship between stress of the tendons and distance from the end of a beam. Figure 7.3(b) shows clearly that, based on the development length theory, the initial stress of a tendon prior to applying the external load, f_{pxi}, is smaller than the effective stress of a tendon after all the losses are considered, f_{pe}. As the external load increases, the stress in the tendon develops and reaches the anchorage bond capacity, f_{px}, through an unknown path, either linear or parabolic. Figure 7.3(c) shows the bond profile within the transfer length prior to loading. The bond stress at the end face is at maximum as it tries to grip the tendon, and the bond stress reduces to zero as it reaches the transfer length. Since it is very difficult to measure the bond stress quantitatively, ACI Code takes the minimum average bond stress within the transfer length conservatively as a uniform stress of 400 psi. Consequently, as the load increases, a uniform-average-bond stress of TPSBs at ultimate stage is higher than 400 psi. This uniform-average-bond stress of TPSBs can be determined from the test in this study. The force from the external load was transferred to the tendon through the bond around the circumference of the tendon. Figure 7.3(d) shows the free body diagram of an isolated tendon.

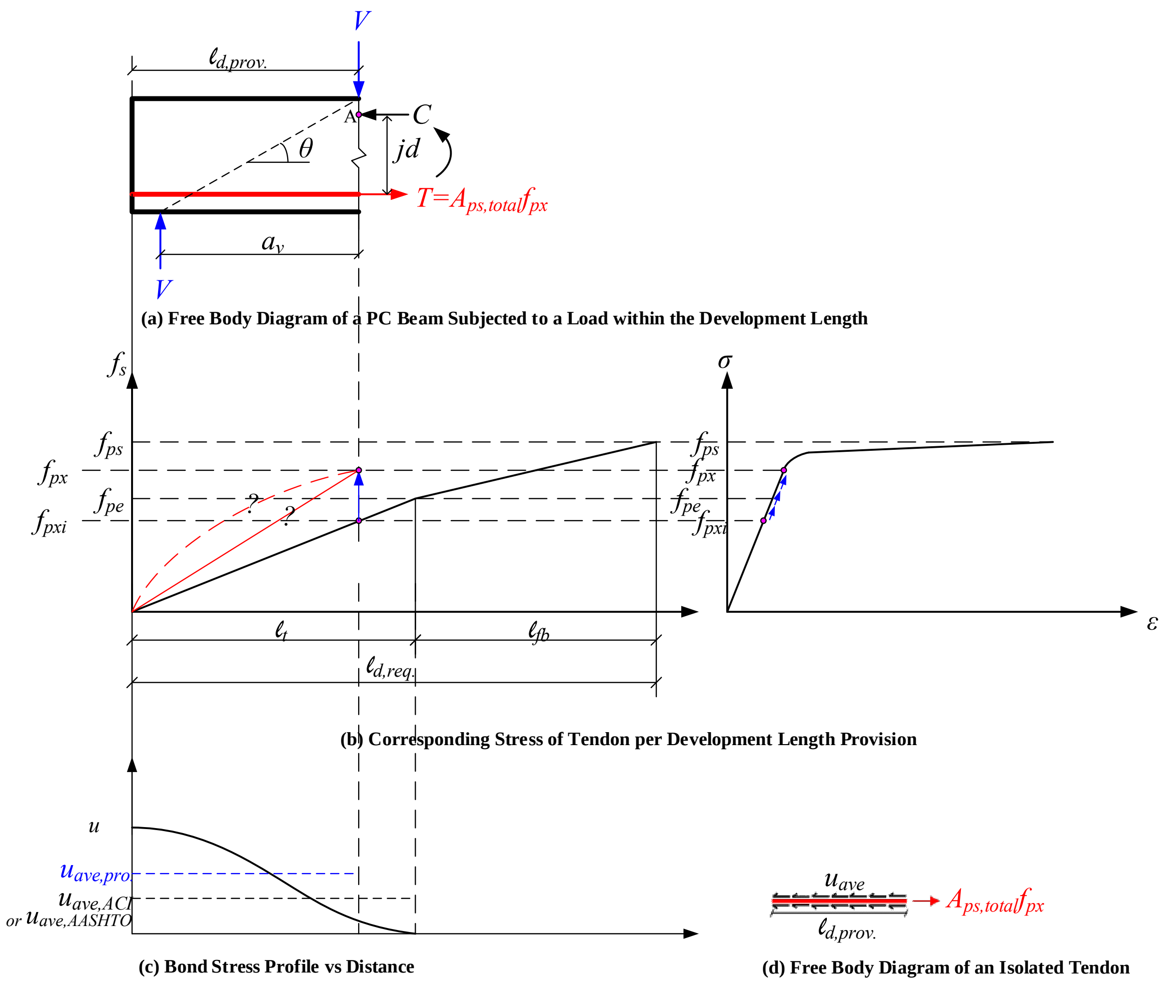


Figure 7.3 Summary of Bond Theory in Prestressed Concrete

Figure 7.3(a), taking a moment equilibrium at point A, Equation 7-2, can be derived as follows:

$$\sum M_A = 0,$$

$$T \times jd = V \times a_v,$$

$$T = \frac{V \times a_v}{jd}; \quad jd, min = \; 0.9\, d\left(AASHTO\right),$$

$$T = \frac{10}{9}\frac{a_v}{d}V \; ,$$

$$A_{ps,total} f_{px} = \frac{10}{9}\frac{a_v}{d}V \text{ , and}$$

$$f_{px} = \frac{10}{9}\frac{a_v}{d}\frac{V}{A_{ps,total}} \; . \tag{7-2}$$

Equation 7-2 shows that the stress of the tendons, for TPSBs loaded within the transfer length at ultimate stage, is proportional to the shear span-to-depth ratio, a_v/d, and the shear force, V. Assuming average bond stress within the shear span to be uniform stress, and taking force equilibrium of the isolated tendon in Figure 7.3(d), Equation 7-3 can be expressed as follows:

$$\sum F_x = 0 \, ,$$

$$f_{px} A_{ps.total} = u_{ave}\left(\sum 0\right)\left(1_{\; d,prov.}\right),$$

$$u_{ave} = \frac{A_{ps,total}}{\left(\sum 0\right)\left(1_{\; d,prov.}\right)} f_{px} \; . \tag{7-3}$$

Equation 7-3 shows that the average bond stress is proportional to the stress of tendon at ultimate stage. Incorporating Equation 7-2 into Equation 7-3 yields

$$u_{ave} = \frac{10}{9}\frac{V}{\left(\sum 0\right)\left(1_{\; d,prov.}\right)}\frac{a_v}{d} \, , \tag{7-4}$$

where $\sum 0 = \sum 4\pi d_b / 3$.

Literature proves that the transfer length decreases as concrete strength increases (Ratz et al., 1958; Zia & Mostafa, 1977); it further proves that transfer bond stress is directly proportional to the square root of concrete compressive strength (Olesniewicz, 1975; Mitchell et al., 1993; Barnes et al., 2003). Cousins et al. (1990) proposed an expression of transfer bond stress as a function of concrete strength at transfer, as shown in Equation 7-5

$$u_t = u_t^{'}\sqrt{f_{ci}^{'}} \ . \tag{7-5}$$

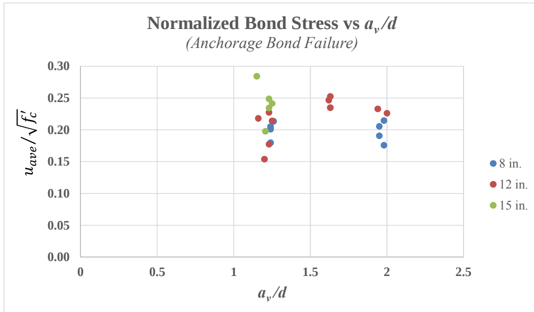
By applying this concept into the transfer bond stress in TPSBs, the average bond stress at ultimate stage can be represented as

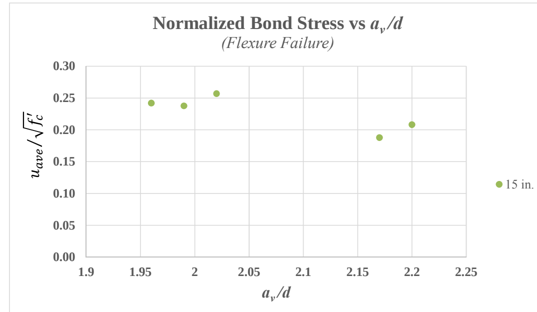
$$u_{ave} = S\sqrt{f_c^{'}} \ , \tag{7-6}$$

where *S* is a ratio of average bond stress of TPSBs at ultimate to square root of specified concrete compressive strength. Incorporating Equation 7-4 into Equation 7-6 and rearranging it into Equation 7-7, yields the *s* factor from the test data

$$S = \frac{u_{ave}}{\sqrt{f_c^{'}}} = \frac{10}{9}\frac{V}{\left(1_{d,prov.}\right)\sqrt{f_c^{'}}}\frac{a_v}{d} \ . \tag{7-7}$$

Figure 7.4 shows the normalized bond stress vs. shear span-to-depth ratio and their relationship for both the anchorage bond failure and the flexure failure. Figure 7.4(a) shows that the test data is scattered, not unexpected because anchorage bond failure is a local failure, with many factors influencing it. The lowest test data is the 12-in. TPSB with no stirrup and the a_v/d of 1.20, is understandable, because the height is relatively shallow, and no stirrup is provided; therefore, the TPSB fails at an early stage. Figure 7.4(b), on the other hand, shows test data less scattered as compared to test data shown in Figure 7.4(a) because the failure is governed by flexure failure.

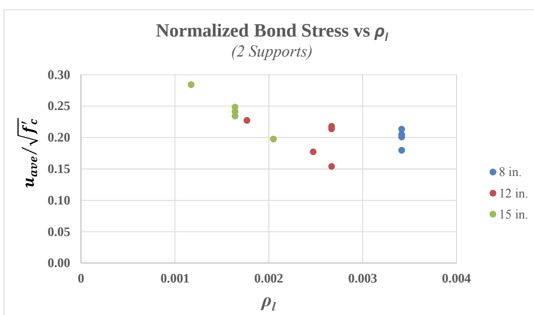


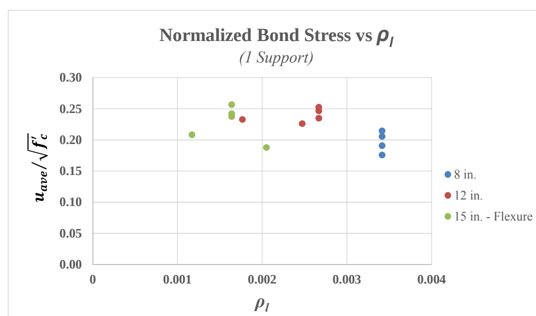


(a) *S*-factor vs. a_v/d of Anchorage Bond Failure (b) *S*-factor vs. a_v/d of Flexure Failure

Figure 7.4 Normalized Bond Stress vs. Shear Span-to-Depth Ratio Relationship

Figures 7.5(a) and (b) show the ratio of normalized bond stress vs. prestressing steel for two supports and one support, respectively. Figure 7.5(a) shows that the average normalized bond stress decreases as the prestressing steel ratio increases. Figure 7.5(b) also shows a relatively similar trend, although it is not as obvious.

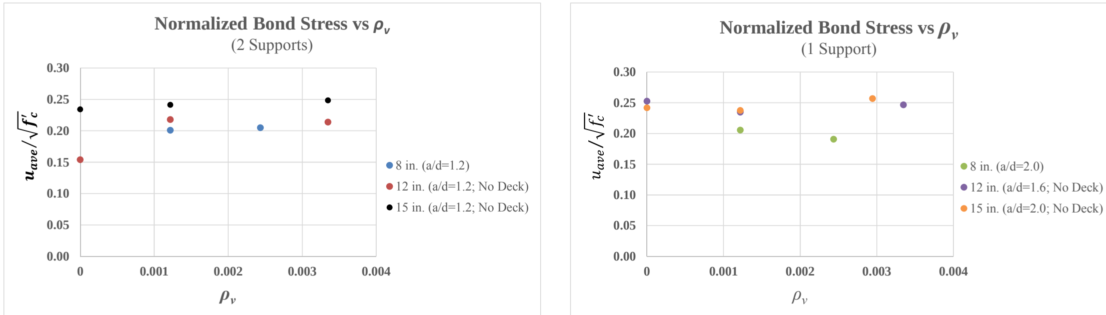




(a) *S*-factor vs. ρ_l of Two Supports (b) *S*-factor vs. ρ_l of One Support

Figure 7.5 Normalized Bond Stress vs. Prestressing Steel Ratio Relationship

Figures 7.6(a) and (b) show the ratio of normalized bond stress vs. transverse steel for two supports and one support, respectively. Figure 7.6(a) shows that the average normalized bond stress is almost constant as the transverse steel ratio increases. Figure 7.6(b) also shows a relatively similar trend. The average normalized bond stress, therefore, is not a function of the number of stirrups.



(a) *S*-factor vs. ρ_v of Two Supports (b) *S*-factor vs. ρ_v of One Support

Figure 7.6 Normalized Bond Stress vs. Transverse Steel Ratio Relationship

Plotting all the test data into the normalized bond stress vs. shear span-to-depth ratio, and assuming a minimum amount of stirrup is provided, the proposed model takes a minimum average bond stress within the transfer length at the ultimate stage, as shown in Figure 7.7.

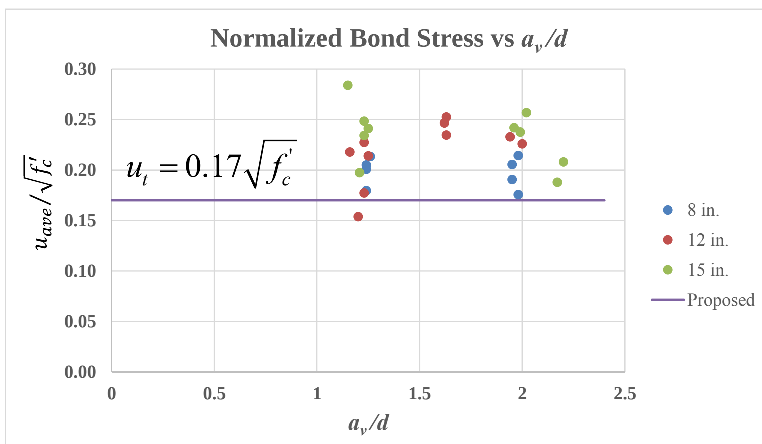


Figure 7.7 Normalized Bond Stress vs. Shear Span-to-Depth Ratio and Proposed Average Transfer Bond Stress

The proposed average transfer bond stress, $u_t = 0.17\sqrt{f'_c\,(ksi)}$, serves as a lower bound solution for predicting the anchorage bond capacity of TPSBs. A comparison of the proposed average bond stress with the ACI Code recommendation or AASHTO LRFD shows the proposed average bond stress higher than 400 *psi*, as depicted in Figure 7.3(c) to be obvious. Integrating the proposed average transfer bond stress into Equation 7-3 for TPSBs subjected to external force within the transfer length, the proposed stress of the prestressing strand at ultimate stage can be expressed as

$$f_{px} = 0.17 \frac{\left(\sum 0\right)\left(1_{d,prov.}\right)}{A_{ps,total}} \sqrt{f_c^{'}\left(ksi\right)} \leq f_{ps}\,. \tag{7-8}$$

Equation 7-8 shows that the proposed stress calculation has clear physical meaning: it is a function of the geometry of steel, development length provided and concrete strength. The proposed stress cannot, however, be greater than the stress at the nominal stage. The understanding of this limitation was gained from test observation: that failure mode of TPSBs is governed by the interaction between anchorage bond and flexure failure. By using force equilibrium and strain compatibility, therefore, as shown in Figure 7.8, the moment arm of TPSBs at ultimate stage can be determined.

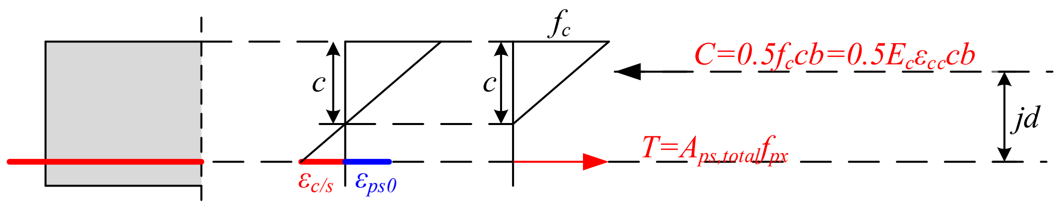


Figure 7.8 Strain and Stress Diagram at Loading Section at Ultimate Stage

From Figure 7.8, the moment capacity and the corresponding shear force (reaction force) can be calculated as

$$M = A_{ps,total} f_{px} jd \text{ and} \tag{7-9}$$

$$V = \frac{M}{a_v} = \frac{A_{ps,total} f_{px} jd}{a_v}\,. \tag{7-10}$$

Table 7.1 shows a prediction comparison between the AASHTO flexural capacity and the proposed method. AASHTO's prediction is not conservative, at an average of 0.84, and it is widely scattered, owing to anchorage bond failure, with a coefficient variance of 0.29. The proposed method, which takes anchorage bond into account, can predict the strength accurately, with an average of 1.28, and the prediction is less scattered than AASHTO's prediction, with a coefficient variance of 0.12.

Table 7.1 Comparison between AASHTO Flexural Analysis and Proposed Method

Specimen ID	V_{test} (*kips*)	V_{AASHTO} (*kips*)	V_{pro} (*kips*)	V_{test}/V_{AASHTO}	V_{test}/V_{pro}	Failure Mode
5SB8T-1.2-14-D	259	424	215	0.61	1.21	Anchorage Bond
5SB8T-2.0-14-D	215	269	191	0.80	1.12	Anchorage Bond
5SB8M-1.2-14-D	249	422	210	0.59	1.19	Anchorage Bond
5SB8M-2.0-14-D	227	268	187	0.85	1.22	Anchorage Bond
5SB8T-1.2-14-D^L	268	417	213	0.64	1.26	Anchorage Bond
5SB8T-2.0-14-D^L	240	265	190	0.91	1.26	Anchorage Bond
5SB8M-1.2-14-D^L	222	422	208	0.53	1.06	Anchorage Bond
5SB8M-2.0-14-D^L	193	264	185	0.73	1.04	Anchorage Bond
5SB12T-1.2-10-D	266	320	205	0.83	1.30	Anchorage Bond
5SB12T-2.0-10-D	249	203	191	1.23	1.30	Anchorage Bond
5SB12T-1.2-10-ND	175	305	139	0.57	1.25	Anchorage Bond
5SB12T-1.6-10-ND	187	235	129	0.80	1.45	Anchorage Bond
5SB12M-1.2-10-ND	196	332	155	0.59	1.26	Anchorage Bond
5SB12M-1.6-10-ND	191	236	140	0.81	1.36	Anchorage Bond
5SB12N-1.2-10-ND	136	321	152	0.42	0.89	Anchorage Bond
5SB12N-1.6-10-ND	204	236	139	0.86	1.46	Anchorage Bond
5SB12T-1.2-14-D	275	436	265	0.63	1.04	Anchorage Bond
5SB12T-2.0-14-D	319	268	247	1.19	1.29	Anchorage Bond
5SB15T-1.2-08-D	298	277	185	1.07	1.61	Anchorage Bond
5SB15T-2.0-08-D	196	145	144	1.35	1.37	Flexure
5SB15T-1.2-08-ND	185	254	129	0.73	1.44	Anchorage Bond
5SB15T-2.0-08-ND	172	155	116	1.11	1.49	Flexure
5SB15M-1.2-08-ND	199	253	145	0.79	1.38	Anchorage Bond
5SB15M-2.0-08-ND	177	159	131	1.12	1.35	Flexure
5SB15N-1.2-08-ND	189	256	141	0.74	1.34	Anchorage Bond
5SB15N-2.0-08-ND	176	161	127	1.10	1.39	Flexure
5SB15T-1.2-14-D	347	449	301	0.77	1.15	Anchorage Bond
5SB15T-2.0-14-D	303	250	245	1.21	1.24	Flexure
			Average	0.84	1.28	
			C.O.V.	0.29	0.12	

CHAPTER 8 DESIGN RECOMMENDATION AND DESIGN EXAMPLE

8.1 Introduction

The new set of design equations for predicting the ultimate strength of Thin Prestressed Slab Beams (TPSBs) is summarized and illustrated with a design example in this chapter. The proposed new set of design equations is simple and unifies both anchorage bond and flexure analysis.

8.2 Design Recommendation

The new set of design guidelines has been developed on the test performed at the University of Houston. Based on the test performed, it was found that when the TPSB was subjected to a concentrated load within the transfer length, the anchorage bond failure governed, although many shear reinforcements were provided within the region. Note that for TPSBs with minimum and no shear reinforcement, there was a similar, shared behavior. The minimum amount of shear reinforcement per AASHTO LRFD is recommended for designing the TPSBs, therefore, because shear failure is not critical.

When the concentrated load was moved beyond the transfer length, the test results showed that the stress of tendons can evolve to nominal stress, f_{ps}. In other words, the flexural behavior controls.

Although shear failure does not exist in the case of TPSBs the anchorage bond is equally important, so capacity must be checked, especially because an overloaded truck might pass through TPSBs. The assessment procedure of anchorage bond capacity within the transfer length can be summarized as follows:

1. Calculate the factored shear force and moment at the desired section.
2. Check the minimum amount of shear reinforcement per AASHTO LRFD:

   $$A_v \geq 0.0316\sqrt{f_c^{'}(ksi)}\frac{b_v s}{f_y}.$$

   Note: A minimum amount of shear reinforcement per AASHTO LRFD needs to be provided to prevent premature failure.
3. Calculate the stress of tendons at nominal stage (it serves as an upper bound solution):

   $$f_{ps} = f_{pu}\left(1 - k\frac{c}{d_p}\right),$$

   where

   $$c = \frac{A_{ps} f_{pu} + A_s f_s - A_s^{'} f_s^{'}}{0.85 f_c^{'} \beta_1 b + k A_{ps}\dfrac{f_{pu}}{d_p}}.$$

4. Calculate the proposed stress of tendons when the concentrated load is applied within the transfer length:

   $$f_{px} = \frac{u_{ave}\left(\sum 0\right)\left(1_{d,prov.}\right)}{A_{ps}} \leq f_{ps},$$

   where:

   $u_{ave} = 0.17\sqrt{f_c^{'}(ksi)}$, and

   $\sum 0 = \sum 4\pi d_b / 3$.
5. Calculate the initial stress of tendons within the transfer length prior to loading (this serves as a lower bound solution) per AASHTO LRFD:

$$f_{pxi} = \frac{l_{d,prov.}}{60d_b} f_{pe} \le f_{pe}.$$

6. Calculate the decompression strain at the analyzed section:

$$\varepsilon_{ps0} = \varepsilon_{c/s} + \frac{f_{pxi}}{E_s},$$

where

$$\sigma_{top} = -\frac{P_{xi}}{A_g} + \frac{(P_{xi} \times e) y_t}{I},$$

$$\sigma_{bot} = -\frac{P_{xi}}{A_g} - \frac{(P_{xi} \times e) y_t}{I},$$

$$c = \frac{\sigma_{top}}{\sigma_{top} - \sigma_{bot}} h,$$

$\varepsilon_{top} = \dfrac{\sigma_{top}}{E_c}$, and

$$\varepsilon_{c/s} = \frac{d-c}{c} \varepsilon_{top}.$$

7. Calculate the moment arm, *jd,*

$jd = d - \frac{1}{3}c$ if the stress of concrete at the extreme top fiber is elastic, and

$jd = d - \frac{1}{2}a = d - \frac{1}{2}\beta_1 c$ if the strain of concrete at the extreme top fiber is ≥ 0.003.

Note: step – 5 and step – 6 are required to find *jd* based on the strain compatibility. For simplicity, *jd* can also be taken as *0.9d*.

8. Calculate the flexural capacity at section $-x$ where the concentrated load is applied

$$M_x = A_{ps} f_{px} jd.$$

Figure 8.1 provides a flowchart that simplifies the detailed procedures of the anchorage bond capacity assessment for TPSBs loaded within the transfer length.

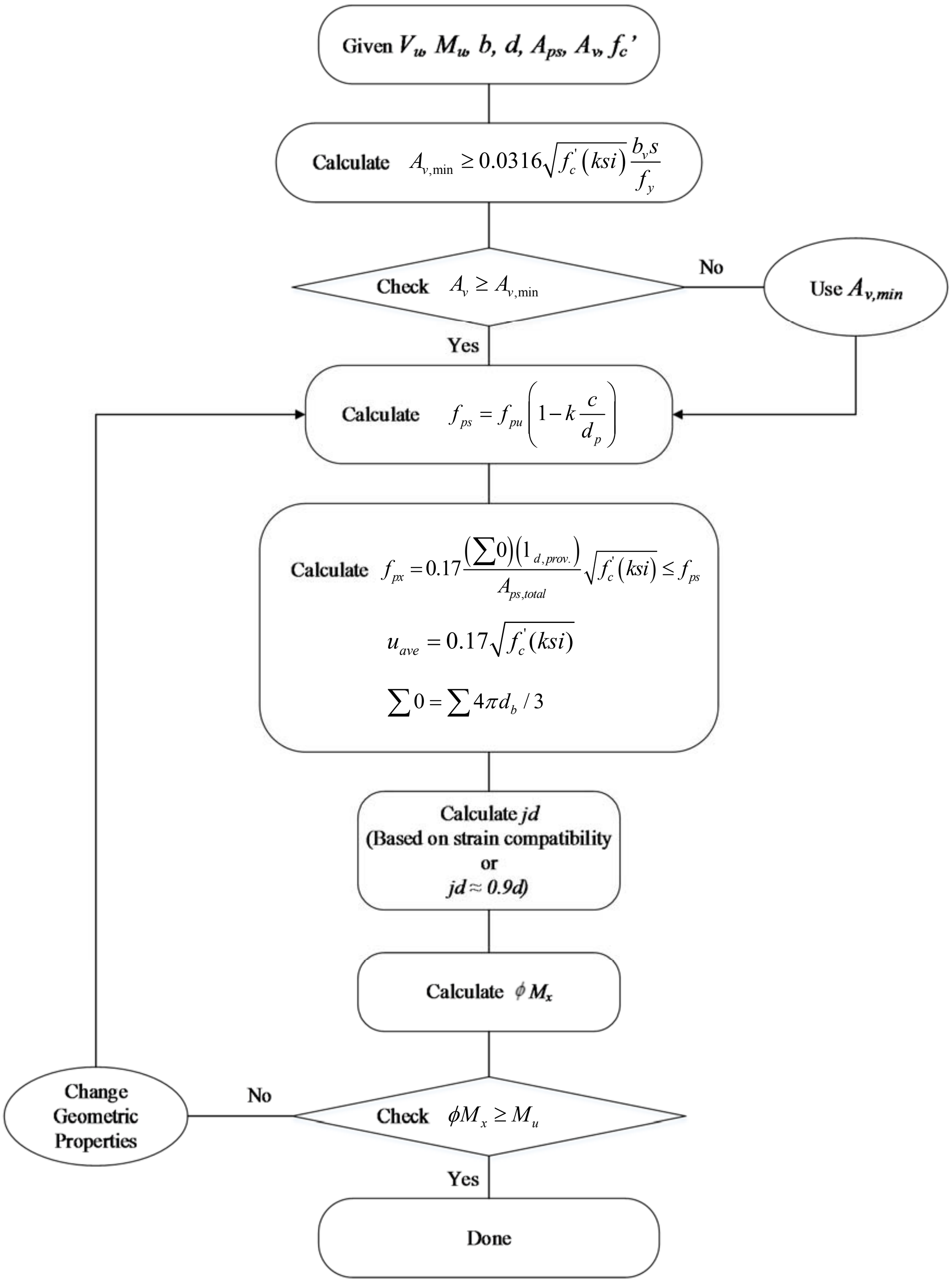


Figure 8.1 Flowchart of Anchorage Bond Capacity Assessment

8.3 Design Example

An anchorage bond capacity of TPSB at transfer length section (60 d_b from end face) is checked in this example. A 15-in. high TPSB supporting a span of 30 ft. (center-to-center between supports) was reinforced with 10 low relaxation strands of half-inch diameter, and a 5-in. cast-in-place deck was considered. An overloaded truck passes on the bridge of the TPSBs; the maximum concentrated load transfer from the wheel is 64 kips.

The values of various parameters required for the design:

Distance of center of gravity of beam cross-section from top extreme fiber = 10-in.

Eccentricity of tendon from center of gravity of concrete = 7.5-in.

Thickness of deck = 5-in.

Distance from edge to center line of support assumed to be 5.5-in.

The effective depth, d = 10 + 7.5 = 17.5-in.

The shear span, a_v = 60 d_b – distance from edge to center line of support = 30 – 5.5 = 24.5-in.

(1) Shear force and moment when the concentrated force is applied at 60d_b from the end face:

$$V_u = 1.6 \times 64 = 102 \ kips,$$

$$M_u = \frac{l - a_v}{l} V_u a_v = \frac{30 - 24.5/12}{30}(102)\left(24.5/12\right) = 194 \ kip - ft.$$

(2) Minimum shear reinforcement per AASHTO:

$$A_v \geq 0.0316\sqrt{f_c^{'}(ksi)}\frac{b_v s}{f_y} = 0.0316\sqrt{9}\frac{(59.75)s}{60} = 0.0944s,$$

$$s \leq \frac{A_v}{0.0944}.$$

Using 2 legs of #4 bar = 2 x 0.2 = 0.4 $in.^2$, the spacing of stirrups yields to

$$s \leq \frac{0.4}{0.0944} = 4.24\ in.,$$

$$s \approx 4\ in.$$

Hence, two-legged #4 stirrup is used with a spacing of 4 in.

(3) Stress of tendons at nominal stage (serves as upper bound solution):

$$f_{ps} = f_{pu}\left(1 - k\frac{c}{d_p}\right) \text{ and}$$

$$c = \frac{A_{ps}f_{pu} + A_s f_s - A_s^{'} f_s^{'}}{0.85 f_c^{'}\beta_1 b + kA_{ps}\dfrac{f_{pu}}{d_p}}.$$

Neglecting the compression longitudinal reinforcement for simplicity:

$$c = \frac{A_{ps}f_{pu} + A_s f_s - A_s^{'} f_s^{'}}{0.85 f_c^{'}\beta_1 b + kA_{ps}\dfrac{f_{pu}}{d_p}} = \frac{10\times0.153\times270+0-0}{0.85\times9\times0.65\times59.75+0.28\times10\times0.153\dfrac{270}{17.5}} = 1.36\ in.,$$

$$f_{ps} = f_{pu}\left(1 - k\frac{c}{d_p}\right) = 270\left(1 - 0.28\frac{1.36}{17.5}\right) = 264\ ksi.$$

(4) The stress of tendons when the concentrated load is applied at the transfer length ($60d_b$ from the end face):

$$f_{px} = \frac{u_{ave}\left(\sum 0\right)\left(1_{d,prov.}\right)}{A_{ps}} \le f_{ps} \ ,$$

$u_{ave} = 0.17\sqrt{f_c^{'}(ksi)} = 0.17\sqrt{9} = 0.51\ ksi$, and

$$\sum 0 = \sum 4\pi d_b / 3 = 10\ tendons \times \left(4\pi \times 0.5/3\right) = 20.9\ in.$$

Assume a distance from edge to centerline of support is 5.5-in.; therefore:

$1_{d,prov.} = 5.5 + 17.5 = 23\ in.$,

$$f_{px} = \frac{u_{ave}\left(\sum 0\right)\left(1_{d,prov.}\right)}{A_{ps}} = \frac{0.51(20.9)(23)}{10\times 0.153} = 160\ ksi\left(governs!\right) < f_{ps}\ \left(\approx 257\ ksi\right) \rightarrow ok!$$

(5) The initial stress of tendons within the transfer length prior to loading (this serves as lower-bound solution) per AASHTO LRFD:

$$f_{pxi} = \frac{1_{d,prov.}}{60d_b} f_{pe} = \frac{23}{60\times 0.5} 162 = 124\ ksi\left(governs!\right) \le f_{pe} \rightarrow ok!$$

(6) Decompression strain ε_{ps0} at the analyzed section:

Initial stresses (before applying load) at the top and bottom fiber at the critical section are:

$$\sigma_{top} = -\frac{P_{xi}}{A_g} + \frac{\left(P_{xi}\times e\right) y_t}{I} = -\frac{\left(10\times 0.153\times 124\right)}{59.75\times 20} + \frac{\left(10\times 0.153\times 124\times 7.5\right)10}{\frac{1}{12} 59.75\times 20^3}$$

$$= -0.159 + 0.446 = 0.198\ ksi \ ,$$

$$\sigma_{bot} = -\frac{P_{xi}}{A_g} - \frac{(P_{xi} \times e) y_t}{I} = -\frac{(10 \times 0.153 \times 124)}{59.75 \times 20} - \frac{(10 \times 0.153 \times 124 \times 7.5)10}{\frac{1}{12} 59.75 \times 20^3}$$

$$= -0.159 - 0.446 = -0.516 \; ksi \, ,$$

$$c = \frac{\sigma_{top}}{\sigma_{top} - \sigma_{bot}} h = \frac{0.198}{0.198 - (-0.516)} 20 = 5.55 \; in. \, ,$$

$$\varepsilon_{top} = \frac{\sigma_{top}}{E_c} = \frac{0.198}{1820\sqrt{9}} = 3.63 \times 10^{-5} \text{, and}$$

$$\varepsilon_{bot} = \frac{\sigma_{bot}}{E_c} = \frac{-0.516}{1820\sqrt{9}} = -9.45 \times 10^{-5} \, .$$

Strain of concrete at tendon level

$\varepsilon_{c/s} = \frac{d - c}{c} \varepsilon_{top} = \frac{17.5 - 5.55}{5.55} 3.63 \times 10^{-5} = 7.82 \times 10^{-5}$, and the decompression strain of tendon is

$$\varepsilon_{ps0} = \varepsilon_{c/s} + \frac{f_{pxi}}{E_s} = 7.82 \times 10^{-5} + \frac{124}{29000} = 4.35 \times 10^{-3} \, .$$

(7) Find moment arm, jd:

$$jd = d - \frac{1}{3} c \, .$$

From force equilibrium in Figure 2.8:

$C = T$ and

$$0.5 E_c \varepsilon_{cc} c b = A_{ps} f_{px} \, .$$

From strain compatibility in Figure 2.8:

$$\frac{c}{d} = \frac{\varepsilon_{cc}}{\varepsilon_{cc} + \varepsilon_{c/s}} \text{ and}$$

$$\varepsilon_{c/s} = \frac{f_{px}}{E_{ps}} - \varepsilon_{ps0} = \frac{160}{29000} - 4.35\times10^{-3} = 1.17\times10^{-3}$$

By solving the equations simultaneously (or by trial and error for *c* value), the following is obtained:

$c = 4.14\ in.$,

$$\varepsilon_{cc} = \frac{c}{d-c}\varepsilon_{c/s} = \frac{4.14}{17.5-4.14}1.17\times10^{-3} = 3.63\times10^{-4} \rightarrow \textit{concrete is still in elastic},$$

$$jd = d - \frac{1}{3}c = 17.5 - \frac{1}{3}4.14 = 16.1\ in.$$

(Note: To avoid calculating the detailed calculation in step – 5 and step – 6, assume conservatively $jd = 0.9d = 15.8\ in.$).

(8) Moment capacity at critical section

$$M_x = A_{ps} f_{px} jd = 10\times0.153\times160\times16.1 = 3941\ kip-in. = 328\ kip-ft$$

The reduction factor, ϕ, is taken as 0.9:

$$\phi M_x = 0.9\times328 = 295\ kip-ft > M_u (=194\ kip-ft) \rightarrow ok!$$

If *jd* is taken as *0.9d*:

$$M_x = A_{ps} f_{px} jd = 10\times0.153\times160\times15.8 = 3868\ kip-in. = 322\ kip-ft,$$

$$\phi M_x = 0.9\times322 = 290\ kip-ft > M_u (=194\ kip-ft) \rightarrow ok!$$

CHAPTER 9 CONCLUSIONS

9.1 Final Summary

The main purposes of this research were to study the structural behavior of Thin Prestressed Slab Beams (TPSBs) and to develop a design methodology to predict the strength of TPSBs. The following conclusions were drawn from this research:

1. Fourteen TPSBs were designed, cast, and tested. Five TPSBs were 15-in. in height, five TPSBs were 12-in. in height, and four TPSBs were 8-in. in height. Multiple variables were evaluated, such as: shear span-to-depth ratio (*a/d*), number of stirrups, depth, number of tendons, longitudinal reinforcement at the end zone, and 5-in. CIP deck.

2. Two main failure modes were observed from the tests.

   a. All TPSBs in Groups A, B, and the TPSBs in Group C with $a/d \approx 1.2$ failed owing to anchorage bond failure. Anchorage bond failure typically yields brittle behavior (small deflection), irregular sawtooth curve for reaction force vs. deflection relationship, and the major cracks formed at the end face of the TPSBs.

   b. All the TPSBs in Group C with the $a/d \approx 2.0$ shared flexure failure as cause of failure. Flexure failure causes ductile behavior, smooth reaction force vs. deflection curve, major (vertical) cracks that formed on west and east sides of the TPSBs, and crushing of concrete at the extreme top fiber at the ultimate load stage.

3. Eight-in. high TPSBs are feasible for implementation in practice, especially for shorter-span bridges, and two different types of detailing have been studied in this research.

4. A minimum amount of shear reinforcement per AASHTO (2010) is recommended. From the experimental work, adding more stirrups and longitudinal reinforcement at the end zone could not prevent the anchorage bond failure. They did, however, help delay the failure.

5. AASHTO (2010) shear provision was not used in the analysis because it is irrelevant. AASHTO (2010) flexure provision was used to compare with the test results, and it was discovered that AASHTO (2010) overestimates the strength of TPSBs because AASHTO (2010) does not take anchorage bond failure into account. TPSBs clearly failed owing to anchorage bond failure; the stress of prestressing tendons could not develop to its nominal stress, f_{ps}. A new set of design guidelines that takes anchorage bond into account is essential for an effective analysis tool.

6. TPSBs will have no cracks under the service load, and the anchorage bond capacity of TPSBs is higher than the design of the ultimate load; this conclusion can be made after comparing the experimental results with the serviceability analysis results.

7. A finite element model to simulate the behavior of TPSBs was developed using the simulation of concrete structures (SCS) program. This program successfully captured the failure modes and predicted the nonlinear behavior of TPSBs. For blind analysis purpose, the stress of tendons can be calculated using Equation 7-8. If the stress of tendons can reach nominal stress then TPSBs are likely to fail in flexure. If the stress of tendons cannot reach nominal stress, however, then the anchorage bond-slip needs to be considered in constitutive law of tendon in Steel02 material module; the ultimate stress is defined as f_{px} and a negative slope of 30% is recommended for conservatism.

8. A new, rational set of design equations is proposed to predict the strength of TPSBs. The set is simple and unifies both anchorage bond and flexure analysis; it is a useful tool for analyzing the strength of prestressed members with wide-and-shallow sections.

9.2 Suggestions for Future Work

Several suggestions for TxDOT engineers and future studies related to this research:

1. Anchorage bond capacity can be enhanced in several ways:
   a. Anchorage bond failure is closely related to its development length. Based on TxDOT's detailed drawings, the current minimum distance from the end of the TPSBs to the centerline of the elastomeric bearing is 5.5-in.; therefore, increasing the distance between the ends of the TPSBs to the centerline of the elastomeric bearings will increase the bond capacity.
   b. Adding a mechanical anchorage device.
   c. Providing a rough layer of coating for tendons.
2. Anchorage bond failure is local, and many factors contribute to its performance; therefore, the test data is scattered and random. To fully understand the bond performance of prestressed concrete members, more experimental work is required.
3. Many new materials have been developed recently, i.e., FRP, CFRP, etc., and the newly developed materials are purported to have better structural performance. It will be interesting to study the behavior of TPSBs using these new materials.
4. The program SCS has successfully predicted the nonlinear behavior of TPSBs under monotonic loading. Further experimental work is needed to verify the capability of predicting the behavior of TPSBs under cyclic loading.

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APPENDIX A

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APPENDIX A EXPERIMENTAL DATA OF THIN PRESTRESSED SLAB BEAMS

A.1 General Description

The experimental data of fourteen Thin Prestressed Slab Beams (TPSBs) are presented in Appendix A. The test data of each end of TPSBs is generally shown in three tables. The first table shows the measurement of load cell(s), deflection right under actuator (LVDT No. 5, see Figure A.1), deflection measured by LVDT attached on the west and east side of the loading section (LVDT Nos. 1 and 3, respectively, see Figure A.1), settlement of the support on the west and east sides (LVDT Nos. 2 and 4, respectively, see Figure A.1), and the net deflection. The net deflection is the mid deflection subtracted by the average of the settlement. However, it is important to note that for the first few tests, the LVDT No. 5 was not installed, therefore, the net deflection for the particular case is the average of the west and east deflection subtracted by the average of the settlement.

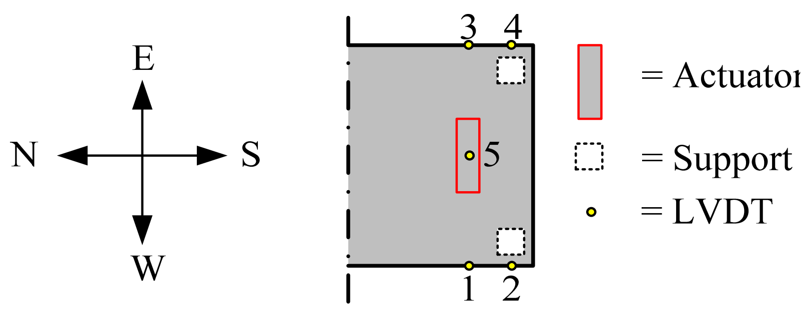


Figure A.1 Schematic Plan of LVDT under TPSBs at South End

The symbols used in presenting the load cell and deflection data are explained below:

N. LC	=	Load Cell measurement at North end support
SW. LC	=	Load Cell measurement at South West support
SE. LC	=	Load Cell measurement at South East support
TRF	=	Total Reaction Force (SW. LC + SE. LC)
Mid. Def.	=	Deflection at Middle of the loading section (underneath the actuator)
W. Def.	=	Deflection on the West side of the loading section
E. Def.	=	Deflection on the East side of the loading section
W. Sett.	=	Settlement on the West side of the support section
E. Sett.	=	Settlement on the East side of the support section
Net Def.	=	Net Deflection [(= Mid. Def. – Average of Sett.) or (=Average of Def. – Average of Sett.)]

The second table presents the measurement of tendon slippage. The LVDTs are positioned parallel to the tendons and attached mechanically on each stick-out portion of the tendons. Figure A.2 shows the typical LVDTs labelling for 8 tendons TPSBs. And for fourteen tendons TPSBs, the labelling continues to T14 accordingly. Moreover, for the first few tests, the tendon LVDTs were not attached because the slippage was not expected.

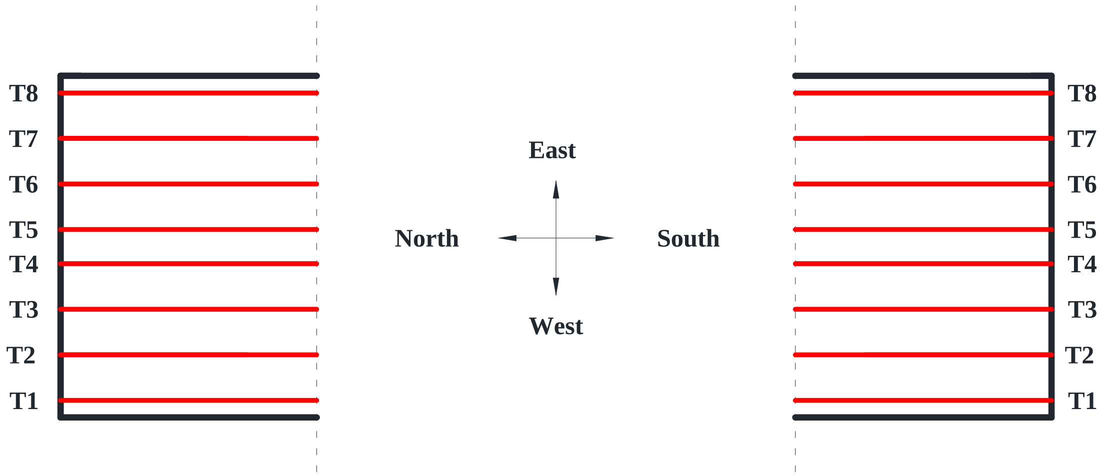


Figure A.2 LVDTs Labelling

The third table displays the strain gauges measurement. The strain gauges in the Phase 1 were attached on the transverse reinforcement and the labelling of the strain gauges is shown in Table 3.3. For convenience, it is shown again in Table A.1. Meanwhile, the strain gauges in the Phase 2 were attached on the prestressing steel. For north end, the strain gauges were attached on the second outermost tendons from the west and east side. For south end, the strain gauges were attached on the two innermost tendons. Figure A.3 shows the strain gauges location with the labelling. The first strain gauge was installed at 10 in. from the end and the spacing between each tendon is 6 in. If the strain gauges fail to sense any strain, they will be labelled as B.G. (Broken Gauges).

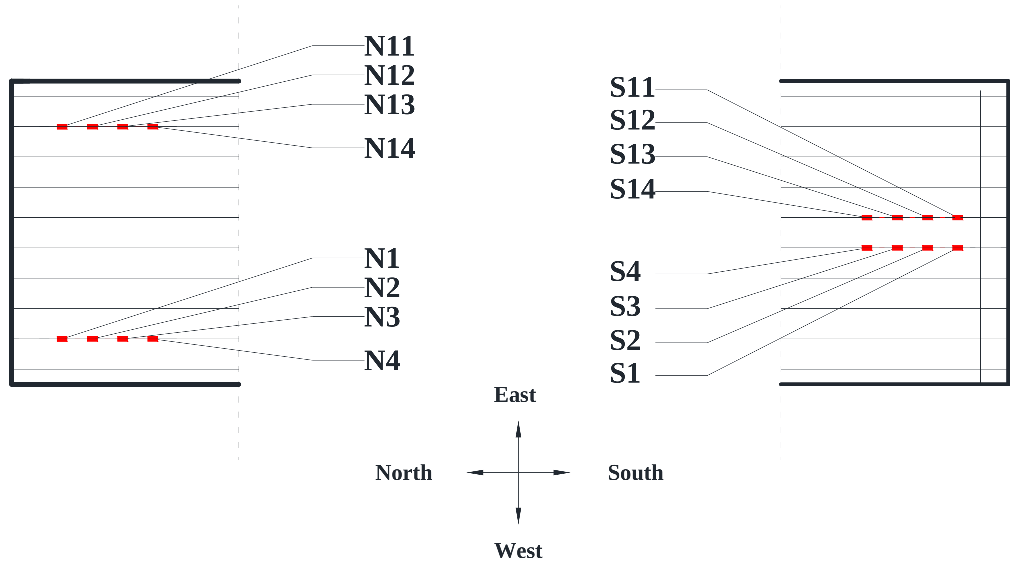


Figure A.3 Typical Strain Gauges on the Stands of Phase 2 TPSBs

In the Phase 1 experimental work, the rosette LVDTs were installed to measured the in-plane smeared strain. Although the measured strain was negligible, the data is presented as well. The typical labelling of rosette LVDTs is shown in Figure A.4.

Table A.1 Strain Gauges ID and Locations for Phase I TPSBs

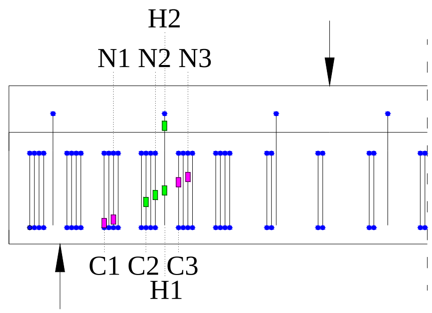
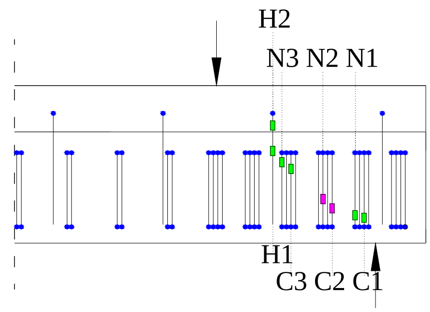
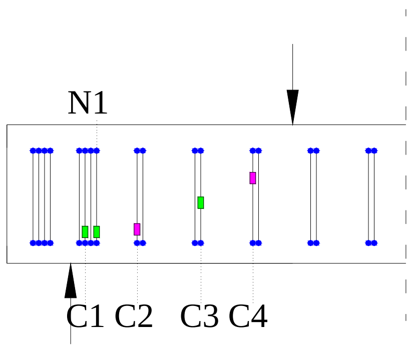
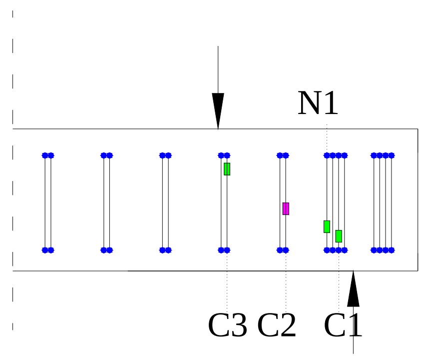
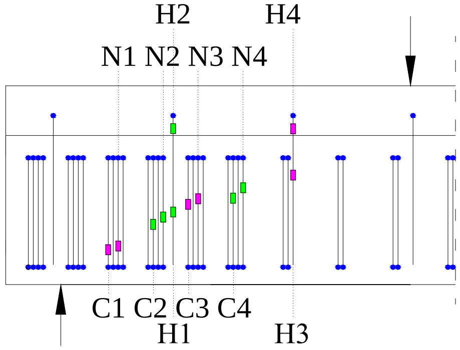
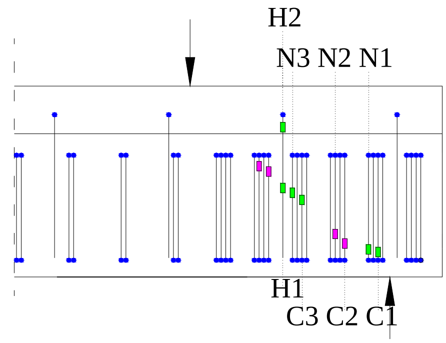
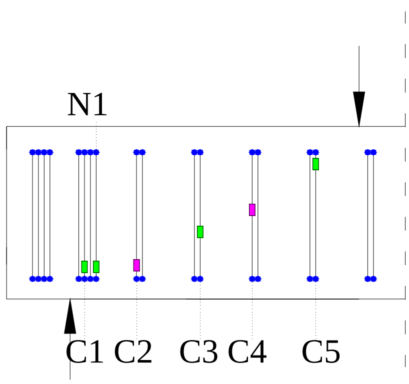
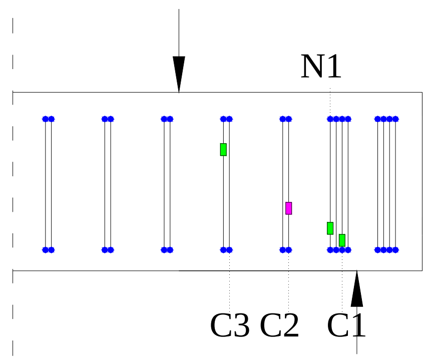
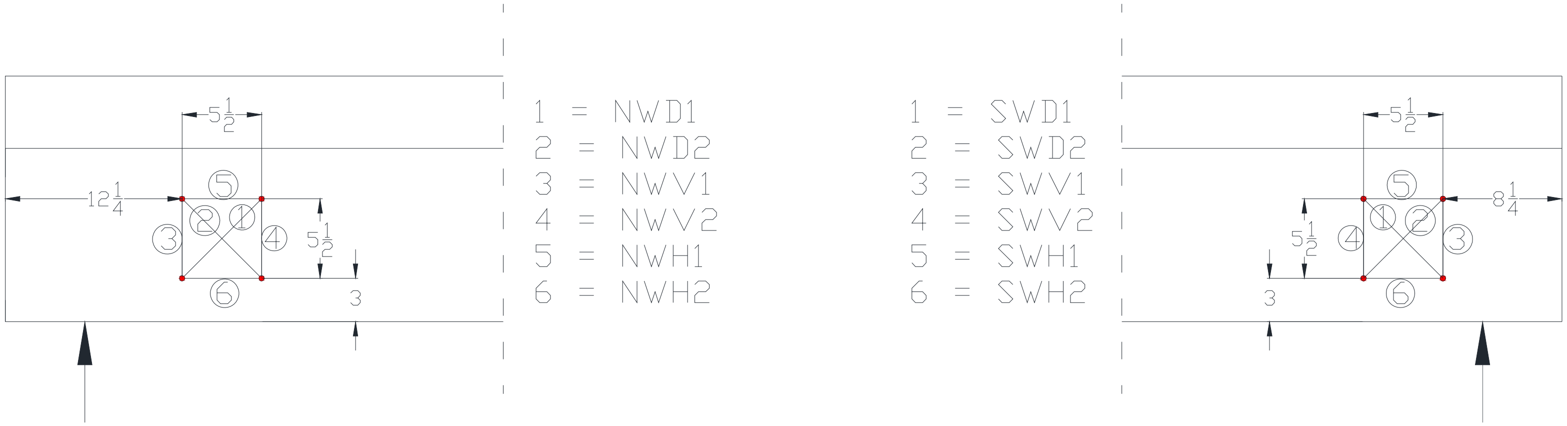
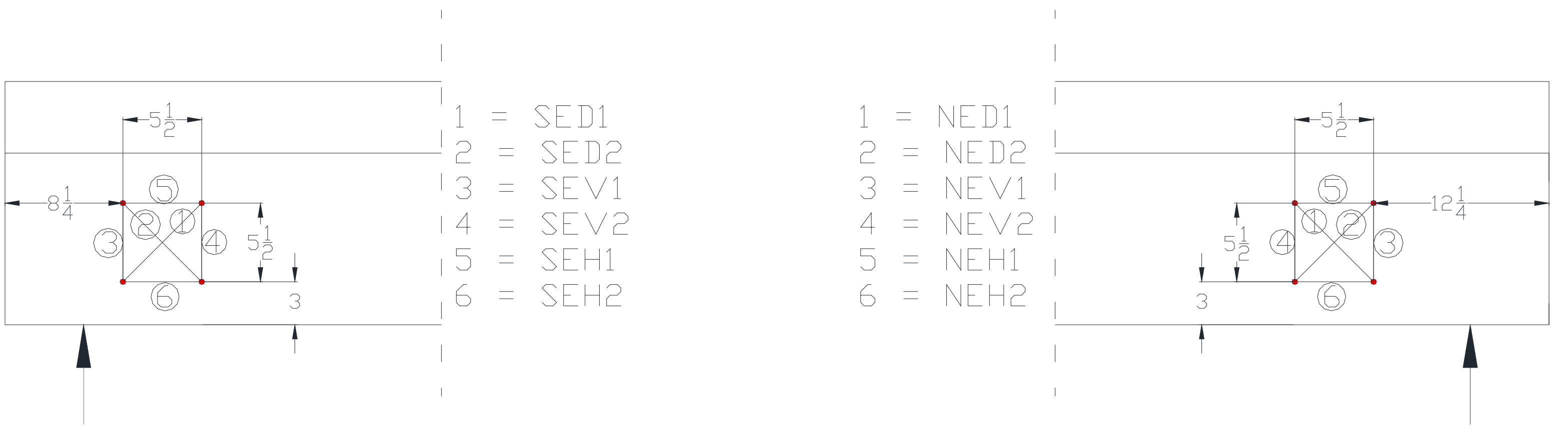
	North		South
5SB12T-2.0-10-D		**5SB12T-1.2-10-D**	
5SB12M-1.6-10-ND		**5SB12M-1.2-10-ND**	
5SB12N-1.6-10-ND	No transverse reinforcement	**5SB12N-1.2-10-ND**	No transverse reinforcement

Table A.1-Cont. Strain Gauges ID and Locations for Phase I TPSBs

<table>
<tr><th></th><th>North</th><th></th><th>South</th></tr>
<tr><td>5SB15T-2.0-8-D</td><td>
</td><td>5SB15T-1.2-8-D</td><td>
</td></tr>
<tr><td>5SB15M-2.0-8-ND</td><td>
</td><td>5SB15M-1.2-8-ND</td><td>
</td></tr>
<tr><td>5SB15N-2.0-8-ND</td><td>No transverse reinforcement</td><td>5SB15N-1.2-8-ND</td><td>No transverse reinforcement</td></tr>
</table>



(a) West Side View



(b) East Side View

Figure A.4 Typical Labelling for Rosette LVDTs of Phase 1 TPSBs

A.2 5SB8T-1.2-14-D

Table A.2 Measurement of Load and Deflection Relationships of 5SB8T-1.2-14-D

SW.LC		SE. LC		TRF		Mid. Def.		SW. Def.		SE. Def.		SW. Sett.		SE. Sett.		Net Def.	
kips	kN	kips	kN	kips	kN	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
0	0	0	0	0	0	0.02	0.63	0.02	0.63	0.02	0.63	0.00	0.10	0.00	0.10	0.00	0.00
10	45	6	26	16	71	0.03	0.64	0.03	0.64	0.03	0.64	0.00	0.10	0.00	0.10	0.01	0.13
19	82	11	50	30	132	0.03	0.75	0.03	0.75	0.03	0.75	0.01	0.25	0.01	0.25	0.01	0.24
31	140	19	86	51	225	0.03	0.89	0.03	0.89	0.03	0.89	0.02	0.47	0.02	0.47	0.01	0.38
49	219	31	136	80	355	0.04	1.10	0.04	1.10	0.04	1.10	0.03	0.67	0.03	0.67	0.02	0.59
61	272	39	172	100	444	0.05	1.24	0.05	1.24	0.05	1.24	0.03	0.79	0.03	0.79	0.03	0.73
79	350	51	227	130	577	0.06	1.48	0.06	1.48	0.06	1.48	0.03	0.89	0.03	0.89	0.04	0.98
96	426	64	284	160	710	0.07	1.76	0.07	1.76	0.07	1.76	0.04	0.95	0.04	0.95	0.05	1.25
107	476	73	323	180	799	0.08	1.97	0.08	1.97	0.08	1.97	0.04	0.98	0.04	0.98	0.06	1.46
113	500	77	344	190	844	0.08	2.08	0.08	2.08	0.08	2.08	0.04	0.98	0.04	0.98	0.06	1.57
118	524	82	364	200	889	0.09	2.20	0.09	2.20	0.09	2.20	0.04	0.98	0.04	0.98	0.07	1.69
123	546	87	387	210	932	0.10	2.42	0.10	2.42	0.10	2.42	0.04	0.98	0.04	0.98	0.08	1.92
128	569	92	409	220	977	0.10	2.60	0.10	2.60	0.10	2.60	0.04	0.98	0.04	0.98	0.08	2.09
133	591	97	430	230	1021	0.11	2.76	0.11	2.76	0.11	2.76	0.04	0.98	0.04	0.98	0.09	2.25
127	563	94	417	220	981	0.12	2.92	0.12	2.92	0.12	2.92	0.04	0.98	0.04	0.98	0.10	2.42
131	583	99	439	230	1021	0.12	3.09	0.12	3.09	0.12	3.09	0.04	0.98	0.04	0.98	0.10	2.58
136	604	104	462	240	1066	0.13	3.36	0.13	3.36	0.13	3.36	0.04	0.98	0.04	0.98	0.11	2.85
138	616	107	474	245	1090	0.14	3.50	0.14	3.50	0.14	3.50	0.04	0.98	0.04	0.98	0.12	2.99
141	625	109	485	250	1110	0.15	3.85	0.15	3.85	0.15	3.85	0.04	0.98	0.04	0.98	0.13	3.34

Table A.2 Measurement of Load and Deflection Relationships of 5SB8T-1.2-14-D (Continued)

SW.LC		SE. LC		TRF		Mid. Def.		SW. Def.		SE. Def.		SW. Sett.		SE. Sett.		Net Def.	
kips	kN	kips	kN	kips	kN	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
144	641	113	503	257	1143	0.17	4.28	0.17	4.28	0.17	4.28	0.04	0.98	0.04	0.98	0.15	3.77
145	644	114	507	259	1151	0.17	4.43	0.17	4.43	0.17	4.43	0.04	0.98	0.04	0.98	0.15	3.93
144	639	113	504	257	1143	0.17	4.44	0.17	4.44	0.17	4.44	0.04	0.98	0.04	0.98	0.15	3.93
144	642	114	507	258	1149	0.18	4.46	0.18	4.46	0.18	4.46	0.04	0.98	0.04	0.98	0.16	3.95
139	619	111	495	250	1114	0.18	4.47	0.18	4.47	0.18	4.47	0.04	0.98	0.04	0.98	0.16	3.96
131	583	107	476	238	1060	0.18	4.58	0.18	4.58	0.18	4.58	0.04	0.98	0.04	0.98	0.16	4.07
127	566	105	465	232	1031	0.19	4.74	0.19	4.74	0.19	4.74	0.04	0.98	0.04	0.98	0.17	4.23
126	563	104	462	230	1025	0.19	4.75	0.19	4.75	0.19	4.75	0.04	0.98	0.04	0.98	0.17	4.25
129	575	106	471	235	1046	0.19	4.78	0.19	4.78	0.19	4.78	0.04	0.98	0.04	0.98	0.17	4.27
131	582	108	481	239	1063	0.19	4.88	0.19	4.88	0.19	4.88	0.04	0.98	0.04	0.98	0.17	4.37
132	589	112	499	245	1088	0.21	5.22	0.21	5.22	0.21	5.22	0.04	0.98	0.04	0.98	0.19	4.72
133	594	115	512	249	1106	0.22	5.52	0.22	5.52	0.22	5.52	0.04	0.98	0.04	0.98	0.20	5.01
134	594	117	522	251	1116	0.23	5.85	0.23	5.85	0.23	5.85	0.04	0.98	0.04	0.98	0.21	5.34
132	585	117	521	249	1106	0.24	6.00	0.24	6.00	0.24	6.00	0.04	0.98	0.04	0.98	0.22	5.49
126	562	116	515	242	1077	0.25	6.23	0.25	6.23	0.25	6.23	0.04	0.98	0.04	0.98	0.23	5.72
127	564	116	517	243	1081	0.25	6.24	0.25	6.24	0.25	6.24	0.04	0.98	0.04	0.98	0.23	5.73
128	570	117	520	245	1090	0.25	6.26	0.25	6.26	0.25	6.26	0.04	0.98	0.04	0.98	0.23	5.75
127	565	116	518	243	1082	0.25	6.27	0.25	6.27	0.25	6.27	0.04	0.98	0.04	0.98	0.23	5.76
126	559	116	515	242	1075	0.25	6.28	0.25	6.28	0.25	6.28	0.04	0.98	0.04	0.98	0.23	5.77
127	565	117	519	244	1084	0.25	6.30	0.25	6.30	0.25	6.30	0.04	0.98	0.04	0.98	0.23	5.79
127	566	117	520	244	1085	0.25	6.31	0.25	6.31	0.25	6.31	0.04	0.98	0.04	0.98	0.23	5.81
126	558	116	516	242	1075	0.25	6.33	0.25	6.33	0.25	6.33	0.04	0.98	0.04	0.98	0.23	5.82

Table A.2 Measurement of Load and Deflection Relationships of 5SB8T-1.2-14-D (Continued)

SW.LC		SE. LC		TRF		Mid. Def.		SW. Def.		SE. Def.		SW. Sett.		SE. Sett.		Net Def.	
kips	kN	kips	kN	kips	kN	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
125	558	116	517	242	1075	0.25	6.34	0.25	6.34	0.25	6.34	0.04	0.98	0.04	0.98	0.23	5.83
126	563	117	519	243	1082	0.25	6.36	0.25	6.36	0.25	6.36	0.04	0.98	0.04	0.98	0.23	5.85
125	557	116	517	242	1074	0.25	6.37	0.25	6.37	0.25	6.37	0.04	0.98	0.04	0.98	0.23	5.86
124	551	116	515	240	1066	0.25	6.39	0.25	6.39	0.25	6.39	0.04	0.98	0.04	0.98	0.23	5.88
125	557	116	518	242	1075	0.25	6.40	0.25	6.40	0.25	6.40	0.04	0.98	0.04	0.98	0.23	5.89
126	559	117	519	242	1078	0.25	6.42	0.25	6.42	0.25	6.42	0.04	0.98	0.04	0.98	0.23	5.91
124	551	116	516	240	1067	0.25	6.43	0.25	6.43	0.25	6.43	0.04	0.98	0.04	0.98	0.23	5.92
124	551	116	516	240	1067	0.25	6.45	0.25	6.45	0.25	6.45	0.04	0.98	0.04	0.98	0.23	5.94
125	557	117	520	242	1077	0.25	6.45	0.25	6.45	0.25	6.45	0.04	0.98	0.04	0.98	0.23	5.95
124	553	116	518	241	1071	0.25	6.47	0.25	6.47	0.25	6.47	0.04	0.98	0.04	0.98	0.23	5.96
123	547	116	515	239	1062	0.26	6.48	0.26	6.48	0.26	6.48	0.04	0.98	0.04	0.98	0.24	5.97
124	551	116	518	240	1069	0.26	6.49	0.26	6.49	0.26	6.49	0.04	0.98	0.04	0.98	0.24	5.99
125	554	117	520	241	1074	0.26	6.51	0.26	6.51	0.26	6.51	0.04	0.98	0.04	0.98	0.24	6.00
123	546	116	516	239	1062	0.26	6.52	0.26	6.52	0.26	6.52	0.04	0.98	0.04	0.98	0.24	6.01
122	544	116	516	238	1060	0.26	6.54	0.26	6.54	0.26	6.54	0.04	0.98	0.04	0.98	0.24	6.03
124	550	117	519	240	1069	0.26	6.55	0.26	6.55	0.26	6.55	0.04	0.98	0.04	0.98	0.24	6.04
123	547	116	518	239	1065	0.26	6.57	0.26	6.57	0.26	6.57	0.04	0.98	0.04	0.98	0.24	6.06
121	540	116	515	237	1055	0.26	6.58	0.26	6.58	0.26	6.58	0.04	0.98	0.04	0.98	0.24	6.07
122	544	116	518	239	1061	0.26	6.60	0.26	6.60	0.26	6.60	0.04	0.98	0.04	0.98	0.24	6.09
123	547	117	519	240	1066	0.26	6.61	0.26	6.61	0.26	6.61	0.04	0.98	0.04	0.98	0.24	6.11
121	540	116	516	237	1056	0.26	6.62	0.26	6.62	0.26	6.62	0.04	0.98	0.04	0.98	0.24	6.11
121	537	116	515	237	1052	0.26	6.64	0.26	6.64	0.26	6.64	0.04	0.98	0.04	0.98	0.24	6.13

Table A.2 Measurement of Load and Deflection Relationships of 5SB8T-1.2-14-D (Continued)

SW.LC		SE. LC		TRF		Mid. Def.		SW. Def.		SE. Def.		SW. Sett.		SE. Sett.		Net Def.	
kips	kN	kips	kN	kips	kN	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
122	542	117	519	239	1061	0.26	6.66	0.26	6.66	0.26	6.66	0.04	0.98	0.04	0.98	0.24	6.15
121	539	116	518	237	1056	0.26	6.67	0.26	6.67	0.26	6.67	0.04	0.98	0.04	0.98	0.24	6.17
119	530	115	514	235	1044	0.26	6.69	0.26	6.69	0.26	6.69	0.04	0.98	0.04	0.98	0.24	6.19
120	533	116	516	236	1048	0.26	6.71	0.26	6.71	0.26	6.71	0.04	0.98	0.04	0.98	0.24	6.20
120	534	116	517	236	1051	0.26	6.73	0.26	6.73	0.26	6.73	0.04	0.98	0.04	0.98	0.24	6.22
118	526	115	513	233	1038	0.27	6.75	0.27	6.75	0.27	6.75	0.04	0.98	0.04	0.98	0.25	6.24
117	519	115	510	231	1029	0.27	6.77	0.27	6.77	0.27	6.77	0.04	0.98	0.04	0.98	0.25	6.26
117	522	115	513	233	1035	0.27	6.79	0.27	6.79	0.27	6.79	0.04	0.98	0.04	0.98	0.25	6.29
116	517	115	511	231	1028	0.27	6.81	0.27	6.81	0.27	6.81	0.04	0.98	0.04	0.98	0.25	6.31
113	500	113	503	226	1004	0.27	6.84	0.27	6.84	0.27	6.84	0.04	0.98	0.04	0.98	0.25	6.33
110	490	112	500	223	990	0.27	6.89	0.27	6.89	0.27	6.89	0.04	0.98	0.04	0.98	0.25	6.38
105	467	110	489	215	956	0.27	6.95	0.27	6.95	0.27	6.95	0.04	0.98	0.04	0.98	0.25	6.44
97	432	106	473	203	905	0.28	7.05	0.28	7.05	0.28	7.05	0.04	0.98	0.04	0.98	0.26	6.54
66	294	92	407	158	701	0.28	7.19	0.28	7.19	0.28	7.19	0.04	0.98	0.04	0.98	0.26	6.68

Table A.3 Measurement of Tendon Slippage of 5SB8T-1.2-14-D

TRF		T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12	T13	T14
kips	kN	in	in	in	in	in	in	in	in	in	in	in	in	in	in
0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
16	71	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
30	132	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
51	225	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
80	355	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
100	444	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
130	577	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
160	710	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.02	0.00	0.00	0.00	0.00	0.00	0.00
180	799	0.00	0.00	0.00	0.00	0.01	0.00	0.03	0.03	0.00	0.00	0.00	0.00	0.00	0.00
190	844	0.00	0.00	0.00	0.00	0.01	0.00	0.03	0.04	0.00	0.00	0.00	0.00	0.00	0.00
200	889	0.00	0.00	0.00	0.00	0.02	0.00	0.04	0.04	0.00	0.00	0.00	0.00	0.00	0.00
210	932	0.00	0.00	0.00	0.00	0.04	0.02	0.04	0.04	0.00	0.00	0.00	0.00	0.00	0.00
220	977	0.00	0.00	0.00	0.00	0.04	0.02	0.05	0.05	0.00	0.00	0.00	0.00	0.00	0.00
230	1021	0.00	0.00	0.00	0.00	0.04	0.02	0.05	0.05	0.00	0.01	0.00	0.00	0.00	0.00
220	981	0.00	0.00	0.00	0.02	0.05	0.02	0.05	0.05	0.00	0.01	0.00	0.00	0.00	0.00
230	1021	0.00	0.00	0.00	0.03	0.05	0.03	0.06	0.06	0.00	0.01	0.00	0.00	0.00	0.00
240	1066	0.00	0.00	0.00	0.04	0.05	0.03	0.06	0.07	0.00	0.01	0.00	0.00	0.00	0.00
245	1090	0.00	0.00	0.00	0.04	0.05	0.04	0.07	0.07	0.01	0.02	0.00	0.00	0.00	0.00
250	1110	0.00	0.00	0.01	0.05	0.06	0.04	0.08	0.08	0.03	0.03	0.00	0.00	0.00	0.00
257	1143	0.00	0.00	0.02	0.06	0.07	0.05	0.09	0.09	0.04	0.04	0.00	0.00	0.00	0.00
259	1151	0.00	0.00	0.02	0.06	0.07	0.05	0.09	0.09	0.04	0.04	0.00	0.00	0.00	0.00
257	1143	0.00	0.00	0.02	0.06	0.07	0.05	0.09	0.09	0.04	0.04	0.00	0.00	0.00	0.00

Table A.3 Measurement of Tendon Slippage of 5SB8T-1.2-14-D (Continued)

TRF		T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12	T13	T14
kips	kN	in	in	in	in	in	in	in	in	in	in	in	in	in	in
258	1149	0.00	0.00	0.02	0.06	0.07	0.05	0.09	0.09	0.04	0.04	0.00	0.00	0.00	0.00
250	1114	0.00	0.00	0.03	0.07	0.07	0.05	0.09	0.10	0.05	0.04	0.00	0.00	0.00	0.00
238	1060	0.01	0.00	0.05	0.09	0.07	0.06	0.09	0.10	0.05	0.04	0.00	0.00	0.00	0.00
232	1031	0.01	0.01	0.05	0.09	0.08	0.06	0.10	0.10	0.05	0.04	0.00	0.00	0.00	0.00
230	1025	0.01	0.01	0.05	0.09	0.08	0.06	0.10	0.10	0.05	0.04	0.00	0.00	0.00	0.00
235	1046	0.02	0.01	0.05	0.09	0.08	0.06	0.10	0.10	0.05	0.04	0.00	0.00	0.00	0.00
239	1063	0.02	0.01	0.05	0.09	0.08	0.06	0.10	0.10	0.05	0.04	0.00	0.00	0.00	0.00
245	1088	0.03	0.01	0.06	0.10	0.08	0.06	0.10	0.10	0.05	0.04	0.00	0.00	0.00	0.00
249	1106	0.03	0.02	0.07	0.10	0.08	0.06	0.10	0.10	0.05	0.04	-0.01	0.00	0.00	0.00
251	1116	0.04	0.03	0.08	0.11	0.08	0.06	0.10	0.10	0.05	0.04	-0.02	0.00	0.00	0.00
249	1106	0.05	0.03	0.08	0.11	0.09	0.06	0.10	0.10	0.05	0.04	-0.02	0.00	0.00	0.00
242	1077	0.06	0.04	0.09	0.11	0.09	0.06	0.10	0.10	0.05	0.04	-0.02	0.00	0.00	0.00
243	1081	0.06	0.04	0.09	0.11	0.09	0.06	0.10	0.10	0.05	0.04	-0.02	0.00	0.00	0.00
245	1090	0.06	0.04	0.09	0.11	0.09	0.06	0.10	0.10	0.05	0.04	-0.02	0.00	0.00	0.00
243	1082	0.06	0.04	0.09	0.11	0.09	0.06	0.10	0.10	0.05	0.04	-0.02	0.00	0.00	0.00
242	1075	0.06	0.04	0.09	0.11	0.09	0.06	0.10	0.10	0.05	0.04	-0.02	0.00	0.00	0.00
244	1084	0.06	0.04	0.09	0.11	0.09	0.06	0.10	0.10	0.05	0.04	-0.02	0.00	0.00	0.00
244	1085	0.06	0.04	0.09	0.11	0.09	0.06	0.10	0.10	0.05	0.04	-0.02	0.00	0.00	0.00
242	1075	0.06	0.04	0.09	0.11	0.09	0.06	0.10	0.10	0.05	0.04	-0.02	0.00	0.00	0.00
242	1075	0.06	0.04	0.09	0.11	0.09	0.06	0.10	0.10	0.05	0.04	-0.02	0.00	0.00	0.00
243	1082	0.06	0.04	0.09	0.11	0.09	0.06	0.10	0.10	0.05	0.04	-0.02	0.00	0.00	0.00
242	1074	0.06	0.04	0.10	0.12	0.09	0.06	0.10	0.10	0.05	0.04	-0.02	0.00	0.00	0.00

Table A.3 Measurement of Tendon Slippage of 5SB8T-1.2-14-D (Continued)

TRF		T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12	T13	T14
kips	kN	in	in	in	in	in	in	in	in	in	in	in	in	in	in
240	1066	0.06	0.04	0.10	0.12	0.09	0.06	0.10	0.10	0.05	0.04	-0.02	0.00	0.00	0.00
242	1075	0.06	0.04	0.10	0.12	0.09	0.06	0.10	0.10	0.05	0.04	-0.02	0.00	0.00	0.00
242	1078	0.06	0.04	0.10	0.12	0.09	0.06	0.10	0.10	0.05	0.04	-0.02	0.00	0.00	0.00
240	1067	0.06	0.04	0.10	0.12	0.09	0.06	0.10	0.10	0.05	0.04	-0.02	0.00	0.00	0.00
240	1067	0.06	0.04	0.10	0.12	0.09	0.06	0.10	0.10	0.05	0.04	-0.02	0.00	0.00	0.00
242	1077	0.06	0.04	0.10	0.12	0.09	0.06	0.10	0.10	0.05	0.04	-0.02	0.00	0.00	0.00
241	1071	0.06	0.04	0.10	0.12	0.09	0.06	0.10	0.10	0.05	0.04	-0.02	0.00	0.00	0.00
239	1062	0.06	0.04	0.10	0.12	0.09	0.06	0.10	0.10	0.05	0.04	-0.02	0.00	0.00	0.00
240	1069	0.06	0.04	0.10	0.12	0.09	0.06	0.10	0.10	0.05	0.04	-0.02	0.00	0.00	0.00
241	1074	0.06	0.04	0.10	0.12	0.09	0.06	0.10	0.10	0.05	0.04	-0.02	0.00	0.00	0.00
239	1062	0.06	0.04	0.10	0.12	0.09	0.06	0.10	0.10	0.05	0.04	-0.02	0.00	0.00	0.00
238	1060	0.06	0.04	0.10	0.12	0.09	0.06	0.10	0.10	0.05	0.04	-0.02	0.00	0.00	0.00
240	1069	0.06	0.04	0.10	0.12	0.09	0.06	0.10	0.10	0.05	0.04	-0.02	0.00	0.00	0.00
239	1065	0.06	0.05	0.10	0.12	0.09	0.06	0.10	0.10	0.05	0.04	-0.02	0.00	0.00	0.00
237	1055	0.06	0.05	0.10	0.12	0.09	0.06	0.10	0.10	0.05	0.04	-0.02	0.00	0.00	0.00
239	1061	0.06	0.05	0.10	0.12	0.09	0.06	0.10	0.10	0.05	0.04	-0.02	0.00	0.00	0.00
240	1066	0.06	0.05	0.10	0.12	0.09	0.06	0.10	0.10	0.05	0.04	-0.02	0.00	0.00	0.00
237	1056	0.06	0.05	0.10	0.12	0.09	0.06	0.10	0.10	0.05	0.04	-0.02	0.00	0.00	0.00
237	1052	0.06	0.05	0.10	0.12	0.09	0.06	0.10	0.10	0.05	0.04	-0.02	0.00	0.00	0.00
239	1061	0.06	0.05	0.11	0.12	0.09	0.06	0.10	0.10	0.05	0.04	-0.02	0.00	0.00	0.00
237	1056	0.06	0.05	0.11	0.12	0.09	0.06	0.10	0.10	0.05	0.04	-0.02	0.00	0.00	0.00
235	1044	0.06	0.05	0.11	0.12	0.09	0.06	0.10	0.10	0.05	0.04	-0.02	0.00	0.00	0.00

Table A.3 Measurement of Tendon Slippage of 5SB8T-1.2-14-D (Continued)

TRF		T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12	T13	T14
kips	kN	in	in	in	in	in	in	in	in	in	in	in	in	in	in
236	1048	0.06	0.05	0.11	0.12	0.09	0.06	0.10	0.10	0.05	0.04	-0.02	0.00	0.00	0.00
236	1051	0.06	0.05	0.11	0.12	0.09	0.06	0.10	0.10	0.05	0.04	-0.02	0.00	0.00	0.00
233	1038	0.06	0.05	0.11	0.12	0.09	0.06	0.10	0.10	0.05	0.04	-0.02	0.00	0.00	0.00
231	1029	0.06	0.05	0.11	0.12	0.09	0.06	0.10	0.10	0.05	0.04	-0.02	0.00	0.00	0.00
233	1035	0.06	0.05	0.11	0.12	0.09	0.06	0.10	0.10	0.05	0.04	-0.02	0.00	0.00	0.00
231	1028	0.06	0.05	0.12	0.12	0.09	0.06	0.10	0.10	0.05	0.04	-0.02	0.00	0.00	0.00
226	1004	0.06	0.05	0.12	0.12	0.09	0.06	0.10	0.10	0.05	0.04	-0.02	0.00	0.00	0.00
223	990	0.06	0.05	0.12	0.12	0.09	0.06	0.10	0.10	0.05	0.04	-0.02	0.00	0.00	0.00
215	956	0.07	0.06	0.12	0.12	0.09	0.06	0.10	0.10	0.05	0.04	-0.02	0.00	0.00	0.00
203	905	0.07	0.06	0.13	0.12	0.09	0.06	0.10	0.10	0.05	0.04	-0.02	0.00	0.00	0.00
158	701	0.06	0.06	0.15	0.12	0.09	0.06	0.10	0.10	0.05	0.04	-0.02	0.00	0.00	0.00

Table A.4 Measurement of Strain Gauges of 5SB8T-1.2-14-D

TRF		S1	S2	S3	S4	S11	S12	S13	S14
kips	kN	m/m	m/m	m/m	m/m	m/m	m/m	m/m	m/m
0	0	B.G.	-16.6	-13.0	B.G.	-17.3	-21.8	-20.2	B.G.
16	71	B.G.	-16.4	-15.2	B.G.	-17.3	-21.8	-20.7	B.G.
30	132	B.G.	-20.2	-21.6	B.G.	-24.1	-30.9	-30.9	B.G.
51	225	B.G.	-25.0	-11.8	B.G.	-27.3	-40.0	-43.2	B.G.
80	355	B.G.	67.1	19.1	B.G.	-32.5	-53.7	-60.7	B.G.
100	444	B.G.	250.2	439.7	B.G.	78.7	-55.5	-71.0	B.G.
130	577	B.G.	712.3	947.5	B.G.	256.4	154.0	32.1	B.G.
160	710	B.G.	1114.5	1301.7	B.G.	387.2	710.4	913.4	B.G.
180	799	B.G.	1292.1	1401.1	B.G.	658.8	1053.3	1354.7	B.G.
190	844	B.G.	1338.5	1434.8	B.G.	1016.2	1124.0	1472.8	B.G.
200	889	B.G.	1435.5	1460.5	B.G.	806.4	1210.5	1579.2	B.G.
210	932	B.G.	1597.9	1615.2	B.G.	889.5	1308.1	1713.7	B.G.
220	977	B.G.	1756.2	1792.6	B.G.	1112.2	1474.6	1904.1	B.G.
230	1021	B.G.	1904.3	1956.9	B.G.	1051.0	1598.8	2059.9	B.G.
220	981	B.G.	2036.0	2519.9	B.G.	1144.5	1668.6	2088.3	B.G.
230	1021	B.G.	2131.6	2658.2	B.G.	1134.9	1730.3	2164.6	B.G.
240	1066	B.G.	2281.7	2992.4	B.G.	1586.5	2052.4	2457.8	B.G.
245	1090	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
158	701	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.

A.3 5SB8T-2.0-14-D

Table A.5 Measurement of Load and Deflection Relationships of 5SB8T-2.0-14-D

LC		Mid. Def.		W. Def.		E. Def.		W. Sett.		E. Sett.		Net Def.	
kips	kN	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm
0	0	0.01	0.30	0.01	0.26	0.08	2.02	0.01	0.37	0.05	1.32	0.00	0.00
31	140	0.04	1.02	0.01	0.26	0.08	2.03	0.01	0.37	0.05	1.33	0.01	0.20
60	268	0.06	1.63	0.02	0.43	0.12	3.17	0.02	0.51	0.08	1.98	0.02	0.41
90	400	0.09	2.17	0.03	0.64	0.16	4.10	0.02	0.61	0.10	2.46	0.03	0.66
120	532	0.10	2.66	0.04	0.89	0.19	4.92	0.03	0.71	0.11	2.86	0.04	0.90
120	536	0.11	2.67	0.04	0.89	0.19	4.92	0.03	0.71	0.11	2.86	0.04	0.91
119	531	0.11	2.67	0.04	0.90	0.19	4.93	0.03	0.71	0.11	2.87	0.04	0.91
120	533	0.11	2.68	0.04	0.90	0.19	4.93	0.03	0.71	0.11	2.87	0.04	0.91
150	666	0.12	3.11	0.04	1.14	0.22	5.67	0.03	0.78	0.13	3.21	0.05	1.15
181	804	0.14	3.57	0.06	1.41	0.25	6.42	0.03	0.85	0.14	3.53	0.06	1.41
190	846	0.15	3.73	0.06	1.50	0.26	6.70	0.03	0.87	0.14	3.62	0.06	1.51
200	889	0.15	3.91	0.06	1.61	0.27	6.97	0.03	0.89	0.15	3.72	0.06	1.63
210	932	0.16	4.14	0.07	1.77	0.29	7.29	0.04	0.91	0.15	3.84	0.07	1.79
215	957	0.17	4.30	0.07	1.89	0.30	7.54	0.04	0.92	0.15	3.91	0.08	1.91
209	928	0.18	4.56	0.08	2.12	0.30	7.73	0.04	0.92	0.15	3.91	0.09	2.17
200	891	0.18	4.63	0.09	2.20	0.31	7.80	0.04	0.92	0.15	3.91	0.09	2.24
187	834	0.18	4.69	0.09	2.27	0.31	7.85	0.04	0.92	0.15	3.91	0.09	2.29
189	841	0.18	4.69	0.09	2.27	0.31	7.86	0.04	0.92	0.15	3.91	0.09	2.30
188	838	0.18	4.69	0.09	2.27	0.31	7.86	0.04	0.92	0.15	3.91	0.09	2.30

Table A.5 Measurement of Load and Deflection Relationships of 5SB8T-2.0-14-D (Continued)

LC		Mid. Def.		W. Def.		E. Def.		W. Sett.		E. Sett.		Net Def.	
kips	kN	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm
187	832	0.19	4.70	0.09	2.27	0.31	7.85	0.04	0.92	0.15	3.91	0.09	2.31
194	862	0.19	4.94	0.10	2.46	0.32	8.17	0.04	0.92	0.15	3.91	0.10	2.55
186	826	0.21	5.29	0.11	2.78	0.34	8.60	0.04	0.92	0.15	3.91	0.11	2.90
187	833	0.21	5.31	0.11	2.79	0.34	8.61	0.04	0.92	0.15	3.91	0.11	2.92
189	838	0.23	5.91	0.13	3.33	0.37	9.35	0.04	0.92	0.15	3.91	0.14	3.51
187	832	0.23	5.92	0.13	3.34	0.37	9.36	0.04	0.92	0.15	3.91	0.14	3.53
187	831	0.23	5.93	0.13	3.35	0.37	9.38	0.04	0.92	0.15	3.91	0.14	3.54
189	839	0.23	5.94	0.13	3.36	0.37	9.40	0.04	0.92	0.15	3.91	0.14	3.55
185	824	0.24	6.12	0.14	3.50	0.38	9.60	0.04	0.92	0.15	3.91	0.15	3.72
187	832	0.27	6.86	0.16	4.18	0.42	10.55	0.04	0.92	0.15	3.91	0.18	4.47
186	825	0.27	6.87	0.17	4.19	0.42	10.56	0.04	0.92	0.15	3.91	0.18	4.48
179	798	0.28	7.07	0.17	4.39	0.43	10.81	0.04	0.92	0.15	3.91	0.18	4.68
182	810	0.28	7.12	0.17	4.43	0.43	10.87	0.04	0.92	0.15	3.91	0.19	4.73
180	803	0.29	7.32	0.18	4.59	0.44	11.11	0.04	0.92	0.15	3.91	0.19	4.92
183	813	0.29	7.34	0.18	4.61	0.44	11.14	0.04	0.92	0.15	3.91	0.19	4.95
183	816	0.30	7.54	0.19	4.78	0.45	11.39	0.04	0.92	0.15	3.91	0.20	5.15
181	805	0.30	7.64	0.19	4.90	0.45	11.53	0.04	0.92	0.15	3.91	0.21	5.25
181	803	0.30	7.66	0.19	4.91	0.45	11.54	0.04	0.92	0.15	3.91	0.21	5.27
179	798	0.30	7.67	0.19	4.92	0.45	11.55	0.04	0.92	0.15	3.91	0.21	5.27
181	804	0.31	7.88	0.20	5.12	0.47	11.82	0.04	0.92	0.15	3.91	0.22	5.49
176	781	0.32	8.11	0.21	5.35	0.48	12.08	0.04	0.92	0.15	3.91	0.23	5.72
168	748	0.34	8.54	0.23	5.78	0.50	12.59	0.04	0.92	0.15	3.91	0.24	6.15

Table A.5 Measurement of Load and Deflection Relationships of 5SB8T-2.0-14-D (Continued)

LC		Mid. Def.		W. Def.		E. Def.		W. Sett.		E. Sett.		Net Def.	
kips	kN	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm
168	746	0.34	8.56	0.23	5.79	0.50	12.60	0.04	0.92	0.15	3.91	0.24	6.16
169	752	0.34	8.58	0.23	5.81	0.50	12.62	0.04	0.92	0.15	3.91	0.24	6.18
169	750	0.34	8.59	0.23	5.83	0.50	12.64	0.04	0.92	0.15	3.91	0.24	6.20
167	743	0.34	8.61	0.23	5.84	0.50	12.67	0.04	0.92	0.15	3.91	0.24	6.21
168	746	0.34	8.62	0.23	5.85	0.50	12.68	0.04	0.92	0.15	3.91	0.24	6.22
168	749	0.34	8.62	0.23	5.86	0.50	12.68	0.04	0.92	0.15	3.91	0.25	6.23
167	741	0.34	8.62	0.23	5.86	0.50	12.68	0.04	0.92	0.15	3.91	0.25	6.23
166	738	0.34	8.62	0.23	5.86	0.50	12.68	0.04	0.92	0.15	3.91	0.25	6.23
167	744	0.34	8.62	0.23	5.87	0.50	12.68	0.04	0.92	0.15	3.91	0.25	6.23
167	742	0.34	8.63	0.23	5.87	0.50	12.69	0.04	0.92	0.15	3.91	0.25	6.24
165	735	0.34	8.64	0.23	5.87	0.50	12.69	0.04	0.92	0.15	3.91	0.25	6.25
166	739	0.34	8.64	0.23	5.88	0.50	12.69	0.04	0.92	0.15	3.91	0.25	6.25
167	742	0.34	8.64	0.23	5.88	0.50	12.70	0.04	0.92	0.15	3.91	0.25	6.25
165	735	0.34	8.64	0.23	5.88	0.50	12.70	0.04	0.92	0.15	3.91	0.25	6.25
165	733	0.34	8.65	0.23	5.89	0.50	12.70	0.04	0.92	0.15	3.91	0.25	6.25
166	740	0.34	8.65	0.23	5.89	0.50	12.71	0.04	0.92	0.15	3.91	0.25	6.25
166	737	0.34	8.65	0.23	5.88	0.50	12.71	0.04	0.92	0.15	3.91	0.25	6.25
164	731	0.34	8.65	0.23	5.89	0.50	12.70	0.04	0.92	0.15	3.91	0.25	6.25
165	735	0.34	8.65	0.23	5.89	0.50	12.71	0.04	0.92	0.15	3.91	0.25	6.26
164	731	0.34	8.65	0.23	5.89	0.50	12.71	0.04	0.92	0.15	3.91	0.25	6.26
166	737	0.34	8.65	0.23	5.89	0.50	12.71	0.04	0.92	0.15	3.91	0.25	6.26
165	735	0.34	8.65	0.23	5.89	0.50	12.71	0.04	0.92	0.15	3.91	0.25	6.26

Table A.5 Measurement of Load and Deflection Relationships of 5SB8T-2.0-14-D (Continued)

LC		Mid. Def.		W. Def.		E. Def.		W. Sett.		E. Sett.		Net Def.	
kips	kN	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm
164	729	0.34	8.65	0.23	5.90	0.50	12.72	0.04	0.92	0.15	3.91	0.25	6.26
165	734	0.34	8.65	0.23	5.89	0.50	12.71	0.04	0.92	0.15	3.91	0.25	6.26
166	737	0.34	8.65	0.23	5.90	0.50	12.71	0.04	0.92	0.15	3.91	0.25	6.26
164	730	0.34	8.66	0.23	5.90	0.50	12.71	0.04	0.92	0.15	3.91	0.25	6.26
164	728	0.34	8.68	0.23	5.93	0.50	12.73	0.04	0.92	0.15	3.91	0.25	6.29
165	732	0.34	8.68	0.23	5.93	0.50	12.74	0.04	0.92	0.15	3.91	0.25	6.29
164	728	0.34	8.68	0.23	5.93	0.50	12.74	0.04	0.92	0.15	3.91	0.25	6.29
162	722	0.34	8.68	0.23	5.93	0.50	12.74	0.04	0.92	0.15	3.91	0.25	6.29
163	727	0.34	8.68	0.23	5.93	0.50	12.73	0.04	0.92	0.15	3.91	0.25	6.29
164	729	0.34	8.68	0.23	5.93	0.50	12.74	0.04	0.92	0.15	3.91	0.25	6.29
162	723	0.34	8.68	0.23	5.93	0.50	12.74	0.04	0.92	0.15	3.91	0.25	6.29
162	722	0.34	8.68	0.23	5.93	0.50	12.74	0.04	0.92	0.15	3.91	0.25	6.29
164	728	0.34	8.69	0.23	5.94	0.50	12.75	0.04	0.92	0.15	3.91	0.25	6.30
163	725	0.34	8.69	0.23	5.94	0.50	12.75	0.04	0.92	0.15	3.91	0.25	6.30
162	719	0.34	8.69	0.23	5.94	0.50	12.74	0.04	0.92	0.15	3.91	0.25	6.30
162	722	0.34	8.69	0.23	5.94	0.50	12.72	0.04	0.92	0.15	3.91	0.25	6.30
162	720	0.34	8.69	0.23	5.94	0.50	12.69	0.04	0.92	0.15	3.91	0.25	6.30
159	708	0.34	8.69	0.23	5.95	0.50	12.67	0.04	0.92	0.15	3.91	0.25	6.30
158	704	0.34	8.69	0.23	5.94	0.50	12.65	0.04	0.92	0.15	3.91	0.25	6.29
159	707	0.34	8.69	0.23	5.94	0.50	12.62	0.04	0.92	0.15	3.91	0.25	6.30
157	700	0.34	8.69	0.23	5.94	0.50	12.59	0.04	0.92	0.15	3.91	0.25	6.30
155	690	0.34	8.69	0.23	5.94	0.49	12.56	0.04	0.92	0.15	3.91	0.25	6.30

Table A.6 Measurement of Tendon Slippage of 5SB8T-2.0-14-D

Load Cell		T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12	T13	T14
kips	kN	in	in	in	in	in	in	in	in	in	in	in	in	in	in
0	0	0.000	0.000	0.000	0.000	0.000	0.000	-0.001	0.000	0.000	0.000	0.000	0.000	0.001	0.000
31	140	0.000	0.000	0.000	0.000	0.000	0.000	-0.001	0.000	0.000	0.000	0.000	0.000	0.001	0.000
60	268	0.000	0.000	0.000	0.000	0.000	0.000	-0.002	0.000	0.000	0.000	0.000	0.000	0.001	0.000
90	400	0.000	0.000	0.000	0.000	0.000	0.000	-0.001	0.000	0.000	0.000	0.000	0.000	0.001	0.000
120	532	0.000	0.000	0.000	0.000	0.000	0.000	-0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.001
120	536	0.000	0.000	0.000	0.000	0.000	0.000	-0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.001
119	531	0.000	0.000	0.000	0.000	0.000	0.000	-0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000
120	533	0.000	0.000	0.000	0.000	0.000	0.000	-0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000
150	666	0.000	0.000	0.000	0.000	0.000	0.000	-0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.001
181	804	0.000	0.000	0.000	0.000	0.000	0.000	-0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000
190	846	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
200	889	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
210	932	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-0.001	-0.001	0.000	0.000	0.000
215	957	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-0.001	-0.001	0.000	0.000	0.000
209	928	0.000	0.000	0.000	0.001	0.005	0.000	0.000	0.000	0.005	0.006	0.011	0.001	0.000	0.000
200	891	0.000	0.000	0.000	0.001	0.010	0.001	0.000	0.000	0.006	0.008	0.015	-0.001	0.000	0.000
187	834	0.000	0.000	0.000	0.001	0.014	0.005	-0.001	0.002	0.008	0.010	0.017	-0.001	0.000	0.000
189	841	0.000	0.000	0.000	0.001	0.015	0.005	-0.001	0.002	0.008	0.010	0.017	-0.001	0.000	0.000
188	838	0.000	0.000	0.000	0.001	0.015	0.005	-0.001	0.002	0.008	0.010	0.017	-0.001	0.000	0.000
187	832	0.000	0.000	0.000	0.001	0.015	0.005	-0.001	0.002	0.008	0.011	0.017	-0.001	0.000	0.000
194	862	0.000	0.000	0.000	0.002	0.021	0.008	-0.001	0.009	0.012	0.013	0.020	-0.001	0.000	0.000
186	826	0.000	0.000	0.006	0.009	0.030	0.016	0.006	0.025	0.022	0.026	0.038	0.000	0.000	0.000

Table A.6 Measurement of Tendon Slippage of 5SB8T-2.0-14-D (Continued)

Load Cell		T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12	T13	T14
kips	kN	in	in	in	in	in	in	in	in	in	in	in	in	in	in
187	833	0.000	0.001	0.006	0.009	0.030	0.017	0.006	0.025	0.022	0.026	0.039	0.000	0.000	0.000
189	838	0.006	0.015	0.010	0.019	0.043	0.029	0.017	0.049	0.038	0.044	0.059	0.001	0.000	0.005
187	832	0.006	0.015	0.010	0.020	0.044	0.029	0.018	0.049	0.038	0.044	0.059	0.001	0.000	0.005
187	831	0.006	0.015	0.010	0.020	0.044	0.029	0.018	0.049	0.038	0.044	0.060	0.001	0.000	0.006
189	839	0.006	0.015	0.010	0.020	0.044	0.029	0.018	0.049	0.038	0.044	0.060	0.001	0.000	0.006
185	824	0.006	0.013	0.010	0.025	0.048	0.036	0.021	0.056	0.043	0.048	0.065	0.001	0.000	0.006
187	832	0.007	0.009	0.015	0.041	0.065	0.043	0.039	0.086	0.064	0.074	0.079	0.001	0.001	0.006
186	825	0.006	0.009	0.015	0.041	0.065	0.043	0.039	0.086	0.064	0.074	0.080	0.001	0.001	0.007
179	798	0.006	0.010	0.018	0.049	0.075	0.047	0.051	0.100	0.072	0.083	0.090	0.001	0.000	0.006
182	810	0.006	0.010	0.018	0.049	0.075	0.047	0.051	0.101	0.074	0.084	0.091	0.001	0.000	0.006
180	803	0.007	0.010	0.019	0.052	0.077	0.050	0.051	0.109	0.079	0.091	0.096	0.001	0.000	0.006
183	813	0.007	0.010	0.019	0.052	0.077	0.050	0.051	0.110	0.079	0.091	0.097	0.001	0.000	0.006
183	816	0.007	0.010	0.020	0.055	0.081	0.050	0.051	0.117	0.084	0.100	0.104	0.001	0.000	0.006
181	805	0.008	0.010	0.022	0.059	0.087	0.054	0.051	0.122	0.087	0.104	0.109	0.001	0.000	0.006
181	803	0.008	0.010	0.022	0.059	0.087	0.054	0.051	0.124	0.088	0.105	0.109	0.001	0.000	0.006
179	798	0.008	0.010	0.022	0.060	0.087	0.054	0.051	0.124	0.088	0.105	0.110	0.001	0.000	0.006
181	804	0.009	0.010	0.023	0.066	0.089	0.056	0.056	0.134	0.095	0.113	0.117	0.001	0.000	0.006
176	781	0.011	0.011	0.024	0.075	0.096	0.058	0.062	0.145	0.101	0.123	0.127	0.001	0.000	0.006
168	748	0.015	0.012	0.029	0.098	0.112	0.073	0.075	0.166	0.114	0.139	0.144	0.001	0.000	0.006
168	746	0.015	0.012	0.029	0.099	0.112	0.073	0.076	0.167	0.114	0.140	0.145	0.001	0.000	0.006
169	752	0.015	0.012	0.029	0.099	0.112	0.074	0.076	0.169	0.116	0.141	0.145	0.001	0.000	0.006
169	750	0.015	0.012	0.029	0.100	0.113	0.074	0.077	0.168	0.117	0.141	0.146	0.001	0.000	0.006

Table A.6 Measurement of Tendon Slippage of 5SB8T-2.0-14-D (Continued)

Load Cell		T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12	T13	T14
kips	kN	in	in	in	in	in	in	in	in	in	in	in	in	in	in
167	743	0.015	0.012	0.030	0.101	0.113	0.074	0.077	0.169	0.117	0.142	0.146	0.001	0.000	0.006
168	746	0.016	0.012	0.030	0.101	0.114	0.074	0.077	0.171	0.118	0.142	0.147	0.001	0.000	0.006
168	749	0.016	0.012	0.030	0.102	0.114	0.075	0.078	0.171	0.118	0.143	0.147	0.001	0.000	0.006
167	741	0.016	0.012	0.030	0.102	0.115	0.075	0.078	0.171	0.118	0.143	0.147	0.001	0.000	0.006
166	738	0.016	0.013	0.030	0.102	0.115	0.075	0.078	0.171	0.118	0.143	0.148	0.001	0.000	0.006
167	744	0.016	0.013	0.030	0.102	0.115	0.075	0.078	0.171	0.118	0.143	0.148	0.001	0.000	0.006
167	742	0.016	0.013	0.031	0.103	0.115	0.075	0.078	0.171	0.119	0.143	0.148	0.001	0.000	0.006
165	735	0.016	0.013	0.031	0.103	0.115	0.075	0.078	0.175	0.119	0.143	0.148	0.001	0.000	0.006
166	739	0.016	0.013	0.031	0.103	0.115	0.076	0.078	0.175	0.119	0.144	0.148	0.001	0.000	0.006
167	742	0.016	0.013	0.031	0.103	0.115	0.076	0.079	0.175	0.119	0.144	0.148	0.001	0.000	0.006
165	735	0.016	0.013	0.031	0.103	0.115	0.077	0.079	0.175	0.120	0.144	0.148	0.001	0.000	0.006
165	733	0.016	0.013	0.031	0.103	0.116	0.077	0.079	0.175	0.120	0.144	0.149	0.001	0.000	0.006
166	740	0.016	0.013	0.031	0.103	0.116	0.077	0.079	0.175	0.120	0.144	0.149	0.001	0.000	0.006
166	737	0.016	0.013	0.031	0.104	0.116	0.077	0.079	0.175	0.120	0.144	0.149	0.001	0.000	0.006
164	731	0.016	0.013	0.031	0.104	0.116	0.077	0.079	0.175	0.120	0.144	0.149	0.001	0.000	0.006
165	735	0.016	0.013	0.031	0.104	0.116	0.077	0.079	0.175	0.120	0.144	0.149	0.001	0.000	0.006
164	731	0.016	0.013	0.031	0.104	0.116	0.077	0.079	0.175	0.120	0.144	0.149	0.001	0.000	0.006
166	737	0.016	0.013	0.031	0.104	0.116	0.077	0.079	0.175	0.120	0.144	0.149	0.001	0.000	0.006
165	735	0.016	0.013	0.031	0.104	0.116	0.077	0.079	0.175	0.120	0.145	0.149	0.001	0.000	0.007
164	729	0.016	0.013	0.031	0.104	0.116	0.077	0.079	0.175	0.120	0.145	0.149	0.001	0.000	0.006
165	734	0.016	0.013	0.031	0.104	0.116	0.077	0.080	0.175	0.120	0.145	0.149	0.001	0.000	0.006
166	737	0.016	0.013	0.031	0.104	0.116	0.077	0.080	0.175	0.120	0.145	0.149	0.001	0.000	0.006

Table A.6 Measurement of Tendon Slippage of 5SB8T-2.0-14-D (Continued)

Load Cell		T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12	T13	T14
kips	kN	in	in	in	in	in	in	in	in	in	in	in	in	in	in
164	730	0.016	0.013	0.031	0.104	0.116	0.077	0.080	0.178	0.121	0.145	0.149	0.001	0.000	0.006
164	728	0.018	0.014	0.032	0.106	0.118	0.080	0.082	0.178	0.121	0.146	0.150	0.001	0.000	0.007
165	732	0.018	0.014	0.032	0.106	0.118	0.080	0.082	0.178	0.121	0.146	0.150	0.001	0.000	0.007
164	728	0.018	0.014	0.032	0.107	0.118	0.080	0.082	0.178	0.121	0.146	0.150	0.001	0.000	0.006
162	722	0.018	0.014	0.032	0.107	0.118	0.080	0.082	0.178	0.121	0.146	0.150	0.001	0.000	0.006
163	727	0.018	0.014	0.032	0.107	0.118	0.080	0.082	0.178	0.121	0.146	0.150	0.001	0.000	0.006
164	729	0.018	0.013	0.032	0.107	0.118	0.080	0.082	0.178	0.121	0.146	0.151	0.001	0.000	0.006
162	723	0.018	0.013	0.032	0.107	0.118	0.080	0.082	0.178	0.121	0.146	0.151	0.001	0.000	0.006
162	722	0.018	0.013	0.032	0.107	0.118	0.080	0.082	0.178	0.121	0.146	0.151	0.001	0.000	0.006
164	728	0.018	0.013	0.032	0.107	0.118	0.080	0.082	0.181	0.123	0.147	0.151	0.001	0.000	0.006
163	725	0.018	0.013	0.033	0.107	0.118	0.080	0.082	0.181	0.123	0.147	0.151	0.001	0.000	0.006
162	719	0.018	0.013	0.033	0.107	0.118	0.080	0.082	0.181	0.123	0.147	0.151	0.001	0.000	0.006
162	722	0.018	0.013	0.033	0.107	0.118	0.080	0.082	0.181	0.123	0.147	0.151	0.001	0.000	0.006
162	720	0.018	0.013	0.033	0.107	0.118	0.080	0.082	0.181	0.123	0.147	0.151	0.001	0.000	0.007
159	708	0.018	0.013	0.033	0.107	0.119	0.080	0.082	0.181	0.123	0.147	0.151	0.001	0.000	0.007
158	704	0.018	0.013	0.033	0.107	0.119	0.080	0.082	0.181	0.123	0.147	0.151	0.001	0.000	0.006
159	707	0.018	0.013	0.033	0.107	0.119	0.080	0.082	0.181	0.123	0.147	0.151	0.001	0.000	0.006
157	700	0.018	0.013	0.033	0.107	0.119	0.080	0.082	0.181	0.123	0.147	0.151	0.001	0.000	0.006
155	690	0.018	0.013	0.033	0.107	0.119	0.080	0.082	0.181	0.123	0.147	0.151	0.001	0.000	0.006

Table A.7 Measurement of Strain Gauges of 5SB8T-2.0-14-D

Load Cell		N1	N2	N3	N4	N11	N12	N13	N14
kips	kN	m/m	m/m	m/m	m/m	m/m	m/m	m/m	m/m
0	0	0	0	0	B.G.	0	B.G.	B.G.	B.G.
31	140	0	0	0	B.G.	0	B.G.	B.G.	B.G.
60	268	24	15	23	B.G.	11	B.G.	B.G.	B.G.
90	400	45	32	49	B.G.	23	B.G.	B.G.	B.G.
120	532	80	58	85	B.G.	42	B.G.	B.G.	B.G.
120	536	80	58	85	B.G.	42	B.G.	B.G.	B.G.
119	531	80	59	85	B.G.	42	B.G.	B.G.	B.G.
120	533	80	59	85	B.G.	42	B.G.	B.G.	B.G.
150	666	93	71	108	B.G.	51	B.G.	B.G.	B.G.
181	804	95	79	129	B.G.	51	B.G.	B.G.	B.G.
190	846	102	86	140	B.G.	55	B.G.	B.G.	B.G.
200	889	106	93	152	B.G.	61	B.G.	B.G.	B.G.
210	932	128	97	163	B.G.	66	B.G.	B.G.	B.G.
215	957	127	100	171	B.G.	70	B.G.	B.G.	B.G.
209	928	128	101	171	B.G.	70	B.G.	B.G.	B.G.
200	891	96	71	142	B.G.	35	B.G.	B.G.	B.G.
187	834	99	67	138	B.G.	36	B.G.	B.G.	B.G.
189	841	99	67	138	B.G.	37	B.G.	B.G.	B.G.
188	838	100	67	138	B.G.	36	B.G.	B.G.	B.G.
187	832	99	67	138	B.G.	36	B.G.	B.G.	B.G.
194	862	106	72	146	B.G.	41	B.G.	B.G.	B.G.
186	826	128	-94	115	B.G.	25	B.G.	B.G.	B.G.

Table A.7 Measurement of Strain Gauges of 5SB8T-2.0-14-D (Continued)

Load Cell		N1	N2	N3	N4	N11	N12	N13	N14
kips	kN	m/m	m/m	m/m	m/m	m/m	m/m	m/m	m/m
187	833	111	-95	115	B.G.	25	B.G.	B.G.	B.G.
189	838	-422	-568	-244	B.G.	23	B.G.	B.G.	B.G.
187	832	-422	-568	-245	B.G.	23	B.G.	B.G.	B.G.
187	831	-422	-568	-245	B.G.	24	B.G.	B.G.	B.G.
189	839	-423	-568	-245	B.G.	24	B.G.	B.G.	B.G.
185	824	-442	-568	-250	B.G.	23	B.G.	B.G.	B.G.
187	832	-249	-570	-251	B.G.	17	B.G.	B.G.	B.G.
186	825	-250	-570	-251	B.G.	17	B.G.	B.G.	B.G.
179	798	-243	-572	-255	B.G.	15	B.G.	B.G.	B.G.
182	810	-238	-571	-253	B.G.	15	B.G.	B.G.	B.G.
180	803	-227	-570	-253	B.G.	15	B.G.	B.G.	B.G.
183	813	-227	-570	-252	B.G.	15	B.G.	B.G.	B.G.
183	816	-224	-569	-251	B.G.	14	B.G.	B.G.	B.G.
181	805	-205	-569	-253	B.G.	13	B.G.	B.G.	B.G.
181	803	-205	-569	-253	B.G.	13	B.G.	B.G.	B.G.
179	798	-206	-569	-253	B.G.	13	B.G.	B.G.	B.G.
181	804	-202	-570	-254	B.G.	13	B.G.	B.G.	B.G.
176	781	-205	-573	-260	B.G.	12	B.G.	B.G.	B.G.
168	748	-209	-578	-271	B.G.	11	B.G.	B.G.	B.G.
168	746	-209	-578	-271	B.G.	12	B.G.	B.G.	B.G.
169	752	-209	-578	-271	B.G.	11	B.G.	B.G.	B.G.
169	750	-209	-578	-271	B.G.	11	B.G.	B.G.	B.G.

Table A.7 Measurement of Strain Gauges of 5SB8T-2.0-14-D (Continued)

Load Cell		N1	N2	N3	N4	N11	N12	N13	N14
kips	kN	m/m	m/m	m/m	m/m	m/m	m/m	m/m	m/m
167	743	-209	-579	-271	B.G.	11	B.G.	B.G.	B.G.
168	746	-209	-578	-271	B.G.	11	B.G.	B.G.	B.G.
168	749	-209	-579	-272	B.G.	11	B.G.	B.G.	B.G.
167	741	-210	-579	-273	B.G.	11	B.G.	B.G.	B.G.
166	738	-210	-579	-273	B.G.	11	B.G.	B.G.	B.G.
167	744	-210	-579	-273	B.G.	11	B.G.	B.G.	B.G.
167	742	-210	-579	-273	B.G.	11	B.G.	B.G.	B.G.
165	735	-210	-579	-273	B.G.	11	B.G.	B.G.	B.G.
166	739	-210	-579	-273	B.G.	11	B.G.	B.G.	B.G.
167	742	-210	-579	-273	B.G.	11	B.G.	B.G.	B.G.
165	735	-210	-580	-273	B.G.	11	B.G.	B.G.	B.G.
165	733	-210	-580	-273	B.G.	11	B.G.	B.G.	B.G.
166	740	-210	-580	-273	B.G.	11	B.G.	B.G.	B.G.
166	737	-210	-579	-273	B.G.	11	B.G.	B.G.	B.G.
164	731	-210	-580	-274	B.G.	11	B.G.	B.G.	B.G.
165	735	-210	-580	-273	B.G.	11	B.G.	B.G.	B.G.
164	731	-210	-580	-274	B.G.	11	B.G.	B.G.	B.G.
166	737	-210	-579	-273	B.G.	11	B.G.	B.G.	B.G.
165	735	-210	-579	-274	B.G.	11	B.G.	B.G.	B.G.
164	729	-210	-580	-274	B.G.	11	B.G.	B.G.	B.G.
165	734	-210	-580	-274	B.G.	11	B.G.	B.G.	B.G.
166	737	-210	-580	-274	B.G.	11	B.G.	B.G.	B.G.

Table A.7 Measurement of Strain Gauges of 5SB8T-2.0-14-D (Continued)

Load Cell		N1	N2	N3	N4	N11	N12	N13	N14
kips	kN	m/m	m/m	m/m	m/m	m/m	m/m	m/m	m/m
164	730	-210	-580	-274	B.G.	11	B.G.	B.G.	B.G.
164	728	-210	-579	-275	B.G.	11	B.G.	B.G.	B.G.
165	732	-209	-579	-275	B.G.	11	B.G.	B.G.	B.G.
164	728	-209	-580	-275	B.G.	11	B.G.	B.G.	B.G.
162	722	-210	-580	-275	B.G.	11	B.G.	B.G.	B.G.
163	727	-210	-580	-275	B.G.	11	B.G.	B.G.	B.G.
164	729	-209	-580	-275	B.G.	11	B.G.	B.G.	B.G.
162	723	-210	-580	-275	B.G.	11	B.G.	B.G.	B.G.
162	722	-210	-580	-275	B.G.	11	B.G.	B.G.	B.G.
164	728	-210	-580	-275	B.G.	11	B.G.	B.G.	B.G.
163	725	-210	-580	-275	B.G.	11	B.G.	B.G.	B.G.
162	719	-210	-580	-275	B.G.	11	B.G.	B.G.	B.G.
162	722	-210	-580	-276	B.G.	10	B.G.	B.G.	B.G.
162	720	-211	-581	-277	B.G.	10	B.G.	B.G.	B.G.
159	708	-211	-581	-278	B.G.	10	B.G.	B.G.	B.G.
158	704	-211	-582	-279	B.G.	10	B.G.	B.G.	B.G.
159	707	-212	-582	-279	B.G.	10	B.G.	B.G.	B.G.
157	700	-212	-583	-280	B.G.	9	B.G.	B.G.	B.G.
155	690	-212	-583	-281	B.G.	9	B.G.	B.G.	B.G.

A.4 5SB8M-1.2-14-D

Table A.8 Measurement of Load and Deflection Relationships of 5SB8M-1.2-14-D

SW.LC		SE. LC		TRF		Mid. Def.		SW. Def.		SE. Def.		SW. Sett.		SE. Sett.		Net Def.	
kips	kN	kips	kN	kips	kN	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
0	0	0	0	0	0	0.04	0.98	0.04	0.98	0.04	0.98	0.00	0.00	0.06	1.59	0.00	0.00
15	66	15	66	30	132	0.04	1.14	0.04	1.14	0.04	1.14	0.00	0.06	0.07	1.74	0.01	0.14
32	140	30	132	61	272	0.06	1.63	0.06	1.63	0.06	1.63	0.01	0.25	0.09	2.22	0.01	0.29
44	197	41	180	85	378	0.08	1.95	0.08	1.95	0.08	1.95	0.01	0.37	0.10	2.49	0.02	0.41
47	210	43	191	90	401	0.08	2.01	0.08	2.01	0.08	2.01	0.02	0.39	0.10	2.54	0.02	0.44
50	224	45	202	96	426	0.08	2.06	0.08	2.06	0.08	2.06	0.02	0.41	0.10	2.56	0.02	0.48
53	236	48	212	101	448	0.08	2.13	0.08	2.13	0.08	2.13	0.02	0.43	0.10	2.60	0.02	0.50
58	257	52	230	110	487	0.09	2.22	0.09	2.22	0.09	2.22	0.02	0.46	0.11	2.67	0.02	0.55
64	283	57	252	120	535	0.09	2.35	0.09	2.35	0.09	2.35	0.02	0.49	0.11	2.75	0.02	0.62
69	308	61	272	130	580	0.10	2.46	0.10	2.46	0.10	2.46	0.02	0.51	0.11	2.82	0.03	0.70
75	333	66	294	141	627	0.10	2.57	0.10	2.57	0.10	2.57	0.02	0.51	0.11	2.87	0.03	0.77
80	354	70	312	150	666	0.11	2.67	0.11	2.67	0.11	2.67	0.02	0.52	0.12	2.93	0.03	0.84
79	351	70	311	149	662	0.11	2.68	0.11	2.68	0.11	2.68	0.02	0.51	0.12	2.93	0.03	0.85
80	356	71	314	151	670	0.11	2.69	0.11	2.69	0.11	2.69	0.02	0.51	0.12	2.93	0.03	0.86
85	379	75	335	161	714	0.11	2.78	0.11	2.78	0.11	2.78	0.02	0.52	0.12	2.98	0.04	0.92
91	403	80	355	170	758	0.11	2.88	0.11	2.88	0.11	2.88	0.02	0.52	0.12	3.00	0.04	1.01
96	425	84	375	180	800	0.12	2.99	0.12	2.99	0.12	2.99	0.02	0.52	0.12	3.02	0.04	1.11
101	449	89	397	190	846	0.12	3.11	0.12	3.11	0.12	3.11	0.02	0.52	0.12	3.04	0.05	1.22
107	476	95	420	201	896	0.13	3.25	0.13	3.25	0.13	3.25	0.02	0.52	0.12	3.09	0.05	1.34

Table A.8 Measurement of Load and Deflection Relationships of 5SB8M-1.2-14-D (Continued)

SW.LC		SE. LC		TRF		Mid. Def.		SW. Def.		SE. Def.		SW. Sett.		SE. Sett.		Net Def.	
kips	kN	kips	kN	kips	kN	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
112	498	99	439	210	936	0.13	3.38	0.13	3.38	0.13	3.38	0.02	0.52	0.12	3.11	0.06	1.45
118	526	104	464	222	989	0.14	3.52	0.14	3.52	0.14	3.52	0.02	0.52	0.12	3.13	0.06	1.59
123	549	109	486	233	1035	0.15	3.70	0.15	3.70	0.15	3.70	0.02	0.53	0.12	3.15	0.07	1.76
119	531	108	480	227	1010	0.15	3.84	0.15	3.84	0.15	3.84	0.02	0.53	0.12	3.15	0.07	1.89
119	528	107	475	225	1002	0.15	3.83	0.15	3.83	0.15	3.83	0.02	0.53	0.12	3.15	0.07	1.89
124	552	112	499	236	1051	0.16	3.96	0.16	3.96	0.16	3.96	0.02	0.53	0.12	3.15	0.08	2.03
126	562	114	509	241	1070	0.16	4.08	0.16	4.08	0.16	4.08	0.02	0.53	0.12	3.15	0.08	2.13
126	560	115	512	241	1072	0.16	4.16	0.16	4.16	0.16	4.16	0.02	0.53	0.12	3.15	0.09	2.21
120	532	113	501	232	1033	0.17	4.29	0.17	4.29	0.17	4.29	0.02	0.53	0.12	3.15	0.09	2.33
122	542	115	512	237	1055	0.17	4.37	0.17	4.37	0.17	4.37	0.02	0.53	0.12	3.15	0.10	2.42
116	515	112	496	227	1011	0.17	4.43	0.17	4.43	0.17	4.43	0.02	0.53	0.12	3.15	0.10	2.49
123	549	120	535	244	1084	0.19	4.71	0.19	4.71	0.19	4.71	0.02	0.53	0.12	3.15	0.11	2.76
124	553	121	540	246	1093	0.19	4.79	0.19	4.79	0.19	4.79	0.02	0.53	0.12	3.15	0.11	2.84
124	553	121	540	246	1093	0.19	4.84	0.19	4.84	0.19	4.84	0.02	0.53	0.12	3.15	0.11	2.87
123	548	120	534	243	1082	0.19	4.92	0.19	4.92	0.19	4.92	0.02	0.53	0.12	3.15	0.12	2.97
126	563	123	545	249	1108	0.21	5.36	0.21	5.36	0.21	5.36	0.02	0.53	0.12	3.15	0.12	3.17
120	534	110	490	230	1024	0.21	5.36	0.21	5.36	0.21	5.36	0.02	0.53	0.12	3.15	0.13	3.42
118	526	108	480	226	1006	0.21	5.37	0.21	5.37	0.21	5.37	0.02	0.53	0.12	3.15	0.14	3.43
118	527	108	480	226	1007	0.21	5.38	0.21	5.38	0.21	5.38	0.02	0.53	0.12	3.15	0.14	3.44
118	523	107	477	225	1001	0.21	5.38	0.21	5.38	0.21	5.38	0.02	0.53	0.12	3.15	0.14	3.44
116	518	106	472	222	989	0.21	5.39	0.21	5.39	0.21	5.39	0.02	0.53	0.12	3.15	0.14	3.45
121	536	108	482	229	1018	0.22	5.64	0.22	5.64	0.22	5.64	0.02	0.53	0.12	3.15	0.15	3.69

Table A.8 Measurement of Load and Deflection Relationships of 5SB8M-1.2-14-D (Continued)

SW.LC		SE. LC		TRF		Mid. Def.		SW. Def.		SE. Def.		SW. Sett.		SE. Sett.		Net Def.	
kips	kN	kips	kN	kips	kN	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
125	554	110	491	235	1045	0.24	5.97	0.24	5.97	0.24	5.97	0.02	0.53	0.12	3.15	0.16	4.02
124	551	110	489	234	1040	0.24	5.98	0.24	5.98	0.24	5.98	0.02	0.53	0.12	3.15	0.16	4.03
124	551	110	490	234	1041	0.24	6.00	0.24	6.00	0.24	6.00	0.02	0.53	0.12	3.15	0.16	4.04
124	553	111	492	235	1045	0.24	6.09	0.24	6.09	0.24	6.09	0.02	0.53	0.12	3.15	0.16	4.06
119	528	108	480	227	1008	0.24	6.11	0.24	6.11	0.24	6.11	0.02	0.53	0.12	3.15	0.16	4.15
118	525	107	477	225	1002	0.24	6.12	0.24	6.12	0.24	6.12	0.02	0.53	0.12	3.15	0.16	4.17
119	528	109	483	227	1010	0.25	6.24	0.25	6.24	0.25	6.24	0.02	0.53	0.12	3.15	0.17	4.28
119	527	109	483	227	1010	0.25	6.24	0.25	6.24	0.25	6.24	0.02	0.53	0.12	3.15	0.17	4.30
118	524	108	481	226	1005	0.25	6.27	0.25	6.27	0.25	6.27	0.02	0.53	0.12	3.15	0.17	4.33
118	526	108	482	227	1008	0.25	6.27	0.25	6.27	0.25	6.27	0.02	0.53	0.12	3.15	0.17	4.33
119	528	109	483	227	1012	0.25	6.28	0.25	6.28	0.25	6.28	0.02	0.53	0.12	3.15	0.17	4.33
118	525	108	481	226	1006	0.25	6.27	0.25	6.27	0.25	6.27	0.02	0.53	0.12	3.15	0.17	4.34
118	524	108	480	226	1004	0.25	6.27	0.25	6.27	0.25	6.27	0.02	0.53	0.12	3.15	0.17	4.33
119	531	111	495	231	1026	0.26	6.66	0.26	6.66	0.26	6.66	0.02	0.53	0.12	3.15	0.19	4.70
119	531	113	501	232	1032	0.27	6.91	0.27	6.91	0.27	6.91	0.02	0.53	0.12	3.15	0.20	4.96
119	530	113	503	232	1033	0.28	7.19	0.28	7.19	0.28	7.19	0.02	0.53	0.12	3.15	0.21	5.24
117	522	113	503	230	1025	0.29	7.41	0.29	7.41	0.29	7.41	0.02	0.53	0.12	3.15	0.22	5.46
118	524	113	504	231	1028	0.29	7.42	0.29	7.42	0.29	7.42	0.02	0.53	0.12	3.15	0.22	5.47
116	514	113	503	229	1017	0.30	7.67	0.30	7.67	0.30	7.67	0.02	0.53	0.12	3.15	0.23	5.73
113	503	113	501	226	1004	0.31	7.94	0.31	7.94	0.31	7.94	0.02	0.53	0.12	3.15	0.24	5.98
111	493	112	499	223	992	0.32	8.18	0.32	8.18	0.32	8.18	0.02	0.53	0.12	3.15	0.25	6.23
107	477	111	495	219	973	0.33	8.46	0.33	8.46	0.33	8.46	0.02	0.53	0.12	3.15	0.26	6.50

Table A.8 Measurement of Load and Deflection Relationships of 5SB8M-1.2-14-D (Continued)

SW.LC		SE. LC		TRF		Mid. Def.		SW. Def.		SE. Def.		SW. Sett.		SE. Sett.		Net Def.	
kips	kN	kips	kN	kips	kN	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
101	449	109	486	210	934	0.34	8.71	0.34	8.71	0.34	8.71	0.02	0.53	0.12	3.15	0.27	6.75
85	376	103	456	187	832	0.35	9.01	0.35	9.01	0.35	9.01	0.02	0.53	0.12	3.15	0.28	7.05
83	368	102	452	184	820	0.36	9.04	0.36	9.04	0.36	9.04	0.02	0.53	0.12	3.15	0.28	7.07
79	353	100	445	179	797	0.36	9.08	0.36	9.08	0.36	9.08	0.02	0.53	0.12	3.15	0.28	7.13
76	338	98	437	174	776	0.36	9.13	0.36	9.13	0.36	9.13	0.02	0.53	0.12	3.15	0.28	7.18
76	340	99	439	175	778	0.36	9.13	0.36	9.13	0.36	9.13	0.02	0.53	0.12	3.15	0.28	7.19
77	341	99	439	175	780	0.36	9.13	0.36	9.13	0.36	9.13	0.02	0.53	0.12	3.15	0.28	7.19
76	337	98	437	174	773	0.36	9.14	0.36	9.14	0.36	9.14	0.02	0.53	0.12	3.15	0.28	7.19
75	335	98	436	173	771	0.36	9.14	0.36	9.14	0.36	9.14	0.02	0.53	0.12	3.15	0.28	7.20
76	337	98	437	174	774	0.36	9.15	0.36	9.15	0.36	9.15	0.02	0.53	0.12	3.15	0.28	7.21
75	335	98	436	173	771	0.36	9.15	0.36	9.15	0.36	9.15	0.02	0.53	0.12	3.15	0.28	7.21
75	331	98	434	172	765	0.36	9.15	0.36	9.15	0.36	9.15	0.02	0.53	0.12	3.15	0.28	7.21
75	333	98	435	173	768	0.36	9.15	0.36	9.15	0.36	9.15	0.02	0.53	0.12	3.15	0.28	7.21
75	333	98	435	173	768	0.36	9.16	0.36	9.16	0.36	9.16	0.02	0.53	0.12	3.15	0.28	7.21
74	330	97	433	172	763	0.36	9.16	0.36	9.16	0.36	9.16	0.02	0.53	0.12	3.15	0.28	7.22
74	329	97	433	171	762	0.36	9.16	0.36	9.16	0.36	9.16	0.02	0.53	0.12	3.15	0.28	7.22
75	332	98	434	172	766	0.36	9.17	0.36	9.17	0.36	9.17	0.02	0.53	0.12	3.15	0.28	7.22
74	330	97	433	172	763	0.36	9.17	0.36	9.17	0.36	9.17	0.02	0.53	0.12	3.15	0.28	7.23
74	327	97	431	171	759	0.36	9.17	0.36	9.17	0.36	9.17	0.02	0.53	0.12	3.15	0.28	7.23
74	329	97	433	171	761	0.36	9.17	0.36	9.17	0.36	9.17	0.02	0.53	0.12	3.15	0.28	7.23
74	330	97	433	172	763	0.36	9.17	0.36	9.17	0.36	9.17	0.02	0.53	0.12	3.15	0.28	7.23

Table A.9 Measurement of Tendon Slippage of 5SB8M-1.2-14-D

TRF		T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12	T13	T14
kips	kN	in	in	in	in	in	in	in	in	in	in	in	in	in	in
0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
30	132	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
61	272	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
85	378	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00
90	401	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00
96	426	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00
101	448	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00
110	487	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00
120	535	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00
130	580	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00
141	627	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00
150	666	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00
149	662	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00
151	670	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00
161	714	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.04	0.00	0.01	0.00	0.00	0.00	0.00
170	758	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.05	0.00	0.01	0.00	0.00	0.00	0.00
180	800	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.05	0.00	0.01	0.00	0.00	0.00	0.00
190	846	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.05	0.00	0.02	0.00	0.00	0.00	0.00
201	896	0.00	0.00	0.00	0.00	0.00	0.06	0.00	0.06	0.00	0.03	0.00	0.00	0.00	0.00
210	936	0.00	0.00	0.00	0.00	0.00	0.06	0.01	0.06	0.00	0.04	0.00	0.00	0.00	0.00
222	989	0.00	0.00	0.00	0.00	0.00	0.06	0.03	0.06	0.00	0.05	0.00	0.00	0.00	0.00
233	1035	0.00	0.00	0.00	0.00	0.01	0.06	0.04	0.07	0.00	0.05	0.00	0.00	0.00	0.00

Table A.9 Measurement of Tendon Slippage of 5SB8M-1.2-14-D (Continued)

TRF		T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12	T13	T14
kips	kN	in	in	in	in	in	in	in	in	in	in	in	in	in	in
227	1010	0.00	0.00	0.00	0.00	0.03	0.06	0.04	0.07	0.00	0.05	0.00	0.00	0.00	0.00
225	1002	0.00	0.00	0.00	0.00	0.03	0.06	0.05	0.07	0.00	0.05	0.00	0.00	0.00	0.00
236	1051	0.00	0.00	0.00	0.00	0.03	0.07	0.05	0.07	0.00	0.06	0.00	0.00	0.00	0.00
241	1070	0.00	0.00	0.00	0.00	0.04	0.07	0.05	0.08	0.00	0.06	0.00	0.00	0.00	0.00
241	1072	0.00	0.00	0.00	0.03	0.04	0.07	0.05	0.08	0.00	0.06	0.00	0.00	0.00	0.00
232	1033	0.00	0.00	0.00	0.05	0.04	0.07	0.05	0.08	0.00	0.06	0.00	0.00	0.00	0.00
237	1055	0.00	0.00	0.00	0.06	0.04	0.07	0.05	0.08	0.00	0.06	0.00	0.00	0.00	0.00
227	1011	0.00	0.00	0.00	0.07	0.04	0.07	0.05	0.08	0.00	0.06	0.00	0.00	0.00	0.00
244	1084	0.00	0.00	0.01	0.09	0.04	0.07	0.05	0.08	0.00	0.06	0.00	0.00	0.00	0.00
246	1093	0.00	0.00	0.01	0.09	0.04	0.07	0.05	0.08	0.01	0.06	0.00	0.00	0.00	0.00
246	1093	0.00	0.00	0.01	0.09	0.04	0.07	0.06	0.08	0.02	0.06	0.00	0.00	0.00	0.00
243	1082	0.00	0.00	0.01	0.09	0.05	0.07	0.06	0.08	0.03	0.06	0.00	0.00	0.00	0.00
249	1108	0.00	0.00	0.01	0.10	0.05	0.07	0.06	0.09	0.04	0.07	0.04	0.00	0.00	0.00
230	1024	0.00	0.00	0.01	0.10	0.05	0.07	0.06	0.09	0.04	0.07	0.04	0.00	0.00	0.00
226	1006	0.00	0.00	0.01	0.10	0.05	0.07	0.06	0.09	0.04	0.07	0.04	0.00	0.00	0.00
226	1007	0.00	0.00	0.01	0.10	0.05	0.07	0.06	0.09	0.04	0.07	0.04	0.00	0.00	0.00
225	1001	0.00	0.00	0.01	0.10	0.05	0.07	0.06	0.09	0.04	0.07	0.04	0.00	0.00	0.00
222	989	0.00	0.00	0.01	0.10	0.05	0.07	0.06	0.09	0.04	0.07	0.04	0.00	0.00	0.00
229	1018	0.00	0.00	0.01	0.10	0.05	0.07	0.06	0.09	0.04	0.07	0.04	0.01	0.00	0.00
235	1045	0.00	0.00	0.01	0.10	0.05	0.07	0.06	0.09	0.04	0.07	0.05	0.01	0.00	0.01
234	1040	0.00	0.00	0.01	0.10	0.05	0.07	0.06	0.09	0.04	0.07	0.05	0.01	0.00	0.01
234	1041	0.00	0.00	0.01	0.11	0.05	0.07	0.06	0.09	0.04	0.07	0.05	0.01	0.00	0.01

Table A.9 Measurement of Tendon Slippage of 5SB8M-1.2-14-D (Continued)

TRF		T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12	T13	T14
kips	kN	in	in	in	in	in	in	in	in	in	in	in	in	in	in
235	1045	0.00	0.00	0.02	0.11	0.05	0.07	0.06	0.09	0.04	0.07	0.05	0.01	0.01	0.01
227	1008	0.00	0.00	0.02	0.11	0.05	0.07	0.06	0.09	0.04	0.07	0.05	0.01	0.01	0.01
225	1002	0.00	0.00	0.02	0.12	0.05	0.07	0.06	0.09	0.04	0.07	0.05	0.01	0.01	0.01
227	1010	0.01	0.00	0.03	0.12	0.05	0.07	0.06	0.09	0.04	0.07	0.05	0.02	0.01	0.01
227	1010	0.01	0.00	0.03	0.12	0.05	0.07	0.06	0.09	0.04	0.07	0.05	0.02	0.01	0.01
226	1005	0.01	0.00	0.03	0.12	0.05	0.07	0.06	0.09	0.04	0.07	0.05	0.02	0.01	0.01
227	1008	0.01	0.00	0.03	0.12	0.05	0.07	0.06	0.09	0.04	0.07	0.05	0.02	0.01	0.01
227	1012	0.01	0.00	0.03	0.12	0.05	0.07	0.06	0.09	0.04	0.07	0.05	0.02	0.01	0.01
226	1006	0.01	0.00	0.03	0.12	0.05	0.07	0.06	0.09	0.04	0.07	0.05	0.02	0.01	0.01
226	1004	0.01	0.00	0.03	0.12	0.05	0.07	0.06	0.09	0.04	0.07	0.05	0.02	0.01	0.01
231	1026	0.02	0.01	0.03	0.13	0.05	0.07	0.06	0.09	0.04	0.07	0.05	0.02	0.01	0.02
232	1032	0.02	0.01	0.04	0.14	0.05	0.07	0.06	0.09	0.04	0.07	0.05	0.02	0.01	0.02
232	1033	0.03	0.02	0.04	0.15	0.05	0.07	0.06	0.09	0.04	0.07	0.05	0.03	0.02	0.03
230	1025	0.04	0.02	0.05	0.16	0.05	0.07	0.06	0.09	0.04	0.07	0.05	0.04	0.02	0.04
231	1028	0.04	0.02	0.05	0.16	0.05	0.07	0.06	0.09	0.04	0.07	0.05	0.04	0.02	0.04
229	1017	0.05	0.02	0.07	0.16	0.05	0.07	0.06	0.09	0.04	0.07	0.05	0.04	0.03	0.04
226	1004	0.05	0.03	0.10	0.16	0.05	0.07	0.06	0.09	0.04	0.07	0.05	0.05	0.03	0.05
223	992	0.06	0.03	0.11	0.17	0.05	0.07	0.06	0.09	0.04	0.07	0.05	0.06	0.04	0.05
219	973	0.07	0.04	0.12	0.17	0.05	0.07	0.06	0.09	0.04	0.07	0.05	0.06	0.04	0.06
210	934	0.08	0.04	0.13	0.17	0.05	0.07	0.06	0.09	0.04	0.07	0.05	0.06	0.04	0.06
187	832	0.08	0.04	0.13	0.17	0.05	0.07	0.06	0.09	0.04	0.07	0.05	0.07	0.04	0.06
184	820	0.08	0.04	0.13	0.17	0.05	0.07	0.06	0.09	0.04	0.07	0.05	0.07	0.04	0.06

Table A.9 Measurement of Tendon Slippage of 5SB8M-1.2-14-D (Continued)

TRF		T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12	T13	T14
kips	kN	in	in	in	in	in	in	in	in	in	in	in	in	in	in
179	797	0.08	0.04	0.13	0.17	0.05	0.07	0.06	0.09	0.04	0.07	0.05	0.07	0.04	0.06
174	776	0.08	0.04	0.13	0.16	0.05	0.07	0.06	0.09	0.04	0.07	0.05	0.07	0.04	0.06
175	778	0.08	0.04	0.13	0.16	0.05	0.07	0.06	0.09	0.04	0.07	0.05	0.07	0.04	0.06
175	780	0.08	0.04	0.13	0.16	0.05	0.07	0.06	0.09	0.04	0.07	0.05	0.07	0.04	0.06
174	773	0.08	0.05	0.13	0.16	0.05	0.07	0.06	0.09	0.04	0.07	0.05	0.07	0.04	0.06
173	771	0.08	0.04	0.13	0.16	0.05	0.07	0.06	0.09	0.04	0.07	0.05	0.07	0.04	0.06
174	774	0.08	0.05	0.13	0.16	0.05	0.07	0.06	0.09	0.04	0.07	0.05	0.07	0.04	0.06
173	771	0.08	0.05	0.13	0.16	0.05	0.07	0.06	0.09	0.04	0.07	0.05	0.07	0.04	0.06
172	765	0.08	0.05	0.13	0.16	0.05	0.07	0.06	0.09	0.04	0.07	0.05	0.07	0.04	0.06
173	768	0.08	0.05	0.13	0.16	0.05	0.07	0.06	0.09	0.04	0.07	0.05	0.07	0.04	0.06
173	768	0.08	0.05	0.13	0.16	0.05	0.07	0.06	0.09	0.04	0.07	0.05	0.07	0.04	0.06
172	763	0.08	0.05	0.13	0.16	0.05	0.07	0.06	0.09	0.04	0.07	0.05	0.07	0.04	0.06
171	762	0.08	0.05	0.13	0.16	0.05	0.07	0.06	0.09	0.04	0.07	0.05	0.07	0.04	0.06
172	766	0.08	0.05	0.13	0.17	0.05	0.07	0.06	0.09	0.04	0.07	0.05	0.07	0.04	0.06
172	763	0.08	0.05	0.13	0.17	0.05	0.07	0.06	0.09	0.04	0.07	0.05	0.07	0.04	0.06
171	759	0.08	0.05	0.13	0.17	0.05	0.07	0.06	0.09	0.04	0.07	0.05	0.07	0.04	0.06
171	761	0.08	0.05	0.13	0.17	0.05	0.07	0.06	0.09	0.04	0.07	0.05	0.07	0.04	0.06
172	763	0.08	0.05	0.13	0.17	0.05	0.07	0.06	0.09	0.04	0.07	0.05	0.07	0.04	0.06

Table A.10 Measurement of Strain Gauges of 5SB8M-1.2-14-D

TRF		S1	S2	S3	S4	S11	S12	S13	S14
kips	kN	m/m	m/m	m/m	m/m	m/m	m/m	m/m	m/m
0	0	B.G.	B.G.	B.G.	B.G.	0.00	0.00	0.00	0.00
30	132	B.G.	B.G.	B.G.	B.G.	6.60	17.06	-2.96	16.83
61	272	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
172	763	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.

A.5 5SB8M-2.0-14-D

Table A.11 Measurement of Load and Deflection Relationships of 5SB8M-2.0-14-D

LC		Mid. Def.		W. Def.		E. Def.		W. Sett.		E. Sett.		Net Def.	
kips	kN	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm
0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
30	131	0.04	0.93	0.05	1.20	0.03	0.75	0.03	0.64	0.02	0.62	0.01	0.30
60	266	0.06	1.56	0.08	1.96	0.05	1.38	0.04	0.99	0.04	0.99	0.02	0.58
90	401	0.08	2.11	0.10	2.56	0.08	1.96	0.05	1.23	0.05	1.27	0.03	0.86
120	533	0.10	2.61	0.12	3.08	0.10	2.50	0.06	1.41	0.06	1.51	0.05	1.14
150	667	0.12	3.09	0.14	3.58	0.12	3.06	0.06	1.58	0.07	1.73	0.06	1.43
160	714	0.13	3.25	0.15	3.77	0.13	3.24	0.06	1.63	0.07	1.80	0.06	1.54
170	758	0.13	3.39	0.16	3.95	0.13	3.40	0.07	1.68	0.07	1.85	0.06	1.63
180	800	0.14	3.56	0.16	4.14	0.14	3.56	0.07	1.74	0.08	1.91	0.07	1.73
190	845	0.15	3.71	0.17	4.31	0.15	3.72	0.07	1.78	0.08	1.96	0.07	1.83
200	888	0.15	3.88	0.18	4.51	0.15	3.88	0.07	1.84	0.08	2.01	0.08	1.95
210	936	0.16	4.07	0.19	4.74	0.16	4.08	0.07	1.89	0.08	2.07	0.08	2.09
215	957	0.16	4.17	0.19	4.85	0.16	4.18	0.08	1.92	0.08	2.10	0.09	2.16
220	978	0.17	4.27	0.20	4.97	0.17	4.28	0.08	1.95	0.08	2.12	0.09	2.24
225	1000	0.17	4.41	0.20	5.14	0.17	4.42	0.08	1.98	0.08	2.16	0.09	2.34
227	1008	0.18	4.47	0.20	5.19	0.18	4.48	0.08	1.99	0.09	2.17	0.09	2.38
227	1008	0.18	4.47	0.20	5.20	0.18	4.49	0.08	2.00	0.09	2.17	0.09	2.39
226	1006	0.18	4.48	0.21	5.21	0.18	4.50	0.08	2.00	0.09	2.18	0.09	2.39
227	1009	0.18	4.49	0.21	5.22	0.18	4.50	0.08	2.00	0.09	2.18	0.09	2.40

Table A.11 Measurement of Load and Deflection Relationships of 5SB8M-2.0-14-D (Continued)

LC		Mid. Def.		W. Def.		E. Def.		W. Sett.		E. Sett.		Net Def.	
kips	kN	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm
227	1012	0.18	4.49	0.21	5.23	0.18	4.52	0.08	2.00	0.09	2.18	0.09	2.40
227	1009	0.18	4.51	0.21	5.25	0.18	4.52	0.08	2.00	0.09	2.18	0.09	2.41
183	815	0.20	5.11	0.23	5.81	0.20	5.04	0.08	2.00	0.09	2.18	0.12	3.02
179	798	0.20	5.17	0.23	5.89	0.20	5.11	0.08	2.00	0.09	2.18	0.12	3.08
177	786	0.20	5.21	0.23	5.93	0.20	5.15	0.08	2.00	0.09	2.18	0.12	3.11
175	777	0.21	5.23	0.23	5.96	0.20	5.17	0.08	2.00	0.09	2.18	0.12	3.13
174	775	0.21	5.25	0.24	5.98	0.20	5.19	0.08	2.00	0.09	2.18	0.12	3.15
171	763	0.21	5.29	0.24	6.05	0.21	5.24	0.08	2.00	0.09	2.18	0.13	3.19
167	742	0.21	5.34	0.24	6.11	0.21	5.30	0.08	2.00	0.09	2.18	0.13	3.25
164	729	0.21	5.39	0.24	6.18	0.21	5.35	0.08	2.00	0.09	2.18	0.13	3.30
162	720	0.21	5.42	0.25	6.23	0.21	5.39	0.08	2.00	0.09	2.18	0.13	3.33
160	712	0.21	5.44	0.25	6.25	0.21	5.41	0.08	2.00	0.09	2.18	0.13	3.35
159	708	0.21	5.45	0.25	6.27	0.21	5.42	0.08	2.00	0.09	2.18	0.13	3.35
159	709	0.22	5.46	0.25	6.28	0.21	5.43	0.08	2.00	0.09	2.18	0.13	3.37
159	707	0.22	5.46	0.25	6.29	0.21	5.44	0.08	2.00	0.09	2.18	0.13	3.37
158	703	0.22	5.47	0.25	6.29	0.21	5.44	0.08	2.00	0.09	2.18	0.13	3.37
158	704	0.22	5.47	0.25	6.30	0.21	5.45	0.08	2.00	0.09	2.18	0.13	3.38
158	704	0.22	5.48	0.25	6.30	0.21	5.45	0.08	2.00	0.09	2.18	0.13	3.38
157	700	0.22	5.48	0.25	6.31	0.22	5.46	0.08	2.00	0.09	2.18	0.13	3.39
157	699	0.22	5.48	0.25	6.31	0.21	5.46	0.08	2.00	0.09	2.18	0.13	3.39
158	702	0.22	5.48	0.25	6.31	0.22	5.46	0.08	2.00	0.09	2.18	0.13	3.39
157	700	0.22	5.48	0.25	6.31	0.22	5.47	0.08	2.00	0.09	2.18	0.13	3.39

Table A.11 Measurement of Load and Deflection Relationships of 5SB8M-2.0-14-D (Continued)

LC		Mid. Def.		W. Def.		E. Def.		W. Sett.		E. Sett.		Net Def.	
kips	kN	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm
157	697	0.22	5.49	0.25	6.32	0.22	5.46	0.08	2.00	0.09	2.18	0.13	3.39
157	700	0.22	5.49	0.25	6.32	0.22	5.47	0.08	2.00	0.09	2.18	0.13	3.39
157	700	0.22	5.49	0.25	6.32	0.22	5.48	0.08	2.00	0.09	2.18	0.13	3.39
157	697	0.22	5.49	0.25	6.33	0.22	5.47	0.08	2.00	0.09	2.18	0.13	3.40
157	698	0.22	5.50	0.25	6.33	0.22	5.47	0.08	2.00	0.09	2.18	0.13	3.40
157	700	0.22	5.50	0.25	6.33	0.22	5.48	0.08	2.00	0.09	2.18	0.13	3.41
157	697	0.22	5.50	0.25	6.33	0.22	5.48	0.08	2.00	0.09	2.18	0.13	3.40
156	695	0.22	5.50	0.25	6.33	0.22	5.47	0.08	2.00	0.09	2.18	0.13	3.41
157	698	0.22	5.50	0.25	6.34	0.22	5.49	0.08	2.00	0.09	2.18	0.13	3.41
157	696	0.22	5.51	0.25	6.34	0.22	5.49	0.08	2.00	0.09	2.18	0.13	3.41
156	693	0.22	5.51	0.25	6.34	0.22	5.49	0.08	2.00	0.09	2.18	0.13	3.41
156	695	0.22	5.50	0.25	6.34	0.22	5.49	0.08	2.00	0.09	2.18	0.13	3.41
157	697	0.22	5.51	0.25	6.34	0.22	5.49	0.08	2.00	0.09	2.18	0.13	3.42
156	693	0.22	5.51	0.25	6.34	0.22	5.50	0.08	2.00	0.09	2.18	0.13	3.41
156	693	0.22	5.51	0.25	6.34	0.22	5.50	0.08	2.00	0.09	2.18	0.13	3.42
156	696	0.22	5.51	0.25	6.34	0.22	5.49	0.08	2.00	0.09	2.18	0.13	3.41
156	694	0.22	5.52	0.25	6.34	0.22	5.50	0.08	2.00	0.09	2.18	0.13	3.42
155	691	0.22	5.51	0.25	6.34	0.22	5.50	0.08	2.00	0.09	2.18	0.13	3.42
156	694	0.22	5.51	0.25	6.35	0.22	5.50	0.08	2.00	0.09	2.18	0.13	3.42
156	695	0.22	5.51	0.25	6.34	0.22	5.50	0.08	2.00	0.09	2.18	0.13	3.42
155	691	0.22	5.51	0.25	6.35	0.22	5.50	0.08	2.00	0.09	2.18	0.13	3.41
156	692	0.22	5.51	0.25	6.35	0.22	5.50	0.08	2.00	0.09	2.18	0.13	3.42

Table A.11 Measurement of Load and Deflection Relationships of 5SB8M-2.0-14-D (Continued)

LC		Mid. Def.		W. Def.		E. Def.		W. Sett.		E. Sett.		Net Def.	
kips	kN	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm
156	695	0.22	5.51	0.25	6.35	0.22	5.50	0.08	2.00	0.09	2.18	0.13	3.42
156	692	0.22	5.51	0.25	6.35	0.22	5.50	0.08	2.00	0.09	2.18	0.13	3.42
155	691	0.22	5.51	0.25	6.35	0.22	5.50	0.08	2.00	0.09	2.18	0.13	3.42
156	694	0.22	5.51	0.25	6.35	0.22	5.50	0.08	2.00	0.09	2.18	0.13	3.42
156	693	0.22	5.52	0.25	6.35	0.22	5.50	0.08	2.00	0.09	2.18	0.13	3.42
155	689	0.22	5.51	0.25	6.35	0.22	5.50	0.08	2.00	0.09	2.18	0.13	3.42
155	691	0.22	5.52	0.25	6.36	0.22	5.51	0.08	2.00	0.09	2.18	0.13	3.42
156	693	0.22	5.52	0.25	6.36	0.22	5.51	0.08	2.00	0.09	2.18	0.13	3.42
155	689	0.22	5.52	0.25	6.35	0.22	5.51	0.08	2.00	0.09	2.18	0.13	3.43
155	689	0.22	5.52	0.25	6.36	0.22	5.51	0.08	2.00	0.09	2.18	0.13	3.42
156	692	0.22	5.52	0.25	6.36	0.22	5.51	0.08	2.00	0.09	2.18	0.13	3.42
154	687	0.22	5.52	0.25	6.37	0.22	5.51	0.08	2.00	0.09	2.18	0.14	3.43
155	689	0.22	5.52	0.25	6.37	0.22	5.51	0.08	2.00	0.09	2.18	0.14	3.43
154	685	0.22	5.53	0.25	6.38	0.22	5.52	0.08	2.00	0.09	2.18	0.14	3.44
155	688	0.22	5.53	0.25	6.38	0.22	5.52	0.08	2.00	0.09	2.18	0.14	3.44
154	685	0.22	5.53	0.25	6.38	0.22	5.52	0.08	2.00	0.09	2.18	0.14	3.44
154	683	0.22	5.54	0.25	6.38	0.22	5.53	0.08	2.00	0.09	2.18	0.14	3.44
154	687	0.22	5.54	0.25	6.38	0.22	5.52	0.08	2.00	0.09	2.18	0.14	3.44
154	686	0.22	5.53	0.25	6.38	0.22	5.53	0.08	2.00	0.09	2.18	0.14	3.44
153	683	0.22	5.53	0.25	6.38	0.22	5.53	0.08	2.00	0.09	2.18	0.14	3.44
154	685	0.22	5.54	0.25	6.39	0.22	5.53	0.08	2.00	0.09	2.18	0.14	3.45

Table A.12 Measurement of Load and Deflection Relationships of 5SB8M-2.0-14-D

Load Cell		T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12	T13	T14
kips	kN	in	in	in	in	in	in	in	in	in	in	in	in	in	in
0	0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
30	131	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
60	266	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
90	401	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
120	533	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
150	667	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
160	714	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
170	758	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
180	800	0.000	-0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
190	845	0.000	-0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
200	888	0.000	-0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
210	936	0.000	-0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
215	957	0.000	-0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
220	978	0.000	-0.001	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000
225	1000	0.000	-0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
227	1008	0.000	-0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
227	1008	0.000	-0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
226	1006	0.000	-0.001	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000
227	1009	0.000	-0.001	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000
227	1012	0.000	-0.001	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000
227	1009	0.000	-0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
183	815	0.000	-0.001	0.000	0.003	0.033	0.019	0.008	0.024	0.015	0.017	0.007	0.007	0.002	0.000

Table A.12 Measurement of Tendon Slippage of 5SB8M-2.0-14-D (Continued)

Load Cell		T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12	T13	T14
kips	kN	in	in	in	in	in	in	in	in	in	in	in	in	in	in
179	798	0.000	-0.001	0.001	0.003	0.040	0.022	0.011	0.031	0.018	0.020	0.009	0.008	0.003	0.000
177	786	0.000	-0.001	0.001	0.003	0.043	0.024	0.013	0.036	0.021	0.022	0.010	0.008	0.005	0.000
175	777	0.000	-0.001	0.001	0.003	0.044	0.025	0.014	0.038	0.022	0.023	0.010	0.008	0.005	0.000
174	775	0.000	-0.001	0.001	0.003	0.045	0.026	0.014	0.040	0.023	0.024	0.011	0.008	0.006	0.000
171	763	0.000	-0.001	0.001	0.003	0.048	0.029	0.016	0.044	0.025	0.026	0.011	0.009	0.006	0.000
167	742	0.000	-0.001	0.001	0.003	0.052	0.032	0.018	0.049	0.029	0.029	0.013	0.009	0.009	0.000
164	729	0.000	-0.001	0.001	0.003	0.055	0.034	0.020	0.054	0.031	0.031	0.015	0.010	0.010	0.000
162	720	0.000	-0.001	0.001	0.003	0.056	0.036	0.022	0.058	0.034	0.033	0.017	0.010	0.011	0.001
160	712	0.000	-0.001	0.001	0.003	0.057	0.037	0.022	0.060	0.036	0.034	0.018	0.011	0.012	0.001
159	708	0.000	-0.001	0.001	0.003	0.057	0.038	0.023	0.062	0.036	0.034	0.018	0.011	0.012	0.001
159	709	0.000	-0.001	0.001	0.003	0.058	0.039	0.023	0.062	0.038	0.035	0.018	0.011	0.013	0.001
159	707	0.000	-0.001	0.001	0.003	0.058	0.039	0.023	0.062	0.038	0.035	0.018	0.011	0.013	0.001
158	703	0.000	-0.001	0.001	0.003	0.058	0.039	0.024	0.064	0.038	0.035	0.018	0.011	0.013	0.001
158	704	0.000	-0.001	0.001	0.003	0.058	0.039	0.024	0.064	0.038	0.035	0.019	0.011	0.013	0.001
158	704	0.000	-0.001	0.001	0.003	0.058	0.040	0.024	0.065	0.040	0.036	0.019	0.011	0.013	0.001
157	700	0.000	-0.001	0.001	0.003	0.058	0.040	0.024	0.065	0.040	0.036	0.019	0.012	0.013	0.001
157	699	0.000	-0.001	0.001	0.003	0.059	0.040	0.024	0.065	0.040	0.036	0.019	0.011	0.013	0.001
158	702	0.000	-0.001	0.001	0.003	0.059	0.040	0.024	0.065	0.040	0.036	0.019	0.011	0.013	0.001
157	700	0.000	-0.001	0.001	0.004	0.059	0.040	0.025	0.065	0.040	0.036	0.019	0.011	0.013	0.001
157	697	0.000	-0.001	0.001	0.003	0.059	0.040	0.025	0.065	0.040	0.036	0.019	0.012	0.013	0.001
157	700	0.000	-0.001	0.001	0.003	0.059	0.041	0.025	0.067	0.040	0.036	0.019	0.012	0.013	0.001
157	700	0.000	-0.001	0.001	0.003	0.059	0.041	0.025	0.067	0.040	0.036	0.019	0.012	0.013	0.001

Table A.12 Measurement of Tendon Slippage of 5SB8M-2.0-14-D (Continued)

Load Cell		T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12	T13	T14
kips	kN	in	in	in	in	in	in	in	in	in	in	in	in	in	in
157	697	0.000	-0.001	0.001	0.004	0.059	0.041	0.025	0.067	0.040	0.036	0.019	0.012	0.013	0.001
157	698	0.000	-0.001	0.001	0.004	0.059	0.041	0.025	0.067	0.040	0.036	0.019	0.012	0.013	0.001
157	700	0.000	-0.001	0.001	0.003	0.059	0.041	0.025	0.067	0.040	0.036	0.019	0.012	0.013	0.001
157	697	0.000	-0.001	0.001	0.004	0.059	0.041	0.025	0.067	0.040	0.036	0.019	0.012	0.013	0.001
156	695	0.000	-0.001	0.001	0.004	0.059	0.041	0.025	0.067	0.040	0.036	0.020	0.012	0.013	0.001
157	698	0.000	-0.001	0.001	0.004	0.059	0.041	0.025	0.070	0.042	0.036	0.020	0.012	0.013	0.001
157	696	0.000	-0.001	0.001	0.004	0.059	0.041	0.025	0.070	0.042	0.037	0.020	0.012	0.014	0.001
156	693	0.000	-0.001	0.001	0.003	0.059	0.042	0.026	0.070	0.042	0.037	0.020	0.012	0.014	0.001
156	695	0.000	-0.001	0.001	0.004	0.059	0.042	0.026	0.070	0.042	0.037	0.020	0.012	0.014	0.001
157	697	0.000	-0.001	0.001	0.004	0.059	0.042	0.026	0.070	0.042	0.037	0.020	0.012	0.014	0.001
156	693	0.000	-0.001	0.001	0.004	0.059	0.042	0.026	0.070	0.042	0.037	0.020	0.012	0.014	0.001
156	693	0.000	-0.001	0.001	0.004	0.059	0.042	0.026	0.070	0.042	0.037	0.020	0.012	0.014	0.001
156	696	0.000	-0.001	0.001	0.004	0.060	0.042	0.026	0.070	0.042	0.037	0.020	0.012	0.014	0.001
156	694	0.000	-0.001	0.001	0.004	0.060	0.042	0.026	0.070	0.042	0.037	0.020	0.012	0.014	0.001
155	691	0.000	-0.001	0.001	0.004	0.060	0.042	0.026	0.070	0.042	0.037	0.020	0.012	0.014	0.001
156	694	0.000	-0.001	0.001	0.004	0.060	0.042	0.026	0.070	0.042	0.037	0.020	0.012	0.014	0.001
156	695	0.000	-0.001	0.001	0.004	0.060	0.042	0.026	0.070	0.042	0.037	0.020	0.012	0.014	0.001
155	691	0.000	-0.001	0.001	0.004	0.060	0.042	0.026	0.070	0.042	0.037	0.020	0.012	0.014	0.001
156	692	0.000	-0.001	0.001	0.004	0.060	0.042	0.026	0.070	0.042	0.037	0.020	0.012	0.014	0.001
156	695	0.000	-0.001	0.001	0.004	0.060	0.042	0.026	0.070	0.042	0.037	0.020	0.012	0.014	0.001
156	692	0.000	-0.001	0.001	0.004	0.060	0.042	0.026	0.070	0.042	0.037	0.020	0.012	0.014	0.001
155	691	0.000	-0.001	0.001	0.004	0.060	0.042	0.026	0.070	0.042	0.037	0.020	0.012	0.014	0.001

Table A.12 Measurement of Tendon Slippage of 5SB8M-2.0-14-D (Continued)

Load Cell		T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12	T13	T14
kips	kN	in	in	in	in	in	in	in	in	in	in	in	in	in	in
156	694	0.000	-0.001	0.001	0.004	0.060	0.042	0.026	0.070	0.042	0.037	0.020	0.012	0.014	0.001
156	693	0.000	-0.001	0.001	0.004	0.060	0.042	0.026	0.070	0.042	0.037	0.020	0.012	0.014	0.001
155	689	0.000	-0.001	0.001	0.004	0.060	0.042	0.026	0.072	0.043	0.037	0.020	0.012	0.014	0.001
155	691	0.000	-0.001	0.001	0.004	0.060	0.043	0.026	0.072	0.042	0.037	0.020	0.012	0.014	0.001
156	693	0.000	-0.001	0.001	0.004	0.060	0.043	0.026	0.072	0.043	0.037	0.020	0.012	0.014	0.001
155	689	0.000	-0.001	0.001	0.004	0.060	0.043	0.027	0.072	0.043	0.037	0.020	0.012	0.014	0.001
155	689	0.000	-0.001	0.001	0.004	0.060	0.043	0.027	0.072	0.043	0.037	0.020	0.012	0.014	0.001
156	692	0.000	-0.001	0.001	0.004	0.060	0.043	0.027	0.072	0.043	0.037	0.020	0.012	0.014	0.001
154	687	0.000	-0.001	0.001	0.004	0.060	0.043	0.027	0.072	0.042	0.038	0.020	0.012	0.014	0.001
155	689	0.000	-0.001	0.001	0.004	0.060	0.043	0.027	0.072	0.042	0.038	0.020	0.012	0.014	0.001
154	685	0.000	-0.001	0.001	0.004	0.061	0.044	0.028	0.074	0.044	0.040	0.021	0.013	0.014	0.001
155	688	0.000	-0.001	0.001	0.004	0.061	0.044	0.028	0.074	0.044	0.040	0.021	0.013	0.014	0.001
154	685	0.000	-0.001	0.001	0.004	0.061	0.044	0.028	0.074	0.044	0.039	0.021	0.013	0.014	0.001
154	683	0.000	-0.001	0.001	0.004	0.061	0.044	0.028	0.074	0.044	0.039	0.021	0.013	0.014	0.001
154	687	0.000	-0.001	0.001	0.004	0.061	0.044	0.028	0.074	0.044	0.040	0.021	0.012	0.014	0.001
154	686	0.000	-0.001	0.001	0.004	0.061	0.044	0.028	0.074	0.044	0.040	0.021	0.012	0.014	0.001
153	683	0.000	-0.001	0.001	0.004	0.061	0.044	0.028	0.075	0.044	0.039	0.021	0.013	0.014	0.001
154	685	0.000	-0.001	0.001	0.004	0.061	0.044	0.028	0.075	0.044	0.040	0.021	0.013	0.014	0.001

Table A.13 Measurement of Load and Deflection Relationships of 5SB8M-2.0-14-D

Load Cell		N1	N2	N3	N4	N11	N12	N13	N14
kips	kN	m/m	m/m	m/m	m/m	m/m	m/m	m/m	m/m
0	0	0	0	0	0	B.G.	B.G.	0	0
30	131	565	24	20	23	B.G.	B.G.	-7	31
60	266	522	42	42	53	B.G.	B.G.	-53	63
90	401	532	56	65	80	B.G.	B.G.	-46	92
120	533	485	74	88	109	B.G.	B.G.	-94	125
150	667	480	86	109	137	B.G.	B.G.	-102	156
160	714	601	92	117	129	B.G.	B.G.	68	142
170	758	659	100	125	134	B.G.	B.G.	124	149
180	800	690	107	139	145	B.G.	B.G.	150	162
190	845	742	115	150	157	B.G.	B.G.	198	170
200	888	784	124	160	168	B.G.	B.G.	236	180
210	936	814	131	174	185	B.G.	B.G.	262	196
215	957	825	135	182	192	B.G.	B.G.	271	202
220	978	815	140	194	197	B.G.	B.G.	328	210
225	1000	809	149	220	204	B.G.	B.G.	306	221
227	1008	813	153	232	210	B.G.	B.G.	254	225
227	1008	813	153	234	209	B.G.	B.G.	270	225
226	1006	813	155	235	208	B.G.	B.G.	281	226
227	1009	807	155	234	208	B.G.	B.G.	285	225
227	1012	807	156	236	209	B.G.	B.G.	272	226
227	1009	806	157	239	205	B.G.	B.G.	333	224
183	815	871	57	109	122	B.G.	B.G.	342	213

Table A.13 Measurement of Strain Gauges of 5SB8M-2.0-14-D (Continued)

Load Cell		N1	N2	N3	N4	N11	N12	N13	N14
kips	kN	m/m	m/m	m/m	m/m	m/m	m/m	m/m	m/m
179	798	874	51	97	109	B.G.	B.G.	397	199
177	786	874	49	93	105	B.G.	B.G.	408	194
175	777	875	47	91	106	B.G.	B.G.	356	195
174	775	876	46	88	101	B.G.	B.G.	409	190
171	763	876	45	87	100	B.G.	B.G.	401	190
167	742	879	38	75	90	B.G.	B.G.	412	185
164	729	880	37	72	87	B.G.	B.G.	413	183
162	720	882	33	65	79	B.G.	B.G.	417	180
160	712	882	32	63	78	B.G.	B.G.	414	178
159	708	882	31	62	77	B.G.	B.G.	416	177
159	709	882	31	62	76	B.G.	B.G.	421	177
159	707	882	31	61	76	B.G.	B.G.	422	175
158	703	883	31	61	75	B.G.	B.G.	419	175
158	704	883	31	60	75	B.G.	B.G.	412	175
158	704	883	31	60	77	B.G.	B.G.	384	176
157	700	883	30	60	78	B.G.	B.G.	357	177
157	699	883	30	59	78	B.G.	B.G.	353	177
158	702	883	30	59	78	B.G.	B.G.	351	177
157	700	883	30	59	80	B.G.	B.G.	318	178
157	697	883	30	59	81	B.G.	B.G.	302	178
157	700	883	30	59	78	B.G.	B.G.	347	177
157	700	883	30	59	77	B.G.	B.G.	361	175

Table A.13 Measurement of Strain Gauges of 5SB8M-2.0-14-D (Continued)

Load Cell		N1	N2	N3	N4	N11	N12	N13	N14
kips	kN	m/m	m/m	m/m	m/m	m/m	m/m	m/m	m/m
157	697	883	30	58	79	B.G.	B.G.	323	177
157	698	884	29	58	76	B.G.	B.G.	364	176
157	700	883	30	58	78	B.G.	B.G.	342	176
157	697	883	30	58	81	B.G.	B.G.	294	177
156	695	884	29	58	78	B.G.	B.G.	331	176
157	698	883	30	58	79	B.G.	B.G.	317	176
157	696	883	30	58	78	B.G.	B.G.	339	176
156	693	883	30	58	79	B.G.	B.G.	326	175
156	695	883	30	58	78	B.G.	B.G.	339	175
157	697	884	29	58	75	B.G.	B.G.	368	173
156	693	884	29	58	77	B.G.	B.G.	339	174
156	693	883	30	58	78	B.G.	B.G.	337	175
156	696	883	30	58	77	B.G.	B.G.	348	175
156	694	884	29	58	78	B.G.	B.G.	328	176
155	691	884	29	58	76	B.G.	B.G.	348	174
156	694	884	29	57	76	B.G.	B.G.	349	173
156	695	884	29	57	77	B.G.	B.G.	334	174
155	691	884	29	58	78	B.G.	B.G.	330	175
156	692	884	29	57	77	B.G.	B.G.	333	174
156	695	883	30	58	76	B.G.	B.G.	361	174
156	692	884	29	57	78	B.G.	B.G.	326	175
155	691	884	30	57	77	B.G.	B.G.	341	175

Table A.13 Measurement of Strain Gauges of 5SB8M-2.0-14-D (Continued)

Load Cell		N1	N2	N3	N4	N11	N12	N13	N14
kips	kN	m/m	m/m	m/m	m/m	m/m	m/m	m/m	m/m
156	694	883	30	58	76	B.G.	B.G.	350	174
156	693	883	30	58	78	B.G.	B.G.	331	174
155	689	883	30	58	75	B.G.	B.G.	372	172
155	691	883	30	57	75	B.G.	B.G.	365	173
156	693	884	30	57	75	B.G.	B.G.	366	173
155	689	884	30	57	74	B.G.	B.G.	379	172
155	689	884	29	57	74	B.G.	B.G.	379	173
156	692	884	30	57	75	B.G.	B.G.	362	176
154	687	884	31	56	72	B.G.	B.G.	399	164
155	689	884	31	56	73	B.G.	B.G.	385	165
154	685	884	31	56	74	B.G.	B.G.	365	165
155	688	884	31	56	74	B.G.	B.G.	354	166
154	685	884	31	56	72	B.G.	B.G.	389	164
154	683	884	31	56	71	B.G.	B.G.	410	163
154	687	884	31	56	72	B.G.	B.G.	396	163
154	686	884	30	55	73	B.G.	B.G.	377	164
153	683	884	30	55	72	B.G.	B.G.	385	164
154	685	884	30	55	70	B.G.	B.G.	412	164

A.6 5SB8T-1.2-14-D^{L}

Table A.14 Measurement of Load and Deflection Relationships of 5SB8T-1.2-14-D^{L}

SW.LC		SE. LC		TRF		Mid. Def.		SW. Def.		SE. Def.		SW. Sett.		SE. Sett.		Net Def.	
kips	kN	kips	kN	kips	kN	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
0	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	42	12	56	22	98	0.04	0.92	0.04	0.92	0.04	0.92	0.00	0.00	0.06	1.51	0.01	0.17
20	87	24	105	43	193	0.05	1.30	0.05	1.30	0.05	1.30	0.00	0.00	0.08	1.91	0.01	0.34
30	135	36	160	66	295	0.06	1.65	0.06	1.65	0.06	1.65	0.00	0.02	0.09	2.23	0.02	0.52
40	177	46	206	86	382	0.07	1.89	0.07	1.89	0.07	1.89	0.00	0.09	0.10	2.41	0.03	0.64
60	265	67	300	127	565	0.09	2.35	0.09	2.35	0.09	2.35	0.01	0.25	0.11	2.71	0.03	0.87
70	309	78	345	147	654	0.10	2.56	0.10	2.56	0.10	2.56	0.01	0.25	0.11	2.82	0.04	1.03
80	354	88	390	167	744	0.11	2.77	0.11	2.77	0.11	2.77	0.01	0.30	0.11	2.92	0.05	1.16
90	399	98	435	187	833	0.12	2.99	0.12	2.99	0.12	2.99	0.01	0.30	0.12	3.00	0.05	1.34
100	443	107	478	207	921	0.13	3.22	0.13	3.22	0.13	3.22	0.01	0.30	0.12	3.05	0.06	1.54
110	487	117	520	226	1007	0.14	3.52	0.14	3.52	0.14	3.52	0.01	0.30	0.12	3.06	0.07	1.84
113	501	120	534	233	1035	0.14	3.67	0.14	3.67	0.14	3.67	0.01	0.30	0.12	3.06	0.08	1.99
113	501	120	534	233	1035	0.14	3.68	0.14	3.68	0.14	3.68	0.01	0.30	0.12	3.06	0.08	2.00
110	491	117	520	227	1011	0.15	3.73	0.15	3.73	0.15	3.73	0.01	0.30	0.12	2.99	0.08	2.09
109	487	116	516	225	1002	0.15	3.73	0.15	3.73	0.15	3.73	0.01	0.30	0.12	2.98	0.08	2.09
112	499	118	525	230	1023	0.15	3.81	0.15	3.81	0.15	3.81	0.01	0.30	0.12	2.96	0.09	2.18
117	519	122	543	239	1062	0.16	4.05	0.16	4.05	0.16	4.05	0.01	0.30	0.12	2.93	0.10	2.43
122	543	127	566	249	1109	0.17	4.30	0.17	4.30	0.17	4.30	0.01	0.30	0.12	2.93	0.11	2.68
127	564	132	587	259	1151	0.18	4.54	0.18	4.54	0.18	4.54	0.01	0.30	0.12	2.93	0.12	2.92

Table A.14 Measurement of Load and Deflection Relationships of 5SB8T-1.2-14-D^L (Continued)

SW.LC		SE. LC		TRF		Mid. Def.		SW. Def.		SE. Def.		SW. Sett.		SE. Sett.		Net Def.	
kips	kN	kips	kN	kips	kN	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
131	583	137	607	268	1190	0.19	4.84	0.19	4.84	0.19	4.84	0.01	0.30	0.12	2.93	0.13	3.22
124	550	125	558	249	1108	0.20	5.03	0.20	5.03	0.20	5.03	0.01	0.30	0.12	2.93	0.13	3.42
123	549	125	558	249	1107	0.20	5.03	0.20	5.03	0.20	5.03	0.01	0.30	0.12	2.93	0.13	3.42
126	562	128	570	254	1131	0.20	5.14	0.20	5.14	0.20	5.14	0.01	0.30	0.12	2.93	0.14	3.52
127	563	128	571	255	1134	0.20	5.14	0.20	5.14	0.20	5.14	0.01	0.30	0.12	2.93	0.14	3.52
129	572	130	578	259	1150	0.21	5.24	0.21	5.24	0.21	5.24	0.01	0.30	0.12	2.93	0.14	3.63
129	573	130	579	259	1152	0.21	5.28	0.21	5.28	0.21	5.28	0.01	0.30	0.12	2.93	0.14	3.66
128	569	130	578	258	1147	0.21	5.31	0.21	5.31	0.21	5.31	0.01	0.30	0.12	2.93	0.15	3.69
130	580	132	589	263	1169	0.22	5.55	0.22	5.55	0.22	5.55	0.01	0.30	0.12	2.93	0.15	3.93
133	591	134	597	267	1188	0.23	5.82	0.23	5.82	0.23	5.82	0.01	0.30	0.12	2.93	0.17	4.20
130	577	134	595	263	1172	0.24	6.02	0.24	6.02	0.24	6.02	0.01	0.30	0.12	2.93	0.17	4.40
124	551	131	584	255	1135	0.24	6.14	0.24	6.14	0.24	6.14	0.01	0.30	0.12	2.93	0.18	4.52
119	531	128	571	248	1102	0.25	6.25	0.25	6.25	0.25	6.25	0.01	0.30	0.12	2.93	0.18	4.63
123	545	132	586	254	1131	0.25	6.36	0.25	6.36	0.25	6.36	0.01	0.30	0.12	2.93	0.19	4.74
127	563	134	595	260	1158	0.27	6.82	0.27	6.82	0.27	6.82	0.01	0.30	0.12	2.93	0.20	5.20
127	563	134	595	260	1158	0.27	6.83	0.27	6.83	0.27	6.83	0.01	0.30	0.12	2.93	0.21	5.21
130	576	134	598	264	1174	0.29	7.29	0.29	7.29	0.29	7.29	0.01	0.30	0.12	2.93	0.22	5.67
130	577	133	591	262	1167	0.29	7.49	0.29	7.49	0.29	7.49	0.01	0.30	0.12	2.93	0.23	5.87
129	572	131	584	260	1155	0.30	7.52	0.30	7.52	0.30	7.52	0.01	0.30	0.12	2.93	0.23	5.90
128	571	131	583	259	1154	0.30	7.53	0.30	7.53	0.30	7.53	0.01	0.30	0.12	2.93	0.23	5.91
128	567	130	577	257	1144	0.30	7.54	0.30	7.54	0.30	7.54	0.01	0.30	0.12	2.93	0.23	5.92
128	567	130	577	257	1144	0.30	7.55	0.30	7.55	0.30	7.55	0.01	0.30	0.12	2.93	0.23	5.93

Table A.14 Measurement of Load and Deflection Relationships of 5SB8T-1.2-14-D^{L} (Continued)

SW.LC		SE. LC		TRF		Mid. Def.		SW. Def.		SE. Def.		SW. Sett.		SE. Sett.		Net Def.	
kips	kN	kips	kN	kips	kN	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
128	568	130	578	258	1147	0.30	7.55	0.30	7.55	0.30	7.55	0.01	0.30	0.12	2.93	0.23	5.93
129	572	131	581	259	1153	0.30	7.60	0.30	7.60	0.30	7.60	0.01	0.30	0.12	2.93	0.24	5.98
129	575	130	579	259	1154	0.30	7.68	0.30	7.68	0.30	7.68	0.01	0.30	0.12	2.93	0.24	6.07
129	575	130	576	259	1151	0.30	7.70	0.30	7.70	0.30	7.70	0.01	0.30	0.12	2.93	0.24	6.08
127	564	122	544	249	1108	0.31	7.86	0.31	7.86	0.31	7.86	0.01	0.30	0.12	2.93	0.25	6.24
124	553	117	519	241	1072	0.31	7.96	0.31	7.96	0.31	7.96	0.01	0.30	0.12	2.93	0.25	6.34
123	546	113	502	236	1048	0.32	8.03	0.32	8.03	0.32	8.03	0.01	0.30	0.12	2.93	0.25	6.41
120	535	107	476	227	1011	0.32	8.14	0.32	8.14	0.32	8.14	0.01	0.30	0.12	2.93	0.26	6.52
102	453	70	312	172	765	0.35	8.82	0.35	8.82	0.35	8.82	0.01	0.30	0.12	2.93	0.28	7.21
100	445	67	300	167	745	0.35	8.85	0.35	8.85	0.35	8.85	0.01	0.30	0.12	2.93	0.28	7.24
99	441	66	291	165	733	0.35	8.90	0.35	8.90	0.35	8.90	0.01	0.30	0.12	2.93	0.29	7.28
99	439	65	289	164	728	0.35	8.92	0.35	8.92	0.35	8.92	0.01	0.30	0.12	2.93	0.29	7.30
98	435	63	282	161	716	0.35	8.96	0.35	8.96	0.35	8.96	0.01	0.30	0.12	2.93	0.29	7.34
98	434	63	281	161	715	0.35	8.97	0.35	8.97	0.35	8.97	0.01	0.30	0.12	2.93	0.29	7.35
97	429	62	276	159	706	0.35	9.00	0.35	9.00	0.35	9.00	0.01	0.30	0.12	2.93	0.29	7.38
96	429	62	276	159	705	0.35	9.00	0.35	9.00	0.35	9.00	0.01	0.30	0.12	2.93	0.29	7.39
96	426	62	274	157	700	0.36	9.02	0.36	9.02	0.36	9.02	0.01	0.30	0.12	2.93	0.29	7.40
96	426	61	273	157	699	0.36	9.02	0.36	9.02	0.36	9.02	0.01	0.30	0.12	2.93	0.29	7.40
96	426	61	273	157	699	0.36	9.02	0.36	9.02	0.36	9.02	0.01	0.30	0.12	2.93	0.29	7.40
96	426	61	273	157	700	0.36	9.02	0.36	9.02	0.36	9.02	0.01	0.30	0.12	2.93	0.29	7.40
96	426	61	273	157	699	0.36	9.03	0.36	9.03	0.36	9.03	0.01	0.30	0.12	2.93	0.29	7.41
96	426	61	273	157	699	0.36	9.02	0.36	9.02	0.36	9.02	0.01	0.30	0.12	2.93	0.29	7.40

Table A.14 Measurement of Load and Deflection Relationships of 5SB8T-1.2-14-D^{L} (Continued)

SW.LC		SE. LC		TRF		Mid. Def.		SW. Def.		SE. Def.		SW. Sett.		SE. Sett.		Net Def.	
kips	kN	kips	kN	kips	kN	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
96	426	61	273	157	699	0.36	9.03	0.36	9.03	0.36	9.03	0.01	0.30	0.12	2.93	0.29	7.41
96	426	61	273	157	699	0.36	9.02	0.36	9.02	0.36	9.02	0.01	0.30	0.12	2.93	0.29	7.40
96	425	61	273	157	698	0.36	9.03	0.36	9.03	0.36	9.03	0.01	0.30	0.12	2.93	0.29	7.41
96	425	61	273	157	698	0.36	9.03	0.36	9.03	0.36	9.03	0.01	0.30	0.12	2.93	0.29	7.41
96	426	61	273	157	699	0.36	9.03	0.36	9.03	0.36	9.03	0.01	0.30	0.12	2.93	0.29	7.41
96	425	61	273	157	698	0.36	9.03	0.36	9.03	0.36	9.03	0.01	0.30	0.12	2.93	0.29	7.41
96	425	61	272	157	698	0.36	9.03	0.36	9.03	0.36	9.03	0.01	0.30	0.12	2.93	0.29	7.41
96	425	61	273	157	698	0.36	9.03	0.36	9.03	0.36	9.03	0.01	0.30	0.12	2.93	0.29	7.41
96	425	61	273	157	698	0.36	9.03	0.36	9.03	0.36	9.03	0.01	0.30	0.12	2.93	0.29	7.41
96	425	61	272	157	697	0.36	9.03	0.36	9.03	0.36	9.03	0.01	0.30	0.12	2.93	0.29	7.41
96	425	61	272	157	698	0.36	9.03	0.36	9.03	0.36	9.03	0.01	0.30	0.12	2.93	0.29	7.41
96	425	61	273	157	698	0.36	9.03	0.36	9.03	0.36	9.03	0.01	0.30	0.12	2.93	0.29	7.41
96	425	61	272	157	697	0.36	9.03	0.36	9.03	0.36	9.03	0.01	0.30	0.12	2.93	0.29	7.41
95	420	60	269	155	689	0.35	9.01	0.35	9.01	0.35	9.01	0.01	0.30	0.12	2.93	0.29	7.39
94	417	60	266	154	684	0.35	8.99	0.35	8.99	0.35	8.99	0.01	0.30	0.12	2.93	0.29	7.37

Table A.15 Measurement of Tendon Slippage of 5SB8T-1.2-14-D^L

TRF		T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12	T13	T14
kips	kN	in	in	in	in	in	in	in	in	in	in	in	in	in	in
0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
22	98	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
43	193	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
66	295	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
86	382	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
127	565	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.01	0.00	0.00	0.00	0.00	0.00
147	654	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.02	0.01	0.00	0.00	0.00	0.00
167	744	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.01	0.03	0.01	0.00	0.00	0.00	0.00
187	833	0.00	0.00	0.00	0.00	0.01	0.00	0.03	0.02	0.03	0.01	0.00	0.00	0.00	0.00
207	921	0.00	0.00	0.00	0.00	0.02	0.00	0.04	0.03	0.04	0.02	0.00	0.00	0.00	0.00
226	1007	0.00	0.00	0.00	0.00	0.03	0.01	0.05	0.04	0.04	0.03	0.00	0.00	0.00	0.00
233	1035	0.00	0.00	0.00	0.00	0.03	0.02	0.05	0.04	0.05	0.03	0.00	0.00	0.00	0.00
233	1035	0.00	0.00	0.00	0.00	0.03	0.02	0.05	0.04	0.05	0.03	0.01	0.00	0.00	0.00
227	1011	0.00	0.00	0.00	0.00	0.03	0.02	0.05	0.04	0.05	0.03	0.02	0.00	0.00	0.00
225	1002	0.00	0.00	0.00	0.00	0.03	0.02	0.05	0.04	0.05	0.03	0.03	0.00	0.00	0.00
230	1023	0.00	0.00	0.00	0.00	0.03	0.02	0.05	0.04	0.05	0.03	0.03	0.00	0.00	0.00
239	1062	0.00	0.00	0.00	0.00	0.03	0.02	0.05	0.05	0.05	0.03	0.04	0.00	0.00	0.00
249	1109	0.00	0.00	0.00	0.00	0.04	0.03	0.06	0.05	0.06	0.03	0.05	0.00	0.00	0.00
259	1151	0.00	0.00	0.00	0.00	0.04	0.03	0.06	0.06	0.06	0.04	0.05	0.00	0.00	0.00
268	1190	0.00	0.00	0.00	0.00	0.05	0.03	0.07	0.06	0.07	0.04	0.06	0.00	0.00	0.00
249	1108	0.00	0.00	0.00	0.01	0.05	0.03	0.07	0.06	0.07	0.04	0.08	0.02	0.00	0.01
249	1107	0.00	0.00	0.00	0.01	0.05	0.03	0.07	0.06	0.07	0.04	0.08	0.02	0.00	0.01

Table A.15 Measurement of Tendon Slippage of 5SB8T-1.2-14-D^{L} (Continued)

TRF		T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12	T13	T14
kips	kN	in	in	in	in	in	in	in	in	in	in	in	in	in	in
254	1131	0.00	0.00	0.00	0.01	0.05	0.03	0.07	0.07	0.07	0.04	0.08	0.02	0.00	0.02
255	1134	0.00	0.00	0.00	0.01	0.05	0.03	0.07	0.07	0.07	0.04	0.08	0.02	0.00	0.02
259	1150	0.00	0.00	0.00	0.01	0.05	0.04	0.07	0.07	0.07	0.04	0.08	0.02	0.00	0.02
259	1152	0.00	0.00	0.00	0.01	0.05	0.04	0.07	0.07	0.07	0.04	0.08	0.02	0.00	0.02
258	1147	0.00	0.00	0.00	0.03	0.05	0.04	0.07	0.07	0.07	0.04	0.08	0.02	0.00	0.02
263	1169	0.00	0.00	0.00	0.04	0.05	0.04	0.07	0.07	0.07	0.04	0.09	0.03	0.00	0.02
267	1188	0.00	0.00	0.00	0.05	0.05	0.04	0.07	0.07	0.07	0.05	0.10	0.03	0.01	0.03
263	1172	0.00	0.00	0.01	0.07	0.05	0.04	0.07	0.07	0.07	0.05	0.16	0.03	0.01	0.04
255	1135	0.01	0.00	0.02	0.08	0.05	0.05	0.07	0.07	0.07	0.05	0.14	0.04	0.01	0.03
248	1102	0.02	0.00	0.03	0.09	0.05	0.05	0.07	0.07	0.07	0.05	0.14	0.04	0.01	0.03
254	1131	0.02	0.00	0.03	0.09	0.05	0.05	0.07	0.07	0.07	0.05	0.14	0.04	0.01	0.04
260	1158	0.03	0.01	0.03	0.09	0.06	0.05	0.08	0.07	0.07	0.05	0.14	0.05	0.02	0.03
260	1158	0.03	0.01	0.03	0.09	0.06	0.05	0.08	0.07	0.07	0.05	0.14	0.05	0.02	0.03
264	1174	0.03	0.01	0.03	0.09	0.06	0.05	0.08	0.07	0.08	0.05	0.14	0.06	0.03	0.03
262	1167	0.03	0.01	0.04	0.09	0.06	0.05	0.08	0.07	0.08	0.05	0.14	0.07	0.03	0.03
260	1155	0.03	0.01	0.04	0.09	0.06	0.05	0.08	0.07	0.08	0.05	0.14	0.07	0.03	0.03
259	1154	0.03	0.01	0.04	0.09	0.06	0.05	0.08	0.07	0.08	0.05	0.14	0.08	0.03	0.03
257	1144	0.03	0.01	0.04	0.09	0.06	0.05	0.08	0.07	0.08	0.05	0.14	0.08	0.03	0.03
257	1144	0.03	0.01	0.04	0.09	0.06	0.05	0.08	0.07	0.08	0.05	0.14	0.08	0.03	0.04
258	1147	0.03	0.01	0.04	0.09	0.06	0.05	0.08	0.07	0.08	0.05	0.14	0.08	0.03	0.03
259	1153	0.03	0.01	0.04	0.09	0.06	0.05	0.08	0.07	0.08	0.05	0.14	0.08	0.03	0.03
259	1154	0.03	0.01	0.04	0.09	0.06	0.05	0.08	0.07	0.08	0.05	0.14	0.09	0.03	0.03

Table A.15 Measurement of Tendon Slippage of 5SB8T-1.2-14-D^{L} (Continued)

TRF		T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12	T13	T14
kips	kN	in	in	in	in	in	in	in	in	in	in	in	in	in	in
259	1151	0.04	0.01	0.04	0.09	0.06	0.05	0.08	0.07	0.08	0.05	0.14	0.09	0.03	0.03
249	1108	0.04	0.01	0.04	0.09	0.06	0.05	0.08	0.07	0.08	0.05	0.14	0.10	0.04	0.04
241	1072	0.04	0.01	0.04	0.09	0.06	0.05	0.08	0.07	0.08	0.05	0.14	0.11	0.04	0.03
236	1048	0.04	0.01	0.04	0.09	0.06	0.05	0.08	0.07	0.08	0.05	0.14	0.12	0.04	0.03
227	1011	0.04	0.01	0.04	0.09	0.06	0.05	0.08	0.07	0.08	0.05	0.14	0.13	0.04	0.04
172	765	0.04	0.01	0.04	0.09	0.06	0.05	0.08	0.07	0.08	0.05	0.14	0.17	0.05	0.03
167	745	0.04	0.01	0.04	0.09	0.06	0.05	0.08	0.07	0.08	0.05	0.14	0.17	0.05	0.03
165	733	0.04	0.01	0.04	0.09	0.06	0.05	0.08	0.07	0.08	0.05	0.14	0.17	0.05	0.03
164	728	0.04	0.01	0.04	0.09	0.06	0.05	0.08	0.07	0.08	0.05	0.14	0.18	0.05	0.03
161	716	0.04	0.01	0.04	0.09	0.06	0.05	0.08	0.07	0.08	0.05	0.14	0.18	0.05	0.03
161	715	0.04	0.01	0.04	0.09	0.06	0.05	0.08	0.07	0.08	0.05	0.14	0.18	0.05	0.03
159	706	0.04	0.01	0.05	0.09	0.06	0.05	0.08	0.07	0.08	0.05	0.14	0.18	0.05	0.03
159	705	0.04	0.01	0.05	0.09	0.06	0.05	0.08	0.07	0.08	0.05	0.14	0.18	0.05	0.03
157	700	0.04	0.01	0.05	0.09	0.06	0.05	0.08	0.07	0.08	0.05	0.14	0.18	0.05	0.03
157	699	0.04	0.01	0.05	0.09	0.06	0.05	0.08	0.07	0.08	0.05	0.14	0.18	0.05	0.03
157	699	0.04	0.01	0.05	0.09	0.06	0.05	0.08	0.07	0.08	0.05	0.14	0.18	0.05	0.03
157	700	0.04	0.01	0.05	0.09	0.06	0.05	0.08	0.07	0.08	0.05	0.14	0.18	0.05	0.03
157	699	0.04	0.01	0.05	0.09	0.06	0.05	0.08	0.07	0.08	0.05	0.14	0.18	0.05	0.03
157	699	0.04	0.01	0.05	0.09	0.06	0.05	0.08	0.07	0.08	0.05	0.14	0.18	0.05	0.03
157	699	0.04	0.01	0.05	0.09	0.06	0.05	0.08	0.07	0.08	0.05	0.14	0.18	0.05	0.03
157	699	0.04	0.01	0.05	0.09	0.06	0.05	0.08	0.07	0.08	0.05	0.14	0.18	0.05	0.03
157	698	0.04	0.01	0.05	0.09	0.06	0.05	0.08	0.07	0.08	0.05	0.14	0.18	0.05	0.03

Table A.15 Measurement of Tendon Slippage of 5SB8T-1.2-14-D^{L} (Continued)

TRF		T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12	T13	T14
kips	kN	in	in	in	in	in	in	in	in	in	in	in	in	in	in
157	698	0.04	0.01	0.05	0.09	0.06	0.05	0.08	0.07	0.08	0.05	0.14	0.18	0.05	0.03
157	699	0.04	0.01	0.05	0.09	0.06	0.05	0.08	0.07	0.08	0.05	0.14	0.18	0.05	0.03
157	698	0.04	0.01	0.05	0.09	0.06	0.05	0.08	0.07	0.08	0.05	0.14	0.18	0.05	0.03
157	698	0.04	0.01	0.05	0.09	0.06	0.05	0.08	0.07	0.08	0.05	0.14	0.18	0.05	0.03
157	698	0.04	0.01	0.05	0.09	0.06	0.05	0.08	0.07	0.08	0.05	0.14	0.18	0.05	0.03
157	698	0.04	0.01	0.05	0.09	0.06	0.05	0.08	0.07	0.08	0.05	0.14	0.18	0.05	0.03
157	697	0.04	0.01	0.05	0.09	0.06	0.05	0.08	0.07	0.08	0.05	0.14	0.18	0.05	0.03
157	698	0.04	0.01	0.05	0.09	0.06	0.05	0.08	0.07	0.08	0.05	0.14	0.18	0.05	0.03
157	698	0.04	0.01	0.05	0.09	0.06	0.05	0.08	0.07	0.08	0.05	0.14	0.18	0.05	0.03
157	697	0.04	0.01	0.05	0.09	0.06	0.05	0.08	0.07	0.08	0.05	0.14	0.18	0.05	0.03
155	689	0.04	0.01	0.05	0.09	0.06	0.05	0.08	0.07	0.08	0.05	0.14	0.18	0.05	0.03
154	684	0.04	0.01	0.05	0.09	0.06	0.05	0.08	0.07	0.08	0.05	0.14	0.18	0.05	0.03

Table A.16 Measurement of Strain Gauges of 5SB8T-1.2-14-D^{L}

TRF		S1	S2	S3	S4	S11	S12	S13	S14
kips	kN	m/m	m/m	m/m	m/m	m/m	m/m	m/m	m/m
0	0	0	0	0	0	B.G.	0	0	0
22	98	0	-18	-5	-21	B.G.	190	-25	-21
43	193	0	-31	-18	-38	B.G.	54	-11	-38
66	295	0	149	121	-38	B.G.	186	6	-38
86	382	0	252	361	128	B.G.	166	24	128
127	565	0	592	791	777	B.G.	278	30	777
147	654	0	936	1008	1052	B.G.	285	37	1052
167	744	0	1118	1222	1273	B.G.	431	111	1273
187	833	2425	1271	1407	1513	B.G.	1028	464	1513
207	921	2963	1401	1598	1692	B.G.	1561	844	1692
226	1007	3472	1561	1728	1890	B.G.	1916	1100	1890
233	1035	3569	1638	1786	1934	B.G.	2047	1188	1934
233	1035	3502	1644	1797	1938	B.G.	2082	1195	1938
227	1011	3526	1650	1806	1952	B.G.	2091	1209	1952
225	1002	3855	1644	1779	1952	B.G.	2010	1207	1952
230	1023	4034	1640	1763	1949	B.G.	1986	1202	1949
239	1062	3572	1731	1906	1994	B.G.	2385	1319	1994
249	1109	4810	1872	1983	2104	B.G.	2797	1427	2104
259	1151	5207	1988	2047	2209	B.G.	3106	1532	2209
268	1190	5439	2097	2097	2323	B.G.	3541	1690	2323
249	1108	5674	2108	2099	2336	B.G.	3604	1712	2336
249	1107	5681	2108	2099	2336	B.G.	3607	1712	2336

Table A.16 Measurement of Strain Gauges of 5SB8T-1.2-14-D^{L} (Continued)

TRF		S1	S2	S3	S4	S11	S12	S13	S14
kips	kN	m/m	m/m	m/m	m/m	m/m	m/m	m/m	m/m
254	1131	5846	2106	2069	2340	B.G.	3688	1720	2340
255	1134	5845	2107	2068	2340	B.G.	3692	1720	2340
259	1150	5824	2130	2068	2345	B.G.	3717	1736	2345
259	1152	5822	2137	2070	2347	B.G.	3739	1742	2347
258	1147	5798	2139	2071	2348	B.G.	3746	1744	2348
263	1169	5814	2175	2091	2366	B.G.	3842	1787	2366
267	1188	5797	2218	2165	2414	B.G.	3961	1834	2414
263	1172	5736	2274	2206	2437	B.G.	4019	1865	2437
255	1135	5759	2285	2216	2445	B.G.	4033	1870	2445
248	1102	6457	2303	2223	2469	B.G.	3791	1894	2469
254	1131	6273	2319	2237	2475	B.G.	4087	1892	2475
260	1158	6258	2358	2257	2515	B.G.	4146	1903	2515
260	1158	6258	2358	2257	2515	B.G.	4143	1903	2515
264	1174	6091	2392	2269	2546	B.G.	3987	1922	2546
262	1167	6045	2400	2273	2559	B.G.	3984	1932	2559
260	1155	6046	2403	2273	2564	B.G.	3906	1938	2564
259	1154	6049	2404	2273	2564	B.G.	3900	1938	2564
257	1144	6069	2411	2276	2576	B.G.	3846	1948	2576
257	1144	6071	2412	2277	2577	B.G.	3845	1949	2577
258	1147	6071	2412	2278	2577	B.G.	3843	1949	2577
259	1153	6077	2411	2278	2579	B.G.	3835	1950	2579
259	1154	6078	2416	2282	2584	B.G.	3802	1955	2584

Table A.16 Measurement of Strain Gauges of 5SB8T-1.2-14-D^L (Continued)

TRF		S1	S2	S3	S4	S11	S12	S13	S14
kips	kN	m/m	m/m	m/m	m/m	m/m	m/m	m/m	m/m
259	1151	6079	2417	2283	2585	B.G.	3798	1956	2585
249	1108	6068	2446	2294	2593	B.G.	3827	1970	2593
241	1072	6059	2459	2299	2596	B.G.	3845	1978	2596
236	1048	6052	2481	2307	2599	B.G.	3875	1990	2599
227	1011	6047	2495	2316	2603	B.G.	3894	2002	2603
172	765	6038	2518	2325	2609	B.G.	3919	2014	2609
167	745	6140	2686	2496	2643	B.G.	3929	2116	2643
165	733	6171	2692	2508	2647	B.G.	3912	2130	2647
164	728	6276	2698	2510	2649	B.G.	3848	2135	2649
161	716	6911	2687	2478	2641	B.G.	3443	2134	2641
161	715	5926	2703	2530	2658	B.G.	4052	2148	2658
159	706	5538	2707	2550	2663	B.G.	4471	2156	2663
159	705	5537	2707	2550	2663	B.G.	4479	2157	2663
157	700	5563	2707	2553	2672	B.G.	4499	2165	2672
157	699	5564	2707	2554	2672	B.G.	4496	2165	2672
157	699	5564	2707	2554	2672	B.G.	4493	2165	2672
157	700	5566	2707	2554	2673	B.G.	4488	2166	2673
157	699	5568	2707	2554	2673	B.G.	4485	2166	2673
157	699	5570	2707	2552	2673	B.G.	4481	2166	2673
157	699	5571	2707	2552	2673	B.G.	4477	2166	2673
157	699	5574	2707	2552	2673	B.G.	4473	2166	2673
157	698	5576	2707	2552	2673	B.G.	4470	2166	2673

Table A.16 Measurement of Strain Gauges of 5SB8T-1.2-14-D^L (Continued)

TRF		S1	S2	S3	S4	S11	S12	S13	S14
kips	kN	m/m	m/m	m/m	m/m	m/m	m/m	m/m	m/m
157	698	5578	2707	2552	2674	B.G.	4467	2167	2674
157	699	5580	2707	2552	2674	B.G.	4463	2167	2674
157	698	5582	2707	2551	2674	B.G.	4460	2167	2674
157	698	5583	2707	2551	2674	B.G.	4457	2167	2674
157	698	5586	2707	2550	2674	B.G.	4455	2167	2674
157	698	5588	2707	2549	2675	B.G.	4452	2167	2675
157	697	5587	2707	2550	2674	B.G.	4449	2167	2674
157	698	5587	2707	2549	2674	B.G.	4446	2168	2674
157	698	5585	2709	2548	2675	B.G.	4444	2167	2675
157	697	5587	2711	2548	2675	B.G.	4440	2168	2675
155	689	5591	2711	2547	2675	B.G.	4436	2168	2675
154	684	5593	2717	2547	2676	B.G.	4436	2170	2676

A.7 5SB8T-2.0-14-D^L

Table A.17 Measurement of Load and Deflection Relationships of 5SB8T-2.0-14-D^L

LC		Mid. Def.		W. Def.		E. Def.		W. Sett.		E. Sett.		Net Def.	
kips	kN	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm
0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
30	134	0.04	0.90	0.04	0.90	0.04	0.90	0.03	0.87	0.02	0.45	0.01	0.24
60	268	0.06	1.62	0.06	1.62	0.06	1.62	0.05	1.33	0.03	0.85	0.02	0.52
90	399	0.09	2.18	0.09	2.18	0.09	2.18	0.07	1.65	0.04	1.10	0.03	0.79
120	533	0.11	2.67	0.11	2.67	0.11	2.67	0.07	1.89	0.05	1.29	0.04	1.08
150	666	0.13	3.20	0.13	3.20	0.13	3.20	0.08	2.10	0.06	1.50	0.05	1.39
180	801	0.15	3.71	0.15	3.71	0.15	3.71	0.09	2.26	0.07	1.70	0.07	1.72
179	798	0.15	3.71	0.15	3.71	0.15	3.71	0.09	2.26	0.07	1.70	0.07	1.72
178	794	0.15	3.72	0.15	3.72	0.15	3.72	0.09	2.27	0.07	1.70	0.07	1.72
180	802	0.15	3.71	0.15	3.71	0.15	3.71	0.09	2.27	0.07	1.70	0.07	1.73
191	848	0.15	3.92	0.15	3.92	0.15	3.92	0.09	2.33	0.07	1.78	0.07	1.86
197	876	0.16	4.13	0.16	4.13	0.16	4.13	0.10	2.46	0.07	1.84	0.08	1.98
201	896	0.17	4.38	0.17	4.38	0.17	4.38	0.10	2.50	0.08	1.91	0.09	2.17
210	934	0.18	4.64	0.18	4.64	0.18	4.64	0.10	2.50	0.08	1.98	0.09	2.38
209	928	0.18	4.65	0.18	4.65	0.18	4.65	0.10	2.50	0.08	1.99	0.09	2.40
210	935	0.18	4.66	0.18	4.66	0.18	4.66	0.10	2.50	0.08	1.99	0.09	2.40
214	950	0.19	4.78	0.19	4.78	0.19	4.78	0.10	2.50	0.08	2.01	0.10	2.52
210	935	0.20	5.03	0.20	5.03	0.20	5.03	0.10	2.50	0.08	2.01	0.11	2.76
209	931	0.20	5.04	0.20	5.04	0.20	5.04	0.10	2.50	0.08	2.01	0.11	2.77

Table A.17 Measurement of Load and Deflection Relationships of 5SB8T-2.0-14-D^L (Continued)

LC		Mid. Def.		W. Def.		E. Def.		W. Sett.		E. Sett.		Net Def.	
kips	kN	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm
215	956	0.21	5.40	0.21	5.40	0.21	5.40	0.10	2.50	0.08	2.01	0.12	3.15
223	990	0.23	5.86	0.23	5.86	0.23	5.86	0.10	2.50	0.08	2.01	0.14	3.60
227	1010	0.25	6.25	0.25	6.25	0.25	6.25	0.10	2.50	0.08	2.01	0.16	4.00
239	1062	0.29	7.29	0.29	7.29	0.29	7.29	0.10	2.50	0.08	2.01	0.20	5.03
240	1068	0.30	7.73	0.30	7.73	0.30	7.73	0.10	2.50	0.08	2.01	0.21	5.39
234	1041	0.31	7.79	0.31	7.79	0.31	7.79	0.10	2.50	0.08	2.01	0.22	5.51
237	1052	0.34	8.70	0.34	8.70	0.34	8.70	0.10	2.50	0.08	2.01	0.25	6.42
236	1049	0.34	8.71	0.34	8.71	0.34	8.71	0.10	2.50	0.08	2.01	0.25	6.44
227	1009	0.39	10.00	0.39	10.00	0.39	10.00	0.10	2.50	0.08	2.01	0.30	7.74
210	935	0.41	10.53	0.41	10.53	0.41	10.53	0.10	2.50	0.08	2.01	0.33	8.26
210	935	0.41	10.53	0.41	10.53	0.41	10.53	0.10	2.50	0.08	2.01	0.33	8.27
210	932	0.41	10.53	0.41	10.53	0.41	10.53	0.10	2.50	0.08	2.01	0.33	8.27
210	932	0.41	10.53	0.41	10.53	0.41	10.53	0.10	2.50	0.08	2.01	0.33	8.27
210	934	0.41	10.53	0.41	10.53	0.41	10.53	0.10	2.50	0.08	2.01	0.33	8.27
210	932	0.41	10.53	0.41	10.53	0.41	10.53	0.10	2.50	0.08	2.01	0.33	8.27
209	931	0.41	10.53	0.41	10.53	0.41	10.53	0.10	2.50	0.08	2.01	0.33	8.27
210	933	0.41	10.53	0.41	10.53	0.41	10.53	0.10	2.50	0.08	2.01	0.33	8.27
210	933	0.41	10.54	0.41	10.54	0.41	10.54	0.10	2.50	0.08	2.01	0.33	8.27
209	930	0.41	10.53	0.41	10.53	0.41	10.53	0.10	2.50	0.08	2.01	0.33	8.28
209	930	0.41	10.54	0.41	10.54	0.41	10.54	0.10	2.50	0.08	2.01	0.33	8.27
210	932	0.41	10.53	0.41	10.53	0.41	10.53	0.10	2.50	0.08	2.01	0.33	8.28
209	931	0.41	10.53	0.41	10.53	0.41	10.53	0.10	2.50	0.08	2.01	0.33	8.27

Table A.17 Measurement of Load and Deflection Relationships of 5SB8T-2.0-14-D^L (Continued)

LC		Mid. Def.		W. Def.		E. Def.		W. Sett.		E. Sett.		Net Def.	
kips	kN	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm
209	930	0.41	10.53	0.41	10.53	0.41	10.53	0.10	2.50	0.08	2.01	0.33	8.27
209	931	0.41	10.53	0.41	10.53	0.41	10.53	0.10	2.50	0.08	2.01	0.33	8.27
209	931	0.41	10.53	0.41	10.53	0.41	10.53	0.10	2.50	0.08	2.01	0.33	8.27
209	929	0.41	10.53	0.41	10.53	0.41	10.53	0.10	2.50	0.08	2.01	0.33	8.27
209	929	0.41	10.54	0.41	10.54	0.41	10.54	0.10	2.50	0.08	2.01	0.33	8.27
209	930	0.42	10.54	0.42	10.54	0.42	10.54	0.10	2.50	0.08	2.01	0.33	8.28
209	928	0.42	10.55	0.42	10.55	0.42	10.55	0.10	2.50	0.08	2.01	0.33	8.28
208	925	0.42	10.55	0.42	10.55	0.42	10.55	0.10	2.50	0.08	2.01	0.33	8.29
208	925	0.42	10.55	0.42	10.55	0.42	10.55	0.10	2.50	0.08	2.01	0.33	8.29
208	925	0.42	10.56	0.42	10.56	0.42	10.56	0.10	2.50	0.08	2.01	0.33	8.29
207	923	0.42	10.56	0.42	10.56	0.42	10.56	0.10	2.50	0.08	2.01	0.33	8.30
207	922	0.42	10.56	0.42	10.56	0.42	10.56	0.10	2.50	0.08	2.01	0.33	8.30
208	924	0.42	10.56	0.42	10.56	0.42	10.56	0.10	2.50	0.08	2.01	0.33	8.30
208	924	0.42	10.56	0.42	10.56	0.42	10.56	0.10	2.50	0.08	2.01	0.33	8.30
207	921	0.42	10.56	0.42	10.56	0.42	10.56	0.10	2.50	0.08	2.01	0.33	8.30
207	921	0.42	10.56	0.42	10.56	0.42	10.56	0.10	2.50	0.08	2.01	0.33	8.30
207	922	0.42	10.56	0.42	10.56	0.42	10.56	0.10	2.50	0.08	2.01	0.33	8.30
207	921	0.42	10.56	0.42	10.56	0.42	10.56	0.10	2.50	0.08	2.01	0.33	8.30
207	920	0.42	10.56	0.42	10.56	0.42	10.56	0.10	2.50	0.08	2.01	0.33	8.30
207	922	0.42	10.56	0.42	10.56	0.42	10.56	0.10	2.50	0.08	2.01	0.33	8.30
207	922	0.42	10.56	0.42	10.56	0.42	10.56	0.10	2.50	0.08	2.01	0.33	8.30
207	919	0.42	10.56	0.42	10.56	0.42	10.56	0.10	2.50	0.08	2.01	0.33	8.30

Table A.17 Measurement of Load and Deflection Relationships of 5SB8T-2.0-14-D^{L} (Continued)

LC		Mid. Def.		W. Def.		E. Def.		W. Sett.		E. Sett.		Net Def.	
kips	kN	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm
207	919	0.42	10.56	0.42	10.56	0.42	10.56	0.10	2.50	0.08	2.01	0.33	8.30
207	921	0.42	10.56	0.42	10.56	0.42	10.56	0.10	2.50	0.08	2.01	0.33	8.30
207	920	0.42	10.56	0.42	10.56	0.42	10.56	0.10	2.50	0.08	2.01	0.33	8.30
207	919	0.42	10.56	0.42	10.56	0.42	10.56	0.10	2.50	0.08	2.01	0.33	8.30
207	920	0.42	10.56	0.42	10.56	0.42	10.56	0.10	2.50	0.08	2.01	0.33	8.30
207	921	0.42	10.57	0.42	10.57	0.42	10.57	0.10	2.50	0.08	2.01	0.33	8.30
206	918	0.42	10.57	0.42	10.57	0.42	10.57	0.10	2.50	0.08	2.01	0.33	8.31
206	918	0.42	10.56	0.42	10.56	0.42	10.56	0.10	2.50	0.08	2.01	0.33	8.31
207	920	0.42	10.57	0.42	10.57	0.42	10.57	0.10	2.50	0.08	2.01	0.33	8.30
207	919	0.42	10.56	0.42	10.56	0.42	10.56	0.10	2.50	0.08	2.01	0.33	8.31
206	918	0.42	10.57	0.42	10.57	0.42	10.57	0.10	2.50	0.08	2.01	0.33	8.30
207	919	0.42	10.57	0.42	10.57	0.42	10.57	0.10	2.50	0.08	2.01	0.33	8.31
207	919	0.42	10.57	0.42	10.57	0.42	10.57	0.10	2.50	0.08	2.01	0.33	8.31
206	917	0.42	10.57	0.42	10.57	0.42	10.57	0.10	2.50	0.08	2.01	0.33	8.31
206	917	0.42	10.57	0.42	10.57	0.42	10.57	0.10	2.50	0.08	2.01	0.33	8.31
207	919	0.42	10.56	0.42	10.56	0.42	10.56	0.10	2.50	0.08	2.01	0.33	8.31
207	919	0.42	10.57	0.42	10.57	0.42	10.57	0.10	2.50	0.08	2.01	0.33	8.30
206	917	0.42	10.57	0.42	10.57	0.42	10.57	0.10	2.50	0.08	2.01	0.33	8.31
206	918	0.42	10.57	0.42	10.57	0.42	10.57	0.10	2.50	0.08	2.01	0.33	8.31
206	918	0.42	10.57	0.42	10.57	0.42	10.57	0.10	2.50	0.08	2.01	0.33	8.31
206	916	0.42	10.56	0.42	10.56	0.42	10.56	0.10	2.50	0.08	2.01	0.33	8.31

Table A.18 Measurement of Tendon Slippage of 5SB8T-2.0-14-D^L

Load Cell		T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12	T13	T14
kips	kN	in	in	in	in	in	in	in	in	in	in	in	in	in	in
0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
30	134	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
60	268	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
90	399	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
120	533	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
150	666	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
180	801	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
179	798	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
178	794	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
180	802	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
191	848	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
197	876	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
201	896	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
210	934	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
209	928	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
210	935	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
214	950	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
210	935	0.00	0.00	0.01	0.01	0.02	0.01	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.00
209	931	0.00	0.00	0.01	0.01	0.02	0.01	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.00
215	956	0.00	0.00	0.01	0.01	0.03	0.01	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.00
223	990	0.00	0.01	0.01	0.02	0.03	0.01	0.01	0.00	0.01	0.02	0.01	0.00	0.00	0.00
227	1010	0.00	0.02	0.02	0.03	0.04	0.01	0.01	0.01	0.01	0.02	0.02	0.00	0.00	0.00

Table A.18 Measurement of Tendon Slippage of 5SB8T-2.0-14-D^{L} (Continued)

Load Cell		T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12	T13	T14
kips	kN	in	in	in	in	in	in	in	in	in	in	in	in	in	in
239	1062	0.01	0.03	0.03	0.05	0.06	0.01	0.01	0.02	0.01	0.02	0.03	0.00	0.00	0.00
240	1068	0.01	0.03	0.03	0.06	0.06	0.01	0.02	0.03	0.02	0.02	0.03	0.00	0.00	0.00
234	1041	0.01	0.03	0.03	0.06	0.07	0.02	0.02	0.03	0.02	0.03	0.04	0.00	0.00	0.00
237	1052	0.01	0.03	0.03	0.06	0.09	0.03	0.03	0.07	0.05	0.05	0.06	0.01	0.00	0.00
236	1049	0.01	0.03	0.03	0.06	0.09	0.03	0.03	0.07	0.05	0.05	0.06	0.01	0.00	0.00
227	1009	0.01	0.03	0.03	0.07	0.13	0.06	0.06	0.12	0.07	0.11	0.11	0.03	0.01	0.02
210	935	0.01	0.03	0.03	0.09	0.16	0.07	0.08	0.16	0.09	0.14	0.13	0.04	0.02	0.03
210	935	0.01	0.03	0.03	0.09	0.16	0.07	0.08	0.16	0.09	0.14	0.13	0.04	0.02	0.03
210	932	0.01	0.03	0.03	0.09	0.16	0.07	0.08	0.16	0.09	0.14	0.13	0.04	0.02	0.03
210	932	0.01	0.03	0.03	0.09	0.16	0.07	0.08	0.16	0.09	0.14	0.13	0.04	0.02	0.03
210	934	0.01	0.03	0.03	0.09	0.16	0.07	0.08	0.16	0.09	0.14	0.13	0.04	0.02	0.03
210	932	0.01	0.03	0.03	0.09	0.16	0.07	0.08	0.16	0.09	0.14	0.13	0.04	0.02	0.03
209	931	0.01	0.03	0.03	0.09	0.16	0.07	0.08	0.16	0.09	0.14	0.13	0.04	0.02	0.03
210	933	0.01	0.03	0.03	0.09	0.16	0.07	0.08	0.16	0.09	0.14	0.13	0.04	0.02	0.03
210	933	0.01	0.03	0.03	0.09	0.16	0.07	0.08	0.16	0.09	0.14	0.13	0.04	0.02	0.03
209	930	0.01	0.03	0.03	0.09	0.16	0.07	0.08	0.16	0.09	0.14	0.13	0.04	0.02	0.03
209	930	0.01	0.03	0.03	0.09	0.16	0.07	0.08	0.16	0.09	0.14	0.13	0.04	0.02	0.03
210	932	0.01	0.03	0.03	0.09	0.16	0.07	0.08	0.16	0.09	0.14	0.13	0.04	0.02	0.03
209	931	0.01	0.03	0.03	0.09	0.16	0.07	0.08	0.16	0.09	0.14	0.13	0.04	0.02	0.03
209	930	0.01	0.03	0.03	0.09	0.16	0.07	0.08	0.16	0.09	0.14	0.13	0.04	0.02	0.03
209	931	0.01	0.03	0.03	0.09	0.16	0.07	0.08	0.16	0.09	0.14	0.13	0.04	0.02	0.03
209	931	0.01	0.03	0.03	0.09	0.16	0.07	0.08	0.16	0.09	0.14	0.13	0.04	0.02	0.03

Table A.18 Measurement of Tendon Slippage of 5SB8T-2.0-14-D^L (Continued)

Load Cell		T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12	T13	T14
kips	kN	in	in	in	in	in	in	in	in	in	in	in	in	in	in
209	929	0.01	0.03	0.03	0.09	0.16	0.07	0.08	0.16	0.09	0.14	0.13	0.04	0.02	0.03
209	929	0.01	0.03	0.03	0.09	0.16	0.07	0.08	0.16	0.09	0.14	0.13	0.04	0.02	0.03
209	930	0.01	0.03	0.03	0.09	0.16	0.07	0.08	0.16	0.09	0.14	0.13	0.04	0.02	0.03
209	928	0.01	0.03	0.03	0.09	0.16	0.07	0.08	0.17	0.10	0.14	0.14	0.05	0.02	0.03
208	925	0.01	0.03	0.03	0.09	0.16	0.08	0.08	0.17	0.10	0.14	0.14	0.05	0.02	0.03
208	925	0.01	0.03	0.03	0.09	0.16	0.08	0.08	0.17	0.10	0.14	0.14	0.05	0.02	0.03
208	925	0.01	0.03	0.03	0.09	0.16	0.08	0.08	0.17	0.10	0.14	0.14	0.05	0.02	0.03
207	923	0.01	0.03	0.03	0.09	0.16	0.08	0.08	0.17	0.10	0.14	0.14	0.05	0.02	0.03
207	922	0.01	0.03	0.03	0.09	0.16	0.08	0.08	0.17	0.10	0.14	0.14	0.05	0.02	0.03
208	924	0.01	0.03	0.03	0.09	0.16	0.08	0.08	0.17	0.10	0.14	0.14	0.05	0.02	0.03
208	924	0.01	0.03	0.03	0.09	0.16	0.08	0.08	0.17	0.10	0.14	0.14	0.05	0.02	0.03
207	921	0.01	0.03	0.03	0.09	0.16	0.08	0.08	0.17	0.10	0.14	0.14	0.05	0.02	0.03
207	921	0.01	0.03	0.03	0.09	0.16	0.08	0.08	0.17	0.10	0.14	0.14	0.05	0.02	0.03
207	922	0.01	0.03	0.03	0.09	0.16	0.08	0.08	0.17	0.10	0.14	0.14	0.05	0.02	0.03
207	921	0.01	0.03	0.03	0.09	0.16	0.08	0.08	0.17	0.10	0.14	0.14	0.05	0.02	0.03
207	920	0.01	0.03	0.03	0.09	0.16	0.08	0.08	0.17	0.10	0.14	0.14	0.05	0.02	0.03
207	922	0.01	0.03	0.03	0.09	0.16	0.08	0.08	0.17	0.10	0.14	0.14	0.05	0.02	0.03
207	922	0.01	0.03	0.03	0.09	0.16	0.08	0.08	0.17	0.10	0.14	0.14	0.05	0.02	0.03
207	919	0.01	0.03	0.03	0.09	0.16	0.08	0.08	0.17	0.10	0.14	0.14	0.05	0.02	0.03
207	919	0.01	0.03	0.03	0.09	0.16	0.08	0.08	0.17	0.10	0.14	0.14	0.05	0.02	0.03
207	921	0.01	0.03	0.03	0.09	0.16	0.08	0.08	0.17	0.10	0.14	0.14	0.05	0.02	0.03
207	920	0.01	0.03	0.03	0.09	0.16	0.08	0.08	0.17	0.10	0.14	0.14	0.05	0.02	0.03

Table A.18 Measurement of Tendon Slippage of 5SB8T-2.0-14-D^{L} (Continued)

Load Cell		T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12	T13	T14
kips	kN	in	in	in	in	in	in	in	in	in	in	in	in	in	in
207	919	0.01	0.03	0.03	0.09	0.16	0.08	0.08	0.17	0.10	0.14	0.14	0.05	0.02	0.03
207	920	0.01	0.03	0.03	0.09	0.16	0.08	0.08	0.17	0.10	0.14	0.14	0.05	0.02	0.03
207	921	0.01	0.03	0.03	0.09	0.16	0.08	0.08	0.17	0.10	0.14	0.14	0.05	0.02	0.03
206	918	0.01	0.03	0.03	0.09	0.16	0.08	0.08	0.17	0.10	0.14	0.14	0.05	0.02	0.03
206	918	0.01	0.03	0.03	0.09	0.16	0.08	0.08	0.17	0.10	0.14	0.14	0.05	0.02	0.03
207	920	0.01	0.03	0.03	0.09	0.16	0.08	0.08	0.17	0.10	0.14	0.14	0.05	0.02	0.03
207	919	0.01	0.03	0.03	0.09	0.16	0.08	0.08	0.17	0.10	0.14	0.14	0.05	0.02	0.03
206	918	0.01	0.03	0.03	0.09	0.16	0.08	0.08	0.17	0.10	0.14	0.14	0.05	0.02	0.03
207	919	0.01	0.03	0.03	0.09	0.16	0.08	0.08	0.17	0.10	0.14	0.14	0.05	0.02	0.03
207	919	0.01	0.03	0.03	0.09	0.16	0.08	0.08	0.17	0.10	0.14	0.14	0.05	0.02	0.03
206	917	0.01	0.03	0.03	0.09	0.16	0.08	0.08	0.17	0.10	0.14	0.14	0.05	0.02	0.03
206	917	0.01	0.03	0.03	0.09	0.16	0.08	0.08	0.17	0.10	0.14	0.14	0.05	0.02	0.03
207	919	0.01	0.03	0.03	0.09	0.16	0.08	0.08	0.17	0.10	0.14	0.14	0.05	0.02	0.03
207	919	0.01	0.03	0.03	0.09	0.16	0.08	0.08	0.17	0.10	0.14	0.14	0.05	0.02	0.03
206	917	0.01	0.03	0.03	0.09	0.16	0.08	0.08	0.17	0.10	0.14	0.14	0.05	0.02	0.03
206	918	0.01	0.03	0.03	0.09	0.16	0.08	0.08	0.17	0.10	0.14	0.14	0.05	0.02	0.03
206	918	0.01	0.03	0.03	0.09	0.16	0.08	0.08	0.17	0.10	0.14	0.14	0.05	0.02	0.03
206	916	0.01	0.03	0.03	0.09	0.16	0.08	0.08	0.17	0.10	0.14	0.14	0.05	0.02	0.03

Table A.19 Measurement of Strain Gauges of 5SB8T-2.0-14-D^{L}

Load Cell		N1	N2	N3	N4	N11	N12	N13	N14
kips	kN	m/m	m/m	m/m	m/m	m/m	m/m	m/m	m/m
0	0	0	0	0	0	0	0	0	B.G.
30	134	0	10	-9	-8	478	562	-10	B.G.
60	268	0	-20	27	35	275	319	13	B.G.
90	399	0	-5	79	67	290	335	35	B.G.
120	533	0	-20	102	92	455	526	56	B.G.
150	666	0	-42	131	128	355	407	75	B.G.
180	801	0	-87	167	175	142	152	104	B.G.
179	798	0	-89	169	178	119	126	105	B.G.
178	794	0	-91	171	180	94	96	106	B.G.
180	802	0	-91	172	181	97	99	106	B.G.
191	848	0	-99	181	192	104	107	117	B.G.
197	876	0	-147	233	246	600	682	189	B.G.
201	896	0	-41	185	194	153	165	135	B.G.
210	934	0	-25	211	221	69	63	152	B.G.
209	928	0	-25	211	221	71	66	152	B.G.
210	935	0	-25	211	221	72	67	152	B.G.
214	950	0	-10	197	205	356	402	149	B.G.
210	935	0	-21	203	209	315	359	128	B.G.
209	931	0	-23	205	211	278	315	129	B.G.
215	956	0	202	225	268	58	49	179	B.G.
223	990	336	647	245	222	76	77	214	B.G.
227	1010	571	731	189	205	269	286	287	B.G.

Table A.19 Measurement of Strain Gauges of 5SB8T-2.0-14-D^{L} (Continued)

Load Cell		N1	N2	N3	N4	N11	N12	N13	N14
kips	kN	m/m	m/m	m/m	m/m	m/m	m/m	m/m	m/m
239	1062	990	1317	-431	214	98	84	278	B.G.
240	1068	853	1437	-505	214	121	112	293	B.G.
234	1041	831	1441	-509	214	102	91	262	B.G.
237	1052	873	1447	-540	214	-5	-5	271	B.G.
236	1049	873	1447	-540	214	-24	-21	269	B.G.
227	1009	894	1447	-544	214	-359	-343	163	B.G.
210	935	806	1474	-568	214	-368	-352	154	B.G.
210	935	805	1474	-568	214	-369	-353	154	B.G.
210	932	794	1476	-569	214	-374	-359	153	B.G.
210	932	793	1476	-569	214	-375	-360	153	B.G.
210	934	788	1477	-570	214	-376	-361	153	B.G.
210	932	788	1476	-570	214	-376	-361	153	B.G.
209	931	788	1477	-570	214	-376	-362	153	B.G.
210	933	786	1477	-570	214	-377	-362	152	B.G.
210	933	782	1477	-570	214	-379	-364	151	B.G.
209	930	779	1478	-571	214	-380	-366	151	B.G.
209	930	781	1478	-571	214	-379	-365	151	B.G.
210	932	777	1478	-571	214	-381	-366	151	B.G.
209	931	776	1478	-571	214	-381	-367	151	B.G.
209	930	777	1478	-571	214	-381	-366	151	B.G.
209	931	776	1478	-571	214	-382	-367	151	B.G.
209	931	781	1478	-571	214	-379	-365	151	B.G.

Table A.19 Measurement of Strain Gauges of 5SB8T-2.0-14-D^{L} (Continued)

Load Cell		N1	N2	N3	N4	N11	N12	N13	N14
kips	kN	m/m	m/m	m/m	m/m	m/m	m/m	m/m	m/m
209	929	785	1477	-570	214	-377	-362	151	B.G.
209	929	789	1477	-570	214	-376	-360	152	B.G.
209	930	778	1478	-571	214	-381	-366	151	B.G.
209	928	781	1477	-570	214	-379	-364	150	B.G.
208	925	783	1478	-571	214	-378	-363	151	B.G.
208	925	782	1478	-571	214	-378	-363	151	B.G.
208	925	779	1478	-571	214	-379	-364	151	B.G.
207	923	779	1478	-571	214	-379	-364	152	B.G.
207	922	779	1479	-572	214	-379	-364	153	B.G.
208	924	779	1479	-572	214	-378	-363	153	B.G.
208	924	784	1478	-571	214	-376	-361	154	B.G.
207	921	783	1478	-571	214	-376	-361	153	B.G.
207	921	783	1478	-571	214	-376	-361	153	B.G.
207	922	786	1478	-571	214	-374	-359	154	B.G.
207	921	785	1478	-571	214	-375	-360	154	B.G.
207	920	784	1478	-571	214	-375	-360	154	B.G.
207	922	782	1478	-571	214	-376	-361	154	B.G.
207	922	786	1478	-571	214	-374	-359	154	B.G.
207	919	784	1478	-571	214	-375	-360	154	B.G.
207	919	785	1478	-571	214	-375	-359	153	B.G.
207	921	784	1478	-571	214	-375	-360	154	B.G.
207	920	785	1478	-571	214	-375	-360	154	B.G.

Table A.19 Measurement of Strain Gauges of 5SB8T-2.0-14-D^{L} (Continued)

Load Cell		N1	N2	N3	N4	N11	N12	N13	N14
kips	kN	m/m	m/m	m/m	m/m	m/m	m/m	m/m	m/m
207	919	787	1478	-571	214	-374	-359	154	B.G.
207	920	787	1478	-571	214	-374	-358	153	B.G.
207	921	788	1478	-571	214	-373	-358	154	B.G.
206	918	788	1478	-571	214	-373	-358	153	B.G.
206	918	790	1477	-570	214	-372	-357	149	B.G.
207	920	783	1478	-571	214	-376	-361	149	B.G.
207	919	786	1477	-571	214	-374	-359	149	B.G.
206	918	784	1478	-571	214	-375	-360	148	B.G.
207	919	789	1477	-570	214	-373	-358	148	B.G.
207	919	788	1477	-570	214	-373	-358	149	B.G.
206	917	781	1478	-571	214	-376	-362	146	B.G.
206	917	774	1478	-571	214	-380	-366	145	B.G.
207	919	774	1479	-572	214	-380	-365	145	B.G.
207	919	773	1478	-572	214	-380	-365	145	B.G.
206	917	773	1478	-571	214	-379	-365	145	B.G.
206	918	772	1478	-571	214	-380	-366	145	B.G.
206	918	773	1478	-571	214	-379	-365	146	B.G.
206	916	773	1478	-571	214	-379	-365	146	B.G.

A.8 5SB8M-1.2-14-D^{L}

Table A.20 Measurement of Load and Deflection Relationships of 5SB8M-1.2-14-D^{L}

SW.LC		SE. LC		TRF		Mid. Def.		SW. Def.		SE. Def.		SW. Sett.		SE. Sett.		Net Def.	
kips	kN	kips	kN	kips	kN	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
0	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
16	71	14	61	30	132	0.04	1.08	0.04	1.08	0.04	1.08	0.01	0.29	0.06	1.50	0.01	0.19
32	144	28	123	60	267	0.06	1.65	0.06	1.65	0.06	1.65	0.02	0.52	0.08	2.00	0.02	0.39
43	191	37	165	80	355	0.08	1.93	0.08	1.93	0.08	1.93	0.02	0.57	0.09	2.18	0.02	0.56
54	238	46	207	100	445	0.09	2.22	0.09	2.22	0.09	2.22	0.03	0.65	0.09	2.34	0.03	0.73
64	286	56	248	120	534	0.10	2.49	0.10	2.49	0.10	2.49	0.03	0.70	0.10	2.46	0.04	0.91
75	335	65	291	141	626	0.11	2.76	0.11	2.76	0.11	2.76	0.03	0.71	0.10	2.56	0.04	1.13
86	381	74	331	160	712	0.12	3.03	0.12	3.03	0.12	3.03	0.03	0.71	0.10	2.62	0.05	1.37
92	411	79	351	171	762	0.13	3.19	0.13	3.19	0.13	3.19	0.03	0.71	0.10	2.63	0.06	1.52
97	430	83	369	180	799	0.13	3.41	0.13	3.41	0.13	3.41	0.03	0.71	0.10	2.63	0.07	1.74
97	431	83	370	180	800	0.13	3.42	0.13	3.42	0.13	3.42	0.03	0.71	0.10	2.63	0.07	1.74
97	431	83	371	180	802	0.13	3.43	0.13	3.43	0.13	3.43	0.03	0.71	0.10	2.63	0.07	1.75
102	453	88	391	190	844	0.14	3.66	0.14	3.66	0.14	3.66	0.03	0.71	0.10	2.63	0.08	1.99
113	503	98	434	211	937	0.17	4.24	0.17	4.24	0.17	4.24	0.03	0.71	0.10	2.61	0.10	2.59
113	501	98	434	210	935	0.17	4.31	0.17	4.31	0.17	4.31	0.03	0.71	0.10	2.61	0.10	2.65
106	469	94	417	199	887	0.17	4.42	0.17	4.42	0.17	4.42	0.03	0.71	0.10	2.61	0.11	2.76
111	492	101	450	212	942	0.20	4.97	0.20	4.97	0.20	4.97	0.03	0.71	0.10	2.61	0.13	3.32
114	507	105	468	219	975	0.22	5.54	0.22	5.54	0.22	5.54	0.03	0.71	0.10	2.61	0.15	3.88
113	504	105	465	218	970	0.22	5.55	0.22	5.55	0.22	5.55	0.03	0.71	0.10	2.61	0.15	3.89

Table A.20 Measurement of Load and Deflection Relationships of 5SB8M-1.2-14-D^L (Continued)

SW.LC		SE. LC		TRF		Mid. Def.		SW. Def.		SE. Def.		SW. Sett.		SE. Sett.		Net Def.	
kips	kN	kips	kN	kips	kN	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
113	503	104	464	217	967	0.22	5.57	0.22	5.57	0.22	5.57	0.03	0.71	0.10	2.61	0.15	3.91
114	506	105	466	219	972	0.22	5.58	0.22	5.58	0.22	5.58	0.03	0.71	0.10	2.61	0.15	3.92
113	504	104	463	217	967	0.22	5.59	0.22	5.59	0.22	5.59	0.03	0.71	0.10	2.61	0.15	3.94
116	517	105	469	222	986	0.24	6.03	0.24	6.03	0.24	6.03	0.03	0.71	0.10	2.61	0.17	4.38
116	516	105	467	221	983	0.24	6.05	0.24	6.05	0.24	6.05	0.03	0.71	0.10	2.61	0.17	4.39
108	482	92	411	201	893	0.25	6.34	0.25	6.34	0.25	6.34	0.03	0.71	0.10	2.61	0.18	4.68
106	473	91	405	197	878	0.25	6.42	0.25	6.42	0.25	6.42	0.03	0.71	0.10	2.61	0.19	4.76
112	497	93	414	205	911	0.27	6.83	0.27	6.83	0.27	6.83	0.03	0.71	0.10	2.61	0.20	5.17
117	519	96	429	213	947	0.30	7.53	0.30	7.53	0.30	7.53	0.03	0.71	0.10	2.61	0.23	5.87
116	517	96	427	212	944	0.30	7.54	0.30	7.54	0.30	7.54	0.03	0.71	0.10	2.61	0.23	5.88
118	523	97	433	215	956	0.31	7.77	0.31	7.77	0.31	7.77	0.03	0.71	0.10	2.61	0.24	6.11
114	509	96	427	210	936	0.31	7.86	0.31	7.86	0.31	7.86	0.03	0.71	0.10	2.61	0.24	6.21
116	515	97	433	213	948	0.31	7.97	0.31	7.97	0.31	7.97	0.03	0.71	0.10	2.61	0.25	6.31
117	519	98	435	215	954	0.32	8.14	0.32	8.14	0.32	8.14	0.03	0.71	0.10	2.61	0.26	6.48
117	520	98	436	215	956	0.32	8.21	0.32	8.21	0.32	8.21	0.03	0.71	0.10	2.61	0.26	6.55
117	522	99	439	216	962	0.34	8.72	0.34	8.72	0.34	8.72	0.03	0.71	0.10	2.61	0.28	7.06
118	525	99	441	217	966	0.34	8.73	0.34	8.73	0.34	8.73	0.03	0.71	0.10	2.61	0.28	7.08
118	527	99	442	218	969	0.35	8.88	0.35	8.88	0.35	8.88	0.03	0.71	0.10	2.61	0.28	7.22
119	529	100	445	219	974	0.36	9.08	0.36	9.08	0.36	9.08	0.03	0.71	0.10	2.61	0.29	7.43
120	532	101	450	221	982	0.37	9.47	0.37	9.47	0.37	9.47	0.03	0.71	0.10	2.61	0.31	7.81
120	532	101	451	221	982	0.38	9.68	0.38	9.68	0.38	9.68	0.03	0.71	0.10	2.61	0.32	8.02
118	525	102	453	220	977	0.40	10.15	0.40	10.15	0.40	10.15	0.03	0.71	0.10	2.61	0.33	8.49

Table A.20 Measurement of Load and Deflection Relationships of 5SB8M-1.2-14-D^L (Continued)

SW.LC		SE. LC		TRF		Mid. Def.		SW. Def.		SE. Def.		SW. Sett.		SE. Sett.		Net Def.	
kips	kN	kips	kN	kips	kN	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
117	522	102	455	220	977	0.41	10.46	0.41	10.46	0.41	10.46	0.03	0.71	0.10	2.61	0.35	8.80
117	522	103	457	220	978	0.42	10.68	0.42	10.68	0.42	10.68	0.03	0.71	0.10	2.61	0.36	9.02
116	517	102	455	219	972	0.43	10.90	0.43	10.90	0.43	10.90	0.03	0.71	0.10	2.61	0.36	9.24
114	505	101	450	215	955	0.44	11.19	0.44	11.19	0.44	11.19	0.03	0.71	0.10	2.61	0.38	9.53
110	489	100	446	210	935	0.45	11.45	0.45	11.45	0.45	11.45	0.03	0.71	0.10	2.61	0.39	9.79
106	472	99	442	205	914	0.46	11.63	0.46	11.63	0.46	11.63	0.03	0.71	0.10	2.61	0.39	9.97
105	468	99	439	204	907	0.46	11.64	0.46	11.64	0.46	11.64	0.03	0.71	0.10	2.61	0.39	9.99
105	469	99	441	204	909	0.46	11.66	0.46	11.66	0.46	11.66	0.03	0.71	0.10	2.61	0.39	10.00
106	469	99	442	205	911	0.46	11.67	0.46	11.67	0.46	11.67	0.03	0.71	0.10	2.61	0.39	10.02
104	464	99	439	203	903	0.46	11.69	0.46	11.69	0.46	11.69	0.03	0.71	0.10	2.61	0.40	10.03
103	460	98	437	202	897	0.46	11.70	0.46	11.70	0.46	11.70	0.03	0.71	0.10	2.61	0.40	10.04
99	441	97	431	196	872	0.46	11.79	0.46	11.79	0.46	11.79	0.03	0.71	0.10	2.61	0.40	10.13
96	425	96	426	191	851	0.47	11.86	0.47	11.86	0.47	11.86	0.03	0.71	0.10	2.61	0.40	10.20
90	398	93	414	183	813	0.47	11.95	0.47	11.95	0.47	11.95	0.03	0.71	0.10	2.61	0.41	10.29
88	390	92	411	180	801	0.47	11.99	0.47	11.99	0.47	11.99	0.03	0.71	0.10	2.61	0.41	10.33
88	389	93	412	180	802	0.47	12.00	0.47	12.00	0.47	12.00	0.03	0.71	0.10	2.61	0.41	10.34
86	384	92	409	178	793	0.47	12.01	0.47	12.01	0.47	12.01	0.03	0.71	0.10	2.61	0.41	10.35
85	377	91	405	176	783	0.47	12.02	0.47	12.02	0.47	12.02	0.03	0.71	0.10	2.61	0.41	10.36
85	377	91	406	176	783	0.47	12.03	0.47	12.03	0.47	12.03	0.03	0.71	0.10	2.61	0.41	10.37
85	378	92	407	177	785	0.47	12.03	0.47	12.03	0.47	12.03	0.03	0.71	0.10	2.61	0.41	10.38
84	373	91	404	175	777	0.47	12.05	0.47	12.05	0.47	12.05	0.03	0.71	0.10	2.61	0.41	10.39
83	369	90	402	173	771	0.47	12.05	0.47	12.05	0.47	12.05	0.03	0.71	0.10	2.61	0.41	10.39

Table A.20 Measurement of Load and Deflection Relationships of 5SB8M-1.2-14-D^{L} (Continued)

SW.LC		SE. LC		TRF		Mid. Def.		SW. Def.		SE. Def.		SW. Sett.		SE. Sett.		Net Def.	
kips	kN	kips	kN	kips	kN	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
84	372	91	404	174	776	0.47	12.05	0.47	12.05	0.47	12.05	0.03	0.71	0.10	2.61	0.41	10.39
84	372	91	404	174	776	0.47	12.05	0.47	12.05	0.47	12.05	0.03	0.71	0.10	2.61	0.41	10.39
83	367	90	401	173	768	0.47	12.06	0.47	12.06	0.47	12.06	0.03	0.71	0.10	2.61	0.41	10.40
82	366	90	401	173	767	0.48	12.07	0.48	12.07	0.48	12.07	0.03	0.71	0.10	2.61	0.41	10.41
83	369	91	403	174	773	0.48	12.07	0.48	12.07	0.48	12.07	0.03	0.71	0.10	2.61	0.41	10.42
83	368	90	402	173	769	0.48	12.08	0.48	12.08	0.48	12.08	0.03	0.71	0.10	2.61	0.41	10.42
82	363	90	399	171	762	0.48	12.08	0.48	12.08	0.48	12.08	0.03	0.71	0.10	2.61	0.41	10.42
82	364	90	400	172	764	0.48	12.09	0.48	12.09	0.48	12.09	0.03	0.71	0.10	2.61	0.41	10.43
82	367	90	402	173	769	0.48	12.09	0.48	12.09	0.48	12.09	0.03	0.71	0.10	2.61	0.41	10.43
82	363	90	399	171	762	0.48	12.09	0.48	12.09	0.48	12.09	0.03	0.71	0.10	2.61	0.41	10.43
81	360	89	397	170	757	0.48	12.08	0.48	12.08	0.48	12.08	0.03	0.71	0.10	2.61	0.41	10.43
81	362	90	399	171	761	0.48	12.09	0.48	12.09	0.48	12.09	0.03	0.71	0.10	2.61	0.41	10.43
82	363	90	400	171	763	0.48	12.09	0.48	12.09	0.48	12.09	0.03	0.71	0.10	2.61	0.41	10.43
81	358	89	397	170	755	0.48	12.09	0.48	12.09	0.48	12.09	0.03	0.71	0.10	2.61	0.41	10.43
80	357	89	396	169	753	0.48	12.10	0.48	12.10	0.48	12.10	0.03	0.71	0.10	2.61	0.41	10.44
81	360	90	399	171	759	0.48	12.09	0.48	12.09	0.48	12.09	0.03	0.71	0.10	2.61	0.41	10.44
81	360	89	398	170	757	0.48	12.11	0.48	12.11	0.48	12.11	0.03	0.71	0.10	2.61	0.41	10.45
80	355	89	395	169	750	0.48	12.11	0.48	12.11	0.48	12.11	0.03	0.71	0.10	2.61	0.41	10.45
80	356	89	396	169	752	0.48	12.11	0.48	12.11	0.48	12.11	0.03	0.71	0.10	2.61	0.41	10.45
81	359	90	398	170	757	0.48	12.11	0.48	12.11	0.48	12.11	0.03	0.71	0.10	2.61	0.41	10.46
80	356	89	396	169	752	0.48	12.12	0.48	12.12	0.48	12.12	0.03	0.71	0.10	2.61	0.41	10.46
79	353	89	394	168	747	0.48	12.12	0.48	12.12	0.48	12.12	0.03	0.71	0.10	2.61	0.41	10.46

Table A.21 Measurement of Tendon Slippage of 5SB8M-1.2-14-D^{L}

TRF		T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12	T13	T14
kips	kN	in	in	in	in	in	in	in	in	in	in	in	in	in	in
0	0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
30	132	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-0.001
60	267	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.001	0.001	0.000	0.000	0.000	0.000	-0.001
80	355	0.000	0.000	0.000	0.000	0.000	0.001	0.006	0.005	0.005	0.000	0.000	0.000	0.000	0.000
100	445	0.000	0.000	0.000	0.000	0.000	0.001	0.014	0.016	0.006	0.000	0.000	0.000	0.000	0.000
120	534	0.000	0.000	0.000	0.000	0.000	0.001	0.021	0.026	0.006	0.000	0.000	0.000	0.000	0.000
141	626	0.000	0.000	0.000	0.000	0.000	0.002	0.030	0.035	0.008	0.002	0.000	0.000	0.000	0.000
160	712	0.000	0.000	0.000	0.000	0.002	0.006	0.038	0.044	0.020	0.003	0.000	0.000	0.000	0.000
171	762	0.000	0.000	0.000	0.000	0.007	0.008	0.043	0.049	0.026	0.003	0.000	0.000	0.000	0.000
180	799	0.000	0.000	0.000	0.000	0.028	0.015	0.047	0.052	0.032	0.004	0.000	0.000	0.000	0.000
180	800	0.000	0.000	0.000	0.000	0.028	0.015	0.047	0.052	0.032	0.003	0.000	0.000	0.000	0.000
180	802	0.000	0.000	0.000	0.000	0.028	0.016	0.048	0.052	0.032	0.003	0.000	0.000	0.000	-0.001
190	844	0.000	0.000	0.000	0.000	0.035	0.022	0.054	0.059	0.040	0.004	0.000	0.000	0.000	0.000
211	937	0.000	0.000	0.000	0.003	0.053	0.039	0.067	0.074	0.054	0.008	0.000	0.000	0.000	0.000
210	935	0.000	0.000	0.000	0.008	0.057	0.041	0.068	0.075	0.055	0.009	0.000	0.000	0.000	0.000
199	887	0.000	0.000	0.000	0.046	0.063	0.042	0.069	0.075	0.055	0.009	0.000	0.000	0.000	0.000
212	942	0.004	0.000	0.017	0.059	0.066	0.044	0.072	0.077	0.058	0.015	0.000	0.001	0.000	-0.001
219	975	0.008	0.005	0.032	0.071	0.068	0.046	0.075	0.083	0.062	0.044	0.000	0.001	0.000	0.000
218	970	0.008	0.006	0.032	0.071	0.068	0.046	0.075	0.083	0.062	0.044	0.000	0.001	0.000	0.000
217	967	0.008	0.006	0.032	0.071	0.068	0.046	0.075	0.083	0.062	0.046	0.000	0.001	0.000	0.000
219	972	0.008	0.006	0.032	0.071	0.068	0.046	0.075	0.084	0.062	0.047	0.001	0.001	0.000	0.000
217	967	0.008	0.006	0.032	0.071	0.068	0.046	0.075	0.084	0.063	0.049	0.001	0.001	0.000	0.000

Table A.21 Measurement of Tendon Slippage of 5SB8M-1.2-14-D^{L} (Continued)

TRF		T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12	T13	T14
kips	kN	in	in	in	in	in	in	in	in	in	in	in	in	in	in
222	986	0.010	0.008	0.039	0.074	0.070	0.049	0.080	0.091	0.070	0.062	0.016	0.001	0.000	0.000
221	983	0.010	0.008	0.039	0.074	0.071	0.049	0.080	0.092	0.070	0.062	0.017	0.001	0.000	0.000
201	893	0.011	0.009	0.039	0.075	0.071	0.049	0.080	0.092	0.071	0.067	0.040	0.029	0.000	0.004
197	878	0.011	0.009	0.041	0.075	0.071	0.049	0.080	0.092	0.071	0.067	0.042	0.038	0.001	0.006
205	911	0.011	0.009	0.041	0.075	0.071	0.049	0.080	0.092	0.072	0.068	0.044	0.061	0.005	0.016
213	947	0.015	0.012	0.047	0.075	0.071	0.049	0.080	0.092	0.072	0.069	0.045	0.083	0.010	0.033
212	944	0.015	0.012	0.047	0.075	0.071	0.049	0.080	0.092	0.072	0.069	0.045	0.083	0.011	0.033
215	956	0.017	0.014	0.053	0.076	0.071	0.049	0.080	0.092	0.072	0.069	0.064	0.087	0.013	0.039
210	936	0.022	0.017	0.055	0.076	0.071	0.049	0.080	0.092	0.072	0.069	0.065	0.088	0.013	0.040
213	948	0.024	0.018	0.059	0.076	0.071	0.049	0.080	0.092	0.072	0.069	0.066	0.089	0.014	0.041
215	954	0.026	0.020	0.062	0.076	0.071	0.049	0.080	0.092	0.072	0.069	0.067	0.093	0.016	0.044
215	956	0.027	0.020	0.063	0.077	0.071	0.049	0.080	0.092	0.072	0.069	0.068	0.094	0.016	0.046
216	962	0.045	0.029	0.071	0.077	0.071	0.049	0.081	0.092	0.072	0.069	0.071	0.099	0.020	0.054
217	966	0.045	0.029	0.071	0.077	0.071	0.049	0.081	0.092	0.072	0.069	0.071	0.099	0.020	0.054
218	969	0.048	0.030	0.074	0.077	0.071	0.049	0.081	0.092	0.072	0.069	0.072	0.101	0.022	0.057
219	974	0.051	0.032	0.076	0.077	0.071	0.049	0.081	0.092	0.072	0.069	0.073	0.103	0.023	0.060
221	982	0.057	0.037	0.080	0.076	0.071	0.049	0.081	0.092	0.072	0.069	0.074	0.108	0.026	0.065
221	982	0.060	0.039	0.082	0.075	0.072	0.049	0.081	0.092	0.072	0.069	0.075	0.111	0.028	0.067
220	977	0.070	0.046	0.092	0.066	0.072	0.049	0.081	0.092	0.072	0.069	0.079	0.115	0.030	0.070
220	977	0.078	0.050	0.095	0.062	0.073	0.049	0.081	0.092	0.072	0.069	0.081	0.118	0.032	0.072
220	978	0.082	0.053	0.100	0.059	0.073	0.049	0.081	0.092	0.072	0.069	0.083	0.121	0.033	0.073
219	972	0.086	0.056	0.103	0.057	0.074	0.049	0.082	0.092	0.072	0.069	0.085	0.123	0.034	0.074

Table A.21 Measurement of Tendon Slippage of 5SB8M-1.2-14-D^{L} (Continued)

TRF		T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12	T13	T14
kips	kN	in	in	in	in	in	in	in	in	in	in	in	in	in	in
215	955	0.093	0.061	0.109	0.054	0.074	0.050	0.082	0.092	0.072	0.069	0.088	0.128	0.036	0.076
210	935	0.098	0.064	0.114	0.051	0.074	0.050	0.082	0.092	0.072	0.069	0.089	0.131	0.037	0.077
205	914	0.101	0.067	0.120	0.049	0.074	0.049	0.082	0.092	0.072	0.069	0.090	0.132	0.037	0.077
204	907	0.102	0.067	0.120	0.048	0.074	0.050	0.082	0.092	0.072	0.069	0.090	0.132	0.037	0.077
204	909	0.102	0.068	0.121	0.048	0.074	0.050	0.082	0.092	0.072	0.069	0.090	0.132	0.037	0.077
205	911	0.104	0.068	0.121	0.048	0.074	0.050	0.082	0.092	0.072	0.069	0.090	0.132	0.037	0.077
203	903	0.104	0.068	0.122	0.048	0.074	0.049	0.082	0.092	0.072	0.069	0.090	0.132	0.037	0.077
202	897	0.104	0.069	0.125	0.047	0.074	0.050	0.082	0.092	0.072	0.069	0.090	0.132	0.037	0.077
196	872	0.106	0.071	0.129	0.043	0.074	0.050	0.082	0.092	0.072	0.070	0.091	0.133	0.037	0.077
191	851	0.109	0.073	0.131	0.039	0.074	0.050	0.082	0.092	0.072	0.070	0.091	0.134	0.037	0.077
183	813	0.113	0.076	0.134	0.034	0.074	0.050	0.082	0.092	0.072	0.070	0.091	0.135	0.037	0.077
180	801	0.115	0.078	0.134	0.033	0.074	0.050	0.082	0.092	0.072	0.070	0.092	0.135	0.037	0.077
180	802	0.115	0.078	0.135	0.032	0.074	0.050	0.082	0.092	0.072	0.070	0.092	0.135	0.037	0.077
178	793	0.116	0.079	0.136	0.031	0.074	0.049	0.082	0.092	0.072	0.070	0.092	0.135	0.037	0.077
176	783	0.117	0.079	0.137	0.030	0.074	0.049	0.082	0.092	0.072	0.070	0.092	0.135	0.037	0.077
176	783	0.117	0.080	0.137	0.030	0.074	0.049	0.082	0.092	0.072	0.069	0.092	0.135	0.037	0.077
177	785	0.118	0.080	0.137	0.029	0.074	0.049	0.082	0.092	0.072	0.070	0.092	0.135	0.037	0.077
175	777	0.118	0.080	0.138	0.029	0.074	0.049	0.082	0.092	0.072	0.070	0.092	0.135	0.037	0.077
173	771	0.118	0.080	0.138	0.029	0.074	0.050	0.082	0.092	0.072	0.070	0.092	0.135	0.037	0.077
174	776	0.118	0.081	0.138	0.028	0.074	0.050	0.082	0.092	0.072	0.070	0.092	0.135	0.037	0.077
174	776	0.118	0.081	0.138	0.028	0.074	0.049	0.082	0.092	0.072	0.070	0.092	0.135	0.037	0.077
173	768	0.118	0.081	0.138	0.028	0.074	0.049	0.082	0.092	0.072	0.070	0.092	0.135	0.037	0.077

Table A.21 Measurement of Tendon Slippage of 5SB8M-1.2-14-D^L (Continued)

TRF		T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12	T13	T14
kips	kN	in	in	in	in	in	in	in	in	in	in	in	in	in	in
173	767	0.119	0.081	0.139	0.028	0.074	0.049	0.082	0.092	0.072	0.070	0.091	0.135	0.037	0.077
174	773	0.119	0.081	0.139	0.027	0.074	0.049	0.082	0.092	0.072	0.070	0.091	0.135	0.037	0.077
173	769	0.119	0.081	0.139	0.027	0.074	0.049	0.082	0.092	0.072	0.070	0.092	0.135	0.037	0.077
171	762	0.119	0.081	0.139	0.027	0.074	0.049	0.082	0.092	0.072	0.070	0.092	0.135	0.037	0.077
172	764	0.119	0.081	0.139	0.027	0.074	0.049	0.082	0.092	0.072	0.069	0.092	0.135	0.037	0.077
173	769	0.119	0.081	0.139	0.027	0.074	0.049	0.082	0.092	0.072	0.070	0.092	0.135	0.037	0.077
171	762	0.120	0.082	0.139	0.027	0.074	0.049	0.082	0.092	0.072	0.070	0.092	0.135	0.037	0.077
170	757	0.120	0.082	0.139	0.027	0.074	0.049	0.082	0.092	0.072	0.070	0.092	0.135	0.037	0.077
171	761	0.120	0.082	0.140	0.026	0.074	0.049	0.082	0.092	0.072	0.070	0.092	0.135	0.038	0.077
171	763	0.120	0.082	0.140	0.026	0.074	0.049	0.082	0.092	0.072	0.070	0.092	0.135	0.037	0.077
170	755	0.121	0.082	0.140	0.026	0.074	0.050	0.082	0.092	0.072	0.070	0.092	0.135	0.037	0.077
169	753	0.121	0.082	0.140	0.026	0.074	0.049	0.082	0.092	0.072	0.070	0.092	0.135	0.037	0.077
171	759	0.121	0.082	0.140	0.026	0.074	0.049	0.082	0.092	0.072	0.070	0.092	0.135	0.037	0.077
170	757	0.121	0.082	0.140	0.026	0.074	0.049	0.082	0.092	0.072	0.070	0.092	0.135	0.038	0.077
169	750	0.121	0.082	0.140	0.026	0.074	0.050	0.082	0.092	0.072	0.069	0.091	0.135	0.037	0.077
169	752	0.121	0.083	0.140	0.026	0.074	0.050	0.082	0.092	0.072	0.069	0.092	0.135	0.037	0.077
170	757	0.121	0.082	0.140	0.026	0.074	0.050	0.082	0.092	0.072	0.070	0.092	0.135	0.038	0.077
169	752	0.121	0.083	0.140	0.026	0.074	0.049	0.082	0.092	0.072	0.070	0.092	0.135	0.038	0.077
168	747	0.121	0.083	0.140	0.025	0.074	0.050	0.082	0.092	0.072	0.070	0.092	0.135	0.038	0.077

Table A.22 Measurement of Strain Gauges of 5SB8M-1.2-14-D^{L}

TRF		S1	S2	S3	S4	S11	S12	S13	S14
kips	kN	m/m	m/m	m/m	m/m	m/m	m/m	m/m	m/m
0	0	0	0	0	0	B.G.	0	0	0
30	132	9	9	-17	-13	B.G.	98	11	-11
60	267	113	203	56	-33	B.G.	210	76	34
80	355	377	453	359	12	B.G.	387	356	369
100	445	632	748	726	220	B.G.	791	710	797
120	534	829	1025	1064	512	B.G.	1088	961	1047
141	626	1105	1396	1499	843	B.G.	1341	1222	1315
160	712	1329	1705	1868	1105	B.G.	1521	1445	1549
171	762	1480	1879	2039	1227	B.G.	1602	1556	1671
180	799	1736	1946	2303	1254	B.G.	1587	B.G.	1686
180	800	1742	1952	2311	1260	B.G.	1595	B.G.	1697
180	802	1749	1960	2318	1266	B.G.	1598	B.G.	1703
190	844	1913	2179	2524	1428	B.G.	1747	B.G.	1852
211	937	2176	2561	2898	1745	B.G.	2037	B.G.	2102
210	935	2214	2604	2924	1763	B.G.	2053	B.G.	2130
199	887	2223	2620	2943	1788	B.G.	2052	B.G.	2146
212	942	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.
219	975	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.
218	970	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
168	747	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.

A.9 5SB8M-2.0-14-D^L

Table A.23 Measurement of Load and Deflection Relationships of 5SB8M-2.0-14-D^L

LC		Mid. Def.		W. Def.		E. Def.		W. Sett.		E. Sett.		Net Def.	
kips	kN	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm
0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
31	136	0.04	1.02	0.04	1.02	0.04	1.02	0.02	0.44	0.04	0.94	0.01	0.34
61	272	0.07	1.74	0.07	1.74	0.07	1.74	0.03	0.76	0.05	1.37	0.03	0.67
90	399	0.09	2.29	0.09	2.29	0.09	2.29	0.04	1.02	0.06	1.60	0.04	0.98
120	532	0.11	2.82	0.11	2.82	0.11	2.82	0.05	1.24	0.07	1.79	0.05	1.31
159	709	0.14	3.55	0.14	3.55	0.14	3.55	0.06	1.48	0.08	2.05	0.07	1.78
170	756	0.15	3.75	0.15	3.75	0.15	3.75	0.06	1.54	0.08	2.11	0.08	1.92
180	799	0.16	3.96	0.16	3.96	0.16	3.96	0.06	1.60	0.09	2.17	0.08	2.08
190	843	0.16	4.18	0.16	4.18	0.16	4.18	0.07	1.66	0.09	2.23	0.09	2.24
193	857	0.17	4.28	0.17	4.28	0.17	4.28	0.07	1.69	0.09	2.27	0.09	2.30
192	854	0.17	4.35	0.17	4.35	0.17	4.35	0.07	1.71	0.09	2.30	0.09	2.35
173	768	0.18	4.65	0.18	4.65	0.18	4.65	0.07	1.71	0.09	2.30	0.10	2.65
186	826	0.22	5.52	0.22	5.52	0.22	5.52	0.07	1.71	0.09	2.30	0.14	3.51
189	841	0.24	6.09	0.24	6.09	0.24	6.09	0.07	1.71	0.09	2.30	0.16	4.09
171	763	0.25	6.34	0.25	6.34	0.25	6.34	0.07	1.71	0.09	2.30	0.17	4.34
164	730	0.28	7.14	0.28	7.14	0.28	7.14	0.07	1.71	0.09	2.30	0.20	5.13
161	717	0.29	7.45	0.29	7.45	0.29	7.45	0.07	1.71	0.09	2.30	0.21	5.44
159	705	0.30	7.70	0.30	7.70	0.30	7.70	0.07	1.71	0.09	2.30	0.22	5.70
158	704	0.31	7.96	0.31	7.96	0.31	7.96	0.07	1.71	0.09	2.30	0.23	5.95

Table A.23 Measurement of Load and Deflection Relationships of 5SB8M-2.0-14-D^L (Continued)

LC		Mid. Def.		W. Def.		E. Def.		W. Sett.		E. Sett.		Net Def.	
kips	kN	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm
158	704	0.32	8.22	0.32	8.22	0.32	8.22	0.07	1.71	0.09	2.30	0.24	6.22
158	704	0.32	8.24	0.32	8.24	0.32	8.24	0.07	1.71	0.09	2.30	0.25	6.24
156	696	0.34	8.72	0.34	8.72	0.34	8.72	0.07	1.71	0.09	2.30	0.26	6.71
156	694	0.35	8.98	0.35	8.98	0.35	8.98	0.07	1.71	0.09	2.30	0.27	6.97
156	693	0.35	8.99	0.35	8.99	0.35	8.99	0.07	1.71	0.09	2.30	0.28	6.99
154	686	0.37	9.49	0.37	9.49	0.37	9.49	0.07	1.71	0.09	2.30	0.29	7.49
154	684	0.37	9.51	0.37	9.51	0.37	9.51	0.07	1.71	0.09	2.30	0.30	7.50
154	686	0.39	10.00	0.39	10.00	0.39	10.00	0.07	1.71	0.09	2.30	0.31	7.99
154	686	0.39	10.01	0.39	10.01	0.39	10.01	0.07	1.71	0.09	2.30	0.32	8.01
154	683	0.41	10.50	0.41	10.50	0.41	10.50	0.07	1.71	0.09	2.30	0.33	8.50
153	680	0.41	10.52	0.41	10.52	0.41	10.52	0.07	1.71	0.09	2.30	0.34	8.51
153	680	0.43	11.01	0.43	11.01	0.43	11.01	0.07	1.71	0.09	2.30	0.35	9.01
153	679	0.43	11.03	0.43	11.03	0.43	11.03	0.07	1.71	0.09	2.30	0.36	9.02
153	683	0.45	11.53	0.45	11.53	0.45	11.53	0.07	1.71	0.09	2.30	0.37	9.52
153	683	0.45	11.54	0.45	11.54	0.45	11.54	0.07	1.71	0.09	2.30	0.38	9.53
153	681	0.47	12.04	0.47	12.04	0.47	12.04	0.07	1.71	0.09	2.30	0.39	10.03
153	681	0.47	12.05	0.47	12.05	0.47	12.05	0.07	1.71	0.09	2.30	0.40	10.04
152	677	0.49	12.54	0.49	12.54	0.49	12.54	0.07	1.71	0.09	2.30	0.41	10.54
152	677	0.49	12.55	0.49	12.55	0.49	12.55	0.07	1.71	0.09	2.30	0.42	10.55
152	678	0.51	13.04	0.51	13.04	0.51	13.04	0.07	1.71	0.09	2.30	0.43	11.03
153	679	0.51	13.05	0.51	13.05	0.51	13.05	0.07	1.71	0.09	2.30	0.44	11.05
152	678	0.53	13.54	0.53	13.54	0.53	13.54	0.07	1.71	0.09	2.30	0.45	11.54

Table A.23 Measurement of Load and Deflection Relationships of 5SB8M-2.0-14-D^L (Continued)

LC		Mid. Def.		W. Def.		E. Def.		W. Sett.		E. Sett.		Net Def.	
kips	kN	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm
153	679	0.54	13.81	0.54	13.81	0.54	13.81	0.07	1.71	0.09	2.30	0.46	11.80
152	678	0.54	13.82	0.54	13.82	0.54	13.82	0.07	1.71	0.09	2.30	0.47	11.81
152	678	0.56	14.32	0.56	14.32	0.56	14.32	0.07	1.71	0.09	2.30	0.48	12.31
152	677	0.56	14.33	0.56	14.33	0.56	14.33	0.07	1.71	0.09	2.30	0.49	12.32
152	677	0.56	14.34	0.56	14.34	0.56	14.34	0.07	1.71	0.09	2.30	0.49	12.34
152	678	0.57	14.36	0.57	14.36	0.57	14.36	0.07	1.71	0.09	2.30	0.49	12.35
151	670	0.57	14.47	0.57	14.47	0.57	14.47	0.07	1.71	0.09	2.30	0.49	12.47
151	671	0.57	14.47	0.57	14.47	0.57	14.47	0.07	1.71	0.09	2.30	0.49	12.47
151	671	0.57	14.48	0.57	14.48	0.57	14.48	0.07	1.71	0.09	2.30	0.49	12.47
150	669	0.57	14.48	0.57	14.48	0.57	14.48	0.07	1.71	0.09	2.30	0.49	12.47
150	669	0.57	14.48	0.57	14.48	0.57	14.48	0.07	1.71	0.09	2.30	0.49	12.48
151	670	0.57	14.48	0.57	14.48	0.57	14.48	0.07	1.71	0.09	2.30	0.49	12.47
150	669	0.57	14.48	0.57	14.48	0.57	14.48	0.07	1.71	0.09	2.30	0.49	12.48
150	668	0.57	14.48	0.57	14.48	0.57	14.48	0.07	1.71	0.09	2.30	0.49	12.48
150	668	0.57	14.48	0.57	14.48	0.57	14.48	0.07	1.71	0.09	2.30	0.49	12.48
150	669	0.57	14.48	0.57	14.48	0.57	14.48	0.07	1.71	0.09	2.30	0.49	12.48
150	668	0.57	14.48	0.57	14.48	0.57	14.48	0.07	1.71	0.09	2.30	0.49	12.48
150	667	0.57	14.48	0.57	14.48	0.57	14.48	0.07	1.71	0.09	2.30	0.49	12.48
150	668	0.57	14.48	0.57	14.48	0.57	14.48	0.07	1.71	0.09	2.30	0.49	12.48
150	668	0.57	14.48	0.57	14.48	0.57	14.48	0.07	1.71	0.09	2.30	0.49	12.48
150	666	0.57	14.48	0.57	14.48	0.57	14.48	0.07	1.71	0.09	2.30	0.49	12.48
150	666	0.57	14.48	0.57	14.48	0.57	14.48	0.07	1.71	0.09	2.30	0.49	12.48

Table A.23 Measurement of Load and Deflection Relationships of 5SB8M-2.0-14-D^L (Continued)

LC		Mid. Def.		W. Def.		E. Def.		W. Sett.		E. Sett.		Net Def.	
kips	kN	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm
150	667	0.57	14.49	0.57	14.49	0.57	14.49	0.07	1.71	0.09	2.30	0.49	12.48
150	666	0.57	14.49	0.57	14.49	0.57	14.49	0.07	1.71	0.09	2.30	0.49	12.48
150	666	0.57	14.49	0.57	14.49	0.57	14.49	0.07	1.71	0.09	2.30	0.49	12.48
150	666	0.57	14.49	0.57	14.49	0.57	14.49	0.07	1.71	0.09	2.30	0.49	12.48
150	666	0.57	14.49	0.57	14.49	0.57	14.49	0.07	1.71	0.09	2.30	0.49	12.48
150	665	0.57	14.49	0.57	14.49	0.57	14.49	0.07	1.71	0.09	2.30	0.49	12.48
149	665	0.57	14.49	0.57	14.49	0.57	14.49	0.07	1.71	0.09	2.30	0.49	12.49
150	666	0.57	14.49	0.57	14.49	0.57	14.49	0.07	1.71	0.09	2.30	0.49	12.49
150	665	0.57	14.49	0.57	14.49	0.57	14.49	0.07	1.71	0.09	2.30	0.49	12.49
149	664	0.57	14.49	0.57	14.49	0.57	14.49	0.07	1.71	0.09	2.30	0.49	12.49
149	665	0.57	14.49	0.57	14.49	0.57	14.49	0.07	1.71	0.09	2.30	0.49	12.49
150	665	0.57	14.49	0.57	14.49	0.57	14.49	0.07	1.71	0.09	2.30	0.49	12.49
149	664	0.57	14.49	0.57	14.49	0.57	14.49	0.07	1.71	0.09	2.30	0.49	12.49
149	664	0.57	14.50	0.57	14.50	0.57	14.50	0.07	1.71	0.09	2.30	0.49	12.49
149	665	0.57	14.49	0.57	14.49	0.57	14.49	0.07	1.71	0.09	2.30	0.49	12.49
149	665	0.57	14.50	0.57	14.50	0.57	14.50	0.07	1.71	0.09	2.30	0.49	12.49
149	664	0.57	14.50	0.57	14.50	0.57	14.50	0.07	1.71	0.09	2.30	0.49	12.49
149	663	0.57	14.50	0.57	14.50	0.57	14.50	0.07	1.71	0.09	2.30	0.49	12.49
149	664	0.57	14.50	0.57	14.50	0.57	14.50	0.07	1.71	0.09	2.30	0.49	12.49
149	664	0.57	14.50	0.57	14.50	0.57	14.50	0.07	1.71	0.09	2.30	0.49	12.49
149	663	0.57	14.50	0.57	14.50	0.57	14.50	0.07	1.71	0.09	2.30	0.49	12.50
149	663	0.57	14.50	0.57	14.50	0.57	14.50	0.07	1.71	0.09	2.30	0.49	12.49

Table A.24 Measurement of Tendon Slippage of 5SB8M-2.0-14-D^{L}

Load Cell		T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12	T13	T14
kips	kN	in	in	in	in	in	in	in	in	in	in	in	in	in	in
0	0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
31	136	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-0.001	0.000	0.001	0.000	0.000	0.000
61	272	0.000	0.000	0.000	0.000	0.000	0.000	-0.001	0.000	-0.001	0.000	0.000	0.000	0.000	0.000
90	399	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-0.001	0.000	0.000	0.000	0.000	0.000
120	532	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-0.001	0.000	0.000	0.000	0.000	0.000
159	709	0.000	0.000	0.000	0.000	0.000	0.000	-0.001	0.000	-0.001	0.000	0.000	0.000	0.000	0.000
170	756	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-0.001	0.000	0.000	0.000	0.000	0.000
180	799	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-0.001	0.000	0.000	0.000	0.000	0.000
190	843	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-0.001	0.000	0.000	0.000	0.000	0.000
193	857	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000
192	854	0.000	0.000	0.000	0.000	0.000	0.000	-0.001	0.000	0.000	0.001	0.002	0.000	0.000	0.000
173	768	0.000	0.000	0.000	0.002	0.011	0.005	0.000	0.000	0.001	0.011	0.016	0.003	0.000	0.000
186	826	0.002	0.001	0.000	0.003	0.031	0.019	0.006	0.019	0.008	0.022	0.025	0.003	0.001	0.002
189	841	0.004	0.001	0.000	0.000	0.045	0.029	0.014	0.042	0.012	0.029	0.032	0.005	0.001	0.005
171	763	0.004	0.000	0.000	-0.002	0.055	0.041	0.028	0.058	0.024	0.059	0.037	0.021	0.000	0.007
164	730	0.006	0.000	0.000	0.002	0.091	0.068	0.050	0.095	0.042	0.096	0.054	0.034	0.000	0.008
161	717	0.007	0.000	0.000	0.007	0.106	0.076	0.058	0.108	0.049	0.106	0.063	0.040	0.000	0.009
159	705	0.008	0.000	0.000	0.011	0.118	0.085	0.064	0.119	0.055	0.115	0.078	0.043	0.000	0.009
158	704	0.008	0.000	0.000	0.014	0.130	0.091	0.070	0.131	0.058	0.123	0.088	0.048	0.000	0.009
158	704	0.009	0.000	0.000	0.018	0.142	0.098	0.076	0.141	0.063	0.132	0.097	0.060	0.000	0.009
158	704	0.009	0.000	0.000	0.018	0.142	0.098	0.077	0.142	0.064	0.132	0.097	0.060	0.000	0.009
156	696	0.012	0.000	0.000	0.025	0.167	0.112	0.089	0.164	0.071	0.147	0.117	0.083	0.000	0.009

Table A.24 Measurement of Tendon Slippage of 5SB8M-2.0-14-D^{L} (Continued)

Load Cell		T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12	T13	T14
kips	kN	in	in	in	in	in	in	in	in	in	in	in	in	in	in
156	694	0.014	0.000	0.000	0.029	0.182	0.119	0.096	0.176	0.076	0.155	0.128	0.092	0.003	0.009
156	693	0.014	0.000	0.000	0.029	0.183	0.120	0.096	0.176	0.076	0.156	0.128	0.092	0.003	0.009
154	686	0.017	0.000	0.000	0.038	0.212	0.133	0.109	0.204	0.089	0.171	0.150	0.113	0.003	0.009
154	684	0.017	0.000	0.000	0.038	0.212	0.134	0.110	0.204	0.089	0.172	0.151	0.115	0.003	0.009
154	686	0.019	0.001	0.000	0.045	0.231	0.147	0.122	0.225	0.094	0.186	0.169	0.138	0.002	0.009
154	686	0.019	0.001	0.000	0.045	0.231	0.147	0.122	0.226	0.094	0.186	0.170	0.138	0.002	0.009
154	683	0.020	0.002	0.000	0.052	0.255	0.160	0.135	0.256	0.105	0.200	0.189	0.158	0.002	0.009
153	680	0.022	0.002	0.000	0.053	0.257	0.162	0.136	0.256	0.105	0.200	0.190	0.159	0.002	0.009
153	680	0.022	0.002	0.000	0.060	0.282	0.175	0.149	0.278	0.115	0.214	0.210	0.175	0.002	0.009
153	679	0.022	0.003	0.000	0.061	0.282	0.175	0.149	0.278	0.115	0.215	0.210	0.176	0.002	0.009
153	683	0.023	0.004	0.000	0.067	0.304	0.188	0.162	0.301	0.120	0.226	0.226	0.190	0.002	0.009
153	683	0.023	0.004	0.000	0.067	0.304	0.188	0.162	0.301	0.120	0.227	0.226	0.190	0.002	0.009
153	681	0.024	0.004	0.000	0.072	0.320	0.201	0.175	0.322	0.125	0.238	0.243	0.202	0.002	0.009
153	681	0.024	0.004	0.000	0.072	0.321	0.201	0.175	0.323	0.126	0.239	0.244	0.202	0.002	0.009
152	677	0.026	0.005	0.000	0.079	0.353	0.215	0.189	0.352	0.136	0.252	0.261	0.210	0.002	0.009
152	677	0.026	0.005	0.000	0.079	0.353	0.215	0.190	0.352	0.136	0.253	0.262	0.210	0.002	0.009
152	678	0.027	0.005	0.000	0.086	0.377	0.228	0.201	0.371	0.144	0.265	0.277	0.210	0.002	0.009
153	679	0.027	0.005	0.000	0.086	0.378	0.228	0.202	0.371	0.144	0.266	0.278	0.210	0.002	0.009
152	678	0.030	0.005	0.000	0.095	0.398	0.241	0.214	0.394	0.155	0.280	0.294	0.212	0.002	0.009
153	679	0.030	0.005	0.000	0.098	0.409	0.248	0.221	0.406	0.160	0.288	0.302	0.212	0.002	0.009
152	678	0.030	0.005	0.000	0.099	0.410	0.248	0.221	0.406	0.161	0.288	0.302	0.212	0.002	0.009
152	678	0.033	0.005	0.000	0.102	0.431	0.261	0.234	0.432	0.171	0.302	0.317	0.214	0.003	0.010

Table A.24 Measurement of Tendon Slippage of 5SB8M-2.0-14-D^{L} (Continued)

Load Cell		T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12	T13	T14
kips	kN	in	in	in	in	in	in	in	in	in	in	in	in	in	in
152	677	0.033	0.005	0.000	0.102	0.431	0.262	0.235	0.432	0.172	0.302	0.318	0.214	0.003	0.010
152	677	0.033	0.005	0.000	0.102	0.432	0.262	0.235	0.432	0.172	0.303	0.318	0.214	0.003	0.009
152	678	0.033	0.005	0.000	0.102	0.432	0.262	0.235	0.432	0.172	0.303	0.318	0.214	0.003	0.009
151	670	0.033	0.005	0.000	0.104	0.438	0.266	0.239	0.436	0.176	0.307	0.322	0.214	0.003	0.009
151	671	0.033	0.005	0.000	0.104	0.438	0.266	0.239	0.436	0.176	0.307	0.322	0.214	0.003	0.010
151	671	0.033	0.005	0.000	0.104	0.438	0.266	0.239	0.436	0.176	0.307	0.322	0.214	0.003	0.010
150	669	0.033	0.005	0.000	0.104	0.438	0.266	0.239	0.436	0.176	0.307	0.322	0.214	0.003	0.009
150	669	0.033	0.005	0.000	0.104	0.439	0.266	0.240	0.437	0.176	0.307	0.322	0.214	0.003	0.010
151	670	0.033	0.005	0.000	0.104	0.439	0.266	0.240	0.437	0.176	0.307	0.322	0.214	0.003	0.009
150	669	0.033	0.005	0.000	0.104	0.439	0.266	0.240	0.437	0.176	0.307	0.322	0.214	0.003	0.010
150	668	0.033	0.005	0.000	0.104	0.439	0.267	0.240	0.437	0.176	0.307	0.322	0.214	0.003	0.009
150	668	0.033	0.005	0.000	0.104	0.439	0.267	0.240	0.437	0.176	0.307	0.322	0.214	0.003	0.009
150	669	0.033	0.005	0.000	0.104	0.439	0.267	0.240	0.437	0.176	0.307	0.322	0.214	0.003	0.010
150	668	0.033	0.005	0.000	0.104	0.439	0.267	0.240	0.437	0.176	0.307	0.322	0.214	0.003	0.010
150	667	0.033	0.005	0.000	0.104	0.439	0.267	0.240	0.437	0.176	0.307	0.322	0.214	0.003	0.010
150	668	0.033	0.005	0.000	0.104	0.439	0.267	0.240	0.438	0.176	0.308	0.322	0.214	0.003	0.010
150	668	0.033	0.005	0.000	0.104	0.439	0.267	0.240	0.438	0.176	0.308	0.322	0.214	0.003	0.010
150	666	0.033	0.005	0.000	0.104	0.439	0.267	0.240	0.438	0.176	0.308	0.322	0.214	0.003	0.010
150	666	0.033	0.005	0.000	0.104	0.439	0.267	0.240	0.438	0.176	0.308	0.322	0.214	0.003	0.009
150	667	0.033	0.005	0.000	0.104	0.439	0.267	0.240	0.438	0.176	0.308	0.322	0.214	0.003	0.010
150	666	0.033	0.005	0.000	0.104	0.439	0.267	0.240	0.438	0.176	0.308	0.322	0.214	0.003	0.010
150	666	0.033	0.005	0.000	0.104	0.439	0.267	0.240	0.438	0.176	0.308	0.322	0.214	0.003	0.010

Table A.24 Measurement of Tendon Slippage of 5SB8M-2.0-14-D^{L} (Continued)

Load Cell		T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12	T13	T14
kips	kN	in	in	in	in	in	in	in	in	in	in	in	in	in	in
150	666	0.033	0.005	0.000	0.105	0.440	0.267	0.240	0.438	0.176	0.308	0.322	0.214	0.003	0.010
150	666	0.033	0.005	0.000	0.105	0.440	0.267	0.241	0.438	0.176	0.308	0.322	0.214	0.003	0.010
150	665	0.033	0.005	0.000	0.104	0.440	0.267	0.241	0.438	0.176	0.308	0.322	0.214	0.003	0.010
149	665	0.033	0.005	0.000	0.105	0.440	0.267	0.241	0.438	0.176	0.308	0.322	0.214	0.003	0.010
150	666	0.033	0.005	0.000	0.105	0.440	0.267	0.241	0.438	0.176	0.308	0.322	0.214	0.003	0.010
150	665	0.033	0.005	0.000	0.105	0.440	0.267	0.241	0.438	0.176	0.308	0.322	0.214	0.003	0.010
149	664	0.033	0.005	0.000	0.105	0.440	0.267	0.241	0.438	0.176	0.308	0.322	0.214	0.003	0.009
149	665	0.033	0.005	0.000	0.105	0.440	0.267	0.241	0.438	0.176	0.308	0.322	0.214	0.003	0.009
150	665	0.033	0.005	0.000	0.105	0.440	0.267	0.241	0.438	0.177	0.308	0.322	0.214	0.003	0.010
149	664	0.033	0.005	0.000	0.105	0.440	0.267	0.241	0.438	0.177	0.308	0.322	0.214	0.003	0.010
149	664	0.033	0.005	0.000	0.105	0.440	0.267	0.241	0.439	0.177	0.308	0.322	0.214	0.003	0.010
149	665	0.033	0.005	0.000	0.105	0.440	0.267	0.241	0.439	0.177	0.309	0.322	0.214	0.003	0.010
149	665	0.033	0.005	0.000	0.105	0.440	0.267	0.241	0.439	0.177	0.309	0.322	0.214	0.003	0.009
149	664	0.033	0.005	0.000	0.105	0.440	0.268	0.241	0.439	0.177	0.309	0.322	0.214	0.003	0.009
149	663	0.033	0.005	0.000	0.105	0.440	0.268	0.241	0.439	0.177	0.309	0.322	0.214	0.003	0.009
149	664	0.033	0.005	0.000	0.105	0.440	0.268	0.241	0.439	0.177	0.309	0.322	0.214	0.003	0.010
149	664	0.033	0.005	0.000	0.105	0.440	0.268	0.241	0.439	0.177	0.309	0.322	0.214	0.003	0.009
149	663	0.033	0.005	0.000	0.105	0.440	0.268	0.241	0.439	0.177	0.309	0.322	0.214	0.003	0.009
149	663	0.033	0.005	0.000	0.105	0.440	0.268	0.241	0.439	0.177	0.309	0.322	0.214	0.003	0.010

Table A.25 Measurement of Strain Gauges of 5SB8M-2.0-14-D^L

Load Cell		N1	N2	N3	N4	N11	N12	N13	N14
kips	kN	m/m	m/m	m/m	m/m	m/m	m/m	m/m	m/m
0	0	0.00	0.00	0.00	B.G.	0.00	0.00	0.00	0.00
31	136	17.52	42.31	23.89	B.G.	18.88	20.93	19.79	11.37
61	272	35.72	65.74	46.64	B.G.	32.08	34.81	35.72	43.45
90	399	56.65	84.63	68.47	B.G.	43.45	46.41	49.59	72.80
120	532	72.57	102.14	89.63	B.G.	56.64	60.06	67.34	106.24
159	709	121.03	129.67	128.08	B.G.	69.38	73.25	85.99	154.24
170	756	128.31	139.00	141.50	B.G.	75.75	79.85	93.73	173.35
180	799	135.59	149.23	155.37	B.G.	82.35	86.67	103.05	195.41
190	843	141.96	159.24	164.25	B.G.	89.17	93.73	112.61	217.71
193	857	145.14	165.16	171.98	B.G.	92.36	96.91	116.25	228.40
192	854	146.96	168.34	175.85	B.G.	94.63	99.41	120.34	231.81
173	768	112.84	118.52	122.39	B.G.	65.52	69.16	81.90	190.41
186	826	137.63	109.65	127.17	B.G.	80.30	85.31	108.97	218.16
189	841	146.96	108.29	117.38	B.G.	89.63	93.50	111.24	240.23
171	763	138.32	108.06	115.11	B.G.	89.63	93.50	111.24	143.77
164	730	135.36	105.56	101.91	B.G.	84.62	88.72	106.47	127.62
161	717	135.13	105.10	96.91	B.G.	83.71	88.04	107.15	122.62
159	705	135.59	103.28	91.00	B.G.	83.71	87.81	107.15	120.34
158	704	136.27	104.87	90.54	B.G.	83.94	88.04	107.38	117.84
158	704	138.09	106.92	90.54	B.G.	84.85	89.18	107.60	116.70
158	704	138.32	107.15	90.54	B.G.	84.62	89.18	107.83	116.70
156	696	136.27	104.19	83.26	B.G.	83.26	87.81	106.47	113.06

Table A.25 Measurement of Strain Gauges of 5SB8M-2.0-14-D^{L} (Continued)

Load Cell		N1	N2	N3	N4	N11	N12	N13	N14
kips	kN	m/m	m/m	m/m	m/m	m/m	m/m	m/m	m/m
156	694	136.04	105.33	82.35	B.G.	83.49	87.81	100.78	113.06
156	693	135.81	105.10	81.90	B.G.	83.26	87.81	100.55	113.06
154	686	129.22	100.10	71.66	B.G.	78.03	82.12	98.73	105.33
154	684	128.31	99.64	70.98	B.G.	77.35	81.67	98.73	103.96
154	686	107.83	96.46	67.34	B.G.	68.02	71.20	82.58	99.87
154	686	108.06	96.46	67.56	B.G.	68.47	71.43	81.67	99.64
154	683	90.32	73.93	64.38	B.G.	60.06	62.33	71.20	96.46
153	680	89.63	71.89	62.10	B.G.	59.83	62.10	70.52	96.46
153	680	73.71	52.55	59.37	B.G.	53.00	54.60	62.33	94.64
153	679	73.48	52.32	59.15	B.G.	52.78	54.37	62.33	94.64
153	683	50.73	18.43	57.78	B.G.	44.81	44.59	43.22	92.82
153	683	50.28	18.20	58.01	B.G.	44.81	44.59	42.77	92.59
153	681	B.G.	36.40	99.87	B.G.	B.G.	B.G.	B.G.	54.60
153	681	B.G.	35.72	99.64	B.G.	B.G.	B.G.	B.G.	54.60
152	677	B.G.	12.29	99.64	B.G.	B.G.	B.G.	B.G.	62.33
152	677	B.G.	12.06	99.87	B.G.	B.G.	B.G.	B.G.	62.33
152	678	B.G.	5.69	101.23	B.G.	B.G.	B.G.	B.G.	68.70
153	679	B.G.	5.69	101.23	B.G.	B.G.	B.G.	B.G.	68.93
152	678	B.G.	1.82	93.95	B.G.	B.G.	B.G.	B.G.	70.75
153	679	B.G.	2.05	93.73	B.G.	B.G.	B.G.	B.G.	71.66
152	678	B.G.	2.28	93.95	B.G.	B.G.	B.G.	B.G.	72.11
152	678	B.G.	2.96	94.86	B.G.	B.G.	B.G.	B.G.	72.80

Table A.25 Measurement of Strain Gauges of 5SB8M-2.0-14-D^{L} (Continued)

Load Cell		N1	N2	N3	N4	N11	N12	N13	N14
kips	kN	m/m	m/m	m/m	m/m	m/m	m/m	m/m	m/m
152	677	B.G.	3.19	95.09	B.G.	B.G.	B.G.	B.G.	72.80
152	677	B.G.	3.19	95.09	B.G.	B.G.	B.G.	B.G.	72.80
152	678	B.G.	3.41	95.32	B.G.	B.G.	B.G.	B.G.	73.02
151	670	B.G.	4.10	95.55	B.G.	B.G.	B.G.	B.G.	71.43
151	671	B.G.	4.10	95.55	B.G.	B.G.	B.G.	B.G.	71.43
151	671	B.G.	3.87	95.32	B.G.	B.G.	B.G.	B.G.	71.43
150	669	B.G.	3.87	95.32	B.G.	B.G.	B.G.	B.G.	71.20
150	669	B.G.	3.87	95.32	B.G.	B.G.	B.G.	B.G.	71.20
151	670	B.G.	4.10	95.55	B.G.	B.G.	B.G.	B.G.	71.20
150	669	B.G.	4.10	95.55	B.G.	B.G.	B.G.	B.G.	70.98
150	668	B.G.	4.32	95.55	B.G.	B.G.	B.G.	B.G.	70.98
150	668	B.G.	4.10	95.32	B.G.	B.G.	B.G.	B.G.	71.20
150	669	B.G.	4.10	95.32	B.G.	B.G.	B.G.	B.G.	71.20
150	668	B.G.	4.10	95.32	B.G.	B.G.	B.G.	B.G.	70.98
150	667	B.G.	4.10	95.32	B.G.	B.G.	B.G.	B.G.	71.20
150	668	B.G.	3.87	95.32	B.G.	B.G.	B.G.	B.G.	71.20
150	668	B.G.	4.32	95.32	B.G.	B.G.	B.G.	B.G.	70.75
150	666	B.G.	4.10	95.32	B.G.	B.G.	B.G.	B.G.	70.52
150	666	B.G.	4.10	95.32	B.G.	B.G.	B.G.	B.G.	70.75
150	667	B.G.	4.10	95.09	B.G.	B.G.	B.G.	B.G.	70.52
150	666	B.G.	4.10	95.32	B.G.	B.G.	B.G.	B.G.	70.75
150	666	B.G.	4.10	95.32	B.G.	B.G.	B.G.	B.G.	70.07

Table A.25 Measurement of Strain Gauges of 5SB8M-2.0-14-D^{L} (Continued)

Load Cell		N1	N2	N3	N4	N11	N12	N13	N14
kips	kN	m/m	m/m	m/m	m/m	m/m	m/m	m/m	m/m
150	666	B.G.	3.87	95.09	B.G.	B.G.	B.G.	B.G.	70.07
150	666	B.G.	3.87	95.09	B.G.	B.G.	B.G.	B.G.	70.29
150	665	B.G.	4.32	95.09	B.G.	B.G.	B.G.	B.G.	70.07
149	665	B.G.	4.10	95.32	B.G.	B.G.	B.G.	B.G.	70.07
150	666	B.G.	3.87	94.86	B.G.	B.G.	B.G.	B.G.	70.98
150	665	B.G.	4.55	95.32	B.G.	B.G.	B.G.	B.G.	70.98
149	664	B.G.	3.87	94.86	B.G.	B.G.	B.G.	B.G.	70.98
149	665	B.G.	4.55	95.55	B.G.	B.G.	B.G.	B.G.	71.20
150	665	B.G.	4.55	95.55	B.G.	B.G.	B.G.	B.G.	70.29
149	664	B.G.	4.32	95.55	B.G.	B.G.	B.G.	B.G.	70.52
149	664	B.G.	4.55	95.32	B.G.	B.G.	B.G.	B.G.	70.07
149	665	B.G.	4.32	95.32	B.G.	B.G.	B.G.	B.G.	69.84
149	665	B.G.	4.32	95.32	B.G.	B.G.	B.G.	B.G.	70.07
149	664	B.G.	4.55	95.32	B.G.	B.G.	B.G.	B.G.	70.07
149	663	B.G.	4.78	95.55	B.G.	B.G.	B.G.	B.G.	70.29
149	664	B.G.	4.32	95.32	B.G.	B.G.	B.G.	B.G.	70.52
149	664	B.G.	4.32	95.09	B.G.	B.G.	B.G.	B.G.	70.98
149	663	B.G.	4.32	95.32	B.G.	B.G.	B.G.	B.G.	70.29
149	663	B.G.	3.87	94.64	B.G.	B.G.	B.G.	B.G.	71.43

A.10 5SB12T-1.2-10-D

Table A.26 Measurement of Load and Deflection Relationships of 5SB12T-1.2-10-D

SW.LC		SE. LC		TRF		SW. Def.		SE. Def.		SW. Sett.		SE. Sett.		Net Def.	
kips	kN	kips	kN	kips	kN	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
0	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
36	160	31	137	67	297	0.03	0.76	0.08	2.06	0.00	0.03	0.04	1.08	0.02	0.39
48	215	42	186	90	401	0.04	1.02	0.09	2.39	0.01	0.22	0.05	1.21	0.02	0.53
65	287	55	246	120	533	0.05	1.33	0.11	2.73	0.02	0.41	0.05	1.34	0.03	0.70
81	360	69	306	150	666	0.06	1.64	0.12	3.04	0.02	0.58	0.06	1.44	0.03	0.87
96	428	84	372	180	799	0.08	1.93	0.13	3.34	0.03	0.74	0.06	1.54	0.04	1.04
96	429	84	372	180	801	0.08	1.94	0.13	3.34	0.03	0.74	0.06	1.54	0.04	1.04
97	430	84	373	180	803	0.08	1.94	0.13	3.35	0.03	0.74	0.06	1.54	0.04	1.04
101	451	89	394	190	844	0.08	2.03	0.14	3.43	0.03	0.78	0.06	1.57	0.04	1.10
106	472	93	416	200	888	0.08	2.11	0.14	3.54	0.03	0.82	0.06	1.60	0.05	1.16
107	477	94	420	202	897	0.08	2.12	0.14	3.56	0.03	0.82	0.06	1.61	0.05	1.17
102	455	90	401	192	856	0.08	2.14	0.14	3.55	0.03	0.84	0.06	1.61	0.05	1.17
102	455	90	400	192	855	0.08	2.14	0.14	3.54	0.03	0.83	0.06	1.60	0.05	1.17
106	473	94	417	200	890	0.08	2.13	0.14	3.56	0.03	0.84	0.06	1.61	0.05	1.17
111	495	98	438	210	933	0.09	2.20	0.14	3.63	0.03	0.85	0.06	1.62	0.05	1.22
116	518	104	460	220	978	0.09	2.29	0.15	3.73	0.03	0.89	0.06	1.65	0.05	1.28
119	531	107	475	226	1006	0.09	2.35	0.15	3.80	0.04	0.90	0.07	1.67	0.05	1.33
121	539	109	485	230	1024	0.10	2.42	0.15	3.86	0.04	0.90	0.07	1.67	0.06	1.40
123	549	111	495	235	1044	0.10	2.54	0.16	3.97	0.04	0.90	0.07	1.67	0.06	1.51

Table A.26 Measurement of Load and Deflection Relationships of 5SB12T-1.2-10-D (Continued)

SW.LC		SE. LC		TRF		SW. Def.		SE. Def.		SW. Sett.		SE. Sett.		Net Def.	
kips	kN	kips	kN	kips	kN	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
122	543	110	490	232	1033	0.10	2.54	0.16	3.97	0.04	0.90	0.07	1.67	0.06	1.52
126	561	114	507	240	1068	0.10	2.63	0.16	4.07	0.04	0.90	0.07	1.67	0.06	1.61
128	571	116	518	245	1089	0.11	2.71	0.16	4.14	0.04	0.90	0.07	1.67	0.07	1.68
131	582	119	530	250	1111	0.11	2.76	0.17	4.23	0.04	0.91	0.07	1.68	0.07	1.75
133	592	122	541	255	1133	0.11	2.87	0.17	4.32	0.04	0.91	0.07	1.67	0.07	1.85
134	597	122	545	257	1142	0.11	2.92	0.17	4.35	0.04	0.91	0.07	1.68	0.07	1.89
131	584	121	537	252	1121	0.12	2.98	0.17	4.36	0.03	0.88	0.07	1.68	0.08	1.94
131	585	122	541	253	1126	0.12	3.11	0.17	4.36	0.03	0.83	0.07	1.68	0.08	2.02
133	591	123	547	256	1138	0.12	3.17	0.17	4.39	0.03	0.83	0.07	1.68	0.08	2.07
132	585	122	543	254	1128	0.13	3.33	0.18	4.47	0.03	0.79	0.07	1.68	0.09	2.21
130	578	121	540	251	1118	0.14	3.48	0.18	4.47	0.03	0.77	0.07	1.68	0.09	2.29
129	575	122	543	251	1118	0.15	3.79	0.18	4.46	0.03	0.75	0.07	1.68	0.10	2.45
130	580	123	548	254	1128	0.15	3.92	0.18	4.48	0.03	0.75	0.07	1.68	0.10	2.53
130	580	123	547	253	1127	0.16	4.09	0.18	4.58	0.03	0.74	0.07	1.68	0.11	2.67
134	598	128	568	262	1165	0.19	4.73	0.19	4.91	0.03	0.73	0.07	1.68	0.12	3.16
135	599	128	568	262	1167	0.19	4.75	0.19	4.91	0.03	0.73	0.07	1.68	0.12	3.17
134	595	128	570	262	1165	0.20	5.07	0.19	4.93	0.03	0.72	0.07	1.68	0.13	3.35
135	601	130	580	266	1181	0.22	5.55	0.20	5.02	0.03	0.72	0.07	1.68	0.14	3.63
134	598	130	579	265	1177	0.22	5.64	0.20	5.02	0.03	0.72	0.07	1.68	0.14	3.68
133	590	130	576	262	1167	0.23	5.91	0.20	4.97	0.03	0.72	0.07	1.68	0.15	3.79
133	594	132	587	265	1180	0.25	6.37	0.20	4.97	0.03	0.72	0.07	1.68	0.16	4.02
129	572	129	574	258	1146	0.26	6.71	0.19	4.89	0.03	0.72	0.07	1.68	0.16	4.14

Table A.26 Measurement of Load and Deflection Relationships of 5SB12T-1.2-10-D (Continued)

SW.LC		SE. LC		TRF		SW. Def.		SE. Def.		SW. Sett.		SE. Sett.		Net Def.	
kips	kN	kips	kN	kips	kN	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
129	574	131	584	260	1158	0.28	7.09	0.19	4.86	0.03	0.72	0.07	1.68	0.17	4.32
129	575	132	585	261	1160	0.28	7.13	0.19	4.86	0.03	0.72	0.07	1.68	0.17	4.34
129	574	132	586	261	1160	0.28	7.17	0.19	4.85	0.03	0.72	0.07	1.68	0.17	4.35
127	564	134	596	261	1159	0.32	8.04	0.19	4.74	0.03	0.72	0.07	1.68	0.19	4.74
125	556	134	595	259	1151	0.33	8.37	0.18	4.70	0.03	0.72	0.07	1.68	0.19	4.88
123	547	133	593	256	1140	0.34	8.51	0.18	4.66	0.03	0.72	0.07	1.68	0.19	4.93
121	539	135	601	256	1140	0.37	9.36	0.18	4.60	0.03	0.72	0.07	1.68	0.21	5.33
120	533	133	590	253	1124	0.37	9.40	0.19	4.79	0.03	0.72	0.07	1.68	0.21	5.44
119	528	130	578	248	1105	0.37	9.39	0.20	5.12	0.03	0.72	0.07	1.68	0.22	5.60
122	542	133	591	255	1133	0.40	10.07	0.24	6.07	0.03	0.72	0.07	1.68	0.25	6.41
122	542	133	593	255	1134	0.40	10.29	0.25	6.27	0.03	0.72	0.07	1.68	0.26	6.62
122	541	133	591	254	1132	0.41	10.42	0.26	6.50	0.03	0.72	0.07	1.68	0.27	6.80
121	538	131	582	252	1120	0.41	10.48	0.27	6.80	0.03	0.72	0.07	1.68	0.28	6.99
119	531	131	582	250	1114	0.42	10.71	0.27	6.87	0.03	0.72	0.07	1.68	0.28	7.13
120	536	132	587	253	1123	0.43	11.04	0.28	7.10	0.03	0.72	0.07	1.68	0.29	7.41
120	535	131	583	251	1118	0.44	11.05	0.29	7.28	0.03	0.72	0.07	1.68	0.30	7.51
121	539	131	583	252	1122	0.44	11.22	0.30	7.63	0.03	0.72	0.07	1.68	0.31	7.77
119	528	130	577	248	1105	0.45	11.55	0.31	7.82	0.03	0.72	0.07	1.68	0.32	8.03
117	520	130	580	247	1100	0.47	11.92	0.31	7.90	0.03	0.72	0.07	1.68	0.33	8.26
117	520	131	581	248	1101	0.47	12.05	0.31	7.98	0.03	0.72	0.07	1.68	0.33	8.36
110	489	127	566	237	1055	0.49	12.51	0.31	7.91	0.03	0.72	0.07	1.68	0.34	8.55
111	493	129	576	240	1069	0.51	12.97	0.32	8.08	0.03	0.72	0.07	1.68	0.35	8.87

Table A.26 Measurement of Load and Deflection Relationships of 5SB12T-1.2-10-D (Continued)

SW.LC		SE. LC		TRF		SW. Def.		SE. Def.		SW. Sett.		SE. Sett.		Net Def.	
kips	kN	kips	kN	kips	kN	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
109	485	129	573	238	1059	0.52	13.09	0.32	8.06	0.03	0.72	0.07	1.68	0.35	8.92
109	486	128	571	238	1057	0.53	13.46	0.34	8.54	0.03	0.72	0.07	1.68	0.37	9.34
108	479	127	567	235	1046	0.54	13.82	0.35	8.96	0.03	0.72	0.07	1.68	0.38	9.73
106	470	124	554	230	1024	0.55	13.87	0.36	9.15	0.03	0.72	0.07	1.68	0.39	9.86
107	475	125	557	232	1032	0.55	14.06	0.37	9.41	0.03	0.72	0.07	1.68	0.40	10.08
107	475	125	556	232	1031	0.55	14.07	0.37	9.41	0.03	0.72	0.07	1.68	0.40	10.09
106	473	125	555	231	1028	0.55	14.07	0.37	9.42	0.03	0.72	0.07	1.68	0.40	10.09
106	473	125	554	231	1027	0.55	14.07	0.37	9.43	0.03	0.72	0.07	1.68	0.40	10.09
106	472	125	554	231	1026	0.55	14.07	0.37	9.43	0.03	0.72	0.07	1.68	0.40	10.10
106	471	125	554	230	1025	0.55	14.07	0.37	9.43	0.03	0.72	0.07	1.68	0.40	10.10
105	469	124	550	229	1018	0.55	14.08	0.37	9.44	0.03	0.72	0.07	1.68	0.40	10.10
105	466	123	548	228	1015	0.55	14.08	0.37	9.43	0.03	0.72	0.07	1.68	0.40	10.10
104	464	123	547	227	1011	0.55	14.08	0.37	9.42	0.03	0.72	0.07	1.68	0.40	10.10
104	464	123	545	227	1009	0.55	14.08	0.37	9.41	0.03	0.72	0.07	1.68	0.40	10.09
104	462	122	543	226	1005	0.55	14.08	0.37	9.40	0.03	0.72	0.07	1.68	0.40	10.08
103	460	122	542	225	1002	0.55	14.08	0.37	9.39	0.03	0.72	0.07	1.68	0.40	10.08
103	458	121	540	224	998	0.55	14.08	0.37	9.38	0.03	0.72	0.07	1.68	0.40	10.07
103	457	121	539	224	996	0.55	14.07	0.37	9.37	0.03	0.72	0.07	1.68	0.40	10.07
102	456	121	537	223	993	0.55	14.05	0.37	9.36	0.03	0.72	0.07	1.68	0.40	10.05

Table A.27 Measurement of Rosette LVDTs of 5SB12T-1.2-10-D

TRF		SWD1	SWD2	SWV1	SWV2	SWH1	SWH2	SED1	SED2	SEV1	SEV2	SEH1	SEH2
kips	kN	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in
0	0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
67	297	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
90	401	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
120	533	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
150	666	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
180	799	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
180	801	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
180	803	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
190	844	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
200	888	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
202	897	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
192	856	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
192	855	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
200	890	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
210	933	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
220	978	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
226	1006	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
230	1024	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
235	1044	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
232	1033	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
240	1068	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
245	1089	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Table A.27 Measurement of Rosette LVDTs of 5SB12T-1.2-10-D (Continued)

TRF		SWD1	SWD2	SWV1	SWV2	SWH1	SWH2	SED1	SED2	SEV1	SEV2	SEH1	SEH2
kips	kN	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in
250	1111	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
255	1133	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
257	1142	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
252	1121	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
253	1126	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
256	1138	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
254	1128	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
251	1118	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
251	1118	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
254	1128	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
253	1127	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
262	1165	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
262	1167	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
262	1165	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
266	1181	-0.001	0.001	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
265	1177	-0.001	0.002	0.001	0.003	-0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000
262	1167	-0.001	0.003	0.001	0.003	-0.001	0.001	0.000	0.000	0.000	0.000	0.000	0.000
265	1180	-0.001	0.004	0.001	0.004	-0.002	0.001	0.000	0.000	0.000	0.000	0.000	0.000
258	1146	-0.001	0.004	0.001	0.004	-0.003	0.001	0.000	0.000	0.000	0.000	0.000	0.000
260	1158	-0.001	0.004	0.001	0.004	-0.003	0.001	0.000	0.000	0.000	0.000	0.000	0.000
261	1160	-0.001	0.004	0.001	0.004	-0.003	0.001	0.000	0.000	0.000	0.000	0.000	0.000
261	1160	-0.001	0.004	0.001	0.004	-0.003	0.001	0.000	0.000	0.000	0.000	0.000	0.000

Table A.27 Measurement of Rosette LVDTs of 5SB12T-1.2-10-D (Continued)

TRF		SWD1	SWD2	SWV1	SWV2	SWH1	SWH2	SED1	SED2	SEV1	SEV2	SEH1	SEH2
kips	kN	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in
261	1159	-0.001	0.004	0.002	0.004	-0.003	0.001	0.000	0.000	0.000	0.000	0.000	0.000
259	1151	-0.001	0.006	0.006	0.004	-0.001	0.001	0.000	0.000	0.000	0.000	0.000	0.000
256	1140	-0.001	0.007	0.006	0.004	-0.001	0.001	0.000	0.000	0.000	0.000	0.000	0.000
256	1140	-0.001	0.008	0.008	0.003	0.001	0.001	0.000	0.000	0.000	0.000	0.000	0.000
253	1124	0.000	0.008	0.008	0.003	0.001	0.001	0.000	0.000	0.000	0.000	0.000	0.000
248	1105	0.000	0.008	0.008	0.003	0.001	0.001	0.000	0.000	0.000	0.000	0.000	0.000
255	1133	0.000	0.008	0.009	0.003	0.002	0.001	0.000	0.000	0.000	0.000	0.000	0.000
255	1134	0.001	0.008	0.009	0.002	0.002	0.001	0.000	0.000	0.000	0.000	0.000	0.000
254	1132	0.001	0.008	0.009	0.002	0.002	0.001	0.000	0.001	0.000	0.001	0.000	0.000
252	1120	0.001	0.008	0.009	0.002	0.002	0.001	0.001	0.002	0.000	0.002	-0.001	0.000
250	1114	0.002	0.008	0.010	0.002	0.003	0.001	0.001	0.002	0.000	0.002	-0.001	0.000
253	1123	0.002	0.009	0.010	0.002	0.003	0.001	0.001	0.003	0.000	0.002	0.001	0.000
251	1118	0.002	0.009	0.010	0.002	0.003	0.001	0.001	0.004	0.001	0.002	0.002	0.000
252	1122	0.002	0.009	0.010	0.002	0.003	0.001	0.001	0.005	0.001	0.002	0.003	0.000
248	1105	0.003	0.009	0.010	0.002	0.004	0.001	0.001	0.005	0.002	0.002	0.004	0.001
247	1100	0.001	0.009	0.010	0.001	0.004	0.001	0.001	0.006	0.002	0.002	0.004	0.001
248	1101	0.001	0.009	0.011	0.000	0.005	0.000	0.001	0.006	0.002	0.002	0.005	0.001
237	1055	0.001	0.009	0.011	0.000	0.005	0.000	0.001	0.006	0.002	0.002	0.005	0.001
240	1069	0.001	0.009	0.012	0.000	0.005	0.000	0.001	0.006	0.002	0.002	0.005	0.001
238	1059	0.001	0.009	0.012	0.000	0.005	0.000	0.001	0.006	0.002	0.002	0.005	0.001
238	1057	0.002	0.009	0.013	0.000	0.005	0.001	0.001	0.007	0.002	0.002	0.005	0.001
235	1046	0.002	0.008	0.016	0.001	0.004	0.002	0.001	0.007	0.002	0.002	0.005	0.001

Table A.27 Measurement of Rosette LVDTs of 5SB12T-1.2-10-D (Continued)

TRF		SWD1	SWD2	SWV1	SWV2	SWH1	SWH2	SED1	SED2	SEV1	SEV2	SEH1	SEH2
kips	kN	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in
230	1024	0.003	0.008	0.016	0.001	0.004	0.002	0.001	0.007	0.002	0.002	0.005	0.001
232	1032	0.003	0.008	0.017	0.001	0.003	0.003	0.001	0.007	0.002	0.002	0.005	0.001
232	1031	0.003	0.008	0.017	0.001	0.003	0.003	0.001	0.007	0.002	0.002	0.005	0.001
231	1028	0.003	0.008	0.017	0.001	0.003	0.003	0.001	0.006	0.002	0.002	0.005	0.001
231	1027	0.003	0.008	0.017	0.001	0.003	0.003	0.001	0.007	0.002	0.002	0.005	0.001
231	1026	0.003	0.008	0.017	0.001	0.003	0.003	0.001	0.007	0.002	0.002	0.005	0.001
230	1025	0.003	0.008	0.017	0.001	0.003	0.003	0.001	0.007	0.002	0.002	0.005	0.001
229	1018	0.003	0.008	0.017	0.001	0.003	0.003	0.001	0.007	0.002	0.002	0.005	0.001
228	1015	0.003	0.008	0.017	0.001	0.003	0.003	0.001	0.007	0.002	0.002	0.005	0.001
227	1011	0.003	0.008	0.017	0.001	0.003	0.003	0.001	0.006	0.002	0.002	0.005	0.001
227	1009	0.003	0.008	0.017	0.001	0.003	0.003	0.001	0.006	0.002	0.002	0.005	0.001
226	1005	0.003	0.008	0.017	0.001	0.003	0.003	0.001	0.007	0.002	0.002	0.005	0.001
225	1002	0.003	0.008	0.017	0.001	0.003	0.003	0.001	0.007	0.002	0.002	0.005	0.001
224	998	0.003	0.008	0.017	0.001	0.003	0.003	0.001	0.007	0.002	0.002	0.005	0.001
224	996	0.003	0.008	0.017	0.001	0.003	0.003	0.001	0.007	0.002	0.002	0.005	0.001
223	993	0.003	0.008	0.017	0.001	0.003	0.003	0.001	0.007	0.002	0.002	0.005	0.001

Table A.28 Measurement of Strain Gauges of 5SB12T-1.2-10-D

TRF		CS1	CS2	CS3	NS1	NS2	NS3	HS1	HS2
kips	kN	m/m	m/m	m/m	m/m	m/m	m/m	m/m	m/m
0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
67	297	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
90	401	-0.46	-3.19	-0.91	-1.14	-3.64	-0.68	4.10	-2.05
120	533	0.00	-4.55	-1.82	4.78	-1.82	5.91	51.87	2.50
150	666	10.01	4.55	10.47	9.33	0.91	11.15	10.92	3.64
180	799	17.52	12.74	19.11	13.65	0.91	16.15	20.47	8.87
180	801	17.52	12.28	19.11	13.88	0.91	16.38	20.93	8.87
180	803	17.52	12.28	18.88	13.88	1.14	16.38	20.70	8.64
190	844	18.20	12.97	20.47	14.33	0.23	17.06	23.20	8.64
200	888	18.88	13.42	22.29	15.70	-0.23	18.65	25.02	8.64
202	897	19.34	14.10	22.29	15.92	-0.68	18.88	25.48	8.64
192	856	12.06	6.37	16.38	9.56	-7.74	12.51	20.93	2.96
192	855	7.73	2.28	11.83	6.14	-11.15	8.64	18.20	-0.68
200	890	4.55	-2.28	8.19	2.50	-15.01	5.46	15.47	-4.10
210	933	4.55	-2.50	7.96	2.50	-16.15	5.69	15.24	-5.23
220	978	2.28	-5.46	5.69	1.14	-20.25	4.32	12.51	-10.47
226	1006	0.91	-6.14	4.32	0.00	-23.20	3.41	11.60	-13.88
230	1024	-0.23	-8.42	2.73	-0.68	-25.02	1.82	12.06	-21.61
235	1044	-0.91	-9.33	0.91	-0.68	-5.23	0.68	15.01	-22.07
232	1033	-0.91	-8.65	0.68	0.00	13.65	1.37	20.25	-21.16
240	1068	-1.14	-9.55	-0.23	0.00	30.26	1.37	21.84	-21.61
245	1089	-1.37	-9.78	-0.23	-0.23	47.09	1.37	21.38	-21.16

Table A.28 Measurement of Strain Gauges of 5SB12T-1.2-10-D (Continued)

TRF		CS1	CS2	CS3	NS1	NS2	NS3	HS1	HS2
kips	kN	m/m	m/m	m/m	m/m	m/m	m/m	m/m	m/m
250	1111	-2.05	-10.92	-1.37	-0.91	75.07	0.91	22.29	-20.02
255	1133	-2.73	-12.51	-2.50	-1.37	117.61	-0.46	21.38	-19.79
257	1142	-3.41	-12.74	-3.87	-1.82	131.49	-0.91	22.07	-19.34
252	1121	-2.50	-8.87	-2.28	-1.82	154.92	-0.68	22.75	-18.20
253	1126	-7.96	-3.87	-6.37	-15.01	156.51	-13.65	-57.10	-31.62
256	1138	-7.51	-3.87	-6.60	-13.19	161.97	-11.83	-45.50	-29.12
254	1128	-7.51	-8.19	-7.51	-44.13	180.17	-8.19	-36.17	-25.02
251	1118	-7.28	-8.42	-7.51	-47.55	204.28	-6.60	-32.99	-24.11
251	1118	-6.37	-4.32	-5.91	-50.50	157.65	-19.56	-22.52	-23.89
254	1128	-5.92	-2.28	-3.41	-54.37	157.19	-47.77	-17.29	-25.25
253	1127	-5.46	0.46	5.92	-65.74	175.85	-136.72	-10.24	-25.48
262	1165	-7.74	6.83	21.61	-135.13	204.97	-318.03	-30.94	-21.61
262	1167	-7.74	7.05	22.07	-136.27	205.42	-320.08	-29.80	-21.38
262	1165	-6.60	12.97	28.44	-146.05	208.38	-337.59	-12.97	-17.97
266	1181	-3.19	60.97	40.49	-161.74	218.16	-363.98	51.41	-6.60
265	1177	-2.96	60.97	41.18	-162.65	218.16	-364.89	52.78	-6.37
262	1167	-4.10	60.97	38.90	-168.57	209.74	-369.67	26.84	-10.92
265	1180	-3.19	255.24	40.95	-172.89	209.74	-377.18	48.46	-6.60
258	1146	5.46	364.89	47.77	-165.84	215.43	-365.57	84.85	4.09
260	1158	8.87	387.19	51.87	-164.25	217.48	-363.53	87.13	7.51
261	1160	9.33	387.19	52.32	-163.79	217.93	-363.07	88.04	8.19
261	1160	9.10	387.19	51.87	-163.56	218.16	-362.84	89.63	8.19

Table A.28 Measurement of Strain Gauges of 5SB12T-1.2-10-D (Continued)

TRF		CS1	CS2	CS3	NS1	NS2	NS3	HS1	HS2
kips	kN	m/m	m/m	m/m	m/m	m/m	m/m	m/m	m/m
261	1159	13.88	387.19	57.56	-164.70	222.26	-359.66	112.38	14.79
259	1151	15.24	387.19	59.15	-166.75	222.26	-361.02	116.70	17.29
256	1140	15.47	387.19	59.38	-166.75	219.98	-360.80	116.47	17.52
256	1140	18.43	387.19	62.56	-185.63	222.71	-372.40	126.48	22.75
253	1124	17.97	387.19	62.10	-200.19	222.71	-386.28	127.17	23.20
248	1105	17.06	387.19	63.24	-222.26	223.62	-432.00	128.08	23.89
255	1133	18.20	387.19	68.93	-304.83	229.54	-546.88	134.45	30.26
255	1134	17.74	387.19	54.60	-328.49	230.90	-568.27	133.99	32.08
254	1132	22.98	387.19	23.89	-356.70	230.90	-593.97	131.49	33.44
252	1120	24.11	387.19	-0.23	-401.97	231.58	-603.98	134.90	35.26
250	1114	22.98	387.19	-3.87	-409.71	229.54	-608.08	135.13	34.81
253	1123	-5.23	387.19	-10.01	-431.32	227.03	-624.91	132.63	33.44
251	1118	-143.55	387.19	-32.53	-435.87	225.44	-629.46	131.03	32.53
252	1122	-255.24	387.19	-77.80	-449.06	220.89	-642.43	124.44	27.53
248	1105	-285.73	387.19	-103.96	-466.35	218.16	-645.84	122.62	26.62
247	1100	-304.61	387.19	-119.66	-472.95	211.56	-653.35	119.43	23.43
248	1101	-313.02	387.19	-126.03	-476.13	210.88	-657.67	118.98	22.52
237	1055	-313.93	387.19	-126.48	-476.59	210.65	-658.35	118.29	22.75
240	1069	-345.56	387.19	-137.63	-488.64	204.97	-688.83	116.02	23.66
238	1059	-346.24	387.19	-139.91	-489.10	203.37	-689.52	116.25	23.89
238	1057	-408.11	387.19	-154.24	-491.83	205.19	-685.42	113.97	25.48
235	1046	-432.00	387.19	-161.74	-495.01	207.70	-679.51	108.97	28.21

Table A.28 Measurement of Strain Gauges of 5SB12T-1.2-10-D (Continued)

TRF		CS1	CS2	CS3	NS1	NS2	NS3	HS1	HS2
kips	kN	m/m	m/m	m/m	m/m	m/m	m/m	m/m	m/m
230	1024	-459.98	387.19	-165.61	-493.42	206.79	-676.55	104.42	30.71
232	1032	-481.59	387.19	-165.38	-496.83	205.19	-678.83	86.22	30.03
232	1031	-482.50	387.19	-165.38	-496.83	205.19	-678.83	85.76	30.26
231	1028	-483.19	387.19	-165.16	-496.83	205.19	-678.83	85.99	30.71
231	1027	-484.32	387.19	-165.38	-496.38	205.42	-678.37	85.99	31.17
231	1026	-484.55	387.19	-165.38	-496.15	205.42	-678.37	85.76	31.17
230	1025	-485.01	387.19	-165.16	-496.15	205.42	-678.14	85.76	31.17
229	1018	-486.60	387.19	-165.38	-495.24	205.42	-677.69	84.85	32.30
228	1015	-486.83	387.19	-166.29	-494.79	205.42	-677.46	85.08	32.08
227	1011	-486.60	387.19	-166.52	-494.79	204.97	-677.23	84.63	32.53
227	1009	-486.83	387.19	-166.98	-494.56	204.06	-677.46	84.85	32.53
226	1005	-486.60	387.19	-167.66	-493.65	204.28	-676.78	84.63	32.76
225	1002	-486.60	387.19	-167.89	-493.19	204.06	-676.32	84.17	32.76
224	998	-486.37	387.19	-168.11	-492.97	203.60	-676.10	85.08	32.76
224	996	-486.14	387.19	-168.57	-492.51	203.60	-675.64	85.08	33.21
223	993	-485.92	387.19	-169.25	-492.06	203.37	-675.64	85.08	32.99

A.11 5SB12T-2.0-10-D

Table A.29 Measurement of Load and Deflection Relationships of 5SB12T-2.0-10-D

LC		W. Def.		E. Def.		W. Sett.		E. Sett.		Net Def.	
kips	kN	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm
0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
30	132	0.02	0.42	0.05	1.26	0.01	0.26	0.04	1.11	0.01	0.15
60	267	0.04	1.06	0.08	2.08	0.03	0.70	0.07	1.75	0.01	0.35
90	400	0.06	1.63	0.11	2.79	0.04	1.07	0.09	2.25	0.02	0.55
120	533	0.09	2.17	0.14	3.50	0.05	1.37	0.11	2.73	0.03	0.78
130	577	0.09	2.31	0.15	3.75	0.06	1.44	0.11	2.89	0.03	0.87
140	621	0.10	2.49	0.16	4.00	0.06	1.52	0.12	3.05	0.04	0.96
150	667	0.11	2.69	0.17	4.28	0.06	1.61	0.13	3.21	0.04	1.08
160	711	0.12	2.99	0.18	4.68	0.07	1.67	0.13	3.38	0.05	1.31
170	755	0.14	3.64	0.22	5.49	0.07	1.69	0.14	3.58	0.08	1.93
180	799	0.18	4.60	0.26	6.58	0.07	1.70	0.15	3.79	0.11	2.85
190	843	0.22	5.53	0.30	7.66	0.07	1.69	0.16	3.99	0.15	3.75
192	853	0.23	5.73	0.31	7.88	0.07	1.70	0.16	4.03	0.16	3.94
194	865	0.24	5.99	0.32	8.18	0.07	1.69	0.16	4.08	0.17	4.20
197	877	0.25	6.25	0.33	8.48	0.07	1.69	0.16	4.12	0.18	4.45
199	886	0.26	6.50	0.34	8.76	0.07	1.69	0.16	4.17	0.19	4.70
202	897	0.27	6.76	0.36	9.06	0.07	1.69	0.17	4.21	0.20	4.96
206	916	0.29	7.26	0.38	9.64	0.07	1.68	0.17	4.30	0.22	5.46
210	936	0.31	7.78	0.40	10.22	0.07	1.66	0.17	4.39	0.24	5.97

Table A.29 Measurement of Load and Deflection Relationships of 5SB12T-2.0-10-D (Continued)

LC		W. Def.		E. Def.		W. Sett.		E. Sett.		Net Def.	
kips	kN	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm
215	955	0.33	8.29	0.43	10.80	0.06	1.65	0.18	4.48	0.26	6.48
219	972	0.35	8.78	0.45	11.38	0.06	1.63	0.18	4.56	0.28	6.99
222	987	0.37	9.29	0.47	11.95	0.06	1.61	0.18	4.63	0.30	7.50
225	1003	0.39	9.80	0.49	12.53	0.06	1.59	0.19	4.70	0.32	8.02
228	1014	0.40	10.28	0.51	13.07	0.06	1.56	0.19	4.76	0.34	8.52
231	1026	0.42	10.76	0.54	13.63	0.06	1.53	0.19	4.83	0.36	9.02
234	1039	0.44	11.26	0.56	14.19	0.06	1.49	0.19	4.88	0.38	9.54
235	1046	0.46	11.75	0.58	14.73	0.06	1.46	0.19	4.93	0.40	10.05
237	1056	0.48	12.26	0.60	15.30	0.06	1.44	0.20	4.99	0.42	10.56
240	1066	0.50	12.73	0.62	15.82	0.06	1.41	0.20	5.03	0.44	11.05
241	1073	0.52	13.25	0.65	16.38	0.05	1.38	0.20	5.07	0.46	11.59
242	1078	0.54	13.71	0.66	16.88	0.05	1.37	0.20	5.08	0.48	12.07
245	1089	0.56	14.27	0.69	17.49	0.05	1.35	0.20	5.15	0.50	12.63
247	1101	0.61	15.39	0.74	18.73	0.05	1.25	0.20	5.19	0.54	13.84
248	1102	0.62	15.65	0.75	19.04	0.05	1.24	0.20	5.21	0.56	14.13
248	1105	0.62	15.86	0.76	19.30	0.05	1.22	0.21	5.22	0.57	14.36
249	1107	0.63	16.09	0.77	19.58	0.05	1.20	0.21	5.22	0.58	14.62
249	1107	0.64	16.30	0.78	19.84	0.05	1.18	0.21	5.23	0.59	14.87
249	1108	0.65	16.43	0.79	19.98	0.05	1.18	0.21	5.23	0.59	15.00
245	1089	0.65	16.57	0.79	20.08	0.05	1.18	0.21	5.23	0.60	15.13
246	1092	0.66	16.81	0.80	20.35	0.05	1.18	0.21	5.23	0.61	15.38
247	1099	0.67	17.05	0.81	20.60	0.05	1.18	0.21	5.23	0.62	15.62

Table A.29 Measurement of Load and Deflection Relationships of 5SB12T-2.0-10-D (Continued)

LC		W. Def.		E. Def.		W. Sett.		E. Sett.		Net Def.	
kips	kN	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm
248	1101	0.68	17.29	0.82	20.89	0.05	1.18	0.21	5.23	0.63	15.89
248	1102	0.69	17.59	0.83	21.18	0.05	1.18	0.21	5.23	0.64	16.18
244	1086	0.70	17.72	0.84	21.28	0.05	1.18	0.21	5.23	0.64	16.30
236	1049	0.70	17.86	0.84	21.42	0.05	1.18	0.21	5.23	0.65	16.43
229	1020	0.71	17.92	0.84	21.44	0.05	1.18	0.21	5.23	0.65	16.48
226	1006	0.71	17.96	0.85	21.48	0.05	1.18	0.21	5.23	0.65	16.51
225	1003	0.71	17.98	0.85	21.49	0.05	1.18	0.21	5.23	0.65	16.53
226	1007	0.71	18.03	0.85	21.52	0.05	1.18	0.21	5.23	0.65	16.57
227	1011	0.71	18.07	0.85	21.57	0.05	1.18	0.21	5.23	0.65	16.62
228	1015	0.71	18.14	0.85	21.65	0.05	1.18	0.21	5.23	0.66	16.69
229	1017	0.71	18.15	0.85	21.66	0.05	1.18	0.21	5.23	0.66	16.70
230	1022	0.72	18.23	0.86	21.74	0.05	1.18	0.21	5.23	0.66	16.78
234	1039	0.75	18.93	0.88	22.39	0.05	1.18	0.21	5.23	0.69	17.46
234	1040	0.76	19.36	0.90	22.84	0.05	1.18	0.21	5.23	0.70	17.90
233	1036	0.76	19.37	0.90	22.85	0.05	1.18	0.21	5.23	0.71	17.91
234	1041	0.78	19.87	0.92	23.33	0.05	1.18	0.21	5.23	0.72	18.40
234	1041	0.78	19.91	0.92	23.34	0.05	1.18	0.21	5.23	0.73	18.42
234	1039	0.79	20.15	0.93	23.60	0.05	1.18	0.21	5.23	0.74	18.67
234	1039	0.80	20.39	0.94	23.88	0.05	1.18	0.21	5.23	0.75	18.93
232	1033	0.81	20.66	0.95	24.15	0.05	1.18	0.21	5.23	0.76	19.20
231	1029	0.82	20.78	0.96	24.27	0.05	1.18	0.21	5.23	0.76	19.32
232	1030	0.82	20.78	0.96	24.27	0.05	1.18	0.21	5.23	0.76	19.33

Table A.29 Measurement of Load and Deflection Relationships of 5SB12T-2.0-10-D (Continued)

LC		W. Def.		E. Def.		W. Sett.		E. Sett.		Net Def.	
kips	kN	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm
232	1031	0.82	20.80	0.96	24.29	0.05	1.18	0.21	5.23	0.76	19.34
231	1029	0.82	20.81	0.96	24.29	0.05	1.18	0.21	5.23	0.76	19.35
231	1029	0.82	20.81	0.96	24.31	0.05	1.18	0.21	5.23	0.76	19.35
232	1031	0.82	20.82	0.96	24.31	0.05	1.18	0.21	5.23	0.76	19.36
232	1031	0.82	20.83	0.96	24.32	0.05	1.18	0.21	5.23	0.76	19.37
232	1030	0.82	20.84	0.96	24.33	0.05	1.18	0.21	5.23	0.76	19.38
232	1030	0.82	20.85	0.96	24.34	0.05	1.18	0.21	5.23	0.76	19.39
232	1031	0.82	20.86	0.96	24.35	0.05	1.18	0.21	5.23	0.76	19.40
232	1031	0.82	20.87	0.96	24.35	0.05	1.18	0.21	5.23	0.76	19.41
231	1030	0.82	20.88	0.96	24.36	0.05	1.18	0.21	5.23	0.76	19.42
232	1030	0.82	20.89	0.96	24.37	0.05	1.18	0.21	5.23	0.76	19.43
232	1032	0.82	20.90	0.96	24.39	0.05	1.18	0.21	5.23	0.77	19.44
232	1031	0.82	20.91	0.96	24.40	0.05	1.18	0.21	5.23	0.77	19.45
232	1031	0.82	20.92	0.96	24.41	0.05	1.18	0.21	5.23	0.77	19.46
232	1031	0.82	20.93	0.96	24.42	0.05	1.18	0.21	5.23	0.77	19.47
232	1032	0.82	20.94	0.96	24.43	0.05	1.18	0.21	5.23	0.77	19.48
232	1031	0.82	20.94	0.96	24.44	0.05	1.18	0.21	5.23	0.77	19.49
232	1031	0.83	20.96	0.96	24.44	0.05	1.18	0.21	5.23	0.77	19.50
232	1031	0.83	20.98	0.96	24.46	0.05	1.18	0.21	5.23	0.77	19.51
232	1032	0.83	20.98	0.96	24.46	0.05	1.18	0.21	5.23	0.77	19.52
232	1031	0.83	20.99	0.96	24.47	0.05	1.18	0.21	5.23	0.77	19.53
228	1016	0.83	21.07	0.97	24.57	0.05	1.18	0.21	5.23	0.77	19.62

Table A.30 Measurement of Rosette LVDTs of 5SB12T-2.0-10-D

LC		NWD1	NWD2	NWV1	NWV2	NWH1	NWH2	NED1	NED2	NEV1	NEV2	NEH1	NEH2
kips	kN	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in
0	0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
30	132	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
60	267	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
90	400	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
120	533	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
130	577	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
140	621	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
150	667	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
160	711	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
170	755	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
180	799	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
190	843	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
192	853	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
194	865	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
197	877	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
199	886	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
202	897	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
206	916	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
210	936	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
215	955	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
219	972	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
222	987	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Table A.30 Measurement of Rosette LVDTs of 5SB12T-2.0-10-D (Continued)

LC		NWD1	NWD2	NWV1	NWV2	NWH1	NWH2	NED1	NED2	NEV1	NEV2	NEH1	NEH2
kips	kN	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in
225	1003	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
228	1014	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
231	1026	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
234	1039	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
235	1046	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
237	1056	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
240	1066	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
241	1073	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
242	1078	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
245	1089	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
247	1101	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
248	1102	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
248	1105	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
249	1107	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
249	1107	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
249	1108	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
245	1089	0.000	0.001	0.000	0.000	0.001	0.002	0.000	0.000	0.000	0.000	0.000	0.000
246	1092	0.001	0.002	0.000	0.000	0.002	0.003	0.000	0.000	0.000	0.000	0.000	0.000
247	1099	0.001	0.002	0.000	0.000	0.002	0.004	0.000	0.000	0.000	0.000	0.000	0.000
248	1101	0.001	0.002	0.000	0.000	0.002	0.004	0.000	0.000	0.000	0.000	0.000	0.000
248	1102	0.001	0.002	0.000	0.000	0.002	0.004	0.000	0.000	0.000	0.000	0.000	0.000
244	1086	0.001	0.002	0.000	0.000	0.002	0.005	0.000	0.002	0.000	0.000	0.000	0.001

Table A.30 Measurement of Rosette LVDTs of 5SB12T-2.0-10-D (Continued)

LC		NWD1	NWD2	NWV1	NWV2	NWH1	NWH2	NED1	NED2	NEV1	NEV2	NEH1	NEH2
kips	kN	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in
236	1049	0.001	0.002	0.000	0.000	0.002	0.005	0.000	0.001	0.000	0.000	0.000	0.001
229	1020	0.001	0.002	0.000	0.000	0.002	0.006	0.000	0.001	0.000	0.000	0.000	0.001
226	1006	0.001	0.002	0.000	0.000	0.002	0.006	0.000	0.002	0.000	0.000	0.000	0.001
225	1003	0.001	0.002	0.000	0.000	0.002	0.007	0.000	0.002	0.000	0.000	0.000	0.001
226	1007	0.001	0.002	0.000	0.000	0.002	0.007	0.000	0.002	0.000	0.000	0.000	0.001
227	1011	0.001	0.002	0.000	0.000	0.002	0.007	0.000	0.002	0.000	0.000	0.000	0.001
228	1015	0.001	0.002	0.000	0.000	0.003	0.007	0.000	0.002	0.000	0.000	0.000	0.001
229	1017	0.001	0.002	0.000	0.000	0.003	0.007	0.000	0.002	0.000	0.000	0.000	0.001
230	1022	0.001	0.002	0.000	0.000	0.002	0.007	-0.001	0.002	0.000	0.000	0.000	0.001
234	1039	0.001	0.001	0.000	0.000	0.003	0.007	-0.001	0.004	0.001	0.000	0.000	0.001
234	1040	0.001	0.001	0.000	0.000	0.003	0.008	-0.001	0.004	0.001	0.000	0.000	0.001
233	1036	0.001	0.001	0.000	0.000	0.002	0.008	-0.001	0.004	0.001	0.000	0.001	0.001
234	1041	0.001	0.001	0.000	0.000	0.002	0.008	-0.001	0.004	0.001	0.000	0.001	0.001
234	1041	0.001	0.001	0.000	0.000	0.002	0.008	-0.001	0.004	0.001	0.000	0.001	0.001
234	1039	0.001	0.001	0.000	0.000	0.003	0.008	-0.001	0.004	0.001	0.000	0.001	0.001
234	1039	0.001	0.001	0.000	0.000	0.002	0.008	-0.001	0.004	0.001	0.000	0.001	0.001
232	1033	0.001	0.001	0.000	0.000	0.002	0.008	-0.001	0.004	0.001	0.000	0.001	0.001
231	1029	0.001	0.001	0.000	0.000	0.002	0.008	-0.001	0.004	0.001	0.000	0.001	0.001
232	1030	0.001	0.001	0.000	0.000	0.002	0.008	-0.001	0.004	0.001	0.000	0.001	0.001
232	1031	0.001	0.001	0.000	0.000	0.002	0.008	-0.001	0.004	0.001	0.000	0.001	0.001
231	1029	0.001	0.001	0.000	0.000	0.002	0.008	-0.001	0.004	0.001	0.000	0.001	0.001
231	1029	0.001	0.001	0.000	0.000	0.002	0.008	-0.001	0.004	0.001	0.000	0.001	0.001

Table A.30 Measurement of Rosette LVDTs of 5SB12T-2.0-10-D (Continued)

LC		NWD1	NWD2	NWV1	NWV2	NWH1	NWH2	NED1	NED2	NEV1	NEV2	NEH1	NEH2
kips	kN	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in
232	1031	0.001	0.001	0.000	0.000	0.002	0.008	-0.001	0.004	0.001	0.000	0.001	0.001
232	1031	0.001	0.001	0.000	0.000	0.002	0.008	-0.001	0.004	0.001	0.000	0.001	0.001
232	1030	0.001	0.001	0.000	0.000	0.002	0.008	-0.001	0.004	0.001	0.000	0.001	0.001
232	1030	0.001	0.001	0.000	0.000	0.002	0.008	-0.001	0.004	0.001	0.000	0.001	0.001
232	1031	0.001	0.001	0.000	0.000	0.002	0.008	-0.001	0.004	0.001	0.000	0.001	0.001
232	1031	0.001	0.001	0.000	0.000	0.002	0.008	-0.001	0.004	0.001	0.000	0.001	0.001
231	1030	0.001	0.001	0.000	0.000	0.002	0.008	-0.001	0.004	0.001	0.000	0.001	0.001
232	1030	0.001	0.001	0.000	0.000	0.002	0.008	-0.001	0.004	0.001	0.000	0.001	0.001
232	1032	0.001	0.001	0.000	0.000	0.002	0.008	-0.001	0.004	0.001	0.000	0.001	0.001
232	1031	0.001	0.001	0.000	0.000	0.003	0.008	-0.001	0.004	0.001	0.000	0.001	0.001
232	1031	0.001	0.001	0.000	0.000	0.003	0.008	-0.001	0.004	0.001	0.000	0.001	0.001
232	1031	0.001	0.001	0.000	0.000	0.002	0.008	-0.001	0.004	0.001	0.000	0.001	0.001
232	1032	0.001	0.001	0.000	0.000	0.003	0.008	-0.001	0.004	0.001	0.000	0.001	0.001
232	1031	0.001	0.001	0.000	0.000	0.002	0.008	-0.001	0.004	0.001	0.000	0.001	0.001
232	1031	0.001	0.001	0.000	0.000	0.002	0.008	-0.001	0.004	0.001	0.000	0.001	0.001
232	1031	0.001	0.001	0.000	0.000	0.002	0.008	-0.001	0.004	0.001	0.000	0.001	0.001
232	1032	0.001	0.001	0.000	0.000	0.002	0.008	-0.001	0.004	0.001	0.000	0.001	0.001
232	1031	0.001	0.001	0.000	0.000	0.002	0.008	-0.001	0.004	0.001	0.000	0.001	0.001
228	1016	0.001	0.001	0.000	0.000	0.002	0.008	-0.001	0.005	0.001	0.000	0.001	0.001

Table A.31 Measurement of Strain Gauges of 5SB12T-2.0-10-D

LC		CN1	CN2	CN3	NN1	NN2	NN3	HN1	HN2
kips	kN	m/m	m/m	m/m	m/m	m/m	m/m	m/m	m/m
0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
30	132	104.42	116.25	4.10	56.64	2.73	4.78	-109.65	6.83
60	267	34.81	39.81	8.19	86.45	5.23	5.92	-175.85	8.19
90	400	66.43	74.62	8.42	172.21	5.46	6.14	-280.26	9.10
120	533	69.84	78.26	9.78	221.80	5.01	6.37	-302.56	11.15
130	577	3.19	3.64	10.92	215.43	6.14	12.74	-290.27	14.10
140	621	2.50	2.73	10.69	214.52	5.46	14.79	-292.55	18.65
150	667	1.82	0.91	10.01	211.57	3.19	15.47	-296.64	24.34
160	711	1.14	0.23	9.56	209.75	1.82	11.38	-298.92	22.29
170	755	-3.64	-5.01	5.69	203.60	-3.41	8.87	-304.38	16.83
180	799	-4.10	-5.69	7.28	202.47	-3.87	9.78	-308.70	9.10
190	843	6.60	6.83	7.05	240.46	-5.01	8.42	-376.49	3.41
192	853	9.10	9.10	6.60	249.10	-5.69	8.19	-391.28	3.64
194	865	-5.23	-6.37	7.74	200.42	-5.01	8.65	-312.11	2.28
197	877	33.21	36.63	6.37	205.65	-6.60	7.28	-323.72	2.96
199	886	33.44	36.85	6.14	208.61	-7.73	6.83	-327.81	2.28
202	897	35.49	38.22	5.01	214.30	-6.82	7.51	-343.73	4.55
206	916	32.53	35.49	5.23	206.11	-8.19	-9.10	-333.50	3.19
210	936	33.44	36.85	7.51	207.02	-7.28	-8.19	-331.68	-5.46
215	955	58.24	63.92	6.83	251.38	-8.42	-8.42	-354.42	0.23
219	972	55.74	61.88	7.74	262.98	-8.42	-8.87	-337.59	-8.87
222	987	35.49	38.67	7.74	262.30	-8.42	-8.42	-353.51	-6.37

Table A.31 Measurement of Strain Gauges of 5SB12T-2.0-10-D (Continued)

LC		CN1	CN2	CN3	NN1	NN2	NN3	HN1	HN2
kips	kN	m/m	m/m	m/m	m/m	m/m	m/m	m/m	m/m
225	1003	33.21	35.72	9.33	253.88	-9.33	-8.64	-336.68	-13.88
228	1014	12.74	13.19	11.15	226.58	-8.64	-7.28	-341.00	-15.92
231	1026	36.17	39.36	10.24	237.95	-10.01	-7.96	-358.29	-14.56
234	1039	35.49	38.67	10.47	237.73	-10.46	-8.19	-362.84	-15.24
235	1046	35.26	37.76	9.56	238.86	-11.83	-8.19	-374.90	-2.96
237	1056	34.35	37.76	10.01	237.95	-12.28	-9.10	-372.40	-5.46
240	1066	35.49	39.36	13.42	238.18	-11.15	-7.73	-365.57	-16.83
241	1073	49.37	54.37	13.19	240.46	-11.83	-7.51	-370.80	-16.15
242	1078	48.91	54.37	14.10	241.14	-12.51	-7.05	-368.76	-18.65
245	1089	48.91	53.92	13.65	242.73	-14.10	-6.82	-374.22	-17.06
247	1101	47.55	52.32	14.79	241.37	-14.33	-6.60	-374.90	-17.06
248	1102	46.86	51.64	14.33	242.05	-15.01	-7.51	-377.40	-14.33
248	1105	46.18	49.82	12.51	240.91	-15.70	-7.73	-389.23	-0.91
249	1107	45.73	49.37	12.28	240.46	-15.24	-7.51	-389.23	-2.96
249	1107	45.27	48.91	12.51	240.91	-15.47	-8.19	-390.37	-1.59
249	1108	45.27	49.82	14.10	240.68	-14.79	-7.96	-381.95	-11.37
245	1089	45.04	49.37	13.88	240.68	-14.79	-8.19	-382.86	-10.24
246	1092	149.46	165.84	12.51	253.42	7.74	-8.42	-367.85	-5.46
247	1099	179.03	199.05	13.88	266.85	19.56	-7.73	-357.84	-12.28
248	1101	164.02	182.90	14.79	271.85	26.16	-7.73	-356.93	-14.33
248	1102	165.61	184.27	15.24	272.76	30.71	-7.51	-358.97	-11.37
244	1086	160.38	178.58	16.15	270.26	54.83	-7.28	-357.38	-15.70

Table A.31 Measurement of Strain Gauges of 5SB12T-2.0-10-D (Continued)

LC		CN1	CN2	CN3	NN1	NN2	NN3	HN1	HN2
kips	kN	m/m	m/m	m/m	m/m	m/m	m/m	m/m	m/m
236	1049	160.38	178.35	15.92	270.49	54.60	-7.28	-358.97	-13.19
229	1020	160.61	178.58	15.92	271.17	55.51	-8.87	-360.79	-10.69
226	1006	419.94	422.67	-1.37	323.72	2064.68	-349.19	-378.54	517.08
225	1003	415.85	416.30	-11.37	304.84	2104.95	-538.24	-365.12	549.16
226	1007	417.90	419.03	-12.74	305.97	2112.00	-594.20	-361.93	548.47
227	1011	419.94	421.76	-11.37	306.88	2114.96	-611.03	-351.47	534.83
228	1015	426.31	428.36	-12.74	323.95	2119.96	-633.33	-384.00	544.38
229	1017	426.31	428.59	-12.97	324.17	2120.87	-636.74	-384.45	545.52
230	1022	428.36	430.64	-17.06	325.99	2145.90	-709.31	-389.46	558.71
234	1039	446.33	445.42	-135.81	335.32	2416.38	-1944.57	-477.50	717.50
234	1040	461.80	463.17	-150.37	349.65	4685.57	-2609.06	-497.97	745.48
233	1036	462.26	463.17	-150.37	349.65	4685.57	-2617.48	-500.47	747.75
234	1041	468.85	470.90	-147.64	375.36	4685.57	-3065.63	-540.28	766.64
234	1041	468.63	470.67	-148.10	375.13	4685.57	-3069.27	-540.74	767.32
234	1039	464.76	466.81	-144.00	378.09	4685.57	-3232.61	-548.93	770.73
234	1039	454.29	457.25	-142.86	363.07	4685.57	-3349.54	-526.41	773.01
232	1033	442.24	444.74	-143.55	345.56	4685.57	-3421.42	-502.97	782.10
231	1029	439.96	443.15	-142.86	345.56	4685.57	-3469.65	-501.61	798.26
232	1030	437.92	441.55	-142.86	345.10	4685.57	-3473.29	-500.70	800.08
232	1031	438.60	442.24	-142.64	345.56	4685.57	-3477.38	-501.15	803.49
231	1029	438.83	442.01	-143.09	345.56	4685.57	-3481.71	-502.97	808.04
231	1029	438.60	441.33	-144.23	345.56	4685.57	-3486.03	-505.70	814.41

Table A.31 Measurement of Strain Gauges of 5SB12T-2.0-10-D (Continued)

LC		CN1	CN2	CN3	NN1	NN2	NN3	HN1	HN2
kips	kN	m/m	m/m	m/m	m/m	m/m	m/m	m/m	m/m
232	1031	436.10	439.96	-144.91	344.87	4685.57	-3490.58	-503.20	815.32
232	1031	436.78	440.42	-147.41	344.87	4685.57	-3499.00	-503.20	821.92
232	1030	435.19	439.05	-153.55	344.65	4685.57	-3510.83	-505.48	830.79
232	1030	433.82	437.92	-160.83	344.42	4685.57	-3519.70	-506.39	837.84
232	1031	434.05	438.14	-165.61	344.65	4685.57	-3525.38	-507.30	841.02
232	1031	434.05	437.92	-169.93	344.65	4685.57	-3531.07	-509.12	846.26
231	1030	431.77	435.87	-174.03	343.96	4685.57	-3536.76	-509.34	848.99
232	1030	431.32	435.64	-181.99	343.96	4685.57	-3541.31	-511.39	855.81
232	1032	431.09	435.41	-187.00	344.19	4685.57	-3545.40	-515.03	862.41
232	1031	431.77	435.41	-189.95	344.65	4685.57	-3549.04	-517.99	866.05
232	1031	431.55	435.64	-192.46	344.65	4685.57	-3552.00	-516.85	866.50
232	1031	431.77	435.87	-194.05	345.10	4685.57	-3555.19	-514.12	863.77
232	1032	429.95	434.50	-195.87	343.96	4685.57	-3561.10	-514.35	866.28
232	1031	429.95	434.05	-199.05	343.96	4685.57	-3565.42	-517.31	871.28
232	1031	430.64	434.96	-201.55	344.65	4685.57	-3568.83	-515.94	871.51
232	1031	430.18	433.14	-206.56	344.65	4685.57	-3571.34	-525.27	884.93
232	1032	430.41	434.05	-209.52	345.10	4685.57	-3573.84	-523.45	885.38
232	1031	430.64	434.05	-212.02	345.10	4685.57	-3576.11	-525.04	888.11
228	1016	426.77	431.55	-270.26	346.24	4685.57	-3643.22	-538.92	930.20

A.12 5SB12T-1.2-10-ND

Table A.32 Measurement of Load and Deflection Relationships of 5SB12T-1.2-10-ND

SW.LC		SE. LC		TRF		Mid. Def.		SW. Def.		SE. Def.		SW. Sett.		SE. Sett.		Net Def.	
kips	kN	kips	kN	kips	kN	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
0	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
19	83	11	49	30	132	0.04	1.11	0.04	1.11	0.04	1.11	0.01	0.31	0.06	1.56	0.01	0.18
36	161	24	105	60	266	0.06	1.63	0.06	1.63	0.06	1.63	0.02	0.53	0.08	2.05	0.01	0.34
42	187	28	123	70	310	0.07	1.79	0.07	1.79	0.07	1.79	0.02	0.59	0.09	2.16	0.02	0.42
48	213	32	142	80	355	0.08	1.93	0.08	1.93	0.08	1.93	0.02	0.63	0.09	2.27	0.02	0.48
54	238	36	161	90	399	0.08	2.07	0.08	2.07	0.08	2.07	0.03	0.69	0.09	2.38	0.02	0.54
59	264	40	180	100	444	0.09	2.21	0.09	2.21	0.09	2.21	0.03	0.73	0.10	2.46	0.02	0.62
65	289	45	200	110	489	0.09	2.37	0.09	2.37	0.09	2.37	0.03	0.75	0.10	2.53	0.03	0.73
71	314	50	220	120	535	0.10	2.53	0.10	2.53	0.10	2.53	0.03	0.77	0.10	2.59	0.03	0.85
76	338	54	240	130	578	0.11	2.69	0.11	2.69	0.11	2.69	0.03	0.77	0.10	2.62	0.04	0.99
82	364	59	261	140	625	0.11	2.89	0.11	2.89	0.11	2.89	0.03	0.77	0.10	2.65	0.05	1.18
83	369	60	266	143	635	0.12	2.94	0.12	2.94	0.12	2.94	0.03	0.77	0.10	2.65	0.05	1.23
80	356	58	257	138	613	0.12	2.97	0.12	2.97	0.12	2.97	0.03	0.77	0.10	2.65	0.05	1.25
81	358	59	264	140	622	0.12	3.11	0.12	3.11	0.12	3.11	0.03	0.77	0.10	2.65	0.06	1.40
83	368	63	279	146	647	0.13	3.38	0.13	3.38	0.13	3.38	0.03	0.77	0.10	2.65	0.07	1.67
84	375	64	285	148	660	0.14	3.47	0.14	3.47	0.14	3.47	0.03	0.77	0.10	2.65	0.07	1.76
83	371	64	283	147	654	0.14	3.47	0.14	3.47	0.14	3.47	0.03	0.77	0.10	2.65	0.07	1.76
83	371	64	284	147	655	0.14	3.47	0.14	3.47	0.14	3.47	0.03	0.77	0.10	2.65	0.07	1.76
85	379	65	289	150	668	0.14	3.52	0.14	3.52	0.14	3.52	0.03	0.77	0.10	2.65	0.07	1.81

Table A.32 Measurement of Load and Deflection Relationships of 5SB12T-1.2-10-ND (Continued)

SW.LC		SE. LC		TRF		Mid. Def.		SW. Def.		SE. Def.		SW. Sett.		SE. Sett.		Net Def.	
kips	kN	kips	kN	kips	kN	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
87	388	67	298	154	686	0.14	3.65	0.14	3.65	0.14	3.65	0.03	0.77	0.10	2.65	0.08	1.94
89	394	69	306	157	700	0.15	3.78	0.15	3.78	0.15	3.78	0.03	0.77	0.10	2.65	0.08	2.07
89	394	68	304	157	698	0.15	3.79	0.15	3.79	0.15	3.79	0.03	0.77	0.10	2.65	0.08	2.08
89	394	68	304	157	698	0.16	4.03	0.16	4.03	0.16	4.03	0.03	0.77	0.10	2.65	0.09	2.31
88	389	68	300	155	690	0.16	4.04	0.16	4.04	0.16	4.04	0.03	0.77	0.10	2.65	0.09	2.32
87	387	67	299	154	686	0.16	4.04	0.16	4.04	0.16	4.04	0.03	0.77	0.10	2.65	0.09	2.32
89	396	69	305	158	701	0.16	4.08	0.16	4.08	0.16	4.08	0.03	0.77	0.10	2.65	0.09	2.37
90	400	70	310	160	710	0.16	4.18	0.16	4.18	0.16	4.18	0.03	0.77	0.10	2.65	0.10	2.46
92	409	72	318	164	728	0.17	4.36	0.17	4.36	0.17	4.36	0.03	0.77	0.10	2.65	0.10	2.64
94	416	73	325	167	741	0.18	4.59	0.18	4.59	0.18	4.59	0.03	0.77	0.10	2.65	0.11	2.88
92	411	72	320	164	731	0.18	4.60	0.18	4.60	0.18	4.60	0.03	0.77	0.10	2.65	0.11	2.88
94	420	74	328	168	748	0.18	4.66	0.18	4.66	0.18	4.66	0.03	0.77	0.10	2.65	0.12	2.95
96	428	76	336	172	764	0.19	4.85	0.19	4.85	0.19	4.85	0.03	0.77	0.10	2.65	0.12	3.13
97	431	77	341	174	772	0.20	5.00	0.20	5.00	0.20	5.00	0.03	0.77	0.10	2.65	0.13	3.28
98	434	77	344	175	778	0.20	5.12	0.20	5.12	0.20	5.12	0.03	0.77	0.10	2.65	0.13	3.41
89	397	73	325	162	722	0.21	5.25	0.21	5.25	0.21	5.25	0.03	0.77	0.10	2.65	0.14	3.53
89	394	73	323	161	717	0.21	5.25	0.21	5.25	0.21	5.25	0.03	0.77	0.10	2.65	0.14	3.54
92	409	76	338	168	747	0.21	5.42	0.21	5.42	0.21	5.42	0.03	0.77	0.10	2.65	0.15	3.70
93	415	78	347	171	762	0.22	5.59	0.22	5.59	0.22	5.59	0.03	0.77	0.10	2.65	0.15	3.88
93	416	79	353	173	769	0.23	5.79	0.23	5.79	0.23	5.79	0.03	0.77	0.10	2.65	0.16	4.08
93	415	80	355	173	769	0.23	5.91	0.23	5.91	0.23	5.91	0.03	0.77	0.10	2.65	0.17	4.19
92	409	81	360	173	768	0.24	6.17	0.24	6.17	0.24	6.17	0.03	0.77	0.10	2.65	0.18	4.46

Table A.32 Measurement of Load and Deflection Relationships of 5SB12T-1.2-10-ND (Continued)

SW.LC		SE. LC		TRF		Mid. Def.		SW. Def.		SE. Def.		SW. Sett.		SE. Sett.		Net Def.	
kips	kN	kips	kN	kips	kN	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
92	407	81	358	172	765	0.24	6.18	0.24	6.18	0.24	6.18	0.03	0.77	0.10	2.65	0.18	4.47
90	398	80	357	170	756	0.25	6.27	0.25	6.27	0.25	6.27	0.03	0.77	0.10	2.65	0.18	4.55
84	374	79	351	163	725	0.25	6.47	0.25	6.47	0.25	6.47	0.03	0.77	0.10	2.65	0.19	4.76
83	369	79	350	162	719	0.26	6.49	0.26	6.49	0.26	6.49	0.03	0.77	0.10	2.65	0.19	4.77
80	354	78	346	157	700	0.26	6.61	0.26	6.61	0.26	6.61	0.03	0.77	0.10	2.65	0.19	4.90
78	347	77	343	155	690	0.26	6.64	0.26	6.64	0.26	6.64	0.03	0.77	0.10	2.65	0.19	4.93
78	348	77	343	156	692	0.26	6.65	0.26	6.65	0.26	6.65	0.03	0.77	0.10	2.65	0.19	4.93
78	346	77	342	155	688	0.26	6.65	0.26	6.65	0.26	6.65	0.03	0.77	0.10	2.65	0.19	4.93
77	343	77	341	154	684	0.26	6.65	0.26	6.65	0.26	6.65	0.03	0.77	0.10	2.65	0.19	4.94
76	337	76	337	152	674	0.26	6.67	0.26	6.67	0.26	6.67	0.03	0.77	0.10	2.65	0.20	4.96
76	338	76	338	152	676	0.26	6.68	0.26	6.68	0.26	6.68	0.03	0.77	0.10	2.65	0.20	4.96
76	340	76	338	152	678	0.26	6.67	0.26	6.67	0.26	6.67	0.03	0.77	0.10	2.65	0.20	4.96
76	338	76	337	152	675	0.26	6.68	0.26	6.68	0.26	6.68	0.03	0.77	0.10	2.65	0.20	4.97
75	336	75	336	151	671	0.26	6.68	0.26	6.68	0.26	6.68	0.03	0.77	0.10	2.65	0.20	4.96
76	337	76	337	152	674	0.26	6.68	0.26	6.68	0.26	6.68	0.03	0.77	0.10	2.65	0.20	4.97
76	339	76	337	152	676	0.26	6.68	0.26	6.68	0.26	6.68	0.03	0.77	0.10	2.65	0.20	4.97
75	336	75	335	151	671	0.26	6.68	0.26	6.68	0.26	6.68	0.03	0.77	0.10	2.65	0.20	4.97
75	334	75	335	150	669	0.26	6.68	0.26	6.68	0.26	6.68	0.03	0.77	0.10	2.65	0.20	4.97
76	337	76	337	151	673	0.26	6.68	0.26	6.68	0.26	6.68	0.03	0.77	0.10	2.65	0.20	4.97
76	337	76	336	151	673	0.26	6.69	0.26	6.69	0.26	6.69	0.03	0.77	0.10	2.65	0.20	4.97
75	334	75	334	150	668	0.26	6.68	0.26	6.68	0.26	6.68	0.03	0.77	0.10	2.65	0.20	4.97
75	334	75	335	150	668	0.26	6.69	0.26	6.69	0.26	6.69	0.03	0.77	0.10	2.65	0.20	4.97

Table A.32 Measurement of Load and Deflection Relationships of 5SB12T-1.2-10-ND (Continued)

SW.LC		SE. LC		TRF		Mid. Def.		SW. Def.		SE. Def.		SW. Sett.		SE. Sett.		Net Def.	
kips	kN	kips	kN	kips	kN	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
76	336	76	336	151	672	0.26	6.69	0.26	6.69	0.26	6.69	0.03	0.77	0.10	2.65	0.20	4.97
75	336	75	335	151	670	0.26	6.69	0.26	6.69	0.26	6.69	0.03	0.77	0.10	2.65	0.20	4.97
75	332	75	333	150	665	0.26	6.69	0.26	6.69	0.26	6.69	0.03	0.77	0.10	2.65	0.20	4.98
75	333	75	334	150	667	0.26	6.69	0.26	6.69	0.26	6.69	0.03	0.77	0.10	2.65	0.20	4.98
75	336	75	335	151	671	0.26	6.69	0.26	6.69	0.26	6.69	0.03	0.77	0.10	2.65	0.20	4.98
75	333	75	333	150	667	0.26	6.69	0.26	6.69	0.26	6.69	0.03	0.77	0.10	2.65	0.20	4.98
74	331	75	333	149	663	0.26	6.69	0.26	6.69	0.26	6.69	0.03	0.77	0.10	2.65	0.20	4.98
75	333	75	334	150	667	0.26	6.70	0.26	6.70	0.26	6.70	0.03	0.77	0.10	2.65	0.20	4.98
75	334	75	334	150	669	0.26	6.69	0.26	6.69	0.26	6.69	0.03	0.77	0.10	2.65	0.20	4.98
75	331	75	332	149	664	0.26	6.69	0.26	6.69	0.26	6.69	0.03	0.77	0.10	2.65	0.20	4.98
74	330	75	332	149	662	0.26	6.69	0.26	6.69	0.26	6.69	0.03	0.77	0.10	2.65	0.20	4.98
75	333	75	334	150	666	0.26	6.69	0.26	6.69	0.26	6.69	0.03	0.77	0.10	2.65	0.20	4.98
75	333	75	333	150	666	0.26	6.70	0.26	6.70	0.26	6.70	0.03	0.77	0.10	2.65	0.20	4.98
74	330	75	331	149	661	0.26	6.69	0.26	6.69	0.26	6.69	0.03	0.77	0.10	2.65	0.20	4.98
74	330	75	332	149	662	0.26	6.70	0.26	6.70	0.26	6.70	0.03	0.77	0.10	2.65	0.20	4.98
75	333	75	334	150	666	0.26	6.70	0.26	6.70	0.26	6.70	0.03	0.77	0.10	2.65	0.20	4.98
75	332	75	332	149	664	0.26	6.70	0.26	6.70	0.26	6.70	0.03	0.77	0.10	2.65	0.20	4.98
74	329	74	331	148	660	0.26	6.70	0.26	6.70	0.26	6.70	0.03	0.77	0.10	2.65	0.20	4.98
74	330	75	332	149	662	0.26	6.70	0.26	6.70	0.26	6.70	0.03	0.77	0.10	2.65	0.20	4.98
75	332	75	333	150	665	0.26	6.70	0.26	6.70	0.26	6.70	0.03	0.77	0.10	2.65	0.20	4.99
74	330	74	331	149	661	0.26	6.70	0.26	6.70	0.26	6.70	0.03	0.77	0.10	2.65	0.20	4.98
74	327	74	330	148	658	0.26	6.70	0.26	6.70	0.26	6.70	0.03	0.77	0.10	2.65	0.20	4.98

Table A.33 Measurement of Tendon Slippage of 5SB12T-1.2-10-ND

TRF		T1	T2	T3	T4	T5	T6	T7	T8	T9	T10
kips	kN	in	in	in	in	in	in	in	in	in	in
0	0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
30	132	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
60	266	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
70	310	0.000	0.000	0.000	0.000	0.002	0.001	0.000	0.000	0.000	0.000
80	355	0.000	0.000	0.000	0.000	0.004	0.001	0.000	0.000	0.000	0.000
90	399	0.000	0.000	0.000	0.001	0.006	0.002	0.000	0.000	0.000	0.000
100	444	0.000	0.000	0.000	0.005	0.008	0.004	0.000	0.000	0.000	0.000
110	489	0.000	0.000	0.000	0.014	0.011	0.006	0.000	0.000	0.000	0.000
120	535	0.000	0.000	0.000	0.019	0.017	0.009	0.000	0.000	0.000	0.000
130	578	0.000	0.000	0.000	0.025	0.022	0.011	0.001	0.000	0.000	0.000
140	625	0.000	0.000	0.000	0.031	0.026	0.014	0.003	0.000	0.000	0.000
143	635	0.000	0.000	0.000	0.032	0.027	0.015	0.004	0.000	0.000	0.000
138	613	0.000	0.000	0.005	0.035	0.028	0.016	0.004	0.000	0.000	0.000
140	622	0.000	0.000	0.017	0.038	0.028	0.016	0.004	0.000	0.000	0.000
146	647	0.000	0.000	0.032	0.041	0.032	0.017	0.005	0.001	0.000	0.000
148	660	0.000	0.000	0.034	0.042	0.034	0.019	0.006	0.001	0.000	0.000
147	654	0.000	0.000	0.034	0.042	0.034	0.019	0.006	0.001	0.000	0.000
147	655	0.000	0.000	0.034	0.043	0.034	0.019	0.006	0.001	0.000	0.000
150	668	0.000	0.000	0.036	0.043	0.035	0.019	0.007	0.002	0.000	0.000
154	686	0.000	0.000	0.038	0.046	0.037	0.021	0.010	0.003	0.000	0.000
157	700	0.000	0.000	0.040	0.048	0.038	0.023	0.015	0.004	0.000	0.000
157	698	0.000	0.000	0.040	0.048	0.039	0.024	0.015	0.004	0.000	0.000

Table A.33 Measurement of Tendon Slippage of 5SB12T-1.2-10-ND (Continued)

TRF		T1	T2	T3	T4	T5	T6	T7	T8	T9	T10
kips	kN	in	in	in	in	in	in	in	in	in	in
157	698	0.000	0.000	0.044	0.054	0.043	0.028	0.026	0.009	0.000	0.000
155	690	0.000	0.000	0.045	0.054	0.043	0.028	0.027	0.010	0.000	0.000
154	686	0.000	0.000	0.045	0.054	0.043	0.028	0.027	0.010	0.000	0.000
158	701	0.000	0.000	0.045	0.055	0.044	0.028	0.027	0.011	0.000	0.000
160	710	0.000	0.000	0.047	0.056	0.046	0.029	0.028	0.013	0.000	0.000
164	728	0.000	0.000	0.051	0.059	0.049	0.032	0.031	0.017	0.000	0.000
167	741	0.000	0.000	0.055	0.063	0.053	0.035	0.035	0.025	0.000	0.000
164	731	0.000	0.000	0.057	0.064	0.054	0.035	0.035	0.025	0.000	0.000
168	748	0.000	0.000	0.057	0.064	0.054	0.036	0.035	0.026	0.000	0.000
172	764	0.000	0.000	0.060	0.067	0.057	0.038	0.038	0.032	0.000	0.000
174	772	0.000	0.000	0.062	0.070	0.060	0.040	0.040	0.040	0.000	0.000
175	778	0.000	0.000	0.064	0.072	0.062	0.041	0.041	0.046	0.000	0.000
162	722	0.000	0.000	0.077	0.073	0.062	0.041	0.042	0.047	0.000	0.000
161	717	0.000	0.000	0.077	0.073	0.062	0.042	0.042	0.047	0.000	0.000
168	747	0.000	0.000	0.080	0.074	0.062	0.042	0.042	0.047	0.000	0.000
171	762	0.000	0.001	0.084	0.075	0.063	0.042	0.042	0.048	0.000	0.000
173	769	0.001	0.002	0.088	0.076	0.064	0.043	0.043	0.050	0.000	0.000
173	769	0.004	0.004	0.090	0.077	0.064	0.044	0.044	0.051	0.000	0.000
173	768	0.010	0.014	0.092	0.077	0.065	0.044	0.045	0.053	0.000	0.000
172	765	0.010	0.014	0.092	0.077	0.065	0.044	0.045	0.053	0.000	0.000
170	756	0.013	0.018	0.092	0.077	0.065	0.044	0.045	0.053	0.000	0.000
163	725	0.018	0.027	0.091	0.077	0.065	0.044	0.045	0.053	0.000	0.000

Table A.33 Measurement of Tendon Slippage of 5SB12T-1.2-10-ND (Continued)

TRF		T1	T2	T3	T4	T5	T6	T7	T8	T9	T10
kips	kN	in	in	in	in	in	in	in	in	in	in
162	719	0.019	0.029	0.091	0.077	0.065	0.044	0.045	0.053	0.000	0.000
157	700	0.022	0.035	0.090	0.077	0.065	0.044	0.045	0.054	0.000	0.000
155	690	0.024	0.037	0.090	0.077	0.065	0.044	0.046	0.054	0.000	0.000
156	692	0.024	0.038	0.090	0.077	0.065	0.044	0.046	0.054	0.000	0.000
155	688	0.024	0.038	0.090	0.077	0.065	0.044	0.046	0.054	0.000	0.000
154	684	0.024	0.038	0.090	0.077	0.065	0.044	0.046	0.054	0.000	0.000
152	674	0.025	0.040	0.090	0.077	0.065	0.044	0.046	0.054	0.000	0.000
152	676	0.025	0.040	0.090	0.077	0.065	0.044	0.046	0.054	0.000	0.000
152	678	0.025	0.040	0.090	0.077	0.065	0.044	0.046	0.054	0.000	0.000
152	675	0.025	0.041	0.090	0.077	0.065	0.044	0.046	0.054	0.000	0.000
151	671	0.025	0.041	0.090	0.077	0.065	0.044	0.046	0.054	0.000	0.000
152	674	0.025	0.041	0.090	0.077	0.065	0.044	0.046	0.054	0.000	0.000
152	676	0.026	0.041	0.090	0.077	0.065	0.044	0.046	0.054	0.000	0.000
151	671	0.025	0.041	0.090	0.077	0.065	0.044	0.046	0.054	0.000	0.000
150	669	0.026	0.041	0.090	0.077	0.065	0.044	0.046	0.054	0.000	0.000
151	673	0.026	0.041	0.090	0.077	0.065	0.044	0.046	0.054	0.000	0.000
151	673	0.026	0.041	0.090	0.077	0.065	0.044	0.046	0.054	0.000	0.000
150	668	0.026	0.042	0.090	0.077	0.065	0.044	0.046	0.054	0.000	0.000
150	668	0.026	0.042	0.090	0.077	0.065	0.044	0.046	0.054	0.000	0.000
151	672	0.026	0.042	0.090	0.077	0.065	0.044	0.046	0.054	0.000	0.000
151	670	0.026	0.042	0.090	0.077	0.065	0.044	0.046	0.054	0.000	0.000
150	665	0.026	0.042	0.090	0.077	0.065	0.044	0.046	0.054	0.000	0.000

Table A.33 Measurement of Tendon Slippage of 5SB12T-1.2-10-ND (Continued)

TRF		T1	T2	T3	T4	T5	T6	T7	T8	T9	T10
kips	kN	in	in	in	in	in	in	in	in	in	in
150	667	0.026	0.042	0.090	0.077	0.065	0.044	0.046	0.054	0.000	0.000
151	671	0.026	0.042	0.090	0.077	0.065	0.044	0.046	0.054	0.000	0.000
150	667	0.026	0.042	0.090	0.077	0.065	0.044	0.046	0.054	0.000	0.000
149	663	0.026	0.042	0.090	0.077	0.065	0.044	0.046	0.054	0.000	0.000
150	667	0.026	0.043	0.090	0.077	0.065	0.044	0.046	0.054	0.000	0.000
150	669	0.026	0.043	0.090	0.077	0.065	0.044	0.046	0.054	0.000	0.000
149	664	0.026	0.043	0.090	0.077	0.065	0.044	0.046	0.054	0.000	0.000
149	662	0.026	0.043	0.090	0.077	0.065	0.044	0.045	0.054	0.000	0.000
150	666	0.026	0.043	0.090	0.077	0.065	0.044	0.046	0.054	0.000	0.000
150	666	0.026	0.043	0.090	0.077	0.065	0.044	0.046	0.054	0.000	0.000
149	661	0.027	0.043	0.090	0.077	0.065	0.044	0.046	0.054	0.000	0.000
149	662	0.027	0.043	0.090	0.077	0.065	0.044	0.046	0.054	0.000	0.000
150	666	0.027	0.043	0.090	0.077	0.065	0.044	0.046	0.054	0.000	0.000
149	664	0.027	0.043	0.090	0.077	0.065	0.044	0.046	0.054	0.000	0.000
148	660	0.027	0.043	0.090	0.077	0.065	0.044	0.046	0.054	0.000	0.000
149	662	0.027	0.044	0.090	0.077	0.065	0.044	0.046	0.054	0.000	0.000
150	665	0.027	0.044	0.090	0.077	0.065	0.044	0.046	0.054	0.000	0.000
149	661	0.027	0.044	0.090	0.077	0.065	0.044	0.046	0.054	0.000	0.000
148	658	0.027	0.044	0.090	0.077	0.065	0.044	0.045	0.054	0.000	0.000

Table A.34 Measurement of Strain Gauges of 5SB12T-1.2-10-ND

TRF		S1	S2	S3	S4	S11	S12	S13	S14
kips	kN	m/m	m/m	m/m	m/m	m/m	m/m	m/m	m/m
0	0	B.G.	0.00	B.G.	0.00	0.00	0.00	0.00	B.G.
30	132	B.G.	-5.92	B.G.	-6.37	-5.01	-6.60	8.42	B.G.
60	266	B.G.	47.55	B.G.	-22.75	5.23	0.68	30.94	B.G.
70	310	B.G.	132.40	B.G.	129.44	34.81	19.56	30.03	B.G.
80	355	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.
90	399	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.
100	444	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.
110	489	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.
120	535	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.
130	578	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.
140	625	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.
143	635	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.
138	613	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.
140	622	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.
146	647	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.
148	660	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.
147	654	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.
147	655	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.
150	668	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
148	658	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.

A.13 5SB12T-1.6-10-ND

Table A.35 Measurement of Load and Deflection Relationships of 5SB12T-1.6-10-ND

LC		Mid. Def.		W. Def.		E. Def.		W. Sett.		E. Sett.		Net Def.	
kips	kN	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm
0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
31	137	0.04	1.08	0.04	1.08	0.04	1.08	0.04	0.97	0.04	0.91	0.01	0.14
61	270	0.07	1.83	0.07	1.83	0.07	1.83	0.06	1.59	0.06	1.42	0.01	0.33
90	400	0.10	2.43	0.10	2.43	0.10	2.43	0.08	2.04	0.07	1.77	0.02	0.53
121	536	0.12	2.94	0.12	2.94	0.12	2.94	0.09	2.38	0.08	2.01	0.03	0.75
130	576	0.12	3.11	0.12	3.11	0.12	3.11	0.10	2.47	0.08	2.09	0.03	0.84
140	625	0.13	3.27	0.13	3.27	0.13	3.27	0.10	2.56	0.08	2.16	0.04	0.92
150	667	0.14	3.45	0.14	3.45	0.14	3.45	0.10	2.64	0.09	2.23	0.04	1.01
160	710	0.14	3.64	0.14	3.64	0.14	3.64	0.11	2.73	0.09	2.31	0.04	1.12
171	759	0.15	3.93	0.15	3.93	0.15	3.93	0.11	2.81	0.09	2.37	0.05	1.35
171	760	0.16	3.94	0.16	3.94	0.16	3.94	0.11	2.81	0.09	2.37	0.05	1.35
169	753	0.16	3.95	0.16	3.95	0.16	3.95	0.11	2.81	0.09	2.37	0.05	1.36
170	754	0.16	3.96	0.16	3.96	0.16	3.96	0.11	2.81	0.09	2.37	0.05	1.37
172	764	0.16	3.98	0.16	3.98	0.16	3.98	0.11	2.81	0.09	2.37	0.05	1.40
174	773	0.16	4.05	0.16	4.05	0.16	4.05	0.11	2.81	0.09	2.37	0.06	1.47
166	737	0.16	4.10	0.16	4.10	0.16	4.10	0.11	2.81	0.09	2.37	0.06	1.52
166	738	0.16	4.11	0.16	4.11	0.16	4.11	0.11	2.81	0.09	2.37	0.06	1.52
172	763	0.17	4.24	0.17	4.24	0.17	4.24	0.11	2.81	0.09	2.37	0.06	1.65
173	767	0.17	4.27	0.17	4.27	0.17	4.27	0.11	2.81	0.09	2.37	0.07	1.68

Table A.35 Measurement of Load and Deflection Relationships of 5SB12T-1.6-10-ND (Continued)

LC		Mid. Def.		W. Def.		E. Def.		W. Sett.		E. Sett.		Net Def.	
kips	kN	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm
174	774	0.17	4.34	0.17	4.34	0.17	4.34	0.11	2.81	0.09	2.37	0.07	1.76
171	761	0.17	4.39	0.17	4.39	0.17	4.39	0.11	2.81	0.09	2.37	0.07	1.80
174	773	0.17	4.43	0.17	4.43	0.17	4.43	0.11	2.81	0.09	2.37	0.07	1.84
175	778	0.18	4.52	0.18	4.52	0.18	4.52	0.11	2.81	0.09	2.37	0.08	1.93
175	778	0.18	4.55	0.18	4.55	0.18	4.55	0.11	2.81	0.09	2.37	0.08	1.96
167	744	0.19	4.78	0.19	4.78	0.19	4.78	0.11	2.81	0.09	2.37	0.09	2.20
160	710	0.19	4.85	0.19	4.85	0.19	4.85	0.11	2.81	0.09	2.37	0.09	2.26
157	700	0.19	4.87	0.19	4.87	0.19	4.87	0.11	2.81	0.09	2.37	0.09	2.28
155	688	0.19	4.93	0.19	4.93	0.19	4.93	0.11	2.81	0.09	2.37	0.09	2.35
154	686	0.19	4.94	0.19	4.94	0.19	4.94	0.11	2.81	0.09	2.37	0.09	2.35
158	701	0.20	5.00	0.20	5.00	0.20	5.00	0.11	2.81	0.09	2.37	0.10	2.42
160	713	0.20	5.16	0.20	5.16	0.20	5.16	0.11	2.81	0.09	2.37	0.10	2.57
163	727	0.21	5.40	0.21	5.40	0.21	5.40	0.11	2.81	0.09	2.37	0.11	2.81
165	733	0.22	5.57	0.22	5.57	0.22	5.57	0.11	2.81	0.09	2.37	0.12	2.98
167	744	0.23	5.82	0.23	5.82	0.23	5.82	0.11	2.81	0.09	2.37	0.13	3.23
168	746	0.24	6.05	0.24	6.05	0.24	6.05	0.11	2.81	0.09	2.37	0.14	3.46
172	764	0.25	6.40	0.25	6.40	0.25	6.40	0.11	2.81	0.09	2.37	0.15	3.82
174	772	0.26	6.66	0.26	6.66	0.26	6.66	0.11	2.81	0.09	2.37	0.16	4.08
175	777	0.27	6.86	0.27	6.86	0.27	6.86	0.11	2.81	0.09	2.37	0.17	4.28
177	787	0.28	7.17	0.28	7.17	0.28	7.17	0.11	2.81	0.09	2.37	0.18	4.58
179	794	0.29	7.42	0.29	7.42	0.29	7.42	0.11	2.81	0.09	2.37	0.19	4.84
180	800	0.30	7.67	0.30	7.67	0.30	7.67	0.11	2.81	0.09	2.37	0.20	5.08

Table A.35 Measurement of Load and Deflection Relationships of 5SB12T-1.6-10-ND (Continued)

LC		Mid. Def.		W. Def.		E. Def.		W. Sett.		E. Sett.		Net Def.	
kips	kN	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm
182	810	0.32	8.01	0.32	8.01	0.32	8.01	0.11	2.81	0.09	2.37	0.21	5.42
183	814	0.32	8.15	0.32	8.15	0.32	8.15	0.11	2.81	0.09	2.37	0.22	5.57
185	821	0.33	8.46	0.33	8.46	0.33	8.46	0.11	2.81	0.09	2.37	0.23	5.87
185	823	0.34	8.60	0.34	8.60	0.34	8.60	0.11	2.81	0.09	2.37	0.24	6.01
187	831	0.35	8.91	0.35	8.91	0.35	8.91	0.11	2.81	0.09	2.37	0.25	6.33
187	832	0.36	9.13	0.36	9.13	0.36	9.13	0.11	2.81	0.09	2.37	0.26	6.55
187	832	0.37	9.32	0.37	9.32	0.37	9.32	0.11	2.81	0.09	2.37	0.26	6.73
179	797	0.37	9.49	0.37	9.49	0.37	9.49	0.11	2.81	0.09	2.37	0.27	6.91
179	797	0.38	9.63	0.38	9.63	0.38	9.63	0.11	2.81	0.09	2.37	0.28	7.05
179	796	0.39	9.89	0.39	9.89	0.39	9.89	0.11	2.81	0.09	2.37	0.29	7.30
179	797	0.39	9.99	0.39	9.99	0.39	9.99	0.11	2.81	0.09	2.37	0.29	7.41
180	800	0.40	10.12	0.40	10.12	0.40	10.12	0.11	2.81	0.09	2.37	0.30	7.53
177	789	0.41	10.36	0.41	10.36	0.41	10.36	0.11	2.81	0.09	2.37	0.31	7.77
175	777	0.42	10.63	0.42	10.63	0.42	10.63	0.11	2.81	0.09	2.37	0.32	8.04
173	768	0.44	11.15	0.44	11.15	0.44	11.15	0.11	2.81	0.09	2.37	0.34	8.56
173	769	0.45	11.54	0.45	11.54	0.45	11.54	0.11	2.81	0.09	2.37	0.35	8.95
173	769	0.46	11.80	0.46	11.80	0.46	11.80	0.11	2.81	0.09	2.37	0.36	9.22
173	769	0.47	11.98	0.47	11.98	0.47	11.98	0.11	2.81	0.09	2.37	0.37	9.40
173	770	0.48	12.17	0.48	12.17	0.48	12.17	0.11	2.81	0.09	2.37	0.38	9.59
173	769	0.49	12.36	0.49	12.36	0.49	12.36	0.11	2.81	0.09	2.37	0.38	9.77
173	768	0.49	12.49	0.49	12.49	0.49	12.49	0.11	2.81	0.09	2.37	0.39	9.90
173	772	0.50	12.78	0.50	12.78	0.50	12.78	0.11	2.81	0.09	2.37	0.40	10.19

Table A.35 Measurement of Load and Deflection Relationships of 5SB12T-1.6-10-ND (Continued)

LC		Mid. Def.		W. Def.		E. Def.		W. Sett.		E. Sett.		Net Def.	
kips	kN	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm
173	771	0.51	13.01	0.51	13.01	0.51	13.01	0.11	2.81	0.09	2.37	0.41	10.43
173	770	0.52	13.21	0.52	13.21	0.52	13.21	0.11	2.81	0.09	2.37	0.42	10.63
173	768	0.53	13.40	0.53	13.40	0.53	13.40	0.11	2.81	0.09	2.37	0.43	10.81
173	769	0.54	13.70	0.54	13.70	0.54	13.70	0.11	2.81	0.09	2.37	0.44	11.12
173	769	0.55	13.94	0.55	13.94	0.55	13.94	0.11	2.81	0.09	2.37	0.45	11.35
173	769	0.56	14.24	0.56	14.24	0.56	14.24	0.11	2.81	0.09	2.37	0.46	11.66
173	770	0.57	14.45	0.57	14.45	0.57	14.45	0.11	2.81	0.09	2.37	0.47	11.86
169	753	0.57	14.47	0.57	14.47	0.57	14.47	0.11	2.81	0.09	2.37	0.47	11.88
173	769	0.57	14.50	0.57	14.50	0.57	14.50	0.11	2.81	0.09	2.37	0.47	11.92
169	753	0.57	14.52	0.57	14.52	0.57	14.52	0.11	2.81	0.09	2.37	0.47	11.94
171	760	0.58	14.63	0.58	14.63	0.58	14.63	0.11	2.81	0.09	2.37	0.47	12.04
166	737	0.58	14.64	0.58	14.64	0.58	14.64	0.11	2.81	0.09	2.37	0.47	12.06
165	736	0.58	14.81	0.58	14.81	0.58	14.81	0.11	2.81	0.09	2.37	0.48	12.22
166	738	0.58	14.82	0.58	14.82	0.58	14.82	0.11	2.81	0.09	2.37	0.48	12.24
167	741	0.59	15.03	0.59	15.03	0.59	15.03	0.11	2.81	0.09	2.37	0.49	12.44
167	743	0.61	15.39	0.61	15.39	0.61	15.39	0.11	2.81	0.09	2.37	0.50	12.80
168	746	0.62	15.63	0.62	15.63	0.62	15.63	0.11	2.81	0.09	2.37	0.51	13.05
168	747	0.63	15.93	0.63	15.93	0.63	15.93	0.11	2.81	0.09	2.37	0.53	13.34
168	745	0.65	16.55	0.65	16.55	0.65	16.55	0.11	2.81	0.09	2.37	0.55	13.97
168	745	0.66	16.79	0.66	16.79	0.66	16.79	0.11	2.81	0.09	2.37	0.56	14.21
167	744	0.66	16.81	0.66	16.81	0.66	16.81	0.11	2.81	0.09	2.37	0.56	14.22
167	743	0.66	16.81	0.66	16.81	0.66	16.81	0.11	2.81	0.09	2.37	0.56	14.23

Table A.36 Measurement of Tendon Slippage of 5SB12T-1.6-10-ND

Load Cell		T1	T2	T3	T4	T5	T6	T7	T8	T9	T10
kips	kN	in	in	in	in	in	in	in	in	in	in
0	0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
31	137	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000
61	270	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000
90	400	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000
121	536	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000
130	576	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000
140	625	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000
150	667	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000
160	710	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000
171	759	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.001	0.001	0.000
171	760	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.001	0.001	0.000
169	753	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.001	0.001	0.000
170	754	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.001	0.001	0.000
172	764	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.001	0.001	0.000
174	773	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.002	0.002	0.000
166	737	0.000	0.000	0.002	0.001	0.000	0.000	0.000	0.008	0.002	0.000
166	738	0.000	0.000	0.002	0.001	0.000	0.000	0.000	0.008	0.003	0.000
172	763	0.000	0.000	0.002	0.002	0.000	0.000	0.000	0.013	0.003	0.000
173	767	0.000	0.000	0.002	0.002	0.000	0.000	0.001	0.014	0.003	0.002
174	774	0.000	0.000	0.002	0.003	0.000	0.000	0.001	0.017	0.003	0.005
171	761	0.000	0.000	0.002	0.005	0.000	0.000	0.001	0.021	0.004	0.006
174	773	0.000	0.000	0.002	0.005	0.000	0.000	0.001	0.024	0.004	0.006

Table A.36 Measurement of Tendon Slippage of 5SB12T-1.6-10-ND (Continued)

Load Cell		T1	T2	T3	T4	T5	T6	T7	T8	T9	T10
kips	kN	in	in	in	in	in	in	in	in	in	in
175	778	0.000	0.000	0.003	0.006	0.000	0.000	0.001	0.028	0.005	0.008
175	778	0.000	0.000	0.003	0.007	0.000	0.000	0.001	0.031	0.005	0.008
167	744	0.000	0.000	0.004	0.010	0.000	0.001	0.002	0.035	0.006	0.009
160	710	0.000	0.008	0.012	0.016	0.002	0.007	0.004	0.044	0.008	0.011
157	700	0.000	0.012	0.015	0.020	0.004	0.008	0.006	0.046	0.009	0.013
155	688	0.001	0.016	0.019	0.024	0.007	0.013	0.009	0.054	0.012	0.016
154	686	0.001	0.016	0.019	0.024	0.007	0.013	0.009	0.055	0.012	0.016
158	701	0.001	0.016	0.020	0.024	0.008	0.014	0.009	0.057	0.012	0.017
160	713	0.001	0.018	0.022	0.027	0.011	0.016	0.011	0.061	0.014	0.020
163	727	0.002	0.021	0.027	0.031	0.015	0.020	0.018	0.069	0.016	0.024
165	733	0.003	0.024	0.030	0.034	0.018	0.024	0.021	0.077	0.019	0.027
167	744	0.005	0.027	0.034	0.038	0.021	0.027	0.026	0.083	0.021	0.031
168	746	0.010	0.031	0.039	0.046	0.027	0.032	0.034	0.093	0.025	0.035
172	764	0.015	0.037	0.045	0.052	0.033	0.037	0.041	0.103	0.029	0.040
174	772	0.022	0.042	0.050	0.058	0.037	0.042	0.048	0.112	0.032	0.043
175	777	0.025	0.045	0.054	0.062	0.040	0.046	0.053	0.119	0.035	0.047
177	787	0.029	0.051	0.062	0.068	0.045	0.050	0.059	0.127	0.039	0.051
179	794	0.032	0.055	0.067	0.072	0.050	0.055	0.065	0.135	0.043	0.055
180	800	0.035	0.059	0.072	0.077	0.054	0.059	0.070	0.144	0.047	0.060
182	810	0.039	0.064	0.077	0.083	0.060	0.064	0.076	0.155	0.052	0.064
183	814	0.041	0.066	0.079	0.086	0.062	0.065	0.078	0.158	0.053	0.066
185	821	0.044	0.071	0.084	0.091	0.066	0.070	0.084	0.169	0.058	0.070

Table A.36 Measurement of Tendon Slippage of 5SB12T-1.6-10-ND (Continued)

Load Cell		T1	T2	T3	T4	T5	T6	T7	T8	T9	T10
kips	kN	in	in	in	in	in	in	in	in	in	in
185	823	0.046	0.073	0.087	0.094	0.068	0.072	0.087	0.174	0.060	0.072
187	831	0.050	0.078	0.092	0.100	0.073	0.076	0.093	0.184	0.065	0.076
187	832	0.054	0.084	0.096	0.104	0.077	0.080	0.098	0.192	0.068	0.079
187	832	0.060	0.093	0.100	0.108	0.080	0.083	0.102	0.200	0.070	0.082
179	797	0.065	0.100	0.105	0.114	0.084	0.088	0.109	0.237	0.071	0.082
179	797	0.069	0.105	0.108	0.119	0.088	0.093	0.115	0.252	0.071	0.082
179	796	0.074	0.112	0.114	0.126	0.095	0.099	0.122	0.272	0.071	0.082
179	797	0.075	0.115	0.117	0.129	0.097	0.102	0.124	0.279	0.071	0.082
180	800	0.077	0.117	0.119	0.132	0.100	0.104	0.127	0.282	0.072	0.082
177	789	0.081	0.123	0.125	0.139	0.105	0.112	0.135	0.294	0.073	0.083
175	777	0.084	0.130	0.132	0.148	0.115	0.120	0.144	0.314	0.075	0.083
173	768	0.090	0.142	0.145	0.163	0.129	0.132	0.160	0.328	0.077	0.083
173	769	0.095	0.151	0.155	0.173	0.140	0.141	0.170	0.341	0.077	0.083
173	769	0.098	0.156	0.162	0.179	0.146	0.147	0.176	0.349	0.078	0.083
173	769	0.100	0.160	0.167	0.184	0.151	0.151	0.181	0.356	0.078	0.082
173	770	0.103	0.164	0.171	0.188	0.156	0.156	0.186	0.362	0.079	0.083
173	769	0.105	0.168	0.177	0.193	0.160	0.161	0.191	0.370	0.079	0.082
173	768	0.107	0.171	0.180	0.196	0.163	0.164	0.194	0.373	0.080	0.082
173	772	0.110	0.177	0.186	0.203	0.171	0.171	0.201	0.382	0.081	0.082
173	771	0.114	0.182	0.193	0.209	0.177	0.177	0.207	0.392	0.082	0.082
173	770	0.117	0.187	0.197	0.214	0.181	0.181	0.212	0.397	0.083	0.082
173	768	0.120	0.191	0.202	0.219	0.185	0.185	0.216	0.405	0.084	0.082

Table A.36 Measurement of Tendon Slippage of 5SB12T-1.6-10-ND (Continued)

Load Cell		T1	T2	T3	T4	T5	T6	T7	T8	T9	T10
kips	kN	in	in	in	in	in	in	in	in	in	in
173	769	0.124	0.198	0.209	0.226	0.193	0.193	0.224	0.418	0.085	0.082
173	769	0.128	0.204	0.215	0.231	0.199	0.199	0.230	0.425	0.086	0.082
173	769	0.133	0.211	0.223	0.238	0.206	0.206	0.237	0.432	0.086	0.082
173	770	0.136	0.215	0.227	0.243	0.210	0.211	0.242	0.438	0.087	0.082
169	753	0.136	0.216	0.228	0.243	0.212	0.212	0.242	0.438	0.087	0.082
173	769	0.136	0.216	0.228	0.244	0.212	0.212	0.243	0.439	0.086	0.082
169	753	0.137	0.217	0.229	0.245	0.213	0.213	0.243	0.440	0.087	0.083
171	760	0.137	0.218	0.229	0.245	0.213	0.214	0.244	0.441	0.087	0.082
166	737	0.143	0.225	0.235	0.250	0.216	0.216	0.245	0.450	0.087	0.082
165	736	0.146	0.230	0.241	0.254	0.222	0.222	0.247	0.451	0.087	0.082
166	738	0.146	0.230	0.241	0.254	0.222	0.222	0.247	0.452	0.087	0.082
167	741	0.150	0.235	0.247	0.259	0.227	0.228	0.251	0.457	0.087	0.082
167	743	0.156	0.245	0.256	0.268	0.236	0.237	0.258	0.463	0.087	0.082
168	746	0.161	0.251	0.263	0.273	0.242	0.243	0.263	0.470	0.088	0.082
168	747	0.166	0.257	0.270	0.279	0.248	0.249	0.269	0.477	0.088	0.082
168	745	0.176	0.273	0.286	0.292	0.262	0.263	0.283	0.497	0.091	0.082
168	745	0.180	0.280	0.293	0.298	0.269	0.269	0.288	0.504	0.092	0.082
167	744	0.181	0.280	0.293	0.298	0.269	0.269	0.288	0.504	0.092	0.082
167	743	0.181	0.281	0.295	0.298	0.270	0.270	0.288	0.505	0.092	0.082

Table A.37 Measurement of Strain Gauges of 5SB12T-1.6-10-ND

Load Cell		N1	N2	N3	N4	N11	N12	N13	N14
kips	kN	m/m	m/m	m/m	m/m	m/m	m/m	m/m	m/m
0	0	0.00	B.G.	B.G.	B.G.	0.00	0.00	0.00	0.00
31	137	-9.78	B.G.	B.G.	B.G.	15.70	-16.15	17.29	22.07
61	270	-18.88	B.G.	B.G.	B.G.	31.39	-30.03	34.35	45.50
90	400	-30.71	B.G.	B.G.	B.G.	47.55	-48.00	52.10	74.39
121	536	-42.31	B.G.	B.G.	B.G.	66.20	-62.79	72.11	104.65
130	576	-44.13	B.G.	B.G.	B.G.	51.64	-58.24	56.42	114.65
140	625	-48.23	B.G.	B.G.	B.G.	60.06	-66.43	65.06	125.57
150	667	-55.28	B.G.	B.G.	B.G.	71.43	-75.53	77.57	141.73
160	710	-63.47	B.G.	B.G.	B.G.	82.81	-85.76	91.22	135.36
171	759	-73.02	B.G.	B.G.	B.G.	111.24	-121.71	118.98	113.74
171	760	-72.80	B.G.	B.G.	B.G.	113.74	-123.53	121.71	113.52
169	753	-73.93	B.G.	B.G.	B.G.	117.16	-125.35	125.80	114.88
170	754	-74.62	B.G.	B.G.	B.G.	119.89	-126.94	128.76	113.74
172	764	-74.39	B.G.	B.G.	B.G.	131.49	-137.18	141.27	114.65
174	773	-77.80	B.G.	B.G.	B.G.	125.57	-141.27	134.22	110.79
166	737	-69.16	B.G.	B.G.	B.G.	112.61	-118.52	119.89	97.37
166	738	-68.93	B.G.	B.G.	B.G.	112.61	-118.29	119.89	96.91
172	763	-73.02	B.G.	B.G.	B.G.	133.54	-161.06	138.09	103.28
173	767	-70.52	B.G.	B.G.	B.G.	145.14	-180.40	146.96	99.64
174	774	-69.61	B.G.	B.G.	B.G.	164.47	-229.99	161.97	98.28
171	761	-70.52	B.G.	B.G.	B.G.	173.35	-256.61	169.25	97.14
174	773	-71.66	B.G.	B.G.	B.G.	155.83	-221.35	154.69	99.41

Table A.37 Measurement of Strain Gauges of 5SB12T-1.6-10-ND (Continued)

Load Cell		N1	N2	N3	N4	N11	N12	N13	N14
kips	kN	m/m	m/m	m/m	m/m	m/m	m/m	m/m	m/m
175	778	-67.34	B.G.	B.G.	B.G.	175.39	-263.20	170.39	102.14
175	778	-66.20	B.G.	B.G.	B.G.	179.49	-265.25	173.35	98.28
167	744	-78.26	B.G.	B.G.	B.G.	184.04	-268.89	177.67	108.51
160	710	272.99	B.G.	B.G.	B.G.	244.10	-175.85	227.03	104.65
157	700	370.12	B.G.	B.G.	B.G.	260.25	-128.08	240.00	102.37
155	688	475.00	B.G.	B.G.	B.G.	240.23	-2.05	222.26	92.82
154	686	484.55	B.G.	B.G.	B.G.	232.95	19.11	215.89	91.45
158	701	486.14	B.G.	B.G.	B.G.	238.41	8.19	220.66	96.46
160	713	491.60	B.G.	B.G.	B.G.	269.35	-11.38	246.14	94.41
163	727	501.16	B.G.	B.G.	B.G.	293.92	-74.62	265.93	104.42
165	733	515.49	B.G.	B.G.	B.G.	282.54	-96.00	257.29	103.05
167	744	517.99	B.G.	B.G.	B.G.	319.62	-141.04	289.37	156.51
168	746	516.63	B.G.	B.G.	B.G.	318.26	-86.90	289.59	178.58
172	764	517.76	B.G.	B.G.	B.G.	395.83	-123.53	362.62	234.09
174	772	515.03	B.G.	B.G.	B.G.	449.97	-98.28	387.87	302.33
175	777	515.26	B.G.	B.G.	B.G.	453.16	-24.57	387.87	317.12
177	787	516.63	B.G.	B.G.	B.G.	450.43	-43.22	387.87	348.97
179	794	518.45	B.G.	B.G.	B.G.	450.43	-17.29	387.87	369.67
180	800	524.13	B.G.	B.G.	B.G.	450.43	-22.29	387.87	384.46
182	810	525.95	B.G.	B.G.	B.G.	450.43	-15.47	387.87	415.17
183	814	528.46	B.G.	B.G.	B.G.	450.43	-37.99	387.87	444.97
185	821	546.20	B.G.	B.G.	B.G.	450.43	-9.10	387.87	452.47

Table A.37 Measurement of Strain Gauges of 5SB12T-1.6-10-ND (Continued)

Load Cell		N1	N2	N3	N4	N11	N12	N13	N14
kips	kN	m/m	m/m	m/m	m/m	m/m	m/m	m/m	m/m
185	823	550.52	B.G.	B.G.	B.G.	450.43	-11.60	387.87	471.36
187	831	564.85	B.G.	B.G.	B.G.	450.43	-20.02	387.87	497.29
187	832	792.80	B.G.	B.G.	B.G.	450.43	-19.34	387.87	507.07
187	832	1147.91	B.G.	B.G.	B.G.	450.43	-18.43	387.87	513.21
179	797	1176.80	B.G.	B.G.	B.G.	450.43	274.35	387.87	353.29
179	797	1195.22	B.G.	B.G.	B.G.	450.43	340.32	387.87	295.28
179	796	1189.54	B.G.	B.G.	B.G.	450.43	362.62	387.87	280.95
179	797	1191.36	B.G.	B.G.	B.G.	450.43	347.60	387.87	281.18
180	800	1192.49	B.G.	B.G.	B.G.	448.15	351.24	387.87	283.91
177	789	1200.46	B.G.	B.G.	B.G.	409.25	408.11	365.80	233.63
175	777	1230.26	B.G.	B.G.	B.G.	520.72	504.57	257.06	154.01
173	768	1277.35	B.G.	B.G.	B.G.	661.54	665.40	114.65	31.17
173	769	1292.36	B.G.	B.G.	B.G.	698.62	684.74	73.25	-20.02
173	769	1291.91	B.G.	B.G.	B.G.	709.31	717.27	63.47	-25.48
173	769	1289.63	B.G.	B.G.	B.G.	727.28	711.81	43.00	-47.77
173	770	1289.86	B.G.	B.G.	B.G.	730.24	722.28	40.04	-50.73
173	769	1288.72	B.G.	B.G.	B.G.	732.51	736.15	37.76	-52.32
173	768	1289.18	B.G.	B.G.	B.G.	753.67	744.11	19.79	-54.14
173	772	1286.90	B.G.	B.G.	B.G.	770.96	756.85	4.55	-55.28
173	771	1288.04	B.G.	B.G.	B.G.	773.69	733.19	-31.85	-80.30
173	770	1288.72	B.G.	B.G.	B.G.	773.69	746.39	-31.85	-84.17
173	768	1291.22	B.G.	B.G.	B.G.	790.52	755.03	-46.41	-84.63

Table A.37 Measurement of Strain Gauges of 5SB12T-1.6-10-ND (Continued)

Load Cell		N1	N2	N3	N4	N11	N12	N13	N14
kips	kN	m/m	m/m	m/m	m/m	m/m	m/m	m/m	m/m
173	769	1297.37	B.G.	B.G.	B.G.	803.26	754.58	-57.55	-86.22
173	769	1307.60	B.G.	B.G.	B.G.	815.77	763.45	-68.25	-88.27
173	769	1331.49	B.G.	B.G.	B.G.	835.34	760.72	-90.54	-110.56
173	770	1338.31	B.G.	B.G.	B.G.	848.08	780.74	-101.01	-111.01
169	753	1339.45	B.G.	B.G.	B.G.	848.30	778.46	-101.23	-110.79
173	769	1340.82	B.G.	B.G.	B.G.	848.99	780.28	-102.14	-111.70
169	753	1341.95	B.G.	B.G.	B.G.	860.82	799.39	-111.92	-112.61
171	760	1342.64	B.G.	B.G.	B.G.	860.59	800.99	-111.92	-112.61
166	737	1306.92	B.G.	B.G.	B.G.	977.29	684.97	-228.40	-4.55
165	736	1332.85	B.G.	B.G.	B.G.	979.34	675.87	-229.76	0.00
166	738	1333.08	B.G.	B.G.	B.G.	979.34	675.87	-229.99	-0.23
167	741	1327.17	B.G.	B.G.	B.G.	990.48	657.90	-239.09	2.28
167	743	1326.03	B.G.	B.G.	B.G.	992.99	643.79	-241.37	4.55
168	746	1329.44	B.G.	B.G.	B.G.	1001.63	658.12	-248.87	4.78
168	747	1332.63	B.G.	B.G.	B.G.	1006.18	666.54	-253.19	5.23
168	745	1372.89	B.G.	B.G.	B.G.	1036.89	735.24	-279.58	3.64
168	745	1390.64	B.G.	B.G.	B.G.	1035.53	729.33	-278.45	3.19
167	744	1391.55	B.G.	B.G.	B.G.	1035.30	728.87	-278.22	3.19
167	743	1392.91	B.G.	B.G.	B.G.	1037.12	724.55	-280.27	5.23

A.14 5SB12M-1.2-10-ND

Table A.38 Measurement of Load and Deflection Relationships of 5SB12M-1.2-10-ND

SW.LC		SE. LC		TRF		Mid. Def.		SW. Def.		SE. Def.		SW. Sett.		SE. Sett.		Net Def.	
kips	kN	kips	kN	kips	kN	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
0	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
30	135	33	148	63	282	0.05	1.28	0.05	1.28	0.05	1.28	0.03	0.73	0.03	0.73	0.02	0.55
43	193	47	208	90	401	0.07	1.74	0.07	1.74	0.07	1.74	0.04	0.95	0.04	0.95	0.03	0.79
59	260	61	273	120	533	0.09	2.23	0.09	2.23	0.09	2.23	0.04	1.11	0.04	1.11	0.04	1.12
64	283	66	294	130	577	0.09	2.41	0.09	2.41	0.09	2.41	0.05	1.16	0.05	1.16	0.05	1.25
69	306	71	316	140	622	0.10	2.64	0.10	2.64	0.10	2.64	0.05	1.17	0.05	1.17	0.06	1.47
73	323	74	331	147	654	0.11	2.82	0.11	2.82	0.11	2.82	0.05	1.17	0.05	1.17	0.07	1.66
75	333	77	341	152	674	0.12	3.08	0.12	3.08	0.12	3.08	0.05	1.17	0.05	1.17	0.08	1.91
77	343	79	352	156	695	0.13	3.33	0.13	3.33	0.13	3.33	0.05	1.17	0.05	1.17	0.09	2.16
80	356	82	365	162	721	0.14	3.60	0.14	3.60	0.14	3.60	0.05	1.17	0.05	1.17	0.10	2.43
81	359	83	370	164	728	0.15	3.87	0.15	3.87	0.15	3.87	0.05	1.17	0.05	1.17	0.11	2.71
83	370	86	382	169	752	0.16	4.15	0.16	4.15	0.16	4.15	0.05	1.17	0.05	1.17	0.12	2.98
84	376	87	386	171	762	0.17	4.34	0.17	4.34	0.17	4.34	0.05	1.17	0.05	1.17	0.13	3.18
89	396	91	405	180	802	0.19	4.83	0.19	4.83	0.19	4.83	0.05	1.17	0.05	1.17	0.14	3.66
91	406	93	415	185	821	0.20	5.10	0.20	5.10	0.20	5.10	0.05	1.17	0.05	1.17	0.15	3.93
91	406	93	415	185	822	0.20	5.11	0.20	5.11	0.20	5.11	0.05	1.17	0.05	1.17	0.16	3.94
91	405	92	409	183	814	0.21	5.35	0.21	5.35	0.21	5.35	0.05	1.17	0.05	1.17	0.16	4.18
93	414	93	416	186	830	0.22	5.61	0.22	5.61	0.22	5.61	0.05	1.17	0.05	1.17	0.17	4.44
95	421	94	420	189	841	0.23	5.86	0.23	5.86	0.23	5.86	0.05	1.17	0.05	1.17	0.18	4.70

Table A.38 Measurement of Load and Deflection Relationships of 5SB12M-1.2-10-ND (Continued)

SW.LC		SE. LC		TRF		Mid. Def.		SW. Def.		SE. Def.		SW. Sett.		SE. Sett.		Net Def.	
kips	kN	kips	kN	kips	kN	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
95	420	94	420	189	840	0.23	5.87	0.23	5.87	0.23	5.87	0.05	1.17	0.05	1.17	0.19	4.70
91	406	93	412	184	819	0.24	6.14	0.24	6.14	0.24	6.14	0.05	1.17	0.05	1.17	0.20	4.97
92	411	95	422	187	834	0.26	6.62	0.26	6.62	0.26	6.62	0.05	1.17	0.05	1.17	0.21	5.46
93	412	95	422	188	834	0.26	6.64	0.26	6.64	0.26	6.64	0.05	1.17	0.05	1.17	0.22	5.47
94	419	96	427	190	846	0.28	7.13	0.28	7.13	0.28	7.13	0.05	1.17	0.05	1.17	0.23	5.96
94	419	96	427	190	846	0.28	7.14	0.28	7.14	0.28	7.14	0.05	1.17	0.05	1.17	0.24	5.97
95	423	98	434	193	857	0.30	7.66	0.30	7.66	0.30	7.66	0.05	1.17	0.05	1.17	0.26	6.49
92	411	97	432	189	843	0.31	7.91	0.31	7.91	0.31	7.91	0.05	1.17	0.05	1.17	0.27	6.74
93	412	98	437	191	850	0.32	8.16	0.32	8.16	0.32	8.16	0.05	1.17	0.05	1.17	0.28	6.99
92	410	99	441	191	850	0.34	8.66	0.34	8.66	0.34	8.66	0.05	1.17	0.05	1.17	0.29	7.49
92	411	99	441	192	853	0.34	8.67	0.34	8.67	0.34	8.67	0.05	1.17	0.05	1.17	0.30	7.50
93	414	100	445	193	858	0.35	8.94	0.35	8.94	0.35	8.94	0.05	1.17	0.05	1.17	0.31	7.77
89	398	99	439	188	836	0.36	9.03	0.36	9.03	0.36	9.03	0.05	1.17	0.05	1.17	0.31	7.86
90	400	100	445	190	844	0.36	9.17	0.36	9.17	0.36	9.17	0.05	1.17	0.05	1.17	0.32	8.00
92	410	102	456	195	866	0.39	9.98	0.39	9.98	0.39	9.98	0.05	1.17	0.05	1.17	0.35	8.81
93	413	103	457	196	870	0.42	10.60	0.42	10.60	0.42	10.60	0.05	1.17	0.05	1.17	0.37	9.43
93	412	103	457	195	869	0.42	10.68	0.42	10.68	0.42	10.68	0.05	1.17	0.05	1.17	0.37	9.51
90	402	102	453	192	855	0.42	10.78	0.42	10.78	0.42	10.78	0.05	1.17	0.05	1.17	0.38	9.61
85	380	100	445	185	825	0.43	10.81	0.43	10.81	0.43	10.81	0.05	1.17	0.05	1.17	0.38	9.64
83	370	100	445	183	815	0.43	10.92	0.43	10.92	0.43	10.92	0.05	1.17	0.05	1.17	0.38	9.76
83	368	101	451	184	819	0.44	11.19	0.44	11.19	0.44	11.19	0.05	1.17	0.05	1.17	0.39	10.02
81	360	102	453	183	812	0.45	11.45	0.45	11.45	0.45	11.45	0.05	1.17	0.05	1.17	0.40	10.28

Table A.38 Measurement of Load and Deflection Relationships of 5SB12M-1.2-10-ND (Continued)

SW.LC		SE. LC		TRF		Mid. Def.		SW. Def.		SE. Def.		SW. Sett.		SE. Sett.		Net Def.	
kips	kN	kips	kN	kips	kN	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
81	362	103	459	185	821	0.46	11.77	0.46	11.77	0.46	11.77	0.05	1.17	0.05	1.17	0.42	10.60
80	356	103	460	183	816	0.47	11.99	0.47	11.99	0.47	11.99	0.05	1.17	0.05	1.17	0.43	10.82
80	355	105	468	185	823	0.50	12.73	0.50	12.73	0.50	12.73	0.05	1.17	0.05	1.17	0.46	11.56
78	349	105	465	183	814	0.51	12.94	0.51	12.94	0.51	12.94	0.05	1.17	0.05	1.17	0.46	11.77
79	352	106	469	185	821	0.52	13.11	0.52	13.11	0.52	13.11	0.05	1.17	0.05	1.17	0.47	11.94
79	352	106	471	185	823	0.54	13.74	0.54	13.74	0.54	13.74	0.05	1.17	0.05	1.17	0.49	12.57
79	353	106	471	185	823	0.55	13.99	0.55	13.99	0.55	13.99	0.05	1.17	0.05	1.17	0.50	12.82
78	346	101	450	179	796	0.55	14.05	0.55	14.05	0.55	14.05	0.05	1.17	0.05	1.17	0.51	12.88
81	358	100	445	181	803	0.58	14.69	0.58	14.69	0.58	14.69	0.05	1.17	0.05	1.17	0.53	13.52
77	343	99	439	176	782	0.58	14.71	0.58	14.71	0.58	14.71	0.05	1.17	0.05	1.17	0.53	13.54
78	348	100	446	179	794	0.59	15.03	0.59	15.03	0.59	15.03	0.05	1.17	0.05	1.17	0.55	13.86
79	349	100	444	178	793	0.61	15.37	0.61	15.37	0.61	15.37	0.05	1.17	0.05	1.17	0.56	14.20
78	346	98	436	176	783	0.61	15.44	0.61	15.44	0.61	15.44	0.05	1.17	0.05	1.17	0.56	14.27
77	342	95	424	172	766	0.61	15.47	0.61	15.47	0.61	15.47	0.05	1.17	0.05	1.17	0.56	14.30
78	349	93	412	171	761	0.62	15.83	0.62	15.83	0.62	15.83	0.05	1.17	0.05	1.17	0.58	14.66
79	352	92	410	171	762	0.63	16.12	0.63	16.12	0.63	16.12	0.05	1.17	0.05	1.17	0.59	14.95
80	356	92	408	172	764	0.65	16.52	0.65	16.52	0.65	16.52	0.05	1.17	0.05	1.17	0.60	15.35
79	351	90	402	169	752	0.66	16.71	0.66	16.71	0.66	16.71	0.05	1.17	0.05	1.17	0.61	15.54
78	348	89	398	168	746	0.66	16.74	0.66	16.74	0.66	16.74	0.05	1.17	0.05	1.17	0.61	15.57
78	347	89	397	167	744	0.66	16.77	0.66	16.77	0.66	16.77	0.05	1.17	0.05	1.17	0.61	15.60
79	353	88	390	167	743	0.68	17.23	0.68	17.23	0.68	17.23	0.05	1.17	0.05	1.17	0.63	16.06
79	352	87	389	167	741	0.68	17.25	0.68	17.25	0.68	17.25	0.05	1.17	0.05	1.17	0.63	16.08

Table A.38 Measurement of Load and Deflection Relationships of 5SB12M-1.2-10-ND (Continued)

SW.LC		SE. LC		TRF		Mid. Def.		SW. Def.		SE. Def.		SW. Sett.		SE. Sett.		Net Def.	
kips	kN	kips	kN	kips	kN	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
79	351	87	389	166	740	0.68	17.27	0.68	17.27	0.68	17.27	0.05	1.17	0.05	1.17	0.63	16.10
79	352	87	388	166	740	0.68	17.29	0.68	17.29	0.68	17.29	0.05	1.17	0.05	1.17	0.63	16.12
79	352	87	388	166	740	0.68	17.32	0.68	17.32	0.68	17.32	0.05	1.17	0.05	1.17	0.64	16.15
79	352	87	387	166	739	0.68	17.33	0.68	17.33	0.68	17.33	0.05	1.17	0.05	1.17	0.64	16.16
79	351	87	388	166	739	0.68	17.36	0.68	17.36	0.68	17.36	0.05	1.17	0.05	1.17	0.64	16.19
79	353	87	388	166	740	0.68	17.38	0.68	17.38	0.68	17.38	0.05	1.17	0.05	1.17	0.64	16.21
79	353	87	386	166	740	0.69	17.40	0.69	17.40	0.69	17.40	0.05	1.17	0.05	1.17	0.64	16.23
79	353	87	387	166	739	0.69	17.42	0.69	17.42	0.69	17.42	0.05	1.17	0.05	1.17	0.64	16.25
79	352	87	386	166	739	0.69	17.46	0.69	17.46	0.69	17.46	0.05	1.17	0.05	1.17	0.64	16.29
79	350	87	386	165	736	0.69	17.48	0.69	17.48	0.69	17.48	0.05	1.17	0.05	1.17	0.64	16.31
79	350	87	386	165	736	0.69	17.50	0.69	17.50	0.69	17.50	0.05	1.17	0.05	1.17	0.64	16.33
78	349	87	385	165	734	0.69	17.53	0.69	17.53	0.69	17.53	0.05	1.17	0.05	1.17	0.64	16.36
78	349	87	385	165	734	0.69	17.55	0.69	17.55	0.69	17.55	0.05	1.17	0.05	1.17	0.64	16.38
79	350	87	385	165	735	0.69	17.57	0.69	17.57	0.69	17.57	0.05	1.17	0.05	1.17	0.65	16.40
79	350	86	384	165	734	0.69	17.60	0.69	17.60	0.69	17.60	0.05	1.17	0.05	1.17	0.65	16.43
78	349	86	384	165	733	0.69	17.61	0.69	17.61	0.69	17.61	0.05	1.17	0.05	1.17	0.65	16.45
78	349	87	385	165	734	0.69	17.64	0.69	17.64	0.69	17.64	0.05	1.17	0.05	1.17	0.65	16.47
79	350	86	385	165	735	0.70	17.66	0.70	17.66	0.70	17.66	0.05	1.17	0.05	1.17	0.65	16.49
79	351	87	385	165	736	0.70	17.68	0.70	17.68	0.70	17.68	0.05	1.17	0.05	1.17	0.65	16.51
79	350	87	385	165	735	0.70	17.70	0.70	17.70	0.70	17.70	0.05	1.17	0.05	1.17	0.65	16.53
79	350	86	385	165	735	0.70	17.72	0.70	17.72	0.70	17.72	0.05	1.17	0.05	1.17	0.65	16.55

Table A.39 Measurement of Rosette LVDTs of 5SB12M-1.2-10-ND

TRF		SWD1	SWD2	SWV1	SWV2	SWH1	SWH2	SED1	SED2	SEV1	SEV2	SEH1	SEH2
kips	kN	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in
0	0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
63	282	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
90	401	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
120	533	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
130	577	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
140	622	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
147	654	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
152	674	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
156	695	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
162	721	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
164	728	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
169	752	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
171	762	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
180	802	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
185	821	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
185	822	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
183	814	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
186	830	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
189	841	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
189	840	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
184	819	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
187	834	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Table A.39 Measurement of Rosette LVDTs of 5SB12M-1.2-10-ND (Continued)

TRF		SWD1	SWD2	SWV1	SWV2	SWH1	SWH2	SED1	SED2	SEV1	SEV2	SEH1	SEH2
kips	kN	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in
188	834	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
190	846	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
190	846	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
193	857	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
189	843	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
191	850	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
191	850	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
192	853	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
193	858	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
188	836	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
190	844	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
195	866	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
196	870	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
195	869	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
192	855	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
185	825	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
183	815	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
184	819	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
183	812	0.000	0.001	0.000	0.001	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000
185	821	0.000	0.001	0.000	0.001	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000
183	816	0.000	0.001	0.000	0.001	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000
185	823	0.000	0.001	0.000	0.001	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000

Table A.39 Measurement of Rosette LVDTs of 5SB12M-1.2-10-ND (Continued)

TRF		SWD1	SWD2	SWV1	SWV2	SWH1	SWH2	SED1	SED2	SEV1	SEV2	SEH1	SEH2
kips	kN	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in
183	814	0.000	0.001	0.000	0.001	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000
185	821	0.000	0.001	0.000	0.001	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000
185	823	0.000	0.001	0.000	0.001	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000
185	823	0.000	0.001	0.000	0.001	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000
179	796	0.000	0.001	0.000	0.001	0.000	0.001	0.000	0.003	0.000	0.003	0.000	0.001
181	803	0.000	0.001	0.000	0.001	0.000	0.001	0.000	0.007	0.000	0.006	0.000	0.004
176	782	0.000	0.001	0.000	0.001	0.000	0.001	0.000	0.007	0.000	0.006	0.000	0.004
179	794	0.000	0.001	0.000	0.001	0.000	0.001	0.000	0.008	0.000	0.007	0.000	0.005
178	793	0.000	0.001	0.000	0.001	0.000	0.001	0.000	0.009	0.000	0.009	0.000	0.005
176	783	0.000	0.001	0.000	0.001	0.000	0.001	0.000	0.010	0.000	0.009	0.000	0.005
172	766	0.000	0.001	0.000	0.001	0.000	0.001	0.000	0.011	0.000	0.011	0.000	0.005
171	761	0.000	0.001	0.000	0.001	0.000	0.001	0.000	0.015	0.000	0.016	0.000	0.006
171	762	0.000	0.001	0.000	0.001	0.000	0.001	0.000	0.017	0.000	0.019	0.000	0.007
172	764	0.000	0.001	0.000	0.002	0.000	0.001	0.000	0.019	0.000	0.023	0.000	0.007
169	752	0.000	0.002	0.000	0.002	0.000	0.001	0.000	0.019	0.000	0.024	-0.001	0.007
168	746	0.000	0.002	0.000	0.002	0.000	0.001	0.000	0.019	0.000	0.024	-0.001	0.007
167	744	0.000	0.002	0.000	0.002	0.000	0.001	0.000	0.020	0.000	0.024	-0.001	0.007
167	743	0.000	0.002	0.000	0.002	0.000	0.001	0.000	0.022	0.000	0.028	-0.001	0.007
167	741	0.000	0.002	0.000	0.002	0.000	0.001	0.000	0.023	0.000	0.028	-0.001	0.007
166	740	0.000	0.002	0.000	0.002	0.000	0.001	0.000	0.023	0.000	0.028	-0.001	0.007
166	740	0.000	0.002	0.000	0.002	0.000	0.001	0.000	0.023	0.000	0.029	-0.001	0.007
166	740	0.000	0.002	0.000	0.002	0.000	0.001	0.000	0.023	0.000	0.029	-0.001	0.007

Table A.39 Measurement of Rosette LVDTs of 5SB12M-1.2-10-ND (Continued)

TRF		SWD1	SWD2	SWV1	SWV2	SWH1	SWH2	SED1	SED2	SEV1	SEV2	SEH1	SEH2
kips	kN	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in
166	739	0.000	0.002	0.000	0.002	0.000	0.001	0.000	0.023	0.000	0.029	-0.001	0.007
166	739	0.000	0.002	0.000	0.002	0.000	0.001	0.000	0.023	0.000	0.029	-0.001	0.007
166	740	0.000	0.002	0.000	0.002	0.000	0.001	0.000	0.023	0.000	0.029	-0.001	0.007
166	740	0.000	0.002	0.000	0.002	0.000	0.001	0.000	0.024	0.000	0.029	-0.001	0.007
166	739	0.000	0.002	0.000	0.002	0.000	0.001	0.000	0.024	0.000	0.030	-0.001	0.007
166	739	0.000	0.002	0.000	0.002	0.000	0.001	0.000	0.024	0.000	0.030	-0.001	0.008
165	736	0.000	0.002	0.000	0.002	0.000	0.001	-0.001	0.024	0.000	0.030	-0.001	0.008
165	736	0.000	0.002	0.000	0.002	0.000	0.001	-0.001	0.024	0.000	0.030	-0.001	0.008
165	734	0.000	0.002	0.000	0.002	0.000	0.001	-0.001	0.024	0.000	0.030	-0.001	0.008
165	734	0.000	0.002	0.000	0.002	0.000	0.001	-0.001	0.025	0.000	0.031	0.000	0.008
165	735	0.000	0.002	0.000	0.002	0.000	0.001	-0.001	0.025	0.000	0.031	0.000	0.008
165	734	0.000	0.002	0.000	0.002	0.000	0.001	-0.001	0.025	0.000	0.031	0.000	0.008
165	733	0.000	0.002	0.000	0.002	0.000	0.001	-0.001	0.025	0.000	0.031	0.000	0.008
165	734	0.000	0.002	0.000	0.002	0.000	0.001	-0.001	0.025	0.000	0.031	0.000	0.008
165	735	0.000	0.002	0.000	0.002	0.000	0.001	-0.001	0.025	0.000	0.031	0.000	0.008
165	736	0.000	0.002	0.000	0.002	0.000	0.001	-0.001	0.025	0.000	0.031	0.000	0.008
165	735	0.000	0.002	0.000	0.002	0.000	0.001	-0.001	0.025	0.000	0.031	0.000	0.008
165	735	0.000	0.002	0.000	0.002	0.000	0.001	-0.001	0.025	0.000	0.031	0.000	0.008

Table A.40 Measurement of Tendon Slippage of 5SB12M-1.2-10-ND

TRF		T1	T2	T3	T4	T5	T6	T7	T8	T9	T10
kips	kN	in	in	in	in	in	in	in	in	in	in
0	0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
63	282	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000
90	401	0.000	0.000	0.000	0.000	0.009	0.010	0.001	0.000	0.000	0.000
120	533	0.000	0.000	0.000	0.005	0.022	0.025	0.008	0.000	0.000	0.000
130	577	0.000	0.000	0.000	0.008	0.027	0.031	0.015	0.000	0.000	0.000
140	622	0.000	0.000	0.000	0.011	0.031	0.036	0.026	0.000	0.000	0.000
147	654	0.000	0.000	0.000	0.016	0.036	0.041	0.030	0.000	0.000	0.000
152	674	0.000	0.000	0.000	0.028	0.042	0.046	0.035	0.000	0.000	0.000
156	695	0.000	0.000	0.000	0.037	0.046	0.050	0.039	0.000	0.000	0.000
162	721	0.000	0.000	0.000	0.046	0.050	0.053	0.043	0.000	0.000	0.000
164	728	0.000	0.000	0.000	0.051	0.053	0.056	0.046	0.000	0.000	0.000
169	752	0.000	0.000	0.000	0.055	0.057	0.058	0.048	0.001	0.000	0.000
171	762	0.000	0.000	0.001	0.057	0.059	0.060	0.050	0.002	0.000	0.000
180	802	0.000	0.000	0.004	0.063	0.065	0.066	0.055	0.010	0.000	0.000
185	821	0.000	0.000	0.006	0.066	0.069	0.069	0.058	0.012	0.000	0.000
185	822	0.000	0.000	0.006	0.066	0.069	0.069	0.058	0.012	0.000	0.000
183	814	0.000	0.000	0.009	0.068	0.071	0.072	0.062	0.035	0.000	0.000
186	830	0.000	0.000	0.012	0.070	0.074	0.074	0.065	0.048	0.000	0.000
189	841	0.000	0.000	0.014	0.072	0.076	0.077	0.067	0.066	0.000	0.000
189	840	0.000	0.000	0.014	0.072	0.076	0.077	0.067	0.066	0.000	0.000
184	819	0.000	0.000	0.034	0.076	0.079	0.080	0.070	0.077	0.000	0.000
187	834	0.000	0.000	0.062	0.081	0.085	0.085	0.075	0.087	0.000	0.000

Table A.40 Measurement of Tendon Slippage of 5SB12M-1.2-10-ND (Continued)

TRF		T1	T2	T3	T4	T5	T6	T7	T8	T9	T10
kips	kN	in	in	in	in	in	in	in	in	in	in
188	834	0.000	0.000	0.062	0.082	0.085	0.085	0.076	0.087	0.000	0.000
190	846	0.000	0.000	0.074	0.086	0.089	0.089	0.080	0.103	0.000	0.000
190	846	0.000	0.000	0.074	0.086	0.089	0.089	0.081	0.105	0.000	0.000
193	857	0.000	0.000	0.091	0.091	0.094	0.095	0.087	0.115	0.000	0.000
189	843	0.000	0.003	0.118	0.094	0.096	0.096	0.089	0.117	0.000	0.000
191	850	0.000	0.008	0.133	0.097	0.098	0.098	0.090	0.120	0.000	0.000
191	850	0.000	0.027	0.147	0.102	0.104	0.103	0.096	0.127	0.000	0.000
192	853	0.000	0.027	0.148	0.102	0.104	0.103	0.096	0.128	0.000	0.000
193	858	0.000	0.034	0.154	0.105	0.106	0.106	0.099	0.132	0.000	0.000
188	836	0.000	0.048	0.160	0.105	0.106	0.106	0.099	0.132	0.000	0.000
190	844	0.002	0.055	0.162	0.105	0.106	0.106	0.099	0.133	0.000	0.000
195	866	0.006	0.070	0.172	0.111	0.112	0.113	0.106	0.145	0.000	0.000
196	870	0.009	0.078	0.181	0.117	0.121	0.122	0.115	0.156	0.000	0.000
195	869	0.010	0.078	0.181	0.118	0.122	0.122	0.116	0.157	0.000	0.000
192	855	0.011	0.085	0.181	0.118	0.122	0.122	0.116	0.157	0.000	0.000
185	825	0.014	0.098	0.182	0.118	0.122	0.122	0.116	0.157	0.000	0.000
183	815	0.017	0.110	0.184	0.118	0.122	0.122	0.116	0.157	0.000	0.000
184	819	0.022	0.125	0.184	0.118	0.122	0.122	0.116	0.157	0.000	0.000
183	812	0.027	0.145	0.186	0.118	0.122	0.122	0.116	0.158	0.000	0.000
185	821	0.033	0.155	0.187	0.118	0.122	0.122	0.116	0.161	0.000	0.000
183	816	0.038	0.179	0.187	0.118	0.122	0.123	0.116	0.162	0.000	0.000
185	823	0.052	0.229	0.190	0.118	0.122	0.123	0.118	0.169	0.003	0.000

Table A.40 Measurement of Tendon Slippage of 5SB12M-1.2-10-ND (Continued)

TRF		T1	T2	T3	T4	T5	T6	T7	T8	T9	T10
kips	kN	in	in	in	in	in	in	in	in	in	in
183	814	0.130	0.252	0.191	0.118	0.122	0.123	0.118	0.171	0.006	0.000
185	821	0.127	0.258	0.191	0.118	0.122	0.123	0.119	0.172	0.006	0.000
185	823	0.129	0.290	0.193	0.118	0.122	0.126	0.122	0.177	0.014	0.000
185	823	0.130	0.294	0.194	0.118	0.123	0.127	0.123	0.178	0.017	0.000
179	796	0.132	0.294	0.194	0.118	0.124	0.127	0.125	0.179	0.030	0.005
181	803	0.134	0.304	0.195	0.118	0.124	0.127	0.126	0.170	0.046	0.018
176	782	0.076	0.314	0.196	0.118	0.124	0.128	0.125	0.169	0.046	0.018
179	794	0.076	0.325	0.197	0.118	0.124	0.127	0.126	0.169	0.049	0.021
178	793	0.076	0.337	0.198	0.118	0.124	0.127	0.125	0.168	0.054	0.025
176	783	0.076	0.337	0.198	0.118	0.124	0.127	0.126	0.167	0.056	0.027
172	766	0.076	0.337	0.198	0.118	0.124	0.127	0.126	0.166	0.058	0.029
171	761	0.076	0.339	0.199	0.118	0.124	0.128	0.126	0.165	0.070	0.041
171	762	0.076	0.344	0.199	0.118	0.124	0.128	0.126	0.177	0.077	0.048
172	764	0.076	0.351	0.200	0.118	0.124	0.127	0.126	0.180	0.084	0.055
169	752	0.076	0.354	0.200	0.118	0.124	0.127	0.126	0.181	0.088	0.059
168	746	0.076	0.354	0.200	0.118	0.124	0.128	0.126	0.181	0.090	0.060
167	744	0.076	0.354	0.200	0.118	0.124	0.127	0.126	0.182	0.092	0.061
167	743	0.076	0.357	0.201	0.118	0.124	0.128	0.126	0.184	0.105	0.076
167	741	0.076	0.358	0.201	0.118	0.124	0.127	0.126	0.184	0.106	0.077
166	740	0.078	0.358	0.201	0.118	0.124	0.128	0.126	0.184	0.106	0.077
166	740	0.078	0.359	0.202	0.118	0.124	0.128	0.126	0.184	0.108	0.078
166	740	0.078	0.359	0.202	0.118	0.124	0.128	0.126	0.184	0.108	0.078

Table A.40 Measurement of Tendon Slippage of 5SB12M-1.2-10-ND (Continued)

TRF		T1	T2	T3	T4	T5	T6	T7	T8	T9	T10
kips	kN	in	in	in	in	in	in	in	in	in	in
166	739	0.078	0.359	0.202	0.118	0.124	0.128	0.126	0.186	0.109	0.080
166	739	0.079	0.359	0.202	0.118	0.124	0.128	0.126	0.186	0.109	0.080
166	740	0.079	0.360	0.202	0.118	0.124	0.128	0.126	0.186	0.109	0.080
166	740	0.079	0.360	0.202	0.118	0.124	0.128	0.125	0.186	0.111	0.082
166	739	0.079	0.360	0.202	0.118	0.124	0.128	0.126	0.186	0.111	0.082
166	739	0.079	0.360	0.202	0.118	0.124	0.128	0.126	0.187	0.112	0.083
165	736	0.082	0.365	0.202	0.118	0.124	0.128	0.126	0.187	0.112	0.083
165	736	0.082	0.365	0.203	0.118	0.124	0.128	0.126	0.187	0.112	0.083
165	734	0.082	0.365	0.203	0.118	0.124	0.128	0.126	0.187	0.113	0.085
165	734	0.082	0.365	0.203	0.118	0.124	0.128	0.126	0.187	0.113	0.086
165	735	0.082	0.365	0.203	0.118	0.124	0.127	0.126	0.187	0.114	0.086
165	734	0.084	0.366	0.203	0.118	0.124	0.127	0.126	0.187	0.115	0.088
165	733	0.084	0.366	0.203	0.118	0.124	0.128	0.126	0.187	0.115	0.088
165	734	0.084	0.366	0.203	0.118	0.124	0.128	0.126	0.187	0.115	0.088
165	735	0.084	0.366	0.203	0.118	0.124	0.128	0.126	0.187	0.117	0.089
165	736	0.084	0.367	0.203	0.118	0.124	0.128	0.126	0.187	0.117	0.089
165	735	0.084	0.367	0.204	0.118	0.124	0.128	0.126	0.187	0.117	0.091
165	735	0.087	0.367	0.204	0.118	0.124	0.128	0.126	0.188	0.118	0.091

Table A.41 Measurement of Strain Gauges of 5SB12M-1.2-10-ND

TRF		CS1	CS2	NS1
kips	kN	m/m	m/m	m/m
0	0	0.000	0.000	0.000
63	282	5.460	5.005	-5.232
90	401	6.825	6.370	-6.369
120	533	9.100	12.284	-8.189
130	577	11.375	14.559	-7.734
140	622	14.332	8.644	-5.687
147	654	15.469	8.190	-4.777
152	674	15.697	11.829	-4.777
156	695	15.242	14.104	-7.279
162	721	15.697	13.877	-6.597
164	728	13.649	12.967	-7.962
169	752	13.649	5.005	-9.099
171	762	11.830	4.550	-10.464
180	802	11.147	6.142	-11.147
185	821	12.967	5.687	-9.554
185	822	12.967	5.460	-11.147
183	814	12.967	5.915	-10.692
186	830	12.967	5.687	-8.872
189	841	12.967	6.370	-11.374
189	840	12.967	7.052	-8.872
184	819	12.967	7.052	-10.464
187	834	12.967	8.417	-11.602

TRF		CS1	CS2	NS1
kips	kN	m/m	m/m	m/m
188	834	12.967	7.962	-11.147
190	846	12.967	10.464	-12.511
190	846	12.967	11.147	-12.284
193	857	12.967	12.284	-16.151
189	843	12.967	2.275	-16.379
191	850	12.967	2.502	-14.786
191	850	12.967	2.730	-15.014
192	853	12.967	3.185	-15.241
193	858	12.967	5.005	-15.241
188	836	12.967	4.777	-15.241
190	844	12.967	4.777	-16.834
195	866	12.967	6.597	-20.246
196	870	12.967	6.142	-17.061
195	869	12.967	6.825	-17.289
192	855	12.967	7.052	-17.744
185	825	12.967	7.052	-17.061
183	815	12.967	7.052	-17.289
184	819	12.967	7.280	-17.971
183	812	12.967	7.507	-16.606
185	821	12.967	8.872	-16.151
183	816	12.967	9.782	-13.876
185	823	12.967	11.602	-13.876

Table A.41 Measurement of Strain Gauges of 5SB12M-1.2-10-ND (Continued)

TRF		CS1	CS2	NS1
kips	kN	m/m	m/m	m/m
183	814	12.967	11.829	-14.104
185	821	12.967	12.512	-14.786
185	823	12.967	13.649	-10.919
185	823	12.967	14.559	-1.365
179	796	12.967	14.787	53.233
181	803	12.967	15.924	637.650
176	782	12.967	15.924	647.204
179	794	12.967	17.289	761.176
178	793	12.967	18.426	895.394
176	783	12.967	18.881	913.138
172	766	12.967	18.881	1014.370
171	761	12.967	18.881	1528.721
171	762	12.967	18.654	1695.470
172	764	12.967	19.109	1862.446
169	752	12.967	19.791	1934.787
168	746	12.967	19.791	2009.631
167	744	12.967	19.336	2034.655
167	743	12.967	20.246	2409.782
167	741	12.967	20.474	2420.247
166	740	12.967	20.929	2431.849
166	740	12.967	21.384	2442.768
166	740	12.967	20.701	2448.455

TRF		CS1	CS2	NS1
kips	kN	m/m	m/m	m/m
166	739	12.967	20.474	2457.328
166	739	12.967	20.929	2465.517
166	740	12.967	20.701	2471.887
166	740	12.967	21.156	2478.711
166	739	12.967	20.701	2485.309
166	739	12.967	21.156	2498.503
165	736	12.967	20.929	2504.645
165	736	12.967	21.156	2506.237
165	734	12.967	20.929	2509.195
165	734	12.967	21.384	2495.318
165	735	12.967	21.611	2495.091
165	734	12.967	21.839	2496.683
165	733	12.967	21.611	2496.455
165	734	12.967	21.611	2498.275
165	735	12.967	21.839	2499.413
165	736	12.967	21.156	2503.053
165	735	12.967	21.611	2506.237
165	735	12.967	21.384	2508.740

A.15 5SB12M-1.6-10-ND

Table A.42 Measurement of Load and Deflection Relationships of 5SB12M-1.6-10-ND

LC		Mid. Def.		W. Def.		E. Def.		W. Sett.		E. Sett.		Net Def.	
kips	kN	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm
0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
30	132	0.04	1.06	0.04	1.06	0.04	1.06	0.01	0.32	0.05	1.19	0.01	0.30
60	265	0.07	1.82	0.07	1.82	0.07	1.82	0.03	0.64	0.07	1.84	0.02	0.57
90	398	0.10	2.42	0.10	2.42	0.10	2.42	0.03	0.88	0.09	2.28	0.03	0.85
120	534	0.12	2.98	0.12	2.98	0.12	2.98	0.04	1.08	0.10	2.63	0.04	1.12
130	579	0.12	3.16	0.12	3.16	0.12	3.16	0.05	1.15	0.11	2.73	0.05	1.22
140	622	0.13	3.33	0.13	3.33	0.13	3.33	0.05	1.20	0.11	2.83	0.05	1.32
150	666	0.14	3.51	0.14	3.51	0.14	3.51	0.05	1.26	0.12	2.93	0.06	1.42
150	667	0.14	3.52	0.14	3.52	0.14	3.52	0.05	1.26	0.12	2.93	0.06	1.42
150	668	0.14	3.53	0.14	3.53	0.14	3.53	0.05	1.26	0.12	2.94	0.06	1.43
160	711	0.15	3.72	0.15	3.72	0.15	3.72	0.05	1.32	0.12	3.03	0.06	1.54
160	712	0.15	3.73	0.15	3.73	0.15	3.73	0.05	1.32	0.12	3.04	0.06	1.55
170	755	0.16	3.94	0.16	3.94	0.16	3.94	0.05	1.38	0.12	3.14	0.07	1.68
180	799	0.16	4.19	0.16	4.19	0.16	4.19	0.06	1.43	0.13	3.25	0.07	1.85
187	834	0.18	4.50	0.18	4.50	0.18	4.50	0.06	1.47	0.13	3.39	0.08	2.07
186	828	0.19	4.78	0.19	4.78	0.19	4.78	0.06	1.44	0.14	3.64	0.09	2.24
188	835	0.20	4.96	0.20	4.96	0.20	4.96	0.06	1.46	0.15	3.77	0.09	2.35
185	822	0.21	5.39	0.21	5.39	0.21	5.39	0.06	1.63	0.16	4.04	0.10	2.55
190	843	0.23	5.76	0.23	5.76	0.23	5.76	0.07	1.75	0.17	4.28	0.11	2.74

Table A.42 Measurement of Load and Deflection Relationships of 5SB12M-1.6-10-ND (Continued)

LC		Mid. Def.		W. Def.		E. Def.		W. Sett.		E. Sett.		Net Def.	
kips	kN	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm
190	847	0.23	5.93	0.23	5.93	0.23	5.93	0.07	1.79	0.18	4.46	0.11	2.81
186	828	0.25	6.37	0.25	6.37	0.25	6.37	0.07	1.82	0.18	4.53	0.13	3.19
187	830	0.26	6.69	0.26	6.69	0.26	6.69	0.07	1.82	0.18	4.53	0.14	3.51
186	828	0.26	6.71	0.26	6.71	0.26	6.71	0.07	1.82	0.18	4.53	0.14	3.53
184	817	0.27	6.77	0.27	6.77	0.27	6.77	0.07	1.82	0.18	4.53	0.14	3.59
180	802	0.29	7.24	0.29	7.24	0.29	7.24	0.07	1.82	0.18	4.53	0.16	4.06
182	809	0.29	7.43	0.29	7.43	0.29	7.43	0.07	1.82	0.18	4.53	0.17	4.25
182	809	0.30	7.63	0.30	7.63	0.30	7.63	0.07	1.82	0.18	4.53	0.18	4.45
180	801	0.30	7.67	0.30	7.67	0.30	7.67	0.07	1.82	0.18	4.53	0.18	4.49
179	798	0.30	7.70	0.30	7.70	0.30	7.70	0.07	1.82	0.18	4.53	0.18	4.52
177	786	0.32	8.10	0.32	8.10	0.32	8.10	0.07	1.82	0.18	4.53	0.19	4.92
174	775	0.33	8.38	0.33	8.38	0.33	8.38	0.07	1.82	0.18	4.53	0.20	5.20
174	776	0.35	8.88	0.35	8.88	0.35	8.88	0.07	1.82	0.18	4.53	0.22	5.70
175	777	0.37	9.39	0.37	9.39	0.37	9.39	0.07	1.82	0.18	4.53	0.24	6.22
175	778	0.39	9.91	0.39	9.91	0.39	9.91	0.07	1.82	0.18	4.53	0.26	6.73
175	778	0.39	9.92	0.39	9.92	0.39	9.92	0.07	1.82	0.18	4.53	0.27	6.75
173	769	0.41	10.41	0.41	10.41	0.41	10.41	0.07	1.82	0.18	4.53	0.28	7.24
173	769	0.41	10.42	0.41	10.42	0.41	10.42	0.07	1.82	0.18	4.53	0.29	7.25
173	768	0.43	10.91	0.43	10.91	0.43	10.91	0.07	1.82	0.18	4.53	0.30	7.73
172	766	0.43	10.93	0.43	10.93	0.43	10.93	0.07	1.82	0.18	4.53	0.31	7.75
170	758	0.45	11.39	0.45	11.39	0.45	11.39	0.07	1.82	0.18	4.53	0.32	8.22
170	758	0.46	11.68	0.46	11.68	0.46	11.68	0.07	1.82	0.18	4.53	0.33	8.50

Table A.42 Measurement of Load and Deflection Relationships of 5SB12M-1.6-10-ND (Continued)

LC		Mid. Def.		W. Def.		E. Def.		W. Sett.		E. Sett.		Net Def.	
kips	kN	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm
170	757	0.46	11.69	0.46	11.69	0.46	11.69	0.07	1.82	0.18	4.53	0.34	8.51
172	764	0.47	11.94	0.47	11.94	0.47	11.94	0.07	1.82	0.18	4.53	0.35	8.77
172	767	0.49	12.46	0.49	12.46	0.49	12.46	0.07	1.82	0.18	4.53	0.37	9.28
172	767	0.51	12.95	0.51	12.95	0.51	12.95	0.07	1.82	0.18	4.53	0.38	9.77
172	767	0.51	12.97	0.51	12.97	0.51	12.97	0.07	1.82	0.18	4.53	0.39	9.79
172	766	0.53	13.46	0.53	13.46	0.53	13.46	0.07	1.82	0.18	4.53	0.40	10.29
172	767	0.53	13.49	0.53	13.49	0.53	13.49	0.07	1.82	0.18	4.53	0.41	10.31
172	764	0.55	13.94	0.55	13.94	0.55	13.94	0.07	1.82	0.18	4.53	0.42	10.76
171	759	0.55	13.99	0.55	13.99	0.55	13.99	0.07	1.82	0.18	4.53	0.43	10.81
165	736	0.57	14.36	0.57	14.36	0.57	14.36	0.07	1.82	0.18	4.53	0.44	11.19
159	707	0.58	14.73	0.58	14.73	0.58	14.73	0.07	1.82	0.18	4.53	0.45	11.55
158	704	0.58	14.78	0.58	14.78	0.58	14.78	0.07	1.82	0.18	4.53	0.46	11.60
154	684	0.59	15.08	0.59	15.08	0.59	15.08	0.07	1.82	0.18	4.53	0.47	11.90
155	688	0.61	15.52	0.61	15.52	0.61	15.52	0.07	1.82	0.18	4.53	0.49	12.34
155	689	0.63	15.99	0.63	15.99	0.63	15.99	0.07	1.82	0.18	4.53	0.50	12.82
152	678	0.64	16.24	0.64	16.24	0.64	16.24	0.07	1.82	0.18	4.53	0.51	13.06
152	677	0.64	16.25	0.64	16.25	0.64	16.25	0.07	1.82	0.18	4.53	0.51	13.07
152	675	0.64	16.25	0.64	16.25	0.64	16.25	0.07	1.82	0.18	4.53	0.51	13.07
152	674	0.64	16.25	0.64	16.25	0.64	16.25	0.07	1.82	0.18	4.53	0.51	13.08
151	674	0.64	16.26	0.64	16.26	0.64	16.26	0.07	1.82	0.18	4.53	0.51	13.08
151	674	0.64	16.26	0.64	16.26	0.64	16.26	0.07	1.82	0.18	4.53	0.52	13.08
151	673	0.64	16.26	0.64	16.26	0.64	16.26	0.07	1.82	0.18	4.53	0.52	13.08

Table A.42 Measurement of Load and Deflection Relationships of 5SB12M-1.6-10-ND (Continued)

LC		Mid. Def.		W. Def.		E. Def.		W. Sett.		E. Sett.		Net Def.	
kips	kN	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm
151	672	0.64	16.26	0.64	16.26	0.64	16.26	0.07	1.82	0.18	4.53	0.52	13.09
151	672	0.64	16.26	0.64	16.26	0.64	16.26	0.07	1.82	0.18	4.53	0.52	13.09
151	672	0.64	16.27	0.64	16.27	0.64	16.27	0.07	1.82	0.18	4.53	0.52	13.09
151	671	0.64	16.27	0.64	16.27	0.64	16.27	0.07	1.82	0.18	4.53	0.52	13.09
151	670	0.64	16.27	0.64	16.27	0.64	16.27	0.07	1.82	0.18	4.53	0.52	13.10
151	670	0.64	16.28	0.64	16.28	0.64	16.28	0.07	1.82	0.18	4.53	0.52	13.10
151	670	0.64	16.28	0.64	16.28	0.64	16.28	0.07	1.82	0.18	4.53	0.52	13.10
150	669	0.64	16.28	0.64	16.28	0.64	16.28	0.07	1.82	0.18	4.53	0.52	13.11
150	669	0.64	16.28	0.64	16.28	0.64	16.28	0.07	1.82	0.18	4.53	0.52	13.11
150	669	0.64	16.28	0.64	16.28	0.64	16.28	0.07	1.82	0.18	4.53	0.52	13.11
150	669	0.64	16.28	0.64	16.28	0.64	16.28	0.07	1.82	0.18	4.53	0.52	13.11
150	668	0.64	16.29	0.64	16.29	0.64	16.29	0.07	1.82	0.18	4.53	0.52	13.11
150	668	0.64	16.29	0.64	16.29	0.64	16.29	0.07	1.82	0.18	4.53	0.52	13.11
150	668	0.64	16.29	0.64	16.29	0.64	16.29	0.07	1.82	0.18	4.53	0.52	13.11
150	668	0.64	16.29	0.64	16.29	0.64	16.29	0.07	1.82	0.18	4.53	0.52	13.11
150	667	0.64	16.29	0.64	16.29	0.64	16.29	0.07	1.82	0.18	4.53	0.52	13.11
150	667	0.64	16.29	0.64	16.29	0.64	16.29	0.07	1.82	0.18	4.53	0.52	13.11
150	668	0.64	16.29	0.64	16.29	0.64	16.29	0.07	1.82	0.18	4.53	0.52	13.11
150	668	0.64	16.29	0.64	16.29	0.64	16.29	0.07	1.82	0.18	4.53	0.52	13.11
150	667	0.64	16.29	0.64	16.29	0.64	16.29	0.07	1.82	0.18	4.53	0.52	13.11
150	667	0.64	16.29	0.64	16.29	0.64	16.29	0.07	1.82	0.18	4.53	0.52	13.12
150	668	0.64	16.29	0.64	16.29	0.64	16.29	0.07	1.82	0.18	4.53	0.52	13.12

Table A.43 Measurement of Rosette LVDTs of 5SB12M-1.6-10-ND

LC		NWD1	NWD2	NWV1	NWV2	NWH1	NWH2	NED1	NED2	NEV1	NEV2	NEH1	NEH2
kips	kN	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in
0	0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
30	132	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
60	265	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
90	398	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
120	534	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
130	579	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
140	622	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
150	666	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
150	667	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
150	668	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
160	711	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
160	712	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
170	755	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
180	799	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
187	834	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
186	828	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
188	835	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
185	822	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
190	843	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
190	847	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
186	828	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
187	830	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Table A.43 Measurement of Rosette LVDTs of 5SB12M-1.6-10-ND (Continued)

LC		NWD1	NWD2	NWV1	NWV2	NWH1	NWH2	NED1	NED2	NEV1	NEV2	NEH1	NEH2
kips	kN	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in
186	828	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
184	817	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
180	802	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
182	809	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
182	809	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
180	801	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
179	798	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
177	786	0.000	-0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
174	775	0.000	-0.001	0.000	0.000	-0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000
174	776	0.000	-0.001	0.000	0.000	-0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000
175	777	0.000	-0.001	0.000	0.000	-0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000
175	778	0.000	-0.001	0.000	0.000	-0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000
175	778	0.000	-0.001	0.000	0.000	-0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000
173	769	0.000	-0.001	0.002	0.000	-0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000
173	769	0.000	-0.001	0.002	0.000	-0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000
173	768	0.000	0.000	0.004	0.000	-0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000
172	766	0.000	0.000	0.004	0.000	-0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000
170	758	0.000	0.001	0.006	0.000	-0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000
170	758	0.000	0.001	0.007	0.000	-0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000
170	757	0.000	0.001	0.007	0.000	-0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000
172	764	0.000	0.002	0.008	0.000	-0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000
172	767	0.000	0.002	0.010	0.000	-0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Table A.43 Measurement of Rosette LVDTs of 5SB12M-1.6-10-ND (Continued)

LC		NWD1	NWD2	NWV1	NWV2	NWH1	NWH2	NED1	NED2	NEV1	NEV2	NEH1	NEH2
kips	kN	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in
172	767	0.000	0.003	0.011	0.000	-0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000
172	767	0.000	0.003	0.011	0.000	-0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000
172	766	0.000	0.003	0.011	0.000	-0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000
172	767	0.000	0.003	0.011	0.000	-0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000
172	764	0.000	0.004	0.012	0.000	-0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000
171	759	0.000	0.004	0.012	0.000	-0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000
165	736	0.000	0.004	0.011	0.000	-0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000
159	707	0.000	0.004	0.011	0.000	-0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000
158	704	0.000	0.004	0.011	0.000	-0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000
154	684	0.000	0.004	0.011	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
155	688	0.000	0.004	0.011	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
155	689	0.000	0.004	0.011	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
152	678	0.000	0.004	0.011	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
152	677	0.000	0.004	0.011	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
152	675	0.000	0.004	0.011	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
152	674	0.000	0.004	0.011	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
151	674	0.000	0.004	0.011	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
151	674	0.000	0.004	0.011	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
151	673	0.000	0.004	0.011	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
151	672	0.000	0.004	0.011	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
151	672	0.000	0.004	0.011	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
151	672	0.000	0.004	0.011	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Table A.43 Measurement of Rosette LVDTs of 5SB12M-1.6-10-ND (Continued)

LC		NWD1	NWD2	NWV1	NWV2	NWH1	NWH2	NED1	NED2	NEV1	NEV2	NEH1	NEH2
kips	kN	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in
151	671	0.000	0.004	0.011	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
151	670	0.000	0.004	0.011	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
151	670	0.000	0.004	0.011	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
151	670	0.000	0.004	0.011	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
150	669	0.000	0.004	0.011	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
150	669	0.000	0.004	0.011	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
150	669	0.000	0.004	0.011	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
150	669	0.000	0.004	0.011	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
150	668	0.000	0.004	0.011	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
150	668	0.000	0.004	0.011	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
150	668	0.000	0.004	0.011	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
150	668	0.000	0.004	0.011	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
150	667	0.000	0.004	0.011	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
150	667	0.000	0.004	0.011	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
150	668	0.000	0.004	0.011	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
150	668	0.000	0.004	0.011	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
150	667	0.000	0.004	0.011	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
150	667	0.000	0.004	0.011	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
150	668	0.000	0.004	0.011	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Table A.44 Measurement of Tendon Slippage of 5SB12M-1.6-10-ND

Load Cell		T1	T2	T3	T4	T5	T6	T7	T8	T9	T10
kips	kN	in	in	in	in	in	in	in	in	in	in
0	0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
30	132	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
60	265	0.001	0.000	0.000	0.000	0.000	0.000	0.000	-0.001	0.000	0.000
90	398	0.001	0.000	0.000	0.000	0.000	0.000	0.000	-0.001	0.000	0.000
120	534	0.001	0.000	0.000	0.000	0.000	0.000	0.000	-0.001	0.000	0.000
130	579	0.001	0.000	0.000	0.000	0.000	0.000	0.000	-0.001	0.000	0.000
140	622	0.001	0.000	0.000	0.000	0.000	0.000	0.000	-0.001	0.000	0.000
150	666	0.001	0.000	0.000	0.000	0.000	0.000	0.000	-0.001	0.000	0.000
150	667	0.001	0.000	0.000	0.000	0.000	0.000	0.000	-0.001	0.000	0.000
150	668	0.001	0.000	0.000	0.000	0.000	0.000	0.000	-0.001	0.000	0.000
160	711	0.001	0.000	0.000	0.000	0.000	0.000	0.003	-0.001	0.000	0.000
160	712	0.001	0.000	0.000	0.000	0.000	0.000	0.003	-0.001	0.000	0.000
170	755	0.001	0.000	0.000	0.000	0.000	0.000	0.003	-0.001	0.000	0.000
180	799	0.001	0.000	0.000	0.000	0.000	0.000	0.003	-0.001	0.000	0.000
187	834	0.001	0.000	0.000	0.000	0.000	0.000	0.003	0.001	0.004	0.000
186	828	0.001	0.000	0.000	0.000	0.000	0.000	0.003	0.005	0.012	0.000
188	835	0.001	0.000	0.000	0.000	0.000	0.000	0.003	0.008	0.014	0.000
185	822	0.001	0.010	0.005	0.001	0.000	0.001	0.006	0.012	0.017	0.000
190	843	0.001	0.013	0.008	0.003	0.000	0.001	0.008	0.017	0.020	0.000
190	847	0.001	0.014	0.010	0.005	0.001	0.001	0.010	0.024	0.020	0.000
186	828	0.002	0.019	0.020	0.013	0.013	0.004	0.019	0.048	0.021	0.000
187	830	0.004	0.024	0.028	0.017	0.021	0.010	0.025	0.057	0.021	0.000

Table A.44 Measurement of Tendon Slippage of 5SB12M-1.6-10-ND (Continued)

Load Cell		T1	T2	T3	T4	T5	T6	T7	T8	T9	T10
kips	kN	in	in	in	in	in	in	in	in	in	in
186	828	0.004	0.024	0.029	0.018	0.022	0.011	0.025	0.058	0.021	0.000
184	817	0.005	0.025	0.031	0.019	0.024	0.014	0.027	0.059	0.022	0.000
180	802	0.008	0.032	0.045	0.031	0.037	0.026	0.043	0.076	0.023	0.000
182	809	0.009	0.033	0.050	0.034	0.040	0.029	0.046	0.081	0.023	0.000
182	809	0.013	0.036	0.054	0.038	0.044	0.033	0.050	0.086	0.023	0.000
180	801	0.014	0.037	0.055	0.039	0.045	0.033	0.052	0.091	0.023	0.000
179	798	0.015	0.037	0.056	0.040	0.046	0.034	0.052	0.092	0.023	0.000
177	786	0.025	0.044	0.064	0.049	0.054	0.042	0.064	0.106	0.023	0.000
174	775	0.028	0.048	0.070	0.057	0.061	0.048	0.073	0.116	0.024	0.000
174	776	0.033	0.055	0.078	0.066	0.071	0.057	0.084	0.131	0.026	0.000
175	777	0.040	0.065	0.088	0.076	0.080	0.067	0.097	0.146	0.027	0.000
175	778	0.048	0.075	0.097	0.087	0.090	0.076	0.109	0.161	0.030	0.000
175	778	0.048	0.075	0.098	0.088	0.091	0.076	0.110	0.161	0.030	0.000
173	769	0.063	0.094	0.109	0.098	0.101	0.086	0.120	0.175	0.033	0.000
173	769	0.063	0.094	0.109	0.098	0.101	0.086	0.121	0.176	0.033	0.000
173	768	0.072	0.108	0.120	0.108	0.109	0.094	0.131	0.188	0.036	0.000
172	766	0.073	0.109	0.121	0.109	0.110	0.095	0.131	0.188	0.036	0.000
170	758	0.080	0.120	0.131	0.119	0.121	0.106	0.141	0.199	0.038	0.000
170	758	0.084	0.126	0.137	0.124	0.129	0.111	0.148	0.206	0.039	0.000
170	757	0.084	0.127	0.137	0.124	0.129	0.111	0.148	0.206	0.039	0.000
172	764	0.087	0.132	0.142	0.129	0.129	0.115	0.153	0.211	0.041	0.000
172	767	0.094	0.142	0.153	0.139	0.136	0.124	0.164	0.224	0.044	0.000

Table A.44 Measurement of Tendon Slippage of 5SB12M-1.6-10-ND (Continued)

Load Cell		T1	T2	T3	T4	T5	T6	T7	T8	T9	T10
kips	kN	in	in	in	in	in	in	in	in	in	in
172	767	0.099	0.152	0.162	0.148	0.146	0.133	0.175	0.239	0.047	0.000
172	767	0.099	0.152	0.162	0.148	0.146	0.133	0.175	0.239	0.047	0.000
172	766	0.104	0.160	0.173	0.161	0.156	0.141	0.185	0.250	0.049	0.000
172	767	0.104	0.160	0.173	0.161	0.157	0.142	0.186	0.251	0.049	0.000
172	764	0.107	0.166	0.185	0.170	0.165	0.149	0.197	0.262	0.051	0.000
171	759	0.107	0.167	0.191	0.171	0.165	0.149	0.198	0.263	0.051	0.000
165	736	0.107	0.168	0.207	0.178	0.171	0.155	0.206	0.270	0.052	0.000
159	707	0.107	0.168	0.219	0.188	0.177	0.161	0.214	0.278	0.052	0.000
158	704	0.107	0.168	0.219	0.190	0.179	0.162	0.215	0.279	0.052	0.000
154	684	0.107	0.168	0.223	0.198	0.194	0.169	0.222	0.288	0.052	0.000
155	688	0.107	0.168	0.224	0.201	0.194	0.176	0.231	0.297	0.052	0.000
155	689	0.107	0.168	0.235	0.210	0.195	0.184	0.241	0.307	0.052	0.000
152	678	0.107	0.168	0.239	0.216	0.205	0.188	0.246	0.313	0.052	0.000
152	677	0.107	0.168	0.239	0.217	0.205	0.189	0.247	0.313	0.052	0.000
152	675	0.107	0.168	0.239	0.217	0.205	0.189	0.247	0.313	0.052	0.000
152	674	0.107	0.168	0.240	0.217	0.205	0.189	0.247	0.313	0.052	0.000
151	674	0.107	0.168	0.240	0.217	0.205	0.189	0.247	0.314	0.052	0.000
151	674	0.107	0.168	0.240	0.217	0.205	0.189	0.247	0.314	0.052	0.000
151	673	0.107	0.168	0.240	0.217	0.205	0.189	0.247	0.314	0.052	0.000
151	672	0.107	0.168	0.240	0.217	0.205	0.189	0.248	0.314	0.052	0.000
151	672	0.107	0.168	0.240	0.217	0.205	0.189	0.248	0.314	0.052	0.000
151	672	0.107	0.168	0.240	0.217	0.205	0.189	0.248	0.314	0.052	0.000

Table A.44 Measurement of Tendon Slippage of 5SB12M-1.6-10-ND (Continued)

Load Cell		T1	T2	T3	T4	T5	T6	T7	T8	T9	T10
kips	kN	in	in	in	in	in	in	in	in	in	in
151	671	0.107	0.168	0.240	0.218	0.205	0.189	0.248	0.314	0.052	0.000
151	670	0.107	0.168	0.240	0.218	0.205	0.191	0.248	0.314	0.052	0.000
151	670	0.107	0.168	0.240	0.218	0.205	0.191	0.248	0.314	0.052	0.000
151	670	0.107	0.168	0.240	0.218	0.205	0.191	0.248	0.314	0.052	-0.001
150	669	0.107	0.168	0.240	0.218	0.205	0.191	0.248	0.314	0.052	0.000
150	669	0.107	0.168	0.240	0.218	0.205	0.191	0.248	0.315	0.052	-0.001
150	669	0.107	0.168	0.241	0.218	0.205	0.191	0.248	0.315	0.052	-0.001
150	669	0.107	0.168	0.241	0.218	0.205	0.191	0.249	0.315	0.052	-0.001
150	668	0.107	0.168	0.241	0.218	0.205	0.191	0.249	0.315	0.052	-0.001
150	668	0.107	0.168	0.241	0.218	0.205	0.191	0.249	0.315	0.052	-0.001
150	668	0.107	0.168	0.241	0.218	0.205	0.191	0.249	0.315	0.052	-0.001
150	668	0.107	0.168	0.241	0.218	0.205	0.191	0.249	0.315	0.052	-0.001
150	667	0.107	0.168	0.241	0.218	0.205	0.191	0.249	0.315	0.052	0.000
150	667	0.107	0.168	0.241	0.218	0.205	0.191	0.249	0.315	0.052	0.000
150	668	0.107	0.168	0.241	0.218	0.205	0.191	0.249	0.315	0.051	0.000
150	668	0.107	0.168	0.241	0.218	0.205	0.191	0.249	0.315	0.052	0.000
150	667	0.107	0.168	0.241	0.218	0.205	0.191	0.249	0.315	0.052	0.000
150	667	0.107	0.168	0.241	0.218	0.205	0.191	0.249	0.315	0.052	0.000
150	668	0.107	0.168	0.241	0.218	0.205	0.191	0.249	0.315	0.052	0.000

Table A.45 Measurement of Strain Gauges of 5SB12M-1.6-10-ND

TRF		CN1	CN2	CN3	CN4	NN1
kips	kN	m/m	m/m	m/m	m/m	m/m
0	0	B.G.	0.00	0.00	0.00	0.00
30	132	B.G.	1.14	-15.70	2.05	2.05
60	265	B.G.	3.87	-72.57	4.10	5.92
90	398	B.G.	3.87	-69.84	5.01	7.96
120	534	B.G.	5.01	-75.75	5.23	10.24
130	579	B.G.	4.32	-76.66	5.01	10.47
140	622	B.G.	3.87	-77.35	3.87	9.56
150	666	B.G.	2.73	-80.30	2.73	9.56
150	667	B.G.	2.73	-80.53	2.50	9.78
150	668	B.G.	2.96	-80.08	2.73	9.33
160	711	B.G.	4.10	-80.30	2.96	10.69
160	712	B.G.	3.64	-80.76	2.50	11.15
170	755	B.G.	3.64	-80.76	1.82	11.38
180	799	B.G.	4.32	-85.99	-1.37	12.74
187	834	B.G.	-1.14	-85.99	-7.96	13.88
186	828	B.G.	2.96	-86.45	-10.69	13.65
188	835	B.G.	4.55	-85.08	-11.15	15.70
185	822	B.G.	2.50	-82.81	-19.34	12.51
190	843	B.G.	3.41	-77.80	-20.25	8.19
190	847	B.G.	3.41	-76.21	-17.97	3.87
186	828	B.G.	4.55	-70.07	-2.50	-1.59
187	830	B.G.	3.87	-64.61	1.37	-8.42

Table A.45 Measurement of Strain Gauges of 5SB12M-1.6-10-ND (Continued)

TRF		CN1	CN2	CN3	CN4	NN1
kips	kN	m/m	m/m	m/m	m/m	m/m
186	828	B.G.	4.10	-64.15	1.59	-9.55
184	817	B.G.	3.87	-63.92	2.73	-10.69
180	802	B.G.	8.42	-55.51	2.96	-15.24
182	809	B.G.	9.33	-51.64	2.73	-13.88
182	809	B.G.	8.42	-49.59	-0.23	-14.79
180	801	B.G.	7.05	-48.91	-0.91	-15.70
179	798	B.G.	7.96	-48.91	-0.45	-15.47
177	786	B.G.	7.51	-44.59	0.46	-15.01
174	775	B.G.	8.65	-42.09	2.73	-3.87
174	776	B.G.	9.33	-32.76	4.32	18.20
175	777	B.G.	11.15	-25.02	7.28	27.53
175	778	B.G.	12.06	-23.89	9.10	29.35
175	778	B.G.	12.97	-23.89	10.01	29.12
173	769	B.G.	13.42	-23.89	9.10	19.34
173	769	B.G.	12.97	-23.89	8.87	18.88
173	768	B.G.	12.97	-23.89	9.10	17.06
172	766	B.G.	12.74	-23.89	8.87	17.74
170	758	B.G.	12.74	-23.89	7.51	22.07
170	758	B.G.	12.74	-23.89	7.96	23.20
170	757	B.G.	13.42	-23.89	8.19	23.43
172	764	B.G.	13.42	-23.89	7.96	28.66
172	767	B.G.	13.19	-23.89	6.83	21.61

Table A.45 Measurement of Strain Gauges of 5SB12M-1.6-10-ND (Continued)

TRF		CN1	CN2	CN3	CN4	NN1
kips	kN	m/m	m/m	m/m	m/m	m/m
172	767	B.G.	15.92	-23.89	7.05	0.46
172	767	B.G.	15.24	-23.89	7.05	-0.23
172	766	B.G.	15.47	-23.89	6.14	-5.69
172	767	B.G.	15.70	-23.89	6.14	-5.46
172	764	B.G.	17.29	-23.89	6.83	-4.32
171	759	B.G.	16.38	-23.89	6.60	-4.78
165	736	B.G.	16.38	-23.89	5.23	-1.59
159	707	B.G.	17.29	-23.89	5.23	9.56
158	704	B.G.	16.38	-23.89	4.78	8.65
154	684	B.G.	17.74	-23.89	5.23	9.78
155	688	B.G.	19.56	-23.89	5.23	12.29
155	689	B.G.	22.07	-23.89	6.60	16.15
152	678	B.G.	22.07	-23.89	5.46	18.20
152	677	B.G.	22.52	-23.89	6.14	18.88
152	675	B.G.	21.61	-23.89	5.92	18.20
152	674	B.G.	21.84	-23.89	5.92	18.43
151	674	B.G.	21.38	-23.89	5.92	17.52
151	674	B.G.	22.29	-23.89	6.37	18.65
151	673	B.G.	22.52	-23.89	6.37	19.34
151	672	B.G.	23.20	-23.89	6.60	19.34
151	672	B.G.	22.75	-23.89	7.05	18.88
151	672	B.G.	22.98	-23.89	7.05	19.11

Table A.45 Measurement of Strain Gauges of 5SB12M-1.6-10-ND (Continued)

TRF		CN1	CN2	CN3	CN4	NN1
kips	kN	m/m	m/m	m/m	m/m	m/m
151	671	B.G.	22.52	-23.89	6.60	17.97
151	670	B.G.	21.61	-23.89	6.37	17.97
151	670	B.G.	22.52	-23.89	6.60	18.88
151	670	B.G.	22.52	-23.89	6.37	18.88
150	669	B.G.	22.07	-23.89	6.60	18.20
150	669	B.G.	22.29	-23.89	6.83	18.65
150	669	B.G.	22.75	-23.89	6.83	19.56
150	669	B.G.	22.98	-23.89	7.05	20.25
150	668	B.G.	23.43	-23.89	7.96	20.70
150	668	B.G.	23.43	-23.89	7.96	20.70
150	668	B.G.	23.66	-23.89	8.19	20.93
150	668	B.G.	24.11	-23.89	8.65	21.61
150	667	B.G.	23.43	-23.89	8.42	21.61
150	667	B.G.	24.34	-23.89	8.87	21.84
150	668	B.G.	24.80	-23.89	8.87	22.52
150	668	B.G.	24.57	-23.89	9.10	22.52
150	667	B.G.	24.80	-23.89	8.87	22.29
150	667	B.G.	25.48	-23.89	9.10	22.75
150	668	B.G.	24.57	-23.89	8.65	22.29

A.16 5SB12N-1.2-10-ND

Table A.46 Measurement of Load and Deflection Relationships of 5SB12N-1.2-10-ND

SW.LC		SE. LC		TRF		Mid. Def.		SW. Def.		SE. Def.		SW. Sett.		SE. Sett.		Net Def.	
kips	kN	kips	kN	kips	kN	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
0	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
20	90	22	99	42	189	0.01	0.17	0.01	0.20	0.01	0.15	0.00	0.00	0.00	0.00	0.01	0.17
29	129	31	137	60	266	0.02	0.45	0.02	0.40	0.02	0.50	0.00	0.11	0.01	0.27	0.01	0.25
31	140	33	147	65	287	0.02	0.51	0.02	0.44	0.02	0.58	0.00	0.12	0.01	0.34	0.01	0.29
34	152	36	159	70	310	0.02	0.58	0.02	0.50	0.03	0.67	0.01	0.15	0.02	0.39	0.01	0.31
37	164	38	168	75	332	0.02	0.63	0.02	0.53	0.03	0.73	0.01	0.16	0.02	0.44	0.01	0.33
39	175	40	179	80	354	0.03	0.70	0.02	0.58	0.03	0.81	0.01	0.20	0.02	0.48	0.01	0.36
42	187	43	190	85	377	0.03	0.75	0.02	0.63	0.03	0.87	0.01	0.20	0.02	0.51	0.02	0.39
45	199	45	200	90	399	0.03	0.79	0.03	0.66	0.04	0.93	0.01	0.21	0.02	0.54	0.02	0.42
47	211	47	211	95	422	0.03	0.85	0.03	0.70	0.04	0.99	0.01	0.22	0.02	0.55	0.02	0.46
50	222	50	220	100	443	0.03	0.88	0.03	0.73	0.04	1.04	0.01	0.22	0.02	0.60	0.02	0.47
53	234	52	231	105	465	0.04	0.93	0.03	0.77	0.04	1.09	0.01	0.22	0.02	0.61	0.02	0.51
55	246	54	242	110	489	0.04	0.98	0.03	0.82	0.05	1.15	0.01	0.22	0.02	0.61	0.02	0.57
59	261	57	253	115	514	0.04	1.01	0.03	0.83	0.05	1.20	0.01	0.22	0.02	0.61	0.02	0.59
59	262	57	254	116	516	0.04	1.02	0.03	0.84	0.05	1.20	0.01	0.22	0.02	0.61	0.02	0.60
59	262	57	255	116	517	0.04	1.02	0.03	0.83	0.05	1.21	0.01	0.22	0.02	0.61	0.02	0.60
59	264	58	257	117	521	0.04	1.02	0.03	0.83	0.05	1.21	0.01	0.22	0.02	0.61	0.02	0.60
60	266	58	258	118	524	0.04	1.03	0.03	0.85	0.05	1.22	0.01	0.22	0.02	0.61	0.02	0.62
60	268	58	259	118	527	0.04	1.04	0.03	0.85	0.05	1.23	0.01	0.22	0.02	0.61	0.02	0.62

Table A.46 Measurement of Load and Deflection Relationships of 5SB12N-1.2-10-ND (Continued)

SW.LC		SE. LC		TRF		Mid. Def.		SW. Def.		SE. Def.		SW. Sett.		SE. Sett.		Net Def.	
kips	kN	kips	kN	kips	kN	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
60	268	59	260	119	528	0.04	1.05	0.03	0.87	0.05	1.23	0.01	0.22	0.02	0.61	0.02	0.63
64	287	60	267	124	554	0.05	1.28	0.04	1.10	0.06	1.47	0.01	0.23	0.02	0.61	0.03	0.86
65	288	60	268	125	556	0.05	1.31	0.04	1.13	0.06	1.49	0.01	0.22	0.02	0.61	0.04	0.89
68	302	63	282	131	585	0.06	1.55	0.05	1.36	0.07	1.73	0.01	0.22	0.02	0.61	0.04	1.13
70	310	64	286	134	596	0.07	1.75	0.06	1.57	0.08	1.93	0.01	0.23	0.02	0.61	0.05	1.33
70	310	64	284	133	594	0.07	1.75	0.06	1.57	0.08	1.93	0.01	0.23	0.02	0.61	0.05	1.33
69	307	63	282	132	589	0.07	1.76	0.06	1.58	0.08	1.94	0.01	0.23	0.02	0.61	0.05	1.34
69	305	63	279	131	584	0.07	1.77	0.06	1.59	0.08	1.95	0.01	0.23	0.02	0.61	0.05	1.35
71	315	65	288	136	603	0.08	1.91	0.07	1.73	0.08	2.09	0.01	0.23	0.02	0.61	0.06	1.49
71	316	65	288	136	604	0.08	1.93	0.07	1.74	0.08	2.11	0.01	0.23	0.02	0.61	0.06	1.51
72	318	65	288	136	606	0.08	2.03	0.07	1.85	0.09	2.21	0.01	0.23	0.02	0.61	0.06	1.61
71	317	64	287	136	604	0.08	2.05	0.07	1.87	0.09	2.23	0.01	0.23	0.02	0.61	0.06	1.63
71	317	64	283	135	600	0.08	2.12	0.08	1.94	0.09	2.30	0.01	0.23	0.02	0.61	0.07	1.70
68	301	57	256	125	557	0.09	2.29	0.08	2.11	0.10	2.47	0.01	0.23	0.02	0.61	0.07	1.87
74	328	58	258	132	586	0.16	4.09	0.15	3.91	0.17	4.27	0.01	0.23	0.02	0.61	0.14	3.67
75	333	58	259	133	591	0.18	4.50	0.17	4.32	0.18	4.68	0.01	0.23	0.02	0.61	0.16	4.08
75	334	58	259	133	593	0.18	4.58	0.17	4.39	0.19	4.76	0.01	0.23	0.02	0.61	0.16	4.15
75	333	58	258	133	591	0.18	4.58	0.17	4.40	0.19	4.76	0.01	0.23	0.02	0.61	0.16	4.16
75	331	58	258	132	589	0.18	4.58	0.17	4.40	0.19	4.77	0.01	0.23	0.02	0.61	0.16	4.16
74	327	57	253	130	580	0.18	4.61	0.17	4.43	0.19	4.79	0.01	0.23	0.02	0.61	0.16	4.19
73	325	56	251	129	576	0.18	4.62	0.17	4.43	0.19	4.80	0.01	0.23	0.02	0.61	0.17	4.19
75	334	58	258	133	592	0.19	4.83	0.18	4.65	0.20	5.01	0.01	0.23	0.02	0.61	0.17	4.41

Table A.46 Measurement of Load and Deflection Relationships of 5SB12N-1.2-10-ND (Continued)

SW.LC		SE. LC		TRF		Mid. Def.		SW. Def.		SE. Def.		SW. Sett.		SE. Sett.		Net Def.	
kips	kN	kips	kN	kips	kN	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
76	339	59	261	135	600	0.20	5.16	0.20	4.98	0.21	5.35	0.01	0.23	0.02	0.61	0.19	4.74
76	338	59	261	135	599	0.20	5.18	0.20	5.00	0.21	5.36	0.01	0.23	0.02	0.61	0.19	4.76
76	339	59	264	136	603	0.24	5.98	0.23	5.80	0.24	6.16	0.01	0.23	0.02	0.61	0.22	5.56
76	340	59	264	136	604	0.24	6.00	0.23	5.82	0.24	6.18	0.01	0.23	0.02	0.61	0.22	5.58
75	336	59	264	135	599	0.24	6.11	0.23	5.93	0.25	6.29	0.01	0.23	0.02	0.61	0.22	5.69
75	335	59	264	135	599	0.24	6.13	0.23	5.95	0.25	6.31	0.01	0.23	0.02	0.61	0.22	5.71
73	323	59	260	131	583	0.25	6.28	0.24	6.09	0.25	6.46	0.01	0.23	0.02	0.61	0.23	5.85
68	303	57	253	125	556	0.25	6.35	0.24	6.17	0.26	6.53	0.01	0.23	0.02	0.61	0.23	5.93
67	299	57	251	124	551	0.25	6.38	0.24	6.19	0.26	6.56	0.01	0.23	0.02	0.61	0.23	5.95
65	288	56	248	120	536	0.26	6.57	0.25	6.39	0.27	6.75	0.01	0.23	0.02	0.61	0.24	6.15
65	287	57	252	121	539	0.27	6.73	0.26	6.55	0.27	6.92	0.01	0.23	0.02	0.61	0.25	6.31
65	289	57	252	122	540	0.27	6.75	0.26	6.57	0.27	6.93	0.01	0.23	0.02	0.61	0.25	6.33
65	289	58	258	123	547	0.28	7.02	0.27	6.84	0.28	7.20	0.01	0.23	0.02	0.61	0.26	6.60
65	289	61	270	126	559	0.33	8.28	0.32	8.10	0.33	8.46	0.01	0.23	0.02	0.61	0.31	7.86
67	298	64	283	131	581	0.46	11.75	0.46	11.57	0.47	11.93	0.01	0.23	0.02	0.61	0.45	11.33
68	303	65	288	133	591	0.51	12.90	0.50	12.72	0.52	13.09	0.01	0.23	0.02	0.61	0.49	12.48
68	305	65	290	134	594	0.59	14.87	0.58	14.69	0.59	15.05	0.01	0.23	0.02	0.61	0.57	14.45
68	300	64	285	131	585	0.59	14.93	0.58	14.75	0.60	15.12	0.01	0.23	0.02	0.61	0.57	14.51
68	301	64	284	132	586	0.59	14.97	0.58	14.78	0.60	15.15	0.01	0.23	0.02	0.61	0.57	14.55
68	302	64	284	132	586	0.59	14.99	0.58	14.81	0.60	15.18	0.01	0.23	0.02	0.61	0.57	14.57
68	301	64	284	131	585	0.59	15.02	0.58	14.84	0.60	15.20	0.01	0.23	0.02	0.61	0.57	14.60
68	301	64	285	132	586	0.59	15.05	0.59	14.87	0.60	15.23	0.01	0.23	0.02	0.61	0.58	14.63

Table A.46 Measurement of Load and Deflection Relationships of 5SB12N-1.2-10-ND (Continued)

SW.LC		SE. LC		TRF		Mid. Def.		SW. Def.		SE. Def.		SW. Sett.		SE. Sett.		Net Def.	
kips	kN	kips	kN	kips	kN	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
68	302	64	285	132	587	0.59	15.08	0.59	14.89	0.60	15.26	0.01	0.23	0.02	0.61	0.58	14.66
67	299	64	284	131	584	0.60	15.26	0.59	15.07	0.61	15.44	0.01	0.23	0.02	0.61	0.58	14.84
67	299	64	284	131	583	0.60	15.29	0.59	15.11	0.61	15.47	0.01	0.23	0.02	0.61	0.59	14.87
67	298	64	283	131	582	0.60	15.33	0.60	15.15	0.61	15.51	0.01	0.23	0.02	0.61	0.59	14.91
67	297	64	283	130	580	0.60	15.36	0.60	15.18	0.61	15.55	0.01	0.23	0.02	0.61	0.59	14.94
66	295	64	284	130	578	0.61	15.57	0.61	15.39	0.62	15.76	0.01	0.23	0.02	0.61	0.60	15.15
66	293	64	284	130	577	0.61	15.61	0.61	15.42	0.62	15.79	0.01	0.23	0.02	0.61	0.60	15.18
60	269	61	271	121	540	0.62	15.84	0.62	15.66	0.63	16.02	0.01	0.23	0.02	0.61	0.61	15.42
53	236	57	252	110	488	0.64	16.14	0.63	15.95	0.64	16.32	0.01	0.23	0.02	0.61	0.62	15.72
52	233	56	250	109	483	0.64	16.16	0.63	15.98	0.64	16.34	0.01	0.23	0.02	0.61	0.62	15.74
52	231	56	250	108	480	0.64	16.17	0.63	15.99	0.64	16.35	0.01	0.23	0.02	0.61	0.62	15.75
52	231	56	249	108	479	0.64	16.18	0.63	15.99	0.64	16.36	0.01	0.23	0.02	0.61	0.62	15.75
52	230	56	248	108	478	0.64	16.18	0.63	16.00	0.64	16.36	0.01	0.23	0.02	0.61	0.62	15.76
51	228	56	247	107	475	0.64	16.19	0.63	16.01	0.64	16.37	0.01	0.23	0.02	0.61	0.62	15.77
51	227	56	247	107	474	0.64	16.19	0.63	16.01	0.64	16.37	0.01	0.23	0.02	0.61	0.62	15.77
51	228	55	247	107	475	0.64	16.20	0.63	16.01	0.64	16.38	0.01	0.23	0.02	0.61	0.62	15.78
51	227	55	246	106	473	0.64	16.20	0.63	16.02	0.65	16.38	0.01	0.23	0.02	0.61	0.62	15.78
51	226	55	245	106	471	0.64	16.20	0.63	16.02	0.65	16.39	0.01	0.23	0.02	0.61	0.62	15.78
51	226	55	245	106	471	0.64	16.21	0.63	16.03	0.65	16.39	0.01	0.23	0.02	0.61	0.62	15.79
51	226	55	245	106	471	0.64	16.21	0.63	16.03	0.65	16.39	0.01	0.23	0.02	0.61	0.62	15.79
51	225	55	244	106	469	0.64	16.21	0.63	16.03	0.65	16.40	0.01	0.23	0.02	0.61	0.62	15.79
50	224	55	244	105	468	0.64	16.22	0.63	16.04	0.65	16.40	0.01	0.23	0.02	0.61	0.62	15.80

Table A.47 Measurement of Tendon Slippage of 5SB12N-1.2-10-ND

TRF		T1	T2	T3	T4	T5	T6	T7	T8	T9	T10
kips	kN	in	in	in	in	in	in	in	in	in	in
0	0	0.009	0.000	0.037	0.058	0.054	0.032	0.070	0.095	0.000	0.000
60	265	0.009	0.000	0.037	0.058	0.054	0.032	0.070	0.095	0.000	0.000
65	288	0.009	0.000	0.037	0.058	0.054	0.032	0.070	0.095	0.000	0.000
70	310	0.009	0.000	0.037	0.058	0.054	0.032	0.070	0.095	0.000	0.000
75	333	0.009	0.000	0.037	0.058	0.054	0.032	0.070	0.096	0.001	0.000
80	355	0.010	0.000	0.037	0.058	0.054	0.032	0.070	0.096	0.001	0.000
85	377	0.009	0.000	0.037	0.058	0.054	0.032	0.070	0.096	0.001	0.000
90	399	0.009	0.000	0.037	0.058	0.054	0.032	0.070	0.096	0.001	0.000
95	421	0.009	0.000	0.037	0.058	0.054	0.032	0.070	0.097	0.001	0.000
100	444	0.008	-0.001	0.037	0.058	0.054	0.032	0.070	0.098	0.000	0.000
105	468	0.009	0.000	0.038	0.058	0.055	0.033	0.070	0.098	0.001	0.000
110	487	0.009	0.000	0.038	0.058	0.055	0.034	0.071	0.100	0.001	0.000
115	510	0.009	0.000	0.038	0.058	0.056	0.035	0.071	0.101	0.000	0.000
120	532	0.009	0.000	0.038	0.059	0.057	0.036	0.072	0.102	0.001	0.000
129	573	0.009	0.000	0.039	0.060	0.059	0.037	0.073	0.104	0.001	0.000
129	575	0.009	0.000	0.039	0.060	0.059	0.037	0.073	0.104	0.001	0.000
130	578	0.009	0.000	0.039	0.060	0.059	0.037	0.073	0.104	0.001	0.000
131	581	0.009	0.000	0.039	0.060	0.059	0.038	0.073	0.104	0.001	0.000
131	582	0.009	-0.001	0.039	0.060	0.059	0.038	0.073	0.104	0.000	0.000
131	585	0.009	0.000	0.039	0.060	0.059	0.038	0.073	0.105	0.001	0.000
132	588	0.009	0.000	0.039	0.060	0.060	0.038	0.074	0.105	0.001	0.000
132	589	0.008	0.000	0.039	0.061	0.060	0.038	0.074	0.109	0.001	0.000

Table A.47 Measurement of Tendon Slippage of 5SB12N-1.2-10-ND (Continued)

TRF		T1	T2	T3	T4	T5	T6	T7	T8	T9	T10
kips	kN	in	in	in	in	in	in	in	in	in	in
132	585	0.008	0.000	0.039	0.061	0.060	0.039	0.074	0.110	0.001	0.000
132	586	0.009	0.000	0.039	0.061	0.060	0.039	0.074	0.110	0.001	0.000
131	584	0.008	0.000	0.039	0.061	0.060	0.039	0.074	0.110	0.001	0.000
132	586	0.008	0.000	0.039	0.061	0.060	0.039	0.074	0.110	0.001	0.000
136	604	0.008	0.000	0.039	0.061	0.061	0.039	0.075	0.116	0.001	0.000
127	563	0.008	-0.001	0.039	0.061	0.061	0.039	0.074	0.121	0.001	0.000
126	560	0.008	0.000	0.039	0.061	0.060	0.039	0.075	0.127	0.001	0.000
125	557	0.009	0.000	0.039	0.061	0.061	0.039	0.074	0.128	0.001	0.000
125	558	0.009	0.000	0.039	0.061	0.061	0.039	0.075	0.134	0.003	0.000
126	559	0.009	-0.001	0.039	0.061	0.061	0.039	0.075	0.134	0.003	0.000
127	563	0.009	-0.001	0.039	0.061	0.061	0.039	0.075	0.139	0.005	0.000
128	568	0.009	0.000	0.039	0.061	0.061	0.039	0.075	0.140	0.006	0.000
130	577	0.009	0.000	0.039	0.061	0.061	0.039	0.075	0.143	0.008	0.000
131	585	0.009	0.000	0.040	0.061	0.061	0.039	0.075	0.146	0.009	0.000
132	589	0.009	0.000	0.040	0.062	0.061	0.039	0.075	0.151	0.010	0.000
131	582	0.009	0.000	0.042	0.063	0.061	0.039	0.075	0.151	0.011	0.000
131	584	0.009	0.000	0.042	0.063	0.061	0.039	0.075	0.151	0.011	0.000
131	584	0.009	0.000	0.042	0.063	0.061	0.039	0.075	0.151	0.011	0.000
131	584	0.009	0.000	0.042	0.063	0.061	0.039	0.075	0.151	0.011	0.000
132	586	0.009	-0.001	0.042	0.063	0.061	0.039	0.075	0.151	0.011	0.000
133	590	0.009	0.000	0.042	0.063	0.061	0.039	0.075	0.152	0.011	0.000
134	597	0.010	0.000	0.043	0.063	0.061	0.039	0.075	0.153	0.011	0.000

Table A.47 Measurement of Tendon Slippage of 5SB12N-1.2-10-ND (Continued)

TRF		T1	T2	T3	T4	T5	T6	T7	T8	T9	T10
kips	kN	in	in	in	in	in	in	in	in	in	in
134	597	0.010	0.000	0.043	0.063	0.061	0.039	0.075	0.153	0.011	0.000
135	598	0.010	0.000	0.043	0.063	0.061	0.039	0.075	0.154	0.011	0.001
136	603	0.010	0.000	0.053	0.064	0.061	0.039	0.075	0.159	0.012	0.000
135	602	0.010	0.000	0.053	0.064	0.061	0.039	0.075	0.159	0.012	0.001
136	603	0.010	0.000	0.053	0.064	0.061	0.039	0.075	0.159	0.012	0.001
136	604	0.010	0.000	0.053	0.064	0.061	0.039	0.075	0.159	0.012	0.000
135	603	0.010	0.000	0.053	0.064	0.061	0.039	0.075	0.160	0.012	0.000
134	597	0.010	0.000	0.057	0.064	0.061	0.039	0.075	0.160	0.012	0.000
133	591	0.010	0.000	0.058	0.064	0.061	0.039	0.075	0.160	0.012	0.000
132	589	0.010	0.001	0.059	0.064	0.061	0.039	0.075	0.160	0.012	0.001
131	583	0.010	0.001	0.060	0.064	0.061	0.039	0.075	0.160	0.012	0.000
125	556	0.010	0.001	0.062	0.064	0.061	0.039	0.075	0.160	0.012	0.000
124	551	0.011	0.001	0.066	0.064	0.061	0.039	0.075	0.160	0.012	0.000
123	548	0.010	0.001	0.068	0.064	0.061	0.039	0.075	0.160	0.012	0.000
122	543	0.010	0.001	0.068	0.064	0.061	0.039	0.075	0.160	0.012	0.000
121	537	0.010	0.001	0.095	0.064	0.061	0.039	0.075	0.160	0.012	0.000
122	541	0.011	0.002	0.120	0.064	0.061	0.039	0.075	0.160	0.012	0.000
126	562	0.011	0.014	0.150	0.064	0.061	0.039	0.077	0.170	0.014	0.000
127	564	0.012	0.015	0.152	0.064	0.061	0.039	0.077	0.172	0.014	0.000
128	568	0.011	0.018	0.156	0.064	0.061	0.039	0.078	0.177	0.014	0.000
129	572	0.011	0.020	0.159	0.064	0.061	0.039	0.078	0.181	0.015	0.000
130	576	0.013	0.024	0.162	0.064	0.061	0.039	0.079	0.188	0.017	0.000

Table A.47 Measurement of Tendon Slippage of 5SB12N-1.2-10-ND (Continued)

TRF		T1	T2	T3	T4	T5	T6	T7	T8	T9	T10
kips	kN	in	in	in	in	in	in	in	in	in	in
131	581	0.012	0.026	0.163	0.064	0.061	0.039	0.080	0.191	0.017	0.000
131	581	0.012	0.026	0.163	0.064	0.061	0.039	0.080	0.191	0.017	0.000
132	586	0.011	0.029	0.165	0.064	0.061	0.039	0.080	0.195	0.018	0.000
131	585	0.011	0.029	0.165	0.064	0.061	0.039	0.080	0.195	0.019	0.000
132	585	0.012	0.029	0.166	0.064	0.061	0.039	0.080	0.195	0.018	0.000
132	586	0.012	0.029	0.166	0.064	0.061	0.039	0.081	0.195	0.019	0.001
131	585	0.012	0.029	0.166	0.064	0.061	0.039	0.081	0.196	0.019	0.000
132	586	0.012	0.029	0.166	0.064	0.061	0.039	0.080	0.196	0.019	0.000
132	589	0.012	0.031	0.166	0.064	0.061	0.039	0.081	0.197	0.019	0.001
133	593	0.013	0.039	0.170	0.065	0.061	0.039	0.083	0.207	0.021	0.000
134	594	0.013	0.041	0.172	0.065	0.061	0.039	0.084	0.212	0.022	0.000
131	585	0.014	0.041	0.172	0.065	0.061	0.039	0.084	0.212	0.022	0.000
132	586	0.013	0.041	0.172	0.065	0.061	0.039	0.084	0.212	0.023	0.000
132	586	0.014	0.042	0.172	0.065	0.061	0.039	0.084	0.212	0.023	0.000
131	585	0.013	0.041	0.172	0.065	0.061	0.039	0.084	0.212	0.023	0.000
132	586	0.013	0.041	0.173	0.065	0.061	0.039	0.084	0.213	0.023	0.000
131	584	0.013	0.041	0.173	0.065	0.061	0.039	0.084	0.214	0.023	0.000
131	582	0.014	0.042	0.173	0.065	0.061	0.039	0.085	0.214	0.023	0.000
105	468	0.014	0.049	0.176	0.065	0.061	0.039	0.085	0.215	0.023	0.000

A.17 5SB12N-1.6-10-ND

Table A.48 Measurement of Load and Deflection Relationships of 5SB12N-1.6-10-ND

LC		Mid. Def.		W. Def.		E. Def.		W. Sett.		E. Sett.		Net Def.	
kips	kN	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm
0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
30	132	0.02	0.61	0.02	0.62	0.02	0.61	0.02	0.49	0.02	0.49	0.01	0.18
60	265	0.05	1.30	0.05	1.26	0.05	1.35	0.04	1.03	0.04	0.97	0.01	0.36
90	399	0.07	1.89	0.07	1.83	0.08	1.96	0.06	1.41	0.05	1.32	0.02	0.58
100	445	0.08	2.07	0.08	2.00	0.08	2.15	0.06	1.53	0.06	1.42	0.03	0.65
110	490	0.09	2.24	0.08	2.15	0.09	2.33	0.06	1.63	0.06	1.51	0.03	0.72
120	533	0.10	2.42	0.09	2.31	0.10	2.53	0.07	1.74	0.06	1.59	0.03	0.81
130	577	0.10	2.57	0.10	2.46	0.11	2.69	0.07	1.82	0.07	1.66	0.03	0.88
140	623	0.11	2.75	0.10	2.61	0.11	2.88	0.08	1.93	0.07	1.74	0.04	0.96
150	667	0.11	2.91	0.11	2.77	0.12	3.06	0.08	2.02	0.07	1.82	0.04	1.04
160	710	0.12	3.09	0.12	2.95	0.13	3.23	0.08	2.10	0.08	1.91	0.04	1.13
170	755	0.13	3.27	0.13	3.21	0.13	3.34	0.08	2.11	0.08	2.07	0.05	1.23
180	799	0.14	3.47	0.14	3.44	0.14	3.50	0.09	2.17	0.09	2.18	0.05	1.34
190	843	0.15	3.68	0.14	3.67	0.15	3.70	0.09	2.25	0.09	2.29	0.06	1.46
200	888	0.16	3.94	0.15	3.93	0.16	3.96	0.09	2.34	0.09	2.40	0.06	1.62
204	905	0.16	4.12	0.16	4.09	0.16	4.15	0.09	2.40	0.09	2.41	0.07	1.77
204	906	0.17	4.20	0.16	4.18	0.17	4.23	0.09	2.41	0.09	2.41	0.07	1.84
203	905	0.17	4.20	0.16	4.18	0.17	4.23	0.09	2.41	0.09	2.41	0.07	1.84
198	881	0.17	4.25	0.17	4.23	0.17	4.27	0.09	2.41	0.09	2.41	0.07	1.89

Table A.48 Measurement of Load and Deflection Relationships of 5SB12N-1.6-10-ND (Continued)

LC		Mid. Def.		W. Def.		E. Def.		W. Sett.		E. Sett.		Net Def.	
kips	kN	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm
197	878	0.17	4.31	0.17	4.29	0.17	4.33	0.09	2.41	0.09	2.41	0.08	1.95
199	883	0.17	4.38	0.17	4.36	0.17	4.40	0.09	2.41	0.09	2.41	0.08	2.02
199	883	0.17	4.39	0.17	4.37	0.17	4.41	0.09	2.41	0.09	2.41	0.08	2.03
198	882	0.17	4.41	0.17	4.38	0.17	4.43	0.09	2.41	0.09	2.41	0.08	2.05
191	848	0.18	4.47	0.17	4.42	0.18	4.51	0.09	2.41	0.09	2.41	0.08	2.11
190	844	0.18	4.48	0.17	4.44	0.18	4.52	0.09	2.41	0.09	2.41	0.08	2.12
190	845	0.19	4.72	0.18	4.66	0.19	4.79	0.09	2.41	0.09	2.41	0.09	2.36
187	831	0.19	4.79	0.19	4.74	0.19	4.84	0.09	2.41	0.09	2.41	0.10	2.43
185	823	0.19	4.83	0.19	4.80	0.19	4.86	0.09	2.41	0.09	2.41	0.10	2.47
185	821	0.19	4.86	0.19	4.83	0.19	4.88	0.09	2.41	0.09	2.41	0.10	2.50
185	821	0.19	4.87	0.19	4.84	0.19	4.89	0.09	2.41	0.09	2.41	0.10	2.51
185	821	0.19	4.88	0.19	4.85	0.19	4.91	0.09	2.41	0.09	2.41	0.10	2.52
184	820	0.19	4.89	0.19	4.88	0.19	4.91	0.09	2.41	0.09	2.41	0.10	2.54
184	820	0.19	4.90	0.19	4.88	0.19	4.93	0.09	2.41	0.09	2.41	0.10	2.54
184	817	0.20	5.19	0.20	5.20	0.20	5.18	0.09	2.41	0.09	2.41	0.11	2.83
183	813	0.21	5.21	0.21	5.23	0.20	5.20	0.09	2.41	0.09	2.41	0.11	2.85
182	810	0.21	5.25	0.21	5.27	0.21	5.23	0.09	2.41	0.09	2.41	0.11	2.89
181	805	0.21	5.28	0.21	5.31	0.21	5.25	0.09	2.41	0.09	2.41	0.11	2.92
180	802	0.21	5.31	0.21	5.33	0.21	5.28	0.09	2.41	0.09	2.41	0.12	2.95
180	799	0.21	5.32	0.21	5.35	0.21	5.30	0.09	2.41	0.09	2.41	0.12	2.96
179	797	0.21	5.35	0.21	5.38	0.21	5.32	0.09	2.41	0.09	2.41	0.12	2.99
179	796	0.21	5.37	0.21	5.41	0.21	5.33	0.09	2.41	0.09	2.41	0.12	3.01

Table A.48 Measurement of Load and Deflection Relationships of 5SB12N-1.6-10-ND (Continued)

LC		Mid. Def.		W. Def.		E. Def.		W. Sett.		E. Sett.		Net Def.	
kips	kN	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm
179	795	0.21	5.40	0.21	5.44	0.21	5.35	0.09	2.41	0.09	2.41	0.12	3.04
178	794	0.21	5.41	0.21	5.45	0.21	5.37	0.09	2.41	0.09	2.41	0.12	3.05
178	790	0.22	5.46	0.22	5.51	0.21	5.41	0.09	2.41	0.09	2.41	0.12	3.10
174	773	0.22	5.53	0.22	5.59	0.22	5.48	0.09	2.41	0.09	2.41	0.12	3.17
172	764	0.22	5.59	0.22	5.65	0.22	5.52	0.09	2.41	0.09	2.41	0.13	3.23
171	762	0.22	5.62	0.22	5.70	0.22	5.54	0.09	2.41	0.09	2.41	0.13	3.26
171	760	0.22	5.63	0.22	5.71	0.22	5.55	0.09	2.41	0.09	2.41	0.13	3.27
170	758	0.22	5.66	0.23	5.74	0.22	5.58	0.09	2.41	0.09	2.41	0.13	3.30
171	759	0.22	5.67	0.23	5.75	0.22	5.59	0.09	2.41	0.09	2.41	0.13	3.31
170	758	0.22	5.69	0.23	5.78	0.22	5.61	0.09	2.41	0.09	2.41	0.13	3.33
170	754	0.23	5.72	0.23	5.80	0.22	5.64	0.09	2.41	0.09	2.41	0.13	3.36
169	752	0.23	5.74	0.23	5.82	0.22	5.65	0.09	2.41	0.09	2.41	0.13	3.38
169	750	0.25	6.37	0.26	6.50	0.25	6.24	0.09	2.41	0.09	2.41	0.16	4.01
168	749	0.25	6.39	0.26	6.53	0.25	6.26	0.09	2.41	0.09	2.41	0.16	4.03
169	754	0.26	6.71	0.27	6.86	0.26	6.57	0.09	2.41	0.09	2.41	0.17	4.35
170	755	0.26	6.72	0.27	6.86	0.26	6.58	0.09	2.41	0.09	2.41	0.17	4.36
170	758	0.28	7.00	0.28	7.16	0.27	6.83	0.09	2.41	0.09	2.41	0.18	4.64
171	760	0.28	7.00	0.28	7.16	0.27	6.85	0.09	2.41	0.09	2.41	0.18	4.64
171	763	0.28	7.20	0.29	7.37	0.28	7.04	0.09	2.41	0.09	2.41	0.19	4.84
172	763	0.28	7.21	0.29	7.37	0.28	7.05	0.09	2.41	0.09	2.41	0.19	4.85
172	763	0.29	7.46	0.30	7.63	0.29	7.30	0.09	2.41	0.09	2.41	0.20	5.10
171	762	0.29	7.49	0.30	7.66	0.29	7.31	0.09	2.41	0.09	2.41	0.20	5.13

Table A.48 Measurement of Load and Deflection Relationships of 5SB12N-1.6-10-ND (Continued)

LC		Mid. Def.		W. Def.		E. Def.		W. Sett.		E. Sett.		Net Def.	
kips	kN	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm
170	754	0.31	7.80	0.31	7.97	0.30	7.63	0.09	2.41	0.09	2.41	0.21	5.44
169	753	0.31	7.80	0.31	7.97	0.30	7.64	0.09	2.41	0.09	2.41	0.21	5.44
168	747	0.31	7.84	0.32	8.01	0.30	7.67	0.09	2.41	0.09	2.41	0.22	5.48
167	745	0.31	7.84	0.32	8.00	0.30	7.68	0.09	2.41	0.09	2.41	0.22	5.48
167	741	0.31	7.87	0.32	8.04	0.30	7.70	0.09	2.41	0.09	2.41	0.22	5.51
166	740	0.31	7.87	0.32	8.04	0.30	7.70	0.09	2.41	0.09	2.41	0.22	5.51
166	740	0.31	7.88	0.32	8.06	0.30	7.70	0.09	2.41	0.09	2.41	0.22	5.52
167	741	0.31	7.87	0.32	8.05	0.30	7.70	0.09	2.41	0.09	2.41	0.22	5.51
166	741	0.31	7.88	0.32	8.05	0.30	7.70	0.09	2.41	0.09	2.41	0.22	5.52
167	742	0.32	8.02	0.32	8.17	0.31	7.87	0.09	2.41	0.09	2.41	0.22	5.66
166	738	0.32	8.08	0.32	8.22	0.31	7.93	0.09	2.41	0.09	2.41	0.23	5.72
165	736	0.32	8.10	0.32	8.24	0.31	7.95	0.09	2.41	0.09	2.41	0.23	5.74
165	734	0.32	8.13	0.33	8.28	0.31	7.98	0.09	2.41	0.09	2.41	0.23	5.77
165	734	0.32	8.15	0.33	8.29	0.32	8.01	0.09	2.41	0.09	2.41	0.23	5.79
165	732	0.32	8.16	0.33	8.30	0.32	8.03	0.09	2.41	0.09	2.41	0.23	5.80
164	731	0.32	8.19	0.33	8.34	0.32	8.05	0.09	2.41	0.09	2.41	0.23	5.83
164	728	0.33	8.33	0.33	8.46	0.32	8.20	0.09	2.41	0.09	2.41	0.23	5.97
163	727	0.33	8.35	0.33	8.47	0.32	8.22	0.09	2.41	0.09	2.41	0.24	5.99
163	724	0.33	8.39	0.34	8.52	0.32	8.25	0.09	2.41	0.09	2.41	0.24	6.03
162	722	0.33	8.42	0.34	8.58	0.33	8.27	0.09	2.41	0.09	2.41	0.24	6.06
161	714	0.33	8.48	0.34	8.62	0.33	8.33	0.09	2.41	0.09	2.41	0.24	6.12
160	713	0.33	8.49	0.34	8.64	0.33	8.33	0.09	2.41	0.09	2.41	0.24	6.13

Table A.49 Measurement of Rosette LVDTs of 5SB12N-1.6-10-ND

LC		NWD1	NWD2	NWV1	NWV2	NWH1	NWH2	NED1	NED2	NEV1	NEV2	NEH1	NEH2
kips	kN	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in
0	0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
30	132	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
60	265	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
90	399	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
100	445	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
110	490	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
120	533	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
130	577	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
140	623	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
150	667	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
160	710	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
170	755	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
180	799	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
190	843	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
200	888	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
204	905	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
204	906	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
203	905	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
198	881	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
197	878	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
199	883	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
199	883	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Table A.49 Measurement of Rosette LVDTs of 5SB12N-1.6-10-ND (Continued)

LC		NWD1	NWD2	NWV1	NWV2	NWH1	NWH2	NED1	NED2	NEV1	NEV2	NEH1	NEH2
kips	kN	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in
198	882	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
191	848	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
190	844	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
190	845	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-0.001	0.000	0.000	0.000	0.000
187	831	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-0.001	0.000	0.000	0.000	0.000
185	823	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-0.001	0.000	0.000	0.000	0.000
185	821	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-0.001	0.000	0.000	0.000	0.000
185	821	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-0.001	0.000	0.000	0.000	0.000
185	821	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-0.001	0.000	0.000	0.000	0.000
184	820	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-0.001	0.000	0.000	0.000	0.000
184	820	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-0.001	0.000	0.000	0.000	0.000
184	817	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-0.001	0.000	0.000	0.000	0.000
183	813	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-0.001	0.000	0.000	0.000	0.000
182	810	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-0.001	0.000	0.000	0.000	0.000
181	805	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-0.001	0.000	0.000	0.000	0.000
180	802	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-0.001	0.000	0.000	0.000	0.000
180	799	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-0.001	0.000	0.000	0.000	0.000
179	797	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-0.001	0.000	0.000	0.000	0.000
179	796	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-0.001	0.000	0.000	0.000	0.000
179	795	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-0.001	0.000	0.000	0.000	0.000
178	794	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-0.001	0.000	0.000	0.000	0.000
178	790	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-0.001	0.000	0.000	0.000	0.000

Table A.49 Measurement of Rosette LVDTs of 5SB12N-1.6-10-ND (Continued)

LC		NWD1	NWD2	NWV1	NWV2	NWH1	NWH2	NED1	NED2	NEV1	NEV2	NEH1	NEH2
kips	kN	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in
174	773	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-0.001	-0.001	0.000	0.000	0.000
172	764	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-0.001	-0.001	0.000	0.000	0.000
171	762	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-0.001	-0.001	0.000	0.000	0.000
171	760	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-0.001	-0.001	0.000	0.000	0.000
170	758	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-0.001	-0.001	0.000	0.000	0.000
171	759	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-0.001	-0.001	0.000	0.000	0.000
170	758	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-0.001	-0.001	0.000	0.000	0.000
170	754	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-0.001	0.000	0.000	0.000	0.000
169	752	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-0.001	0.000	0.000	0.000	0.000
169	750	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-0.001	0.000	0.000	0.000	0.000
168	749	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-0.001	0.000	0.000	0.000	0.000
169	754	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-0.001	0.000	0.000	0.000	0.000
170	755	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-0.001	0.000	0.000	0.000	0.000
170	758	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
171	760	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
171	763	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-0.001	0.000	0.000	0.000	0.000
172	763	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-0.001	0.000	0.000	0.000	0.000
172	763	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.001	0.000	0.000
171	762	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.001	0.000	0.000
170	754	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.004	0.001	0.001	0.000
169	753	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.005	0.001	0.001	0.000
168	747	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.005	0.001	0.001	0.000

Table A.49 Measurement of Rosette LVDTs of 5SB12N-1.6-10-ND (Continued)

LC		NWD1	NWD2	NWV1	NWV2	NWH1	NWH2	NED1	NED2	NEV1	NEV2	NEH1	NEH2
kips	kN	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in
167	745	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.005	0.001	0.001	0.000
167	741	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.005	0.001	0.001	0.000
166	740	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.005	0.001	0.001	0.000
166	740	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.005	0.001	0.001	0.000
167	741	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.005	0.001	0.001	0.000
166	741	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.005	0.001	0.001	0.000
167	742	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.003	0.007	0.001	0.002	0.000
166	738	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.004	0.008	0.001	0.002	0.000
165	736	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.005	0.008	0.001	0.002	0.000
165	734	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.005	0.009	0.001	0.002	0.000
165	734	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.005	0.009	0.001	0.002	0.000
165	732	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.006	0.009	0.001	0.002	0.000
164	731	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.006	0.009	0.001	0.002	0.000
164	728	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.007	0.011	0.001	0.002	0.000
163	727	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.007	0.011	0.001	0.002	0.000
163	724	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.008	0.011	0.001	0.002	0.000
162	722	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.008	0.011	0.001	0.002	0.000
161	714	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.008	0.012	0.001	0.002	0.000
160	713	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.008	0.012	0.001	0.002	0.000

Table A.50 Measurement of Tendon Slippage of 5SB12N-1.6-10-ND

Load Cell		T1	T2	T3	T4	T5	T6	T7	T8	T9	T10
kips	kN	in	in	in	in	in	in	in	in	in	in
0	0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
30	132	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
60	265	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
90	399	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
100	445	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
110	490	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
120	533	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
130	577	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
140	623	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
150	667	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
160	710	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
170	755	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
180	799	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000
190	843	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000
200	888	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000
204	905	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.001	0.000	0.000
204	906	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.001	0.000	0.000
203	905	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.001	0.000	0.000
198	881	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.004	0.008	0.000
197	878	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.005	0.010	0.000
199	883	0.000	0.000	0.000	0.001	0.000	0.000	0.001	0.005	0.011	0.000
199	883	0.000	0.000	0.000	0.001	0.000	0.000	0.001	0.005	0.012	0.000

Table A.50 Measurement of Tendon Slippage of 5SB12N-1.6-10-ND (Continued)

Load Cell		T1	T2	T3	T4	T5	T6	T7	T8	T9	T10
kips	kN	in	in	in	in	in	in	in	in	in	in
198	882	0.000	0.000	0.001	0.001	0.000	0.000	0.001	0.006	0.012	0.000
191	848	0.000	0.000	0.008	0.003	0.000	0.000	0.002	0.007	0.014	0.000
190	844	0.000	0.000	0.009	0.003	0.000	0.000	0.003	0.007	0.015	0.000
190	845	0.000	0.001	0.020	0.008	0.002	0.000	0.007	0.012	0.020	0.000
187	831	0.000	0.002	0.030	0.011	0.004	0.000	0.008	0.013	0.021	0.000
185	823	0.000	0.002	0.032	0.012	0.005	0.000	0.009	0.013	0.022	-0.001
185	821	0.000	0.002	0.032	0.012	0.005	0.000	0.010	0.014	0.022	-0.001
185	821	0.000	0.003	0.033	0.012	0.005	0.000	0.010	0.014	0.022	-0.001
185	821	0.000	0.003	0.033	0.013	0.006	0.000	0.010	0.014	0.023	-0.001
184	820	0.000	0.003	0.033	0.013	0.006	0.000	0.011	0.015	0.023	-0.001
184	820	0.000	0.003	0.034	0.013	0.006	0.000	0.011	0.015	0.023	-0.001
184	817	0.000	0.004	0.040	0.018	0.012	0.007	0.016	0.021	0.028	-0.001
183	813	0.000	0.005	0.042	0.019	0.013	0.008	0.017	0.022	0.029	0.000
182	810	0.000	0.005	0.043	0.019	0.014	0.010	0.018	0.022	0.030	0.000
181	805	0.000	0.006	0.045	0.021	0.015	0.012	0.019	0.023	0.031	0.000
180	802	0.000	0.006	0.046	0.022	0.016	0.013	0.020	0.024	0.031	0.000
180	799	0.001	0.007	0.047	0.023	0.016	0.014	0.021	0.025	0.032	0.001
179	797	0.000	0.007	0.048	0.023	0.017	0.015	0.022	0.026	0.032	0.001
179	796	0.000	0.008	0.049	0.024	0.017	0.016	0.022	0.026	0.033	0.001
179	795	0.000	0.008	0.049	0.025	0.018	0.017	0.023	0.027	0.034	0.001
178	794	0.000	0.008	0.050	0.025	0.019	0.017	0.024	0.028	0.035	0.001
178	790	0.000	0.009	0.052	0.026	0.021	0.020	0.025	0.030	0.036	0.005

Table A.50 Measurement of Tendon Slippage of 5SB12N-1.6-10-ND (Continued)

Load Cell		T1	T2	T3	T4	T5	T6	T7	T8	T9	T10
kips	kN	in	in	in	in	in	in	in	in	in	in
174	773	0.000	0.010	0.057	0.029	0.025	0.025	0.029	0.033	0.038	0.007
172	764	0.000	0.011	0.059	0.031	0.027	0.028	0.031	0.035	0.040	0.010
171	762	0.000	0.012	0.061	0.032	0.028	0.029	0.031	0.036	0.041	0.010
171	760	0.000	0.012	0.062	0.033	0.028	0.029	0.032	0.037	0.041	0.011
170	758	0.000	0.012	0.063	0.033	0.029	0.030	0.032	0.040	0.042	0.011
171	759	0.000	0.013	0.064	0.033	0.029	0.030	0.033	0.043	0.042	0.013
170	758	0.000	0.013	0.065	0.034	0.030	0.031	0.033	0.046	0.043	0.013
170	754	0.000	0.014	0.066	0.034	0.031	0.032	0.034	0.048	0.044	0.014
169	752	0.000	0.014	0.067	0.036	0.031	0.033	0.034	0.050	0.045	0.016
169	750	0.000	0.024	0.100	0.050	0.044	0.047	0.046	0.063	0.056	0.024
168	749	0.000	0.024	0.101	0.050	0.045	0.048	0.046	0.064	0.057	0.024
169	754	0.001	0.028	0.109	0.056	0.051	0.054	0.052	0.069	0.063	0.027
170	755	0.001	0.029	0.109	0.056	0.051	0.054	0.053	0.069	0.063	0.027
170	758	0.000	0.032	0.115	0.061	0.057	0.060	0.058	0.074	0.068	0.030
171	760	0.000	0.033	0.115	0.061	0.057	0.060	0.058	0.074	0.068	0.030
171	763	0.000	0.035	0.119	0.063	0.061	0.065	0.062	0.079	0.072	0.032
172	763	0.000	0.035	0.119	0.063	0.061	0.065	0.062	0.079	0.072	0.032
172	763	0.001	0.037	0.125	0.069	0.065	0.070	0.069	0.085	0.079	0.037
171	762	0.000	0.037	0.125	0.069	0.066	0.070	0.069	0.085	0.079	0.039
170	754	0.000	0.040	0.131	0.073	0.072	0.076	0.076	0.095	0.090	0.054
169	753	0.000	0.040	0.132	0.073	0.072	0.076	0.077	0.095	0.090	0.054
168	747	0.000	0.041	0.132	0.074	0.073	0.078	0.078	0.096	0.091	0.056

Table A.50 Measurement of Tendon Slippage of 5SB12N-1.6-10-ND (Continued)

Load Cell		T1	T2	T3	T4	T5	T6	T7	T8	T9	T10
kips	kN	in	in	in	in	in	in	in	in	in	in
167	745	0.000	0.041	0.133	0.075	0.073	0.078	0.079	0.097	0.092	0.056
167	741	0.000	0.041	0.133	0.076	0.074	0.079	0.079	0.098	0.093	0.057
166	740	0.001	0.041	0.133	0.076	0.074	0.079	0.079	0.098	0.093	0.057
166	740	0.001	0.041	0.133	0.076	0.074	0.079	0.079	0.098	0.093	0.057
167	741	0.001	0.041	0.133	0.076	0.074	0.079	0.079	0.098	0.093	0.057
166	741	0.000	0.041	0.133	0.076	0.074	0.079	0.079	0.098	0.093	0.057
167	742	0.000	0.041	0.135	0.078	0.077	0.082	0.082	0.102	0.098	0.064
166	738	0.001	0.042	0.136	0.078	0.077	0.082	0.083	0.103	0.100	0.066
165	736	0.000	0.042	0.136	0.078	0.078	0.083	0.084	0.103	0.101	0.067
165	734	0.000	0.042	0.137	0.078	0.078	0.084	0.084	0.104	0.102	0.068
165	734	0.000	0.043	0.138	0.080	0.078	0.084	0.085	0.104	0.103	0.069
165	732	0.000	0.043	0.138	0.080	0.079	0.085	0.085	0.105	0.103	0.070
164	731	0.000	0.043	0.138	0.080	0.079	0.085	0.085	0.106	0.104	0.070
164	728	0.000	0.044	0.141	0.083	0.082	0.088	0.088	0.109	0.108	0.074
163	727	0.000	0.045	0.141	0.083	0.082	0.088	0.088	0.110	0.108	0.074
163	724	0.000	0.046	0.144	0.085	0.083	0.089	0.089	0.110	0.109	0.075
162	722	0.000	0.047	0.145	0.085	0.083	0.089	0.090	0.111	0.110	0.076
161	714	0.000	0.048	0.146	0.087	0.086	0.092	0.091	0.113	0.112	0.078
160	713	0.000	0.048	0.147	0.087	0.086	0.092	0.091	0.113	0.112	0.078

A.18 5SB12T-1.2-14-D

Table A.51 Measurement of Load and Deflection Relationships of 5SB12T-1.2-14-D

SW.LC		SE. LC		TRF		Mid. Def.		SW. Def.		SE. Def.		SW. Sett.		SE. Sett.		Net Def.	
kips	kN	kips	kN	kips	kN	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
0	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
18	81	11	50	30	132	0.01	0.32	0.02	0.48	0.01	0.16	0.00	0.02	0.00	0.05	0.01	0.18
37	165	24	107	61	272	0.03	0.79	0.03	0.89	0.03	0.70	0.01	0.22	0.02	0.59	0.01	0.29
54	239	36	159	90	398	0.04	1.13	0.05	1.19	0.04	1.07	0.01	0.34	0.04	0.91	0.02	0.40
71	317	49	216	120	533	0.06	1.44	0.06	1.46	0.06	1.42	0.02	0.47	0.05	1.14	0.02	0.53
72	318	49	218	120	536	0.06	1.45	0.06	1.47	0.06	1.43	0.02	0.47	0.05	1.14	0.02	0.54
88	392	62	274	150	666	0.07	1.73	0.07	1.72	0.07	1.75	0.02	0.56	0.05	1.33	0.03	0.68
105	467	75	333	180	800	0.08	1.98	0.08	1.94	0.08	2.03	0.02	0.61	0.06	1.52	0.03	0.81
116	517	84	373	200	890	0.08	2.16	0.08	2.08	0.09	2.23	0.03	0.65	0.06	1.63	0.04	0.91
122	540	88	392	210	932	0.09	2.23	0.08	2.14	0.09	2.31	0.03	0.66	0.07	1.71	0.04	0.94
127	566	93	413	220	979	0.09	2.32	0.09	2.21	0.10	2.42	0.03	0.67	0.07	1.75	0.04	1.00
133	591	97	433	230	1025	0.10	2.44	0.09	2.31	0.10	2.56	0.03	0.68	0.07	1.76	0.04	1.11
138	613	102	453	240	1066	0.10	2.54	0.09	2.38	0.11	2.69	0.03	0.68	0.07	1.78	0.05	1.20
140	625	104	463	245	1088	0.10	2.59	0.10	2.42	0.11	2.76	0.03	0.68	0.07	1.79	0.05	1.25
143	637	107	474	250	1111	0.10	2.65	0.10	2.48	0.11	2.83	0.03	0.68	0.07	1.90	0.05	1.26
145	646	108	482	254	1128	0.11	2.71	0.10	2.52	0.11	2.90	0.03	0.68	0.07	1.90	0.05	1.32
145	647	109	485	255	1132	0.11	2.78	0.10	2.59	0.12	2.97	0.03	0.68	0.07	1.90	0.05	1.38
142	630	108	479	249	1108	0.12	2.96	0.11	2.76	0.12	3.16	0.03	0.68	0.07	1.90	0.06	1.56
141	625	107	477	248	1102	0.12	2.99	0.11	2.79	0.13	3.18	0.03	0.68	0.08	1.91	0.06	1.59

Table A.51 Measurement of Load and Deflection Relationships of 5SB12T-1.2-14-D (Continued)

SW.LC		SE. LC		TRF		Mid. Def.		SW. Def.		SE. Def.		SW. Sett.		SE. Sett.		Net Def.	
kips	kN	kips	kN	kips	kN	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
140	623	107	476	247	1099	0.12	3.01	0.11	2.81	0.13	3.20	0.03	0.68	0.08	1.91	0.06	1.61
140	622	107	475	247	1097	0.12	3.02	0.11	2.83	0.13	3.22	0.03	0.68	0.08	1.91	0.06	1.63
140	621	107	475	246	1096	0.12	3.04	0.11	2.85	0.13	3.24	0.03	0.68	0.08	1.91	0.06	1.65
138	612	105	469	243	1081	0.12	3.08	0.11	2.88	0.13	3.27	0.03	0.68	0.08	1.91	0.07	1.68
141	629	109	484	250	1113	0.12	3.16	0.12	2.96	0.13	3.36	0.03	0.68	0.08	1.91	0.07	1.76
144	639	111	495	255	1134	0.13	3.24	0.12	3.03	0.14	3.44	0.03	0.68	0.08	1.91	0.07	1.84
146	648	114	507	260	1155	0.13	3.36	0.12	3.14	0.14	3.58	0.03	0.68	0.08	1.91	0.08	1.97
148	658	117	520	265	1177	0.14	3.50	0.13	3.27	0.15	3.72	0.03	0.68	0.08	1.91	0.08	2.10
148	660	120	533	268	1193	0.15	3.82	0.14	3.56	0.16	4.08	0.03	0.68	0.08	1.91	0.10	2.42
139	620	115	511	254	1131	0.17	4.26	0.17	4.25	0.17	4.28	0.03	0.68	0.08	1.91	0.11	2.87
138	615	114	508	252	1123	0.17	4.30	0.17	4.31	0.17	4.30	0.03	0.68	0.08	1.91	0.11	2.90
137	611	113	504	251	1115	0.17	4.34	0.17	4.36	0.17	4.32	0.03	0.68	0.08	1.91	0.12	2.94
141	629	118	524	259	1153	0.18	4.50	0.18	4.56	0.17	4.44	0.03	0.68	0.08	1.91	0.12	3.10
144	638	121	539	265	1177	0.19	4.76	0.19	4.90	0.18	4.63	0.03	0.68	0.08	1.91	0.13	3.37
143	637	121	538	264	1174	0.19	4.78	0.19	4.92	0.18	4.64	0.03	0.68	0.08	1.91	0.13	3.39
143	634	121	536	263	1171	0.19	4.80	0.19	4.95	0.18	4.65	0.03	0.68	0.08	1.91	0.13	3.40
143	637	121	540	265	1177	0.19	4.81	0.20	4.97	0.18	4.65	0.03	0.68	0.08	1.91	0.13	3.42
143	637	122	544	265	1181	0.20	4.97	0.20	5.20	0.19	4.74	0.03	0.68	0.08	1.91	0.14	3.57
143	636	122	543	265	1179	0.20	5.00	0.21	5.22	0.19	4.78	0.03	0.68	0.08	1.91	0.14	3.60
142	633	123	549	266	1182	0.21	5.21	0.22	5.52	0.19	4.91	0.03	0.68	0.08	1.91	0.15	3.82
137	611	123	547	260	1158	0.22	5.64	0.24	6.12	0.20	5.17	0.03	0.68	0.08	1.91	0.17	4.24
137	607	125	556	261	1163	0.24	5.99	0.26	6.59	0.21	5.39	0.03	0.68	0.08	1.91	0.18	4.59

Table A.51 Measurement of Load and Deflection Relationships of 5SB12T-1.2-14-D (Continued)

SW.LC		SE. LC		TRF		Mid. Def.		SW. Def.		SE. Def.		SW. Sett.		SE. Sett.		Net Def.	
kips	kN	kips	kN	kips	kN	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
136	606	126	562	263	1168	0.25	6.23	0.27	6.92	0.22	5.54	0.03	0.68	0.08	1.91	0.19	4.84
134	598	125	556	259	1154	0.25	6.27	0.27	6.98	0.22	5.56	0.03	0.68	0.08	1.91	0.19	4.87
135	599	126	559	260	1158	0.25	6.29	0.28	7.00	0.22	5.57	0.03	0.68	0.08	1.91	0.19	4.89
133	592	124	552	257	1144	0.25	6.31	0.28	7.03	0.22	5.59	0.03	0.68	0.08	1.91	0.19	4.91
135	602	127	563	262	1166	0.25	6.39	0.28	7.14	0.22	5.64	0.03	0.68	0.08	1.91	0.20	4.99
133	594	130	577	263	1171	0.27	6.98	0.31	7.95	0.24	6.01	0.03	0.68	0.08	1.91	0.22	5.59
131	581	133	593	264	1174	0.31	7.77	0.36	9.03	0.26	6.52	0.03	0.68	0.08	1.91	0.25	6.38
128	568	131	584	259	1152	0.31	7.86	0.36	9.16	0.26	6.55	0.03	0.68	0.08	1.91	0.25	6.46
128	571	132	587	261	1159	0.31	7.87	0.36	9.17	0.26	6.57	0.03	0.68	0.08	1.91	0.25	6.47
131	582	139	618	270	1200	0.34	8.71	0.40	10.23	0.28	7.19	0.03	0.68	0.08	1.91	0.29	7.31
131	582	139	619	270	1201	0.34	8.73	0.40	10.25	0.28	7.21	0.03	0.68	0.08	1.91	0.29	7.33
128	570	137	611	266	1181	0.35	8.82	0.41	10.39	0.29	7.26	0.03	0.68	0.08	1.91	0.29	7.43
128	569	138	612	265	1181	0.35	8.84	0.41	10.42	0.29	7.26	0.03	0.68	0.08	1.91	0.29	7.45
129	576	142	630	271	1205	0.37	9.33	0.43	11.04	0.30	7.61	0.03	0.68	0.08	1.91	0.31	7.93
128	571	141	626	269	1198	0.37	9.33	0.43	11.05	0.30	7.62	0.03	0.68	0.08	1.91	0.31	7.94
128	571	141	627	269	1198	0.37	9.43	0.44	11.17	0.30	7.68	0.03	0.68	0.08	1.91	0.32	8.03
128	567	140	625	268	1192	0.37	9.43	0.44	11.19	0.30	7.67	0.03	0.68	0.08	1.91	0.32	8.03
130	578	145	645	275	1223	0.39	9.82	0.46	11.68	0.31	7.96	0.03	0.68	0.08	1.91	0.33	8.43
129	575	145	643	274	1218	0.39	9.83	0.46	11.70	0.31	7.96	0.03	0.68	0.08	1.91	0.33	8.43
128	570	144	640	272	1210	0.39	9.89	0.46	11.78	0.31	7.99	0.03	0.68	0.08	1.91	0.33	8.49
127	565	146	650	273	1215	0.41	10.38	0.49	12.42	0.33	8.34	0.03	0.68	0.08	1.91	0.35	8.98
125	558	143	635	268	1192	0.41	10.41	0.49	12.43	0.33	8.40	0.03	0.68	0.08	1.91	0.35	9.01

Table A.51 Measurement of Load and Deflection Relationships of 5SB12T-1.2-14-D (Continued)

SW.LC		SE. LC		TRF		Mid. Def.		SW. Def.		SE. Def.		SW. Sett.		SE. Sett.		Net Def.	
kips	kN	kips	kN	kips	kN	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
123	547	139	619	262	1167	0.41	10.50	0.49	12.43	0.34	8.57	0.03	0.68	0.08	1.91	0.36	9.10
124	551	140	622	264	1173	0.41	10.50	0.49	12.43	0.34	8.57	0.03	0.68	0.08	1.91	0.36	9.10
124	551	139	620	263	1172	0.41	10.52	0.49	12.44	0.34	8.59	0.03	0.68	0.08	1.91	0.36	9.12
123	545	137	611	260	1156	0.41	10.54	0.49	12.45	0.34	8.64	0.03	0.68	0.08	1.91	0.36	9.14
118	523	127	565	245	1088	0.41	10.49	0.48	12.17	0.35	8.81	0.03	0.68	0.08	1.91	0.36	9.09
119	529	128	567	246	1096	0.42	10.55	0.48	12.17	0.35	8.93	0.03	0.68	0.08	1.91	0.36	9.15
121	537	129	575	250	1112	0.42	10.63	0.48	12.23	0.36	9.03	0.03	0.68	0.08	1.91	0.36	9.23
120	535	131	584	252	1120	0.44	11.16	0.50	12.81	0.37	9.52	0.03	0.68	0.08	1.91	0.38	9.77
112	500	130	576	242	1076	0.48	12.14	0.55	13.96	0.41	10.32	0.03	0.68	0.08	1.91	0.42	10.74
107	476	122	543	229	1019	0.52	13.19	0.59	14.92	0.45	11.45	0.03	0.68	0.08	1.91	0.46	11.79
107	477	122	542	229	1019	0.52	13.21	0.59	14.93	0.45	11.49	0.03	0.68	0.08	1.91	0.47	11.81
101	449	118	524	219	973	0.56	14.18	0.63	15.97	0.49	12.39	0.03	0.68	0.08	1.91	0.50	12.79
99	441	117	519	216	960	0.56	14.28	0.63	16.09	0.49	12.47	0.03	0.68	0.08	1.91	0.51	12.88
98	437	116	516	214	953	0.56	14.28	0.63	16.10	0.49	12.47	0.03	0.68	0.08	1.91	0.51	12.89
99	439	117	518	215	958	0.56	14.30	0.63	16.12	0.49	12.48	0.03	0.68	0.08	1.91	0.51	12.90
98	437	116	516	214	953	0.56	14.30	0.63	16.12	0.49	12.47	0.03	0.68	0.08	1.91	0.51	12.90
98	434	115	513	213	947	0.56	14.30	0.63	16.12	0.49	12.49	0.03	0.68	0.08	1.91	0.51	12.91
98	435	116	515	214	950	0.56	14.31	0.64	16.13	0.49	12.49	0.03	0.68	0.08	1.91	0.51	12.91
98	436	116	515	214	951	0.56	14.30	0.63	16.13	0.49	12.47	0.03	0.68	0.08	1.91	0.51	12.90
97	432	115	511	212	944	0.56	14.30	0.64	16.13	0.49	12.48	0.03	0.68	0.08	1.91	0.51	12.91
96	429	114	509	211	938	0.56	14.30	0.64	16.13	0.49	12.47	0.03	0.68	0.08	1.91	0.51	12.91
97	431	115	510	211	940	0.56	14.29	0.64	16.13	0.49	12.45	0.03	0.68	0.08	1.91	0.51	12.90

Table A.52 Measurement of Tendon Slippage of 5SB12T-1.2-14-D

TRF		T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12	T13	T14
kips	kN	in	in	in	in	in	in	in	in	in	in	in	in	in	in
0	0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-0.001	0.000
30	132	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
61	272	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000
90	398	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.003	0.000	0.000	0.000	0.000	0.000	0.000
120	533	0.000	0.000	0.000	0.000	0.000	0.002	0.002	0.006	0.001	0.000	0.000	0.000	0.000	0.000
120	536	0.000	0.000	0.000	0.000	0.000	0.003	0.002	0.006	0.001	0.000	0.000	0.000	0.000	0.000
150	666	0.000	0.000	0.000	0.000	0.000	0.005	0.003	0.016	0.003	0.009	0.000	0.000	-0.001	0.000
180	800	0.000	0.000	0.000	0.001	0.000	0.008	0.003	0.025	0.003	0.015	0.000	0.000	0.000	0.000
200	890	0.000	0.000	0.000	0.001	0.000	0.011	0.004	0.032	0.003	0.020	0.000	0.000	-0.001	0.000
210	932	0.000	-0.001	0.000	0.001	0.000	0.011	0.004	0.035	0.003	0.023	0.001	0.000	0.000	0.000
220	979	0.000	0.000	0.000	0.001	0.005	0.012	0.005	0.037	0.003	0.029	0.001	0.000	0.000	0.000
230	1025	0.000	0.000	0.000	0.001	0.034	0.014	0.006	0.038	0.003	0.032	0.000	0.000	-0.001	0.000
240	1066	0.000	0.000	0.000	0.003	0.038	0.016	0.007	0.039	0.003	0.039	0.001	0.000	0.000	0.000
245	1088	0.000	0.000	0.000	0.014	0.039	0.016	0.007	0.039	0.003	0.042	0.001	0.000	-0.001	0.000
250	1111	0.000	0.000	-0.001	0.024	0.040	0.016	0.008	0.039	0.005	0.044	0.000	0.000	0.000	0.000
254	1128	0.000	0.000	0.000	0.031	0.041	0.016	0.008	0.039	0.005	0.045	0.001	0.000	0.000	0.000
255	1132	0.000	-0.001	0.000	0.044	0.041	0.017	0.008	0.039	0.005	0.046	0.000	0.000	0.000	0.000
249	1108	0.000	-0.001	0.004	0.057	0.045	0.020	0.011	0.040	0.005	0.046	0.000	0.000	0.000	0.000
248	1102	0.000	0.000	0.010	0.061	0.046	0.020	0.012	0.040	0.005	0.046	0.000	0.000	0.000	0.000
247	1099	0.000	0.000	0.016	0.061	0.046	0.020	0.012	0.040	0.005	0.046	0.000	0.000	-0.001	0.000
247	1097	0.000	0.000	0.021	0.063	0.046	0.020	0.013	0.040	0.005	0.046	0.001	0.000	0.000	0.000
246	1096	0.000	-0.001	0.024	0.063	0.046	0.021	0.013	0.040	0.005	0.046	0.001	0.000	0.000	0.000

Table A.52 Measurement of Tendon Slippage of 5SB12T-1.2-14-D (Continued)

TRF		T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12	T13	T14
kips	kN	in	in	in	in	in	in	in	in	in	in	in	in	in	in
243	1081	0.000	0.000	0.033	0.066	0.047	0.021	0.015	0.040	0.005	0.046	0.000	0.000	-0.001	0.000
250	1113	0.000	0.000	0.039	0.071	0.048	0.022	0.016	0.040	0.005	0.046	0.000	0.000	-0.001	0.000
255	1134	0.000	0.000	0.039	0.071	0.050	0.022	0.019	0.040	0.005	0.046	0.001	0.000	-0.001	0.000
260	1155	0.000	0.000	0.044	0.075	0.052	0.023	0.021	0.041	0.005	0.046	0.001	0.000	0.000	0.000
265	1177	0.000	-0.001	0.052	0.079	0.054	0.024	0.025	0.044	0.006	0.048	0.001	0.000	-0.001	0.000
268	1193	0.002	-0.001	0.063	0.091	0.059	0.028	0.032	0.051	0.009	0.050	0.001	0.000	0.000	0.000
254	1131	0.012	0.007	0.083	0.098	0.060	0.028	0.032	0.051	0.008	0.051	0.000	0.000	0.000	0.000
252	1123	0.013	0.008	0.086	0.099	0.060	0.028	0.032	0.051	0.008	0.050	0.001	0.000	0.000	0.000
251	1115	0.015	0.010	0.090	0.099	0.060	0.028	0.033	0.051	0.009	0.051	0.001	0.000	0.000	-0.001
259	1153	0.018	0.012	0.092	0.102	0.061	0.029	0.033	0.051	0.008	0.051	0.001	0.000	-0.001	0.000
265	1177	0.024	0.018	0.103	0.105	0.061	0.029	0.033	0.052	0.009	0.051	0.000	0.000	0.000	0.000
264	1174	0.024	0.018	0.103	0.105	0.061	0.029	0.033	0.052	0.009	0.051	0.000	0.000	0.000	0.000
263	1171	0.025	0.019	0.103	0.107	0.061	0.029	0.033	0.052	0.008	0.051	0.001	0.000	-0.001	0.000
265	1177	0.025	0.019	0.103	0.107	0.061	0.029	0.033	0.052	0.009	0.051	0.001	0.000	0.000	0.000
265	1181	0.029	0.024	0.108	0.110	0.061	0.029	0.033	0.052	0.009	0.051	0.001	0.000	-0.001	0.000
265	1179	0.029	0.025	0.108	0.110	0.061	0.029	0.033	0.052	0.008	0.051	0.001	0.000	-0.001	0.000
266	1182	0.037	0.031	0.118	0.113	0.061	0.029	0.034	0.052	0.008	0.051	0.001	0.000	-0.001	0.000
260	1158	0.062	0.044	0.140	0.119	0.061	0.029	0.034	0.052	0.008	0.051	0.001	0.000	-0.001	0.000
261	1163	0.061	0.054	0.155	0.126	0.061	0.029	0.034	0.052	0.008	0.051	0.001	0.000	-0.001	0.000
263	1168	0.064	0.061	0.167	0.134	0.061	0.029	0.034	0.052	0.009	0.051	0.001	0.000	-0.001	-0.001
259	1154	0.065	0.063	0.168	0.135	0.061	0.029	0.033	0.052	0.008	0.051	0.000	0.000	-0.001	0.000
260	1158	0.067	0.065	0.170	0.136	0.061	0.029	0.033	0.052	0.008	0.051	0.001	0.000	-0.001	0.000

Table A.52 Measurement of Tendon Slippage of 5SB12T-1.2-14-D (Continued)

TRF		T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12	T13	T14
kips	kN	in	in	in	in	in	in	in	in	in	in	in	in	in	in
257	1144	0.068	0.065	0.171	0.137	0.061	0.029	0.034	0.052	0.008	0.051	0.001	0.000	0.000	0.000
262	1166	0.069	0.067	0.173	0.139	0.061	0.029	0.034	0.052	0.009	0.052	0.000	0.000	-0.001	0.000
263	1171	0.090	0.084	0.198	0.162	0.061	0.029	0.034	0.052	0.009	0.052	0.000	0.000	0.000	-0.001
264	1174	0.096	0.112	0.235	0.195	0.061	0.029	0.033	0.052	0.011	0.056	0.001	0.000	0.000	0.000
259	1152	0.108	0.116	0.239	0.200	0.061	0.029	0.034	0.053	0.011	0.056	0.005	0.000	-0.001	-0.001
261	1159	0.108	0.116	0.239	0.200	0.061	0.029	0.034	0.053	0.011	0.056	0.005	0.000	-0.001	-0.001
270	1200	0.110	0.140	0.271	0.227	0.062	0.028	0.035	0.056	0.014	0.063	0.009	0.000	-0.001	-0.001
270	1201	0.110	0.140	0.271	0.228	0.062	0.028	0.035	0.056	0.014	0.063	0.009	0.000	-0.001	-0.001
266	1181	0.118	0.143	0.277	0.232	0.062	0.028	0.035	0.056	0.014	0.063	0.009	0.000	-0.001	-0.001
265	1181	0.118	0.145	0.279	0.232	0.062	0.029	0.035	0.056	0.014	0.063	0.009	0.000	-0.001	-0.001
271	1205	0.119	0.158	0.298	0.247	0.063	0.029	0.035	0.057	0.018	0.066	0.012	0.000	0.000	0.000
269	1198	0.119	0.158	0.298	0.247	0.063	0.029	0.035	0.058	0.018	0.066	0.012	0.000	0.000	0.000
269	1198	0.122	0.162	0.303	0.250	0.063	0.029	0.035	0.058	0.018	0.066	0.012	0.000	-0.001	-0.001
268	1192	0.122	0.163	0.305	0.250	0.063	0.029	0.035	0.058	0.018	0.066	0.012	0.000	-0.001	-0.001
275	1223	0.124	0.172	0.318	0.261	0.064	0.029	0.036	0.059	0.021	0.068	0.015	0.000	-0.001	0.000
274	1218	0.124	0.172	0.319	0.261	0.064	0.029	0.036	0.059	0.021	0.068	0.014	0.000	0.000	-0.001
272	1210	0.127	0.175	0.322	0.264	0.064	0.029	0.036	0.059	0.021	0.068	0.014	0.000	-0.001	-0.001
273	1215	0.132	0.188	0.343	0.278	0.065	0.029	0.037	0.061	0.021	0.072	0.033	0.000	0.000	0.000
268	1192	0.132	0.188	0.343	0.278	0.065	0.029	0.036	0.061	0.021	0.072	0.046	0.000	0.000	-0.001
262	1167	0.136	0.191	0.348	0.281	0.065	0.029	0.037	0.064	0.028	0.075	0.061	0.000	-0.001	0.000
264	1173	0.136	0.192	0.348	0.281	0.065	0.029	0.037	0.064	0.029	0.076	0.062	0.000	-0.001	0.000
263	1172	0.136	0.192	0.348	0.281	0.065	0.029	0.037	0.065	0.029	0.077	0.063	0.004	0.000	0.000

Table A.52 Measurement of Tendon Slippage of 5SB12T-1.2-14-D (Continued)

TRF		T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12	T13	T14
kips	kN	in	in	in	in	in	in	in	in	in	in	in	in	in	in
260	1156	0.136	0.192	0.348	0.282	0.065	0.029	0.037	0.067	0.031	0.077	0.068	0.013	0.000	0.000
245	1088	0.136	0.192	0.349	0.282	0.065	0.029	0.037	0.067	0.031	0.078	0.073	0.049	0.000	0.007
246	1096	0.136	0.192	0.350	0.283	0.065	0.029	0.037	0.067	0.031	0.078	0.073	0.058	-0.001	0.013
250	1112	0.137	0.194	0.352	0.285	0.065	0.029	0.037	0.067	0.034	0.079	0.075	0.063	0.000	0.016
252	1120	0.145	0.207	0.373	0.304	0.065	0.029	0.037	0.068	0.034	0.080	0.081	0.077	0.005	0.027
242	1076	0.161	0.228	0.412	0.331	0.065	0.029	0.037	0.069	0.035	0.081	0.085	0.098	0.023	0.044
229	1019	0.177	0.251	0.452	0.360	0.065	0.029	0.037	0.069	0.035	0.083	0.090	0.153	0.064	0.103
229	1019	0.177	0.251	0.452	0.360	0.065	0.029	0.037	0.069	0.035	0.083	0.090	0.154	0.065	0.106
219	973	0.192	0.275	0.489	0.384	0.065	0.029	0.037	0.069	0.035	0.083	0.087	0.191	0.096	0.140
216	960	0.196	0.278	0.493	0.387	0.065	0.029	0.037	0.069	0.035	0.083	0.087	0.195	0.099	0.145
214	953	0.196	0.278	0.493	0.387	0.065	0.029	0.037	0.069	0.035	0.083	0.087	0.195	0.099	0.145
215	958	0.196	0.279	0.495	0.388	0.065	0.029	0.037	0.069	0.035	0.083	0.086	0.195	0.100	0.145
214	953	0.196	0.279	0.495	0.388	0.065	0.029	0.037	0.069	0.035	0.083	0.086	0.197	0.102	0.147
213	947	0.196	0.279	0.495	0.388	0.065	0.029	0.037	0.069	0.035	0.083	0.086	0.197	0.102	0.147
214	950	0.196	0.279	0.495	0.388	0.065	0.029	0.037	0.069	0.035	0.083	0.087	0.197	0.102	0.147
214	951	0.196	0.279	0.495	0.388	0.065	0.029	0.037	0.069	0.035	0.083	0.087	0.197	0.102	0.147
212	944	0.196	0.279	0.495	0.388	0.065	0.029	0.037	0.069	0.035	0.083	0.087	0.197	0.102	0.147
211	938	0.196	0.279	0.495	0.388	0.065	0.029	0.037	0.069	0.035	0.083	0.087	0.198	0.102	0.147
211	940	0.196	0.279	0.495	0.388	0.065	0.029	0.037	0.069	0.035	0.083	0.087	0.198	0.102	0.147

Table A.53 Measurement of Strain Gauges of 5SB12T-1.2-14-D

TRF		S1	S2	S3	S4	S11	S12	S13	S14
kips	kN	m/m	m/m	m/m	m/m	m/m	m/m	m/m	m/m
0	0	-19.34	-20.93	B.G.	0.00	-12.06	-18.88	-20.02	-23.89
30	132	-20.93	-24.11	B.G.	24.11	-14.56	-21.38	-22.98	-27.53
61	272	-22.52	58.92	B.G.	41.86	81.21	31.39	-36.85	-45.04
90	398	26.62	117.61	B.G.	58.69	266.84	184.72	-45.95	-61.65
120	533	35.26	181.31	B.G.	B.G.	446.79	342.37	-54.37	-79.85
120	536	34.81	181.08	B.G.	B.G.	448.61	342.60	-53.91	-80.08
150	666	80.53	255.93	B.G.	B.G.	664.27	945.44	370.12	-89.86
180	800	107.83	298.69	B.G.	B.G.	849.90	1286.22	876.06	204.06
200	890	128.99	325.76	B.G.	B.G.	1082.39	1543.28	1173.16	545.29
210	932	150.60	364.66	B.G.	B.G.	1147.91	1629.27	1270.29	657.90
220	979	200.19	425.18	B.G.	B.G.	1210.47	1712.30	1380.63	777.33
230	1025	212.70	435.64	B.G.	B.G.	1204.32	1729.37	1407.47	806.22
240	1066	277.08	523.91	B.G.	B.G.	1205.46	1754.39	1462.75	862.41
245	1088	282.09	543.02	B.G.	B.G.	1197.50	1756.44	1470.03	873.33
250	1111	280.72	553.48	B.G.	B.G.	1189.54	1755.07	1475.72	883.11
254	1128	295.74	567.13	B.G.	B.G.	1187.03	1755.53	1474.81	896.30
255	1132	314.16	570.54	B.G.	B.G.	1192.49	1757.57	1471.17	896.30
249	1108	479.32	747.75	B.G.	B.G.	1203.87	1765.99	1474.35	895.17
248	1102	519.13	789.38	B.G.	B.G.	1203.19	1766.22	1476.85	895.85
247	1099	536.42	811.91	B.G.	B.G.	1203.41	1766.45	1477.99	896.30
247	1097	546.20	831.70	B.G.	B.G.	1203.87	1767.13	1479.13	896.99
246	1096	554.84	846.48	B.G.	B.G.	1203.87	1767.36	1479.81	896.99

Table A.53 Measurement of Strain Gauges of 5SB12T-1.2-14-D (Continued)

TRF		S1	S2	S3	S4	S11	S12	S13	S14
kips	kN	m/m	m/m	m/m	m/m	m/m	m/m	m/m	m/m
243	1081	620.13	938.62	B.G.	B.G.	1204.32	1770.09	1482.77	900.85
250	1113	680.65	1011.87	B.G.	B.G.	1191.13	1762.12	1486.86	912.68
255	1134	788.47	1126.52	B.G.	B.G.	1182.48	1756.21	1487.09	915.19
260	1155	873.33	1228.89	B.G.	B.G.	1229.12	1808.08	1550.11	980.02
265	1177	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.
268	1193	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.
254	1131	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.
252	1123	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.
251	1115	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.
259	1153	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.
265	1177	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.
264	1174	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.
263	1171	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.
265	1177	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.
265	1181	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.
265	1179	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.
266	1182	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.
260	1158	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.
261	1163	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
211	940	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.

A.19 5SB12T-2.0-14-D

Table A.54 Measurement of Load and Deflection Relationships of 5SB12T-2.0-14-D

LC		Mid. Def.		W. Def.		E. Def.		W. Sett.		E. Sett.		Net Def.	
kips	kN	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm
0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
30	132	0.04	0.92	0.03	0.68	0.05	1.16	0.02	0.47	0.03	0.76	0.01	0.30
60	265	0.06	1.60	0.05	1.26	0.08	1.98	0.03	0.78	0.05	1.25	0.02	0.60
90	398	0.09	2.18	0.07	1.75	0.11	2.68	0.04	1.01	0.06	1.62	0.04	0.90
120	534	0.11	2.71	0.09	2.18	0.13	3.35	0.05	1.19	0.08	1.93	0.05	1.21
150	666	0.13	3.21	0.10	2.56	0.16	4.00	0.05	1.33	0.09	2.21	0.06	1.51
180	800	0.15	3.69	0.12	2.97	0.18	4.60	0.06	1.46	0.10	2.44	0.07	1.84
200	888	0.16	4.03	0.13	3.28	0.20	4.99	0.06	1.55	0.10	2.58	0.08	2.07
210	936	0.17	4.29	0.14	3.51	0.21	5.27	0.06	1.60	0.10	2.66	0.09	2.26
220	977	0.18	4.58	0.15	3.77	0.22	5.58	0.06	1.63	0.11	2.72	0.10	2.50
230	1021	0.20	5.10	0.16	4.16	0.24	6.07	0.07	1.67	0.11	2.81	0.11	2.88
240	1065	0.22	5.57	0.18	4.58	0.26	6.58	0.07	1.70	0.11	2.88	0.13	3.29
250	1110	0.25	6.30	0.21	5.24	0.29	7.31	0.07	1.74	0.12	2.96	0.15	3.93
260	1154	0.28	7.03	0.23	5.92	0.32	8.10	0.07	1.76	0.12	3.04	0.18	4.61
264	1176	0.29	7.45	0.25	6.31	0.34	8.56	0.07	1.78	0.12	3.08	0.20	5.01
259	1151	0.30	7.54	0.25	6.37	0.34	8.69	0.07	1.75	0.12	3.08	0.20	5.12
265	1177	0.31	7.80	0.26	6.60	0.35	8.99	0.07	1.76	0.12	3.11	0.21	5.36
270	1199	0.32	8.09	0.27	6.94	0.37	9.40	0.07	1.77	0.12	3.15	0.22	5.71
275	1221	0.34	8.64	0.29	7.43	0.39	10.01	0.07	1.79	0.13	3.20	0.25	6.23

Table A.54 Measurement of Load and Deflection Relationships of 5SB12T-2.0-14-D (Continued)

LC		Mid. Def.		W. Def.		E. Def.		W. Sett.		E. Sett.		Net Def.	
kips	kN	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm
280	1244	0.36	9.06	0.31	7.81	0.41	10.47	0.07	1.80	0.13	3.24	0.26	6.62
285	1266	0.38	9.62	0.33	8.32	0.44	11.08	0.07	1.81	0.13	3.29	0.28	7.15
290	1288	0.40	10.18	0.35	8.85	0.46	11.72	0.07	1.82	0.13	3.34	0.30	7.71
295	1310	0.43	10.80	0.37	9.39	0.49	12.40	0.07	1.83	0.13	3.39	0.33	8.29
300	1332	0.45	11.44	0.39	9.97	0.52	13.09	0.07	1.84	0.14	3.44	0.35	8.89
310	1377	0.51	12.92	0.45	11.31	0.58	14.69	0.07	1.87	0.14	3.54	0.41	10.29
319	1418	0.59	14.93	0.51	12.90	0.65	16.54	0.07	1.90	0.14	3.65	0.47	11.94
317	1412	0.59	14.96	0.51	12.93	0.65	16.58	0.08	1.95	0.15	3.70	0.47	11.93
293	1303	0.61	15.37	0.52	13.29	0.67	16.90	0.08	1.95	0.15	3.70	0.48	12.27
291	1297	0.61	15.38	0.52	13.29	0.67	16.90	0.08	1.95	0.15	3.70	0.48	12.27
291	1294	0.61	15.38	0.52	13.30	0.67	16.91	0.08	1.95	0.15	3.70	0.48	12.28
287	1278	0.61	15.43	0.53	13.35	0.67	16.94	0.08	1.95	0.15	3.70	0.49	12.32
291	1293	0.61	15.60	0.53	13.51	0.67	17.10	0.08	1.95	0.15	3.70	0.49	12.48
293	1302	0.62	15.68	0.54	13.59	0.68	17.19	0.08	1.95	0.15	3.70	0.49	12.57
293	1304	0.62	15.70	0.54	13.61	0.68	17.20	0.08	1.95	0.15	3.70	0.50	12.58
295	1312	0.63	15.94	0.54	13.84	0.69	17.44	0.08	1.95	0.15	3.70	0.50	12.82
295	1312	0.63	15.95	0.55	13.85	0.69	17.45	0.08	1.95	0.15	3.70	0.51	12.83
297	1323	0.64	16.19	0.55	14.08	0.70	17.68	0.08	1.95	0.15	3.70	0.51	13.05
298	1323	0.64	16.21	0.55	14.09	0.70	17.69	0.08	1.95	0.15	3.70	0.51	13.07
298	1324	0.64	16.23	0.56	14.10	0.70	17.72	0.08	1.95	0.15	3.70	0.52	13.09
299	1328	0.65	16.51	0.57	14.35	0.71	17.96	0.08	1.95	0.15	3.70	0.53	13.34
301	1337	0.66	16.68	0.57	14.54	0.72	18.16	0.08	1.95	0.15	3.70	0.53	13.53

Table A.54 Measurement of Load and Deflection Relationships of 5SB12T-2.0-14-D (Continued)

LC		Mid. Def.		W. Def.		E. Def.		W. Sett.		E. Sett.		Net Def.	
kips	kN	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm
301	1337	0.66	16.85	0.58	14.71	0.72	18.37	0.08	1.95	0.15	3.70	0.54	13.71
299	1331	0.67	16.91	0.58	14.74	0.72	18.41	0.08	1.95	0.15	3.70	0.54	13.75
297	1321	0.67	16.96	0.58	14.78	0.73	18.48	0.08	1.95	0.15	3.70	0.54	13.81
296	1318	0.67	16.96	0.58	14.81	0.73	18.52	0.08	1.95	0.15	3.70	0.54	13.84
294	1309	0.67	17.04	0.58	14.85	0.73	18.56	0.08	1.95	0.15	3.70	0.55	13.88
293	1305	0.69	17.42	0.60	15.25	0.75	18.99	0.08	1.95	0.15	3.70	0.56	14.30
293	1305	0.69	17.44	0.60	15.26	0.75	19.01	0.08	1.95	0.15	3.70	0.56	14.31
294	1306	0.69	17.45	0.60	15.28	0.75	19.03	0.08	1.95	0.15	3.70	0.56	14.33
294	1307	0.69	17.47	0.60	15.30	0.75	19.05	0.08	1.95	0.15	3.70	0.57	14.35
296	1318	0.70	17.68	0.61	15.50	0.76	19.28	0.08	1.95	0.15	3.70	0.57	14.57
296	1319	0.70	17.71	0.61	15.54	0.76	19.32	0.08	1.95	0.15	3.70	0.58	14.61
298	1324	0.71	17.92	0.62	15.77	0.77	19.57	0.08	1.95	0.15	3.70	0.58	14.84
297	1320	0.72	18.18	0.63	16.00	0.78	19.82	0.08	1.95	0.15	3.70	0.59	15.08
298	1326	0.73	18.46	0.64	16.29	0.79	20.12	0.08	1.95	0.15	3.70	0.61	15.38
296	1317	0.74	18.68	0.65	16.53	0.80	20.37	0.08	1.95	0.15	3.70	0.62	15.63
296	1317	0.74	18.70	0.65	16.55	0.80	20.39	0.08	1.95	0.15	3.70	0.62	15.65
297	1320	0.74	18.92	0.66	16.79	0.81	20.63	0.08	1.95	0.15	3.70	0.63	15.89
295	1313	0.76	19.22	0.67	17.03	0.82	20.88	0.08	1.95	0.15	3.70	0.64	16.13
295	1314	0.77	19.45	0.68	17.29	0.83	21.13	0.08	1.95	0.15	3.70	0.65	16.39
296	1316	0.78	19.72	0.69	17.56	0.84	21.42	0.08	1.95	0.15	3.70	0.66	16.67
297	1322	0.78	19.92	0.70	17.78	0.85	21.66	0.08	1.95	0.15	3.70	0.67	16.90
297	1322	0.79	19.94	0.70	17.80	0.85	21.68	0.08	1.95	0.15	3.70	0.67	16.91

Table A.54 Measurement of Load and Deflection Relationships of 5SB12T-2.0-14-D (Continued)

LC		Mid. Def.		W. Def.		E. Def.		W. Sett.		E. Sett.		Net Def.	
kips	kN	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm
297	1322	0.79	19.96	0.70	17.81	0.85	21.69	0.08	1.95	0.15	3.70	0.67	16.93
297	1323	0.79	19.97	0.70	17.83	0.85	21.72	0.08	1.95	0.15	3.70	0.67	16.95
298	1324	0.79	19.99	0.70	17.85	0.86	21.73	0.08	1.95	0.15	3.70	0.67	16.97
298	1324	0.79	20.01	0.70	17.87	0.86	21.74	0.08	1.95	0.15	3.70	0.67	16.98
298	1325	0.79	20.02	0.70	17.88	0.86	21.76	0.08	1.95	0.15	3.70	0.67	17.00
298	1326	0.79	20.04	0.70	17.91	0.86	21.78	0.08	1.95	0.15	3.70	0.67	17.02
298	1326	0.79	20.06	0.71	17.92	0.86	21.81	0.08	1.95	0.15	3.70	0.67	17.04
298	1325	0.79	20.08	0.71	17.95	0.86	21.83	0.08	1.95	0.15	3.70	0.67	17.07
295	1313	0.79	20.14	0.71	18.01	0.86	21.90	0.08	1.95	0.15	3.70	0.67	17.13
295	1313	0.79	20.16	0.71	18.02	0.86	21.92	0.08	1.95	0.15	3.70	0.68	17.15
295	1313	0.79	20.18	0.71	18.04	0.86	21.95	0.08	1.95	0.15	3.70	0.68	17.17
295	1311	0.80	20.29	0.72	18.17	0.87	22.08	0.08	1.95	0.15	3.70	0.68	17.30
295	1311	0.80	20.32	0.72	18.19	0.87	22.09	0.08	1.95	0.15	3.70	0.68	17.32
295	1312	0.80	20.33	0.72	18.21	0.87	22.12	0.08	1.95	0.15	3.70	0.68	17.34
295	1312	0.80	20.35	0.72	18.22	0.87	22.13	0.08	1.95	0.15	3.70	0.68	17.35
295	1313	0.80	20.37	0.72	18.24	0.87	22.15	0.08	1.95	0.15	3.70	0.68	17.37
295	1313	0.80	20.38	0.72	18.26	0.87	22.17	0.08	1.95	0.15	3.70	0.68	17.39
295	1314	0.80	20.40	0.72	18.28	0.87	22.18	0.08	1.95	0.15	3.70	0.69	17.41
295	1312	0.80	20.42	0.72	18.30	0.87	22.21	0.08	1.95	0.15	3.70	0.69	17.43
295	1312	0.80	20.44	0.72	18.32	0.88	22.23	0.08	1.95	0.15	3.70	0.69	17.45
295	1312	0.81	20.46	0.72	18.34	0.88	22.25	0.08	1.95	0.15	3.70	0.69	17.47
295	1313	0.81	20.47	0.72	18.36	0.88	22.27	0.08	1.95	0.15	3.70	0.69	17.49

Table A.55 Measurement of Tendon Slippage of 5SB12T-2.0-14-D

TRF		T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12	T13	T14
kips	kN	in	in	in	in	in	in	in	in	in	in	in	in	in	in
0	0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
30	132	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-0.001	0.002	0.000	0.000
60	265	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000
90	398	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-0.001	0.001	0.000	0.000
120	534	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000
150	666	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000
180	800	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-0.001	0.000	0.000	0.000
200	888	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
210	936	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
220	977	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
230	1021	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
240	1065	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
250	1110	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-0.001	0.000	0.000	0.000
260	1154	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
264	1176	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
259	1151	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
265	1177	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
270	1199	0.000	0.000	0.000	0.000	-0.001	-0.001	0.002	-0.003	0.000	0.000	0.000	0.000	0.000	0.000
275	1221	0.000	0.000	0.000	0.000	-0.001	-0.002	0.002	-0.003	0.000	0.000	0.000	0.000	0.001	0.000
280	1244	0.000	0.000	0.000	0.000	-0.001	-0.002	0.002	-0.003	0.000	0.000	0.000	0.000	0.002	0.000
285	1266	0.000	0.004	0.000	0.000	-0.001	-0.001	0.002	-0.003	0.000	0.000	0.000	0.000	0.003	0.000
290	1288	0.000	0.010	0.000	0.000	-0.001	-0.001	0.002	-0.003	0.000	0.000	0.000	0.000	0.004	0.000

Table A.55 Measurement of Tendon Slippage of 5SB12T-2.0-14-D (Continued)

TRF		T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12	T13	T14
kips	kN	in	in	in	in	in	in	in	in	in	in	in	in	in	in
295	1310	0.000	0.013	0.000	0.000	-0.001	-0.002	0.002	-0.003	0.000	0.000	0.000	0.000	0.005	0.000
300	1332	0.000	0.015	0.000	0.000	-0.001	-0.002	0.002	-0.003	0.000	0.000	0.000	0.000	0.007	0.000
310	1377	0.000	0.022	0.000	0.000	-0.001	-0.001	0.002	-0.003	0.000	0.000	0.000	0.000	0.010	0.000
319	1418	0.000	0.030	0.000	0.000	-0.001	-0.001	0.002	-0.003	0.000	0.000	0.000	0.000	0.014	0.000
317	1412	0.000	0.030	0.000	0.000	-0.001	0.001	0.002	-0.003	0.002	0.002	0.000	0.000	0.014	0.000
293	1303	0.000	0.031	0.004	0.015	0.028	0.015	0.013	0.021	0.021	0.024	0.021	0.000	0.022	0.001
291	1297	0.000	0.031	0.005	0.018	0.030	0.015	0.013	0.025	0.030	0.025	0.025	0.000	0.023	0.001
291	1294	0.000	0.031	0.006	0.019	0.031	0.025	0.013	0.027	0.030	0.025	0.026	0.000	0.024	0.001
287	1278	0.000	0.033	0.007	0.026	0.035	0.025	0.023	0.036	0.030	0.030	0.033	0.000	0.028	0.002
291	1293	0.000	0.034	0.008	0.030	0.036	0.025	0.023	0.036	0.030	0.031	0.035	0.000	0.029	0.002
293	1302	0.000	0.034	0.008	0.030	0.036	0.025	0.023	0.036	0.030	0.030	0.036	0.000	0.030	0.002
293	1304	0.000	0.034	0.008	0.030	0.036	0.025	0.023	0.036	0.030	0.031	0.036	0.000	0.030	0.002
295	1312	0.000	0.036	0.013	0.036	0.039	0.025	0.023	0.036	0.031	0.031	0.038	0.000	0.031	0.003
295	1312	0.000	0.038	0.013	0.036	0.040	0.025	0.023	0.036	0.031	0.031	0.039	0.000	0.031	0.003
297	1323	0.001	0.042	0.015	0.039	0.042	0.025	0.023	0.043	0.031	0.033	0.042	0.002	0.033	0.003
298	1323	0.001	0.043	0.015	0.039	0.042	0.025	0.023	0.043	0.031	0.033	0.043	0.002	0.033	0.003
298	1324	0.001	0.043	0.015	0.039	0.042	0.025	0.023	0.043	0.031	0.033	0.043	0.002	0.033	0.003
299	1328	0.003	0.057	0.020	0.044	0.046	0.029	0.032	0.048	0.038	0.036	0.049	0.016	0.036	0.003
301	1337	0.005	0.062	0.021	0.045	0.048	0.029	0.033	0.048	0.038	0.039	0.053	0.025	0.038	0.003
301	1337	0.005	0.065	0.023	0.048	0.050	0.029	0.033	0.048	0.038	0.039	0.061	0.040	0.042	0.003
299	1331	0.007	0.066	0.024	0.050	0.051	0.029	0.032	0.053	0.044	0.041	0.063	0.047	0.044	0.003
297	1321	0.008	0.067	0.026	0.052	0.053	0.029	0.033	0.053	0.044	0.044	0.068	0.059	0.048	0.006

Table A.55 Measurement of Tendon Slippage of 5SB12T-2.0-14-D (Continued)

TRF		T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12	T13	T14
kips	kN	in	in	in	in	in	in	in	in	in	in	in	in	in	in
296	1318	0.009	0.067	0.027	0.053	0.054	0.029	0.033	0.053	0.044	0.045	0.069	0.063	0.050	0.008
294	1309	0.011	0.069	0.029	0.057	0.056	0.034	0.041	0.055	0.049	0.048	0.072	0.069	0.052	0.010
293	1305	0.030	0.080	0.040	0.069	0.066	0.035	0.047	0.070	0.058	0.058	0.086	0.093	0.062	0.017
293	1305	0.030	0.081	0.040	0.069	0.066	0.035	0.047	0.070	0.058	0.058	0.087	0.093	0.062	0.017
294	1306	0.031	0.082	0.041	0.070	0.066	0.035	0.047	0.070	0.058	0.058	0.087	0.093	0.062	0.017
294	1307	0.031	0.082	0.041	0.070	0.066	0.035	0.047	0.070	0.058	0.058	0.087	0.093	0.062	0.018
296	1318	0.035	0.087	0.044	0.072	0.068	0.035	0.046	0.070	0.058	0.058	0.091	0.109	0.066	0.020
296	1319	0.038	0.088	0.044	0.074	0.068	0.035	0.046	0.070	0.058	0.058	0.091	0.109	0.066	0.020
298	1324	0.043	0.093	0.048	0.078	0.072	0.038	0.047	0.077	0.064	0.060	0.096	0.113	0.069	0.022
297	1320	0.044	0.097	0.052	0.083	0.076	0.039	0.053	0.077	0.067	0.067	0.102	0.126	0.083	0.028
298	1326	0.048	0.103	0.057	0.089	0.081	0.043	0.053	0.084	0.070	0.067	0.108	0.136	0.083	0.028
296	1317	0.062	0.117	0.065	0.096	0.088	0.048	0.057	0.093	0.077	0.070	0.115	0.152	0.086	0.030
296	1317	0.063	0.118	0.066	0.097	0.088	0.048	0.058	0.093	0.077	0.070	0.115	0.152	0.086	0.030
297	1320	0.068	0.126	0.070	0.101	0.090	0.048	0.057	0.093	0.077	0.072	0.121	0.160	0.089	0.032
295	1313	0.076	0.134	0.076	0.108	0.102	0.054	0.066	0.097	0.085	0.087	0.127	0.173	0.094	0.037
295	1314	0.083	0.141	0.082	0.114	0.102	0.056	0.066	0.107	0.088	0.087	0.132	0.181	0.097	0.040
296	1316	0.089	0.147	0.086	0.118	0.102	0.058	0.073	0.112	0.094	0.088	0.138	0.192	0.101	0.045
297	1322	0.092	0.151	0.090	0.120	0.103	0.058	0.073	0.113	0.094	0.088	0.142	0.201	0.105	0.047
297	1322	0.094	0.152	0.090	0.121	0.103	0.058	0.073	0.113	0.094	0.088	0.142	0.201	0.105	0.047
297	1322	0.094	0.152	0.090	0.121	0.103	0.058	0.073	0.113	0.094	0.088	0.144	0.201	0.106	0.047
297	1323	0.094	0.152	0.090	0.121	0.103	0.058	0.073	0.112	0.094	0.088	0.144	0.201	0.106	0.047
298	1324	0.094	0.152	0.090	0.121	0.103	0.058	0.073	0.113	0.094	0.088	0.144	0.201	0.106	0.047

Table A.55 Measurement of Tendon Slippage of 5SB12T-2.0-14-D (Continued)

TRF		T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12	T13	T14
kips	kN	in	in	in	in	in	in	in	in	in	in	in	in	in	in
298	1324	0.094	0.152	0.090	0.121	0.104	0.058	0.073	0.113	0.094	0.088	0.144	0.201	0.106	0.047
298	1325	0.094	0.154	0.091	0.121	0.104	0.058	0.073	0.113	0.094	0.088	0.144	0.201	0.107	0.047
298	1326	0.094	0.154	0.091	0.121	0.104	0.058	0.073	0.113	0.094	0.088	0.144	0.201	0.107	0.049
298	1326	0.094	0.154	0.091	0.121	0.104	0.058	0.073	0.113	0.094	0.088	0.144	0.201	0.108	0.048
298	1325	0.096	0.155	0.094	0.122	0.104	0.058	0.073	0.113	0.094	0.088	0.145	0.202	0.108	0.049
295	1313	0.097	0.157	0.096	0.124	0.111	0.063	0.075	0.118	0.099	0.101	0.147	0.210	0.123	0.051
295	1313	0.097	0.157	0.097	0.126	0.111	0.063	0.075	0.118	0.099	0.101	0.149	0.210	0.123	0.051
295	1313	0.097	0.158	0.097	0.126	0.111	0.063	0.075	0.118	0.099	0.101	0.149	0.210	0.123	0.051
295	1311	0.100	0.162	0.100	0.129	0.111	0.064	0.075	0.128	0.104	0.101	0.151	0.220	0.123	0.053
295	1311	0.100	0.162	0.100	0.129	0.111	0.064	0.075	0.128	0.104	0.101	0.153	0.220	0.123	0.053
295	1312	0.102	0.163	0.101	0.130	0.111	0.064	0.075	0.128	0.104	0.101	0.153	0.220	0.123	0.053
295	1312	0.102	0.163	0.101	0.129	0.111	0.064	0.075	0.128	0.104	0.101	0.153	0.220	0.123	0.053
295	1313	0.102	0.165	0.101	0.130	0.111	0.064	0.075	0.128	0.104	0.101	0.153	0.221	0.123	0.053
295	1313	0.102	0.165	0.101	0.130	0.111	0.064	0.075	0.128	0.104	0.101	0.153	0.220	0.123	0.053
295	1314	0.104	0.165	0.104	0.131	0.111	0.064	0.075	0.128	0.104	0.101	0.153	0.220	0.123	0.053
295	1312	0.104	0.165	0.104	0.131	0.111	0.064	0.075	0.128	0.104	0.101	0.154	0.227	0.123	0.057
295	1312	0.104	0.166	0.104	0.131	0.111	0.064	0.075	0.128	0.104	0.101	0.154	0.227	0.123	0.057
295	1312	0.104	0.167	0.104	0.131	0.111	0.064	0.075	0.128	0.103	0.101	0.154	0.227	0.123	0.058
295	1313	0.104	0.167	0.104	0.131	0.111	0.064	0.075	0.128	0.103	0.101	0.154	0.227	0.123	0.058

Table A.56 Measurement of Strain Gauges of 5SB12T-2.0-14-D

Load Cell		N1	N2	N3	N4	N11	N12	N13	N14
kips	kN	m/m	m/m	m/m	m/m	m/m	m/m	m/m	m/m
0	0	-0.68	-0.68	-0.68	-0.68	-0.91	-0.45	2.73	3.87
30	132	-196.55	21.16	22.29	155.83	14.33	101.69	159.47	35.49
60	265	-146.50	29.57	35.72	120.11	16.61	88.95	119.89	48.46
90	398	-138.54	38.45	49.82	130.81	19.79	97.37	133.08	71.43
120	534	-151.51	47.77	64.61	136.95	25.02	103.28	133.54	85.76
150	666	-123.98	54.37	77.35	146.50	26.84	109.19	143.77	104.64
180	800	-119.43	69.61	102.37	192.68	45.27	122.39	122.39	47.55
200	888	-109.19	77.35	115.11	206.10	48.91	131.26	134.22	68.25
210	936	-94.64	81.90	122.84	213.61	50.27	135.81	140.82	79.62
220	977	-58.69	80.99	120.80	191.77	43.22	141.04	180.63	181.76
230	1021	27.98	86.67	129.44	198.83	45.73	143.32	187.22	461.80
240	1065	54.60	97.14	145.37	213.84	49.59	151.28	200.19	717.73
250	1110	91.00	101.69	154.92	278.90	50.05	175.17	269.80	975.01
260	1154	113.29	106.24	B.G.	477.50	127.17	281.40	434.28	1078.52
264	1176	158.56	108.97	B.G.	563.03	182.22	330.54	497.29	1124.25
259	1151	159.24	106.47	B.G.	561.21	183.36	330.54	495.92	1117.42
265	1177	158.33	108.29	B.G.	570.31	195.41	341.69	510.03	1144.95
270	1199	169.25	113.52	B.G.	645.38	215.66	375.58	564.85	1189.08
275	1221	222.26	110.56	B.G.	739.56	238.86	413.12	639.01	1239.81
280	1244	253.65	121.93	B.G.	786.65	262.07	439.51	677.92	1283.49
285	1266	297.10	B.G.	B.G.	735.92	286.18	446.56	677.01	1339.68
290	1288	342.37	B.G.	B.G.	683.60	309.38	451.79	673.37	1403.15

Table A.56 Measurement of Strain Gauges of 5SB12T-2.0-14-D (Continued)

Load Cell		N1	N2	N3	N4	N11	N12	N13	N14
kips	kN	m/m	m/m	m/m	m/m	m/m	m/m	m/m	m/m
295	1310	146.96	B.G.	B.G.	689.97	330.09	469.99	696.11	1457.97
300	1332	132.85	B.G.	B.G.	707.72	358.52	496.15	728.65	1520.08
310	1377	-272.99	B.G.	B.G.	717.73	412.66	535.05	770.73	1650.20
319	1418	-1154.96	B.G.	B.G.	811.68	475.00	609.67	870.14	1858.35
317	1412	-1154.50	B.G.	B.G.	813.95	476.13	610.81	871.28	1853.80
293	1303	-1145.86	B.G.	B.G.	694.52	203.83	464.30	712.72	1289.63
291	1297	-1147.00	B.G.	B.G.	636.51	205.19	442.01	607.62	1222.29
291	1294	-1146.77	B.G.	B.G.	613.76	199.05	428.59	566.45	1195.91
287	1278	-1832.42	B.G.	B.G.	496.38	137.63	344.19	398.79	1089.90
291	1293	-2106.31	B.G.	B.G.	462.48	112.38	319.85	364.89	1078.29
293	1302	-2111.77	B.G.	B.G.	461.12	111.01	318.48	362.39	1077.16
293	1304	-2110.86	B.G.	B.G.	461.80	112.61	319.85	362.39	1077.61
295	1312	-2507.15	B.G.	B.G.	413.35	108.28	302.79	307.34	1045.99
295	1312	-2528.76	B.G.	B.G.	387.87	107.60	293.92	285.27	1041.90
297	1323	-2938.47	B.G.	B.G.	322.58	91.91	262.75	223.85	1020.97
298	1323	-2978.50	B.G.	B.G.	322.58	91.91	262.75	223.62	1020.06
298	1324	-2974.41	B.G.	B.G.	304.15	91.22	257.29	210.88	1020.28
299	1328	-3049.93	B.G.	B.G.	80.99	45.95	170.62	37.99	855.13
301	1337	-3104.08	B.G.	B.G.	27.98	44.82	158.56	1.59	770.05
301	1337	-3111.13	B.G.	B.G.	6.14	72.11	193.14	-21.16	634.24
299	1331	-3111.58	B.G.	B.G.	-6.37	88.27	211.79	-45.27	568.27
297	1321	-3112.72	B.G.	B.G.	-30.94	146.73	215.43	-91.45	434.50

Table A.56 Measurement of Strain Gauges of 5SB12T-2.0-14-D (Continued)

Load Cell		N1	N2	N3	N4	N11	N12	N13	N14
kips	kN	m/m	m/m	m/m	m/m	m/m	m/m	m/m	m/m
296	1318	-3112.95	B.G.	B.G.	-43.45	162.43	202.01	-113.74	383.55
294	1309	-3114.09	B.G.	B.G.	-43.45	183.36	202.01	-144.68	383.55
293	1305	-3180.06	B.G.	B.G.	-138.54	187.45	193.37	-230.67	215.66
293	1305	-3181.20	B.G.	B.G.	-137.86	199.96	199.28	-229.08	214.07
294	1306	-3189.84	B.G.	B.G.	-171.30	209.74	197.46	-245.46	217.71
294	1307	-3193.48	B.G.	B.G.	-173.80	204.97	194.50	-247.28	216.57
296	1318	-3237.38	B.G.	B.G.	-211.56	191.55	180.40	-280.49	207.01
296	1319	-3240.80	B.G.	B.G.	-209.29	204.28	188.59	-277.54	214.07
298	1324	-3280.15	B.G.	B.G.	-240.23	210.43	192.46	-305.06	208.83
297	1320	-3304.27	B.G.	B.G.	-330.31	-58.69	33.44	-441.55	133.08
298	1326	-3363.41	B.G.	B.G.	-324.63	141.95	139.68	-408.80	150.82
296	1317	-3389.12	B.G.	B.G.	-419.26	179.72	133.54	-468.17	121.93
296	1317	-3390.71	B.G.	B.G.	-423.36	193.36	137.40	-473.18	122.16
297	1320	-3475.79	B.G.	B.G.	-486.82	186.09	117.84	-517.31	139.00
295	1313	-3502.64	B.G.	B.G.	-420.85	196.09	189.50	-423.36	100.09
295	1314	-3549.04	B.G.	B.G.	-482.73	157.65	146.28	-486.83	101.46
296	1316	-3628.44	B.G.	B.G.	-502.75	157.65	147.19	-500.93	130.58
297	1322	-3710.33	B.G.	B.G.	-560.08	99.87	96.23	-563.26	135.81
297	1322	-3709.65	B.G.	B.G.	-565.76	83.72	87.13	-568.95	141.73
297	1322	-3712.38	B.G.	B.G.	-565.31	84.40	87.81	-567.81	143.55
297	1323	-3714.65	B.G.	B.G.	-565.76	82.81	84.40	-569.86	149.00
298	1324	-3718.29	B.G.	B.G.	-565.08	79.17	82.12	-569.63	154.69

Table A.56 Measurement of Strain Gauges of 5SB12T-2.0-14-D (Continued)

Load Cell		N1	N2	N3	N4	N11	N12	N13	N14
kips	kN	m/m	m/m	m/m	m/m	m/m	m/m	m/m	m/m
298	1324	-3720.80	B.G.	B.G.	-565.08	78.94	81.44	-571.45	159.24
298	1325	-3723.98	B.G.	B.G.	-590.56	75.75	73.71	-585.55	166.29
298	1326	-3727.62	B.G.	B.G.	-590.10	63.70	71.20	-586.69	166.98
298	1326	-3731.26	B.G.	B.G.	-594.20	61.65	64.38	-594.65	170.62
298	1325	-3733.99	B.G.	B.G.	-592.15	66.88	70.98	-592.38	175.39
295	1313	-3736.95	B.G.	B.G.	-767.32	-431.77	-267.98	-866.50	-59.83
295	1313	-3739.22	B.G.	B.G.	-761.18	-408.57	-252.51	-856.72	-60.51
295	1313	-3742.41	B.G.	B.G.	-761.40	-385.37	-249.56	-854.45	-59.83
295	1311	-3782.45	B.G.	B.G.	-740.70	-249.56	-184.95	-819.19	-65.06
295	1311	-3790.41	B.G.	B.G.	-737.06	-235.91	-176.08	-813.50	-64.38
295	1312	-3795.18	B.G.	B.G.	-737.52	-226.81	-173.57	-813.27	-60.74
295	1312	-3800.87	B.G.	B.G.	-735.24	-219.07	-169.25	-810.54	-56.87
295	1313	-3806.56	B.G.	B.G.	-766.41	-211.34	-173.12	-825.55	-53.23
295	1313	-3809.97	B.G.	B.G.	-765.27	-204.29	-169.71	-823.51	-49.37
295	1314	-3815.89	B.G.	B.G.	-764.59	-196.32	-164.93	-821.23	-45.04
295	1312	-3822.26	B.G.	B.G.	-752.30	-141.04	-137.40	-803.03	-73.25
295	1312	-3828.17	B.G.	B.G.	-749.35	-129.67	-128.53	-796.44	-68.47
295	1312	-3834.77	B.G.	B.G.	-747.75	-118.75	-120.11	-792.80	-61.42
295	1313	-3840.23	B.G.	B.G.	-745.02	-108.06	-113.06	-788.70	-57.10

A.20 5SB15T-1.2-8-D

Table A.57 Measurement of Load and Deflection Relationships of 5SB15T-1.2-8-D

SW.LC		SE. LC		TRF		SW. Def.		SE. Def.		SW. Sett.		SE. Sett.		Net Def.	
kips	kN	kips	kN	kips	kN	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
0	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
16	69	14	62	30	132	0.01	0.20	0.04	1.06	0.00	0.05	0.04	1.04	0.00	0.09
32	141	28	124	60	265	0.02	0.43	0.07	1.67	0.00	0.11	0.06	1.61	0.01	0.19
47	211	42	188	90	399	0.03	0.66	0.09	2.21	0.01	0.17	0.08	2.10	0.01	0.30
63	282	56	250	120	532	0.04	0.91	0.10	2.58	0.01	0.24	0.09	2.40	0.02	0.42
80	357	70	313	151	670	0.05	1.19	0.11	2.87	0.01	0.32	0.10	2.63	0.02	0.56
96	426	84	373	180	799	0.06	1.42	0.12	3.13	0.01	0.37	0.11	2.80	0.03	0.69
112	498	98	435	210	933	0.07	1.65	0.13	3.39	0.02	0.43	0.12	2.97	0.03	0.82
117	521	103	456	220	977	0.07	1.73	0.14	3.46	0.02	0.45	0.12	3.02	0.03	0.87
123	545	107	477	230	1022	0.07	1.81	0.14	3.55	0.02	0.46	0.12	3.07	0.04	0.91
128	570	112	499	240	1069	0.07	1.89	0.14	3.63	0.02	0.48	0.12	3.11	0.04	0.96
133	590	116	517	249	1107	0.08	1.98	0.15	3.72	0.02	0.49	0.12	3.15	0.04	1.03
129	575	113	504	243	1079	0.08	2.03	0.15	3.77	0.02	0.49	0.12	3.13	0.04	1.09
126	561	111	492	237	1053	0.08	2.05	0.15	3.79	0.02	0.49	0.12	3.10	0.04	1.12
124	553	109	485	233	1038	0.08	2.06	0.15	3.79	0.02	0.49	0.12	3.08	0.04	1.14
125	556	109	487	234	1043	0.08	2.07	0.15	3.79	0.02	0.49	0.12	3.08	0.05	1.14
130	578	115	510	245	1088	0.09	2.31	0.16	4.05	0.02	0.49	0.12	3.08	0.06	1.40
135	601	120	532	255	1133	0.10	2.56	0.17	4.30	0.02	0.49	0.12	3.07	0.06	1.65
135	602	120	533	255	1135	0.10	2.57	0.17	4.31	0.02	0.49	0.12	3.07	0.07	1.66

Table A.57 Measurement of Load and Deflection Relationships of 5SB15T-1.2-8-D (Continued)

SW.LC		SE. LC		TRF		SW. Def.		SE. Def.		SW. Sett.		SE. Sett.		Net Def.	
kips	kN	kips	kN	kips	kN	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
140	621	124	553	264	1174	0.11	2.80	0.18	4.55	0.02	0.49	0.12	3.07	0.07	1.90
144	640	128	570	272	1210	0.12	3.05	0.19	4.82	0.02	0.49	0.12	3.07	0.08	2.15
144	641	128	571	272	1212	0.12	3.06	0.19	4.83	0.02	0.49	0.12	3.07	0.09	2.16
147	653	131	582	278	1235	0.13	3.25	0.20	5.02	0.02	0.49	0.12	3.09	0.09	2.34
144	643	129	573	273	1216	0.13	3.29	0.20	5.10	0.02	0.48	0.12	3.07	0.10	2.42
144	640	128	571	272	1211	0.13	3.30	0.20	5.11	0.02	0.48	0.12	3.06	0.10	2.43
144	642	128	571	273	1213	0.13	3.31	0.20	5.13	0.02	0.48	0.12	3.06	0.10	2.45
145	644	129	574	274	1217	0.13	3.36	0.20	5.20	0.02	0.48	0.12	3.06	0.10	2.51
144	639	128	570	272	1209	0.14	3.45	0.21	5.30	0.02	0.44	0.12	3.05	0.10	2.62
146	648	130	577	275	1224	0.14	3.47	0.21	5.33	0.02	0.44	0.12	3.06	0.10	2.65
146	648	130	578	276	1226	0.14	3.48	0.21	5.34	0.02	0.44	0.12	3.06	0.10	2.66
146	649	130	578	276	1227	0.14	3.48	0.21	5.35	0.02	0.44	0.12	3.06	0.10	2.67
146	651	130	580	277	1231	0.14	3.49	0.21	5.37	0.02	0.44	0.12	3.06	0.11	2.68
150	666	133	594	283	1260	0.15	3.71	0.22	5.63	0.02	0.44	0.12	3.07	0.11	2.91
150	667	134	595	284	1262	0.15	3.72	0.22	5.64	0.02	0.44	0.12	3.07	0.12	2.93
152	674	135	602	287	1276	0.15	3.93	0.23	5.92	0.02	0.44	0.12	3.07	0.12	3.17
151	673	135	601	287	1275	0.16	3.94	0.23	5.93	0.02	0.45	0.12	3.07	0.13	3.18
151	673	135	601	286	1274	0.16	3.95	0.23	5.95	0.02	0.45	0.12	3.07	0.13	3.19
152	674	135	601	287	1275	0.18	4.55	0.27	6.79	0.02	0.44	0.12	3.04	0.15	3.93
152	675	135	602	287	1277	0.18	4.56	0.27	6.79	0.02	0.44	0.12	3.04	0.15	3.93
152	676	136	604	288	1280	0.18	4.57	0.27	6.81	0.02	0.44	0.12	3.04	0.16	3.94
157	700	141	626	298	1326	0.22	5.66	0.33	8.26	0.02	0.44	0.12	3.04	0.21	5.22

Table A.57 Measurement of Load and Deflection Relationships of 5SB15T-1.2-8-D (Continued)

SW.LC		SE. LC		TRF		SW. Def.		SE. Def.		SW. Sett.		SE. Sett.		Net Def.	
kips	kN	kips	kN	kips	kN	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
151	672	134	595	285	1267	0.22	5.58	0.35	8.78	0.02	0.44	0.12	3.04	0.21	5.45
150	665	133	590	282	1255	0.22	5.56	0.35	8.78	0.02	0.44	0.12	3.04	0.21	5.43
151	671	134	595	285	1267	0.22	5.62	0.35	8.99	0.02	0.44	0.12	3.04	0.22	5.57
152	677	135	600	287	1276	0.22	5.71	0.36	9.14	0.02	0.44	0.12	3.04	0.22	5.69
152	675	135	598	286	1273	0.23	5.73	0.36	9.17	0.02	0.44	0.12	3.04	0.22	5.71
152	678	135	601	287	1279	0.23	5.92	0.37	9.47	0.02	0.44	0.12	3.04	0.23	5.96
153	678	135	602	288	1280	0.23	5.93	0.37	9.48	0.02	0.44	0.12	3.04	0.23	5.97
152	675	135	599	286	1274	0.24	6.14	0.38	9.75	0.02	0.44	0.12	3.04	0.24	6.21
152	675	135	599	286	1274	0.24	6.15	0.38	9.76	0.02	0.44	0.12	3.04	0.24	6.22
152	677	135	600	287	1276	0.24	6.16	0.39	9.78	0.02	0.44	0.12	3.04	0.25	6.23
152	676	135	600	287	1275	0.24	6.18	0.39	9.81	0.02	0.44	0.12	3.04	0.25	6.26
150	669	134	595	284	1264	0.25	6.29	0.39	9.83	0.02	0.44	0.12	3.04	0.25	6.32
149	663	133	590	282	1254	0.25	6.34	0.39	9.86	0.02	0.44	0.12	3.04	0.25	6.36
149	661	132	589	281	1250	0.25	6.34	0.39	9.86	0.02	0.44	0.12	3.04	0.25	6.36
145	644	131	583	276	1227	0.27	6.83	0.40	10.15	0.02	0.44	0.12	3.04	0.27	6.75
142	631	130	576	271	1207	0.27	6.97	0.40	10.15	0.02	0.44	0.12	3.04	0.27	6.82
141	626	129	573	270	1199	0.28	7.03	0.40	10.14	0.02	0.44	0.12	3.04	0.27	6.85
141	625	129	573	269	1198	0.28	7.04	0.40	10.14	0.02	0.44	0.12	3.04	0.27	6.86
143	635	131	582	274	1217	0.29	7.24	0.40	10.18	0.02	0.44	0.12	3.04	0.27	6.97
143	635	131	581	273	1216	0.29	7.26	0.40	10.22	0.02	0.44	0.12	3.04	0.28	7.00
143	635	131	582	274	1217	0.29	7.26	0.40	10.22	0.02	0.44	0.12	3.04	0.28	7.01
147	654	137	607	284	1261	0.34	8.64	0.45	11.48	0.02	0.44	0.12	3.04	0.33	8.33

Table A.57 Measurement of Load and Deflection Relationships of 5SB15T-1.2-8-D (Continued)

SW.LC		SE. LC		TRF		SW. Def.		SE. Def.		SW. Sett.		SE. Sett.		Net Def.	
kips	kN	kips	kN	kips	kN	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
148	657	137	609	284	1265	0.36	9.09	0.47	12.01	0.02	0.44	0.12	3.04	0.35	8.81
146	651	136	603	282	1255	0.36	9.14	0.47	12.06	0.02	0.44	0.12	3.04	0.35	8.86
146	649	136	603	282	1252	0.38	9.55	0.49	12.50	0.02	0.44	0.12	3.04	0.37	9.29
146	648	136	603	281	1250	0.38	9.61	0.49	12.57	0.02	0.44	0.12	3.04	0.37	9.35
145	645	135	601	280	1245	0.38	9.63	0.50	12.62	0.02	0.44	0.12	3.04	0.37	9.39
145	644	135	600	280	1244	0.38	9.71	0.50	12.70	0.02	0.44	0.12	3.04	0.37	9.47
144	641	134	597	278	1238	0.38	9.74	0.50	12.75	0.02	0.44	0.12	3.04	0.37	9.51
144	640	134	597	278	1237	0.38	9.76	0.50	12.76	0.02	0.44	0.12	3.04	0.37	9.52
144	640	134	597	278	1236	0.38	9.78	0.50	12.78	0.02	0.44	0.12	3.04	0.38	9.54
144	639	134	596	278	1235	0.39	9.79	0.50	12.80	0.02	0.44	0.12	3.04	0.38	9.56
144	640	134	596	278	1235	0.39	9.80	0.50	12.81	0.02	0.44	0.12	3.04	0.38	9.57
144	640	134	596	278	1236	0.39	9.82	0.50	12.82	0.02	0.44	0.12	3.04	0.38	9.58
141	628	132	587	273	1215	0.39	9.90	0.51	12.89	0.02	0.44	0.12	3.04	0.38	9.66
141	628	132	587	273	1215	0.47	12.05	0.61	15.58	0.02	0.44	0.12	3.04	0.48	12.08
142	630	132	589	274	1219	0.49	12.43	0.63	16.07	0.02	0.44	0.12	3.04	0.49	12.51
140	623	131	584	271	1207	0.49	12.51	0.64	16.14	0.02	0.44	0.12	3.04	0.50	12.58
141	628	132	589	274	1217	0.50	12.71	0.65	16.42	0.02	0.44	0.12	3.04	0.50	12.82
141	627	133	590	274	1217	0.54	13.59	0.69	17.54	0.02	0.44	0.12	3.04	0.54	13.83
141	626	132	587	273	1213	0.54	13.63	0.69	17.59	0.02	0.44	0.12	3.04	0.55	13.87
142	630	133	592	275	1222	0.55	13.99	0.71	18.07	0.02	0.44	0.12	3.04	0.56	14.29
141	626	132	588	273	1214	0.55	14.05	0.71	18.13	0.02	0.44	0.12	3.04	0.57	14.36
139	619	131	583	270	1202	0.56	14.24	0.72	18.38	0.02	0.44	0.12	3.04	0.57	14.57

Table A.58 Measurement of Rosette LVDTs of 5SB12T-1.2-10-D

TRF		SWD1	SWD2	SWV1	SWV2	SWH1	SWH2	SED1	SED2	SEV1	SEV2	SEH1	SEH2
kips	kN	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in
0	0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
30	132	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
60	265	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
90	399	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
120	532	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
151	670	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
180	799	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
210	933	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
220	977	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
230	1022	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
240	1069	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
249	1107	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
243	1079	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
237	1053	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
233	1038	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
234	1043	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
245	1088	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
255	1133	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
255	1135	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
264	1174	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
272	1210	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
272	1212	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Table A.58 Measurement of Rosette LVDTs of 5SB12T-1.2-10-D (Continued)

TRF		SWD1	SWD2	SWV1	SWV2	SWH1	SWH2	SED1	SED2	SEV1	SEV2	SEH1	SEH2
kips	kN	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in
278	1235	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
273	1216	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
272	1211	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
273	1213	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
274	1217	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
272	1209	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
275	1224	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
276	1226	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
276	1227	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
277	1231	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
283	1260	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
284	1262	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
287	1276	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
287	1275	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
286	1274	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
287	1275	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
287	1277	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
288	1280	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
298	1326	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	-0.001
285	1267	0.000	0.000	0.000	0.000	0.000	0.000	-0.001	0.002	0.001	0.002	0.001	-0.001
282	1255	0.000	0.000	0.000	0.000	0.000	0.000	-0.001	0.002	0.001	0.002	0.001	-0.001
285	1267	0.000	0.000	0.000	0.000	0.000	0.000	-0.001	0.002	0.001	0.003	0.001	-0.001

Table A.58 Measurement of Rosette LVDTs of 5SB12T-1.2-10-D (Continued)

TRF		SWD1	SWD2	SWV1	SWV2	SWH1	SWH2	SED1	SED2	SEV1	SEV2	SEH1	SEH2
kips	kN	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in
287	1276	0.000	0.000	0.000	0.000	0.000	0.000	-0.001	0.003	0.001	0.003	0.001	-0.001
286	1273	0.000	0.000	0.000	0.000	0.000	0.000	-0.001	0.003	0.001	0.003	0.001	-0.001
287	1279	0.000	0.000	0.000	0.000	0.000	0.000	-0.001	0.003	0.002	0.003	0.001	-0.001
288	1280	0.000	0.000	0.000	0.000	0.000	0.000	-0.001	0.003	0.002	0.003	0.001	-0.001
286	1274	0.000	0.000	0.000	0.000	0.000	0.000	-0.001	0.003	0.002	0.003	0.001	-0.001
286	1274	0.000	0.000	0.000	0.000	0.000	0.000	-0.001	0.003	0.002	0.003	0.001	-0.001
287	1276	0.000	0.000	0.000	0.000	0.000	0.000	-0.001	0.003	0.002	0.003	0.001	-0.001
287	1275	0.000	0.000	0.000	0.000	0.000	0.000	-0.001	0.003	0.002	0.003	0.001	-0.001
284	1264	0.000	0.000	0.000	0.000	0.000	0.000	-0.001	0.003	0.002	0.003	0.001	-0.001
282	1254	0.000	0.001	0.000	0.000	0.000	-0.001	-0.001	0.003	0.002	0.003	0.001	-0.001
281	1250	0.000	0.001	0.000	0.000	0.000	-0.001	-0.001	0.003	0.002	0.003	0.001	-0.001
276	1227	0.000	0.003	0.000	0.001	0.001	0.001	-0.001	0.003	0.002	0.003	0.001	-0.001
271	1207	0.000	0.004	0.000	0.001	0.002	0.002	-0.001	0.003	0.002	0.003	0.001	-0.001
270	1199	0.000	0.004	0.000	0.001	0.002	0.003	-0.001	0.003	0.002	0.003	0.001	-0.001
269	1198	0.000	0.004	0.000	0.001	0.002	0.003	-0.001	0.003	0.002	0.003	0.001	-0.001
274	1217	0.000	0.005	0.000	0.001	0.002	0.003	-0.001	0.003	0.002	0.003	0.001	-0.001
273	1216	0.000	0.005	0.000	0.001	0.003	0.003	-0.001	0.003	0.002	0.003	0.001	-0.001
274	1217	0.000	0.005	0.000	0.001	0.003	0.003	-0.001	0.003	0.002	0.003	0.001	-0.001
284	1261	0.000	0.007	0.000	0.003	0.003	0.006	-0.001	0.003	0.002	0.003	0.002	-0.001
284	1265	0.000	0.009	0.000	0.004	0.004	0.008	-0.001	0.003	0.002	0.003	0.002	-0.001
282	1255	0.000	0.009	0.000	0.005	0.004	0.008	-0.001	0.003	0.002	0.003	0.002	-0.001
282	1252	0.000	0.011	0.001	0.005	0.005	0.009	-0.001	0.003	0.002	0.003	0.002	-0.001

Table A.58 Measurement of Rosette LVDTs of 5SB12T-1.2-10-D (Continued)

TRF		SWD1	SWD2	SWV1	SWV2	SWH1	SWH2	SED1	SED2	SEV1	SEV2	SEH1	SEH2
kips	kN	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in
281	1250	0.000	0.011	0.001	0.005	0.005	0.009	-0.001	0.003	0.002	0.003	0.002	-0.001
280	1245	0.000	0.011	0.001	0.005	0.005	0.009	-0.001	0.003	0.002	0.003	0.002	-0.001
280	1244	0.000	0.011	0.001	0.005	0.005	0.009	-0.001	0.003	0.002	0.003	0.002	-0.001
278	1238	0.000	0.011	0.001	0.005	0.005	0.009	-0.001	0.003	0.002	0.003	0.002	-0.001
278	1237	0.000	0.011	0.001	0.005	0.005	0.009	-0.001	0.003	0.002	0.003	0.002	-0.001
278	1236	0.000	0.011	0.001	0.005	0.005	0.009	-0.001	0.003	0.002	0.003	0.002	-0.001
278	1235	0.000	0.011	0.001	0.005	0.005	0.009	-0.001	0.003	0.002	0.003	0.002	-0.001
278	1235	0.000	0.011	0.001	0.005	0.005	0.009	-0.001	0.003	0.002	0.003	0.002	-0.001
278	1236	0.000	0.011	0.001	0.005	0.005	0.009	-0.001	0.003	0.002	0.003	0.002	-0.001
273	1215	0.000	0.011	0.001	0.005	0.005	0.009	-0.001	0.003	0.002	0.003	0.002	-0.001
273	1215	0.000	0.012	0.001	0.006	0.006	0.010	-0.001	0.004	0.003	0.003	0.003	-0.001
274	1219	0.000	0.013	0.001	0.006	0.007	0.010	0.000	0.004	0.003	0.003	0.003	-0.001
271	1207	0.000	0.013	0.001	0.006	0.007	0.010	0.000	0.004	0.003	0.003	0.003	-0.001
274	1217	0.000	0.013	0.001	0.006	0.007	0.010	0.000	0.004	0.003	0.003	0.003	-0.001
274	1217	0.000	0.013	0.001	0.006	0.007	0.010	0.000	0.004	0.003	0.003	0.003	-0.001
273	1213	0.000	0.013	0.001	0.006	0.007	0.010	0.000	0.004	0.003	0.003	0.003	-0.001
275	1222	0.000	0.014	0.001	0.006	0.008	0.011	0.000	0.004	0.003	0.002	0.003	-0.001
273	1214	0.000	0.014	0.001	0.006	0.008	0.011	0.000	0.004	0.003	0.002	0.003	-0.001
270	1202	0.000	0.014	0.001	0.006	0.008	0.011	0.000	0.004	0.003	0.002	0.003	-0.001

Table A.59 Measurement of Strain Gauges of 5SB12T-1.2-10-D

TRF		CS1	CS2	CS3	CS4	NS1	NS2	NS3	NS4	HS1	HS2
kips	kN	m/m	m/m	m/m	m/m	m/m	m/m	m/m	m/m	m/m	m/m
0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
30	132	0.23	-1.37	-1.59	2.05	-0.23	0.91	-0.23	4.32	6.37	-1.14
60	265	1.59	-2.50	-2.05	5.46	1.14	0.91	0.00	9.10	8.65	-0.68
90	399	2.73	-7.28	-4.10	3.87	1.82	0.00	-0.23	10.92	10.69	-1.14
120	532	3.87	-11.15	-6.14	4.32	2.05	-1.82	-1.59	14.56	12.74	-2.05
151	670	4.55	-14.33	-8.19	5.69	1.82	-4.10	-3.19	17.74	15.02	-4.78
180	799	5.00	-18.20	-10.92	6.14	-1.59	-0.68	-2.05	20.70	14.79	-6.60
210	933	6.60	-22.07	-13.88	7.28	-0.23	4.78	-1.14	24.34	16.15	-8.19
220	977	6.82	-23.20	-14.79	7.74	1.37	8.19	-0.45	26.39	15.93	-8.87
230	1022	7.73	-24.34	-15.24	7.74	2.05	9.55	0.23	28.21	17.52	-10.01
240	1069	7.73	-26.16	-15.24	7.96	2.73	11.15	-0.23	29.12	17.29	-10.92
249	1107	8.64	-26.62	-16.61	10.01	3.19	14.56	-3.19	33.90	17.74	-14.11
243	1079	8.87	-25.48	-17.74	11.15	3.41	16.83	-5.01	35.94	18.20	-15.93
237	1053	9.10	-23.89	-16.38	11.15	3.19	29.12	-6.60	35.26	17.97	-16.15
233	1038	9.55	-22.98	-16.38	11.15	2.73	51.41	-5.46	34.12	19.56	-16.15
234	1043	9.55	-23.43	-16.15	11.15	2.73	51.41	-5.46	34.12	19.56	-16.61
245	1088	10.46	-23.20	-16.61	13.65	-116.47	83.72	-0.68	39.13	21.16	-17.97
255	1133	10.92	-24.34	-17.74	15.92	-170.62	208.15	20.93	34.35	21.61	-20.02
255	1135	10.69	-24.11	-18.20	16.38	-171.75	209.97	22.29	34.58	21.38	-20.47
264	1174	10.92	-24.34	-19.56	17.97	-215.43	276.40	61.42	34.58	21.84	-22.07
272	1210	11.60	-25.48	-21.16	21.84	-239.09	372.40	98.73	33.90	23.20	-24.34
272	1212	12.06	-25.71	-21.16	21.61	-239.55	376.49	99.87	33.90	23.20	-24.11

Table A.59 Measurement of Strain Gauges of 5SB12T-1.2-10-D (Continued)

TRF		CS1	CS2	CS3	CS4	NS1	NS2	NS3	NS4	HS1	HS2
kips	kN	m/m	m/m	m/m	m/m	m/m	m/m	m/m	m/m	m/m	m/m
278	1235	11.83	-30.71	-23.20	20.02	-251.37	485.46	126.26	32.76	22.52	-26.62
273	1216	12.06	-29.35	-23.66	24.11	-250.24	587.83	125.80	17.06	22.52	-27.75
272	1211	12.28	-29.12	-23.43	24.57	-249.78	623.09	126.26	12.28	22.29	-27.53
273	1213	12.06	-30.03	-23.66	24.11	-250.01	639.47	126.26	9.55	22.98	-27.98
274	1217	12.28	-29.80	-24.34	23.89	-249.78	700.21	128.08	-0.68	22.75	-27.98
272	1209	28.21	-17.97	-13.65	30.26	-236.59	811.91	147.87	-12.29	30.48	-18.88
275	1224	26.62	-18.88	-15.24	30.03	-238.41	821.00	147.19	-13.88	29.80	-20.25
276	1226	26.39	-19.34	-15.24	29.80	-238.41	825.55	147.19	-14.56	28.89	-20.25
276	1227	26.84	-19.79	-15.24	29.80	-238.86	829.42	146.96	-14.79	30.03	-20.47
277	1231	26.84	-18.88	-15.24	29.80	-238.64	839.89	147.41	-16.61	29.12	-20.25
283	1260	24.57	-21.38	-18.65	-11.60	-246.37	986.39	148.10	-62.10	29.80	-24.57
284	1262	24.57	-21.16	-18.65	-13.42	-246.14	990.94	148.55	-62.79	29.35	-24.57
287	1276	25.48	-18.65	-19.34	-75.75	-251.60	1102.64	161.97	-88.04	30.26	-25.71
287	1275	13.19	-27.98	-27.53	-84.17	-262.52	1097.63	153.10	-98.28	24.57	-32.99
286	1274	13.19	-27.53	-27.98	-85.31	-262.75	1104.46	153.78	-99.87	24.34	-33.21
287	1275	26.39	-10.92	-20.70	-164.25	-293.23	1467.30	249.33	-266.39	32.08	-26.84
287	1277	26.62	-10.92	-20.70	-164.25	-293.23	1468.66	249.33	-266.84	32.30	-26.84
288	1280	26.39	-10.69	-20.93	-164.93	-293.23	1472.08	249.55	-267.53	31.85	-26.84
298	1326	17.06	-7.51	-26.84	-344.19	-358.07	1889.97	345.78	-549.16	29.80	-29.57
285	1267	32.08	-7.51	-19.34	-344.19	-343.05	1735.28	361.48	-583.74	36.17	-22.07
282	1255	31.39	3.41	-20.02	-384.91	-342.83	1725.50	363.75	-581.69	35.72	-21.84
285	1267	20.93	32.53	-33.90	-501.16	-354.43	1714.12	371.72	-589.88	28.44	-30.26

Table A.59 Measurement of Strain Gauges of 5SB12T-1.2-10-D (Continued)

TRF		CS1	CS2	CS3	CS4	NS1	NS2	NS3	NS4	HS1	HS2
kips	kN	m/m	m/m	m/m	m/m	m/m	m/m	m/m	m/m	m/m	m/m
287	1276	19.56	46.18	-37.08	-549.38	-358.07	1690.46	380.59	-594.43	26.84	-30.48
286	1273	22.29	50.96	-36.17	-555.75	-355.56	1693.65	384.00	-593.06	27.53	-28.66
287	1279	14.56	47.09	-47.55	-613.08	-366.03	1680.00	406.75	-604.44	55.74	-27.30
288	1280	14.33	47.55	-47.55	-614.45	-366.48	1680.68	407.89	-604.66	55.74	-26.84
286	1274	11.83	46.86	-23.20	-640.15	-383.77	1685.69	443.60	-608.76	37.08	-15.47
286	1274	11.60	46.64	-20.02	-640.15	-385.37	1684.32	446.33	-609.67	29.12	-16.15
287	1276	10.92	46.41	-18.20	-641.06	-387.64	1684.10	448.83	-610.58	22.07	-17.06
287	1275	10.01	45.04	-9.78	-643.11	-391.96	1681.82	461.35	-611.72	10.69	-18.88
284	1264	10.24	44.13	-0.91	-643.79	-394.69	1681.14	471.36	-612.40	2.73	-20.47
282	1254	10.46	38.45	11.15	-643.11	-422.45	1700.02	582.83	-613.08	-2.96	-14.33
281	1250	10.24	36.85	12.74	-642.20	-430.41	1701.16	613.31	-614.45	-7.96	-13.42
276	1227	7.05	37.54	389.23	-657.21	-591.47	1771.00	1092.40	-653.12	-131.49	89.40
271	1207	9.10	41.18	389.23	-653.12	-591.47	1772.13	1186.12	-652.66	-118.52	89.40
270	1199	11.37	46.64	414.48	-649.25	-609.44	1762.35	1204.55	-652.89	-124.66	130.35
269	1198	12.06	48.68	425.18	-648.34	-613.76	1761.67	1204.32	-652.66	-123.98	149.23
274	1217	10.24	70.07	526.86	-642.65	-669.73	1781.00	1269.16	-666.77	-56.19	330.31
273	1216	19.79	80.08	535.51	-637.42	-665.86	1795.11	1280.76	-662.90	-48.91	343.96
274	1217	20.25	81.90	538.47	-635.38	-671.55	1796.93	1285.31	-665.40	-45.95	351.24
284	1261	19.34	106.92	806.22	-614.67	-1003.00	1895.43	1559.89	-733.42	-82.81	886.29
284	1265	38.90	114.65	895.85	-604.21	-1090.58	1907.26	1721.63	-722.73	-202.24	966.37
282	1255	39.13	113.97	906.54	-606.03	-1087.85	1903.62	1741.88	-722.73	-219.75	972.51
282	1252	28.44	109.65	943.85	-597.61	-1177.25	1897.93	1779.87	-719.09	-508.66	1048.72

Table A.59 Measurement of Strain Gauges of 5SB12T-1.2-10-D (Continued)

TRF		CS1	CS2	CS3	CS4	NS1	NS2	NS3	NS4	HS1	HS2
kips	kN	m/m	m/m	m/m	m/m	m/m	m/m	m/m	m/m	m/m	m/m
281	1250	27.53	109.42	930.20	-597.84	-1192.72	1893.16	1777.82	-717.27	-519.81	1036.66
280	1245	27.53	108.74	928.38	-598.98	-1195.22	1892.02	1775.09	-717.04	-522.09	1036.44
280	1244	8.87	95.55	910.41	-608.53	-1215.47	1874.05	1751.89	-729.10	-541.42	1022.56
278	1238	25.93	107.15	921.10	-600.34	-1201.82	1887.70	1757.57	-717.73	-538.24	1035.53
278	1237	25.93	107.37	919.74	-599.43	-1201.37	1883.83	1751.43	-717.04	-548.25	1043.49
278	1236	25.48	108.28	916.55	-599.66	-1202.50	1882.24	1749.84	-716.82	-561.44	1045.31
278	1235	25.71	108.06	914.05	-598.98	-1202.73	1881.10	1747.79	-716.59	-572.59	1045.76
278	1235	25.48	108.51	908.59	-598.52	-1202.50	1879.51	1745.97	-716.13	-585.55	1043.72
278	1236	25.48	107.60	904.49	-598.29	-1202.73	1880.64	1745.29	-715.91	-595.79	1043.49
273	1215	24.11	107.15	897.90	-599.66	-1182.94	1866.31	1750.07	-713.40	-625.37	1043.72
273	1215	-43.00	72.57	830.10	-576.91	-1247.32	1857.44	1712.30	-726.14	-1187.72	1013.46
274	1219	-37.99	83.03	845.12	-561.44	-1245.95	1872.68	1726.86	-718.64	-1254.37	1033.71
271	1207	-38.45	81.44	846.26	-563.72	-1245.04	1867.00	1732.32	-717.95	-1261.88	1037.80
274	1217	-44.36	83.72	848.76	-555.98	-1255.51	1874.28	1733.92	-718.18	-1308.51	1044.40
274	1217	-58.92	85.08	860.59	-541.42	-1275.75	1883.15	1743.01	-720.23	-1439.77	1074.43
273	1213	-59.15	85.76	861.73	-541.65	-1276.66	1883.15	1741.65	-720.46	-1441.37	1074.88
275	1222	-63.01	89.40	865.82	-534.83	-1285.99	1889.06	1751.20	-720.91	-1486.41	1089.67
273	1214	-63.47	88.95	866.05	-534.83	-1286.67	1890.65	1752.11	-721.37	-1488.23	1091.03
270	1202	-65.74	84.17	861.04	-527.09	-1288.49	1882.01	1750.07	-721.14	-1516.66	1093.54

A.21 5SB15T-2.0-8-D

Table A.60 Measurement of Load and Deflection Relationships of 5SB15T-2.0-8-D

LC		Mid. Def.		W. Def.		E. Def.		W. Sett.		E. Sett.		Net Def.	
kips	kN	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm
0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
30	131	0.04	0.98	0.04	1.13	0.03	0.82	0.04	0.96	0.03	0.81	0.00	0.10
60	265	0.07	1.89	0.08	1.97	0.07	1.82	0.07	1.71	0.06	1.60	0.01	0.24
90	399	0.10	2.63	0.11	2.70	0.10	2.55	0.09	2.32	0.08	2.13	0.02	0.40
120	532	0.13	3.28	0.14	3.43	0.12	3.13	0.11	2.91	0.10	2.47	0.02	0.59
130	577	0.14	3.49	0.14	3.66	0.13	3.33	0.12	3.09	0.10	2.58	0.03	0.66
130	577	0.14	3.50	0.14	3.66	0.13	3.33	0.12	3.09	0.10	2.58	0.03	0.67
130	578	0.14	3.50	0.14	3.67	0.13	3.33	0.12	3.09	0.10	2.58	0.03	0.66
130	579	0.14	3.50	0.14	3.67	0.13	3.34	0.12	3.09	0.10	2.58	0.03	0.67
136	606	0.15	3.69	0.15	3.87	0.14	3.51	0.13	3.18	0.10	2.63	0.03	0.78
138	612	0.18	4.46	0.19	4.72	0.17	4.21	0.13	3.28	0.10	2.63	0.06	1.51
140	622	0.18	4.61	0.19	4.87	0.17	4.36	0.13	3.32	0.10	2.63	0.06	1.64
145	643	0.20	4.99	0.21	5.29	0.18	4.69	0.14	3.49	0.10	2.63	0.08	1.93
150	665	0.21	5.28	0.22	5.59	0.20	4.97	0.14	3.56	0.10	2.63	0.09	2.18
155	689	0.22	5.66	0.23	5.97	0.21	5.34	0.14	3.66	0.10	2.64	0.10	2.51
145	646	0.22	5.68	0.23	5.94	0.21	5.41	0.15	3.70	0.10	2.64	0.10	2.51
146	650	0.22	5.68	0.23	5.95	0.21	5.41	0.15	3.71	0.10	2.64	0.10	2.51
150	665	0.22	5.71	0.24	6.01	0.21	5.41	0.15	3.73	0.10	2.64	0.10	2.53
155	687	0.23	5.81	0.24	6.15	0.22	5.48	0.15	3.77	0.10	2.64	0.10	2.61

Table A.60 Measurement of Load and Deflection Relationships of 5SB15T-2.0-8-D (Continued)

LC		Mid. Def.		W. Def.		E. Def.		W. Sett.		E. Sett.		Net Def.	
kips	kN	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm
160	710	0.24	6.16	0.26	6.49	0.23	5.82	0.15	3.85	0.10	2.64	0.11	2.91
160	710	0.25	6.23	0.26	6.56	0.23	5.89	0.15	3.86	0.10	2.64	0.12	2.98
146	651	0.26	6.50	0.27	6.82	0.24	6.18	0.15	3.84	0.10	2.63	0.13	3.26
146	648	0.26	6.50	0.27	6.83	0.24	6.18	0.15	3.84	0.10	2.64	0.13	3.26
144	643	0.26	6.50	0.27	6.81	0.24	6.18	0.15	3.84	0.10	2.64	0.13	3.26
144	642	0.26	6.49	0.27	6.80	0.24	6.17	0.15	3.84	0.10	2.64	0.13	3.25
146	650	0.26	6.52	0.27	6.87	0.24	6.18	0.15	3.85	0.10	2.63	0.13	3.28
149	664	0.26	6.68	0.28	7.02	0.25	6.34	0.15	3.87	0.10	2.64	0.13	3.43
149	664	0.26	6.69	0.28	7.03	0.25	6.35	0.15	3.86	0.10	2.63	0.14	3.44
154	684	0.27	6.95	0.29	7.28	0.26	6.63	0.15	3.91	0.10	2.63	0.14	3.68
154	685	0.27	6.96	0.29	7.29	0.26	6.63	0.15	3.91	0.10	2.63	0.15	3.69
158	702	0.28	7.22	0.30	7.53	0.27	6.91	0.16	3.94	0.10	2.63	0.15	3.93
158	702	0.28	7.23	0.30	7.54	0.27	6.92	0.16	3.95	0.10	2.63	0.16	3.94
161	715	0.29	7.49	0.31	7.78	0.28	7.20	0.16	3.99	0.10	2.63	0.16	4.18
161	717	0.30	7.50	0.31	7.80	0.28	7.21	0.16	3.99	0.10	2.63	0.17	4.19
164	728	0.31	7.77	0.32	8.06	0.29	7.48	0.16	4.04	0.10	2.63	0.17	4.43
164	730	0.31	7.78	0.32	8.07	0.30	7.49	0.16	4.04	0.10	2.63	0.18	4.45
166	740	0.32	8.07	0.33	8.36	0.31	7.78	0.16	4.10	0.10	2.63	0.19	4.70
170	756	0.34	8.62	0.35	8.91	0.33	8.34	0.17	4.20	0.10	2.63	0.21	5.21
172	765	0.35	8.91	0.36	9.19	0.34	8.63	0.17	4.25	0.10	2.63	0.22	5.47
173	771	0.36	9.19	0.37	9.47	0.35	8.91	0.17	4.30	0.10	2.63	0.23	5.72
176	784	0.38	9.73	0.39	10.02	0.37	9.45	0.17	4.43	0.10	2.63	0.24	6.20

Table A.60 Measurement of Load and Deflection Relationships of 5SB15T-2.0-8-D (Continued)

LC		Mid. Def.		W. Def.		E. Def.		W. Sett.		E. Sett.		Net Def.	
kips	kN	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm
177	785	0.38	9.76	0.40	10.04	0.37	9.47	0.17	4.43	0.10	2.63	0.25	6.22
179	796	0.41	10.31	0.42	10.60	0.39	10.02	0.18	4.53	0.10	2.63	0.26	6.73
179	797	0.41	10.33	0.42	10.62	0.40	10.03	0.18	4.53	0.10	2.63	0.27	6.74
180	803	0.43	10.87	0.44	11.18	0.42	10.55	0.18	4.63	0.10	2.63	0.28	7.24
180	803	0.43	10.87	0.44	11.19	0.42	10.56	0.18	4.63	0.10	2.63	0.29	7.24
185	821	0.49	12.41	0.49	12.41	0.49	12.41	0.19	4.71	0.10	2.62	0.34	8.74
190	843	0.62	15.81	0.62	15.81	0.62	15.81	0.19	4.71	0.10	2.62	0.48	12.14
195	865	0.89	22.69	0.89	22.69	0.89	22.69	0.19	4.71	0.10	2.62	0.75	19.03
196	870	0.98	24.90	0.98	24.90	0.98	24.90	0.19	4.71	0.10	2.62	0.84	21.23
196	870	0.98	24.92	0.98	24.92	0.98	24.92	0.19	4.71	0.10	2.62	0.84	21.25
195	868	0.98	24.92	0.98	24.92	0.98	24.92	0.19	4.71	0.10	2.62	0.84	21.26
195	866	0.98	24.93	0.98	24.93	0.98	24.93	0.19	4.71	0.10	2.62	0.84	21.26
195	865	1.01	25.66	1.01	25.66	1.01	25.66	0.19	4.71	0.10	2.62	0.87	21.99
192	853	1.01	25.74	1.01	25.74	1.01	25.74	0.19	4.71	0.10	2.62	0.87	22.07
191	850	1.01	25.77	1.01	25.77	1.01	25.77	0.19	4.71	0.10	2.62	0.87	22.11
191	849	1.02	25.80	1.02	25.80	1.02	25.80	0.19	4.71	0.10	2.62	0.87	22.13
191	849	1.02	25.83	1.02	25.83	1.02	25.83	0.19	4.71	0.10	2.62	0.87	22.16
179	798	1.03	26.22	1.03	26.22	1.03	26.22	0.19	4.71	0.10	2.62	0.89	22.55
179	794	1.03	26.22	1.03	26.22	1.03	26.22	0.19	4.71	0.10	2.62	0.89	22.55
178	793	1.03	26.22	1.03	26.22	1.03	26.22	0.19	4.71	0.10	2.62	0.89	22.55
178	792	1.03	26.25	1.03	26.25	1.03	26.25	0.19	4.71	0.10	2.62	0.89	22.59
179	797	1.10	27.99	1.10	27.99	1.10	27.99	0.19	4.71	0.10	2.62	0.96	24.32

Table A.60 Measurement of Load and Deflection Relationships of 5SB15T-2.0-8-D (Continued)

LC		Mid. Def.		W. Def.		E. Def.		W. Sett.		E. Sett.		Net Def.	
kips	kN	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm
177	787	1.11	28.08	1.11	28.08	1.11	28.08	0.19	4.71	0.10	2.62	0.96	24.42
176	781	1.18	30.00	1.18	30.00	1.18	30.00	0.19	4.71	0.10	2.62	1.04	26.33
175	780	1.18	30.03	1.18	30.03	1.18	30.03	0.19	4.71	0.10	2.62	1.04	26.37
175	777	1.19	30.16	1.19	30.16	1.19	30.16	0.19	4.71	0.10	2.62	1.04	26.50
174	776	1.19	30.21	1.19	30.21	1.19	30.21	0.19	4.71	0.10	2.62	1.05	26.55
174	774	1.19	30.25	1.19	30.25	1.19	30.25	0.19	4.71	0.10	2.62	1.05	26.58
174	773	1.19	30.28	1.19	30.28	1.19	30.28	0.19	4.71	0.10	2.62	1.05	26.62
173	770	1.19	30.34	1.19	30.34	1.19	30.34	0.19	4.71	0.10	2.62	1.05	26.67
172	766	1.20	30.39	1.20	30.39	1.20	30.39	0.19	4.71	0.10	2.62	1.05	26.72
37	163	1.39	35.25	1.39	35.25	1.39	35.25	0.19	4.71	0.10	2.62	1.24	31.58

Table A.61 Measurement of Tendon Slippage of 5SB15T-2.0-8-D

Load Cell		T1	T2	T3	T4	T5	T6	T7	T8
kips	kN	in	in	in	in	in	in	in	in
0	0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
30	132	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000
60	265	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000
90	399	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000
120	532	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000
150	666	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000
160	710	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000
170	755	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000
176	781	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000
165	735	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.000
170	755	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.000
180	799	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.000
185	821	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.000
190	843	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.000
193	856	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.000
195	866	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000
196	870	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000
195	868	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000
195	866	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000
195	865	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000
194	865	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000
194	865	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000

Table A.61 Measurement of Tendon Slippage of 5SB15T-2.0-8-D (Continued)

Load Cell		T1	T2	T3	T4	T5	T6	T7	T8
kips	kN	in	in	in	in	in	in	in	in
194	864	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000
194	864	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000
194	863	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000
194	863	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000
194	862	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000
194	863	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000
195	866	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000
195	868	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000
195	868	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000
195	868	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000
195	869	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000
195	869	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000
195	869	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000
196	870	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000
196	870	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000
195	869	0.000	0.000	0.000	0.001	0.000	0.001	0.000	0.000
195	869	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000
195	869	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000
195	868	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000
195	868	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000
195	868	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000
195	868	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000

Table A.61 Measurement of Tendon Slippage of 5SB15T-2.0-8-D (Continued)

Load Cell		T1	T2	T3	T4	T5	T6	T7	T8
kips	kN	in	in	in	in	in	in	in	in
195	868	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000
195	867	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000
195	867	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000
195	866	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000
195	865	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000
192	853	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.000
191	850	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.000
191	849	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.000
191	849	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.000
179	798	0.000	0.000	0.000	0.000	0.001	0.002	0.000	0.001
179	794	0.000	0.000	0.001	0.001	0.001	0.002	0.000	0.001
178	793	0.000	0.000	0.001	0.000	0.001	0.002	0.000	0.001
178	792	0.000	0.000	0.000	0.000	0.001	0.002	0.000	0.001
178	793	0.000	0.000	0.001	0.000	0.001	0.002	0.000	0.001
178	793	0.000	0.000	0.001	0.001	0.001	0.002	0.000	0.001
178	794	0.000	0.000	0.001	0.001	0.001	0.002	0.000	0.001
178	794	0.000	0.000	0.001	0.001	0.001	0.002	0.000	0.001
179	794	0.000	0.000	0.001	0.001	0.001	0.002	0.000	0.001
179	794	0.000	0.000	0.001	0.001	0.001	0.002	0.000	0.001
177	787	0.000	0.000	0.001	0.001	0.001	0.002	0.000	0.001
177	785	0.000	0.000	0.001	0.001	0.001	0.002	0.000	0.002
176	785	0.000	0.000	0.001	0.000	0.001	0.002	0.000	0.001

Table A.61 Measurement of Tendon Slippage of 5SB15T-2.0-8-D (Continued)

Load Cell		T1	T2	T3	T4	T5	T6	T7	T8
kips	kN	in	in	in	in	in	in	in	in
175	780	0.000	0.000	0.001	0.001	0.001	0.002	0.000	0.001
175	780	0.000	0.000	0.001	0.001	0.001	0.002	0.000	0.001
175	779	0.000	0.000	0.001	0.001	0.001	0.002	0.000	0.001
175	777	0.000	0.000	0.001	0.001	0.001	0.002	0.000	0.001
174	776	0.000	0.000	0.001	0.001	0.001	0.002	0.000	0.001
174	774	0.000	0.000	0.001	0.001	0.001	0.002	0.000	0.002
174	773	0.000	0.000	0.001	0.000	0.001	0.002	0.000	0.001
173	770	0.000	0.000	0.001	0.001	0.001	0.002	0.000	0.001
172	766	0.000	0.000	0.001	0.000	0.001	0.002	0.000	0.002
37	163	0.000	0.000	0.001	0.001	0.002	0.003	0.000	0.002

A.22 5SB15T-1.2-8-ND

Table A.62 Measurement of Load and Deflection Relationships of 5SB15T-1.2-8-ND

SW.LC		SE. LC		TRF		Mid. Def.		SW. Def.		SE. Def.		SW. Sett.		SE. Sett.		Net Def.	
kips	kN	kips	kN	kips	kN	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
0	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
18	79	12	53	30	132	0.02	0.47	0.02	0.47	0.02	0.47	0.00	0.00	0.02	0.39	0.01	0.28
35	153	25	111	60	265	0.04	1.00	0.04	1.00	0.04	1.00	0.00	0.00	0.04	0.91	0.02	0.54
51	228	39	172	90	400	0.06	1.42	0.06	1.42	0.06	1.42	0.00	0.00	0.05	1.32	0.03	0.76
68	301	52	231	120	533	0.07	1.78	0.07	1.78	0.07	1.78	0.00	0.00	0.06	1.58	0.04	0.99
85	379	66	293	151	672	0.08	2.11	0.08	2.11	0.08	2.11	0.00	0.00	0.07	1.78	0.05	1.22
85	378	66	293	151	670	0.08	2.11	0.08	2.11	0.08	2.11	0.00	0.00	0.07	1.78	0.05	1.22
85	376	66	292	150	668	0.08	2.11	0.08	2.11	0.08	2.11	0.00	0.00	0.07	1.79	0.05	1.22
97	430	76	336	172	766	0.09	2.34	0.09	2.34	0.09	2.34	0.00	-0.01	0.08	1.92	0.05	1.39
96	427	75	335	171	761	0.09	2.34	0.09	2.34	0.09	2.34	0.00	-0.01	0.08	1.92	0.05	1.39
96	428	76	337	172	765	0.09	2.36	0.09	2.36	0.09	2.36	0.00	-0.01	0.08	1.92	0.06	1.41
98	435	77	341	174	775	0.09	2.37	0.09	2.37	0.09	2.37	0.00	-0.01	0.08	1.93	0.06	1.41
98	434	77	340	174	774	0.09	2.37	0.09	2.37	0.09	2.37	0.00	-0.01	0.08	1.93	0.06	1.41
97	432	76	339	173	771	0.09	2.38	0.09	2.38	0.09	2.38	0.00	-0.01	0.08	1.93	0.06	1.42
98	436	77	343	175	779	0.09	2.39	0.09	2.39	0.09	2.39	0.00	-0.01	0.08	1.94	0.06	1.43
99	440	78	345	177	785	0.09	2.40	0.09	2.40	0.09	2.40	0.00	-0.01	0.08	1.94	0.06	1.43
101	451	80	356	181	807	0.10	2.51	0.10	2.51	0.10	2.51	0.00	-0.01	0.08	1.96	0.06	1.53
103	459	81	362	185	821	0.10	2.61	0.10	2.61	0.10	2.61	0.00	-0.01	0.08	1.97	0.06	1.64
104	461	82	364	185	825	0.10	2.63	0.10	2.63	0.10	2.63	0.00	-0.01	0.08	1.97	0.06	1.65

Table A.62 Measurement of Load and Deflection Relationships of 5SB15T-1.2-8-ND (Continued)

SW.LC		SE. LC		TRF		Mid. Def.		SW. Def.		SE. Def.		SW. Sett.		SE. Sett.		Net Def.	
kips	kN	kips	kN	kips	kN	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
103	457	81	361	184	819	0.10	2.64	0.10	2.64	0.10	2.64	0.00	-0.01	0.08	1.97	0.07	1.66
103	456	81	361	184	818	0.10	2.66	0.10	2.66	0.10	2.66	0.00	-0.01	0.08	1.97	0.07	1.68
103	460	82	364	185	824	0.11	2.67	0.11	2.67	0.11	2.67	0.00	-0.01	0.08	1.97	0.07	1.70
103	460	82	364	185	823	0.11	2.69	0.11	2.69	0.11	2.69	0.00	-0.01	0.08	1.97	0.07	1.71
102	453	81	360	183	813	0.11	2.72	0.11	2.72	0.11	2.72	0.00	-0.01	0.08	1.97	0.07	1.75
101	447	80	356	181	803	0.11	2.77	0.11	2.77	0.11	2.77	0.00	-0.01	0.08	1.97	0.07	1.79
100	445	80	354	180	799	0.11	2.79	0.11	2.79	0.11	2.79	0.00	-0.01	0.08	1.97	0.07	1.81
99	441	79	351	178	792	0.11	2.79	0.11	2.79	0.11	2.79	0.00	-0.01	0.08	1.97	0.07	1.81
96	427	77	340	172	767	0.11	2.82	0.11	2.82	0.11	2.82	0.00	-0.01	0.08	1.97	0.07	1.84
98	436	78	349	176	785	0.11	2.88	0.11	2.88	0.11	2.88	0.00	-0.01	0.08	1.97	0.08	1.91
100	443	79	353	179	796	0.12	3.14	0.12	3.14	0.12	3.14	0.00	-0.01	0.08	1.97	0.09	2.16
101	450	81	359	182	809	0.13	3.39	0.13	3.39	0.13	3.39	0.00	-0.01	0.08	1.97	0.09	2.41
100	447	80	357	181	804	0.13	3.40	0.13	3.40	0.13	3.40	0.00	-0.01	0.08	1.97	0.10	2.42
102	456	82	364	184	819	0.14	3.63	0.14	3.63	0.14	3.63	0.00	-0.01	0.08	1.97	0.10	2.65
103	456	82	364	184	820	0.16	4.06	0.16	4.06	0.16	4.06	0.00	-0.01	0.08	1.97	0.12	3.08
101	448	80	357	181	805	0.17	4.41	0.17	4.41	0.17	4.41	0.00	-0.01	0.08	1.97	0.13	3.43
102	453	81	360	183	813	0.18	4.63	0.18	4.63	0.18	4.63	0.00	-0.01	0.08	1.97	0.14	3.65
102	453	81	360	183	813	0.19	4.85	0.19	4.85	0.19	4.85	0.00	-0.01	0.08	1.97	0.15	3.87
103	458	82	365	185	823	0.21	5.25	0.21	5.25	0.21	5.25	0.00	0.00	0.08	1.97	0.17	4.27
96	428	77	344	173	771	0.21	5.45	0.21	5.45	0.21	5.45	0.00	0.00	0.08	1.97	0.18	4.47
97	433	78	349	176	782	0.22	5.67	0.22	5.67	0.22	5.67	0.00	0.00	0.08	1.97	0.18	4.68
98	436	79	352	177	788	0.23	5.93	0.23	5.93	0.23	5.93	0.00	0.00	0.08	1.97	0.19	4.94

Table A.62 Measurement of Load and Deflection Relationships of 5SB15T-1.2-8-ND (Continued)

SW.LC		SE. LC		TRF		Mid. Def.		SW. Def.		SE. Def.		SW. Sett.		SE. Sett.		Net Def.	
kips	kN	kips	kN	kips	kN	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
99	439	80	354	178	793	0.24	6.14	0.24	6.14	0.24	6.14	0.00	0.00	0.08	1.97	0.20	5.16
99	439	80	356	179	795	0.25	6.44	0.25	6.44	0.25	6.44	0.00	0.00	0.08	1.97	0.21	5.46
98	436	79	353	177	789	0.25	6.45	0.25	6.45	0.25	6.45	0.00	0.00	0.08	1.97	0.22	5.47
98	435	79	353	177	788	0.25	6.47	0.25	6.47	0.25	6.47	0.00	0.00	0.08	1.97	0.22	5.48
99	439	80	355	178	793	0.26	6.48	0.26	6.48	0.26	6.48	0.00	0.00	0.08	1.97	0.22	5.50
98	437	80	354	178	791	0.26	6.50	0.26	6.50	0.26	6.50	0.00	0.00	0.08	1.97	0.22	5.52
94	417	75	332	168	749	0.26	6.61	0.26	6.61	0.26	6.61	0.00	0.00	0.08	1.97	0.22	5.62
94	417	75	332	168	749	0.26	6.61	0.26	6.61	0.26	6.61	0.00	0.00	0.08	1.97	0.22	5.63
94	420	75	333	169	753	0.26	6.63	0.26	6.63	0.26	6.63	0.00	0.00	0.08	1.97	0.22	5.65
94	418	75	331	168	749	0.26	6.64	0.26	6.64	0.26	6.64	0.00	0.00	0.08	1.97	0.22	5.66
93	415	74	330	167	745	0.26	6.66	0.26	6.66	0.26	6.66	0.00	0.00	0.08	1.97	0.22	5.67
94	418	75	332	169	750	0.26	6.67	0.26	6.67	0.26	6.67	0.00	0.00	0.08	1.97	0.22	5.69
94	420	75	333	169	753	0.26	6.68	0.26	6.68	0.26	6.68	0.00	0.00	0.08	1.97	0.22	5.70
94	417	74	331	168	748	0.26	6.69	0.26	6.69	0.26	6.69	0.00	0.00	0.08	1.97	0.22	5.71
93	416	74	331	168	747	0.26	6.70	0.26	6.70	0.26	6.70	0.00	0.00	0.08	1.97	0.23	5.72
94	419	75	333	169	751	0.26	6.72	0.26	6.72	0.26	6.72	0.00	0.00	0.08	1.97	0.23	5.74
94	420	75	333	169	753	0.27	6.86	0.27	6.86	0.27	6.86	0.00	0.00	0.08	1.97	0.23	5.88
96	427	77	341	173	768	0.31	7.83	0.31	7.83	0.31	7.83	0.00	0.00	0.08	1.97	0.27	6.85
98	436	79	350	177	786	0.36	9.16	0.36	9.16	0.36	9.16	0.00	0.00	0.08	1.97	0.32	8.17
99	442	81	358	180	800	0.42	10.59	0.42	10.59	0.42	10.59	0.00	0.00	0.08	1.97	0.38	9.61
99	442	81	359	180	800	0.43	10.90	0.43	10.90	0.43	10.90	0.00	0.00	0.08	1.97	0.39	9.92
99	442	81	359	180	801	0.44	11.25	0.44	11.25	0.44	11.25	0.00	0.00	0.08	1.97	0.40	10.26

Table A.62 Measurement of Load and Deflection Relationships of 5SB15T-1.2-8-ND (Continued)

SW.LC		SE. LC		TRF		Mid. Def.		SW. Def.		SE. Def.		SW. Sett.		SE. Sett.		Net Def.	
kips	kN	kips	kN	kips	kN	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
99	441	81	359	180	799	0.45	11.43	0.45	11.43	0.45	11.43	0.00	0.00	0.08	1.97	0.41	10.45
99	439	80	357	179	796	0.46	11.66	0.46	11.66	0.46	11.66	0.00	0.00	0.08	1.97	0.42	10.67
98	436	80	354	178	790	0.47	11.86	0.47	11.86	0.47	11.86	0.00	0.00	0.08	1.97	0.43	10.87
97	433	79	353	177	787	0.48	12.15	0.48	12.15	0.48	12.15	0.00	0.00	0.08	1.97	0.44	11.16
98	436	80	355	178	791	0.49	12.51	0.49	12.51	0.49	12.51	0.00	0.00	0.08	1.97	0.45	11.53
98	437	80	357	178	794	0.50	12.76	0.50	12.76	0.50	12.76	0.00	0.00	0.08	1.97	0.46	11.78
98	435	80	355	178	790	0.51	12.98	0.51	12.98	0.51	12.98	0.00	0.00	0.08	1.97	0.47	11.99
98	435	80	355	178	790	0.52	13.30	0.52	13.30	0.52	13.30	0.00	0.00	0.08	1.97	0.48	12.31
97	432	80	355	177	787	0.57	14.49	0.57	14.49	0.57	14.49	0.00	0.00	0.08	1.97	0.53	13.51
96	428	79	353	176	781	0.61	15.39	0.61	15.39	0.61	15.39	0.00	0.00	0.08	1.97	0.57	14.41
96	426	80	354	175	780	0.64	16.27	0.64	16.27	0.64	16.27	0.00	0.01	0.08	1.97	0.60	15.28
95	421	79	353	174	774	0.68	17.19	0.68	17.19	0.68	17.19	0.00	0.01	0.08	1.97	0.64	16.21
94	416	79	350	172	766	0.72	18.25	0.72	18.25	0.72	18.25	0.00	0.01	0.08	1.97	0.68	17.26
93	412	78	347	171	759	0.74	18.74	0.74	18.74	0.74	18.74	0.00	0.01	0.08	1.97	0.70	17.75
91	406	77	343	168	749	0.74	18.76	0.74	18.76	0.74	18.76	0.00	0.00	0.08	1.97	0.70	17.78
90	400	76	339	166	739	0.74	18.90	0.74	18.90	0.74	18.90	0.00	0.00	0.08	1.97	0.71	17.91
88	393	75	334	164	727	0.75	19.08	0.75	19.08	0.75	19.08	0.00	0.00	0.08	1.97	0.71	18.10
67	298	58	258	125	556	0.77	19.45	0.77	19.45	0.77	19.45	0.00	0.01	0.08	1.97	0.73	18.46

Table A.63 Measurement of Tendon Slippage of 5SB15T-1.2-8-ND

TRF		T1	T2	T3	T4	T5	T6	T7	T8
kips	kN	in	in	in	in	in	in	in	in
0	0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
30	132	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
60	265	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
90	400	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
120	533	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000
151	672	0.000	0.000	0.000	0.001	0.003	0.004	0.000	0.000
151	670	0.000	0.000	0.000	0.001	0.003	0.004	0.000	0.000
150	668	0.000	0.000	0.000	0.001	0.003	0.004	0.000	0.000
172	766	0.000	0.000	0.003	0.005	0.018	0.006	0.000	0.000
171	761	0.000	0.000	0.003	0.005	0.018	0.006	0.000	0.000
172	765	0.000	0.000	0.003	0.005	0.019	0.006	0.000	0.000
174	775	0.000	0.000	0.003	0.006	0.019	0.006	0.000	0.000
174	774	0.000	0.000	0.003	0.006	0.019	0.006	0.000	0.000
173	771	0.000	0.000	0.003	0.006	0.020	0.006	0.000	0.000
175	779	0.000	0.000	0.004	0.006	0.020	0.006	0.000	0.000
177	785	0.000	0.000	0.004	0.007	0.020	0.006	0.000	0.000
181	807	0.000	0.000	0.007	0.015	0.027	0.008	0.000	0.000
185	821	0.000	0.000	0.014	0.021	0.031	0.012	0.000	0.000
185	825	0.000	0.000	0.015	0.022	0.031	0.013	0.000	0.000
184	819	0.000	0.000	0.018	0.022	0.032	0.014	0.000	0.000
184	818	0.000	0.000	0.020	0.023	0.032	0.014	0.000	0.000
185	824	0.000	0.000	0.022	0.023	0.032	0.015	0.000	0.000

Table A.63 Measurement of Tendon Slippage of 5SB15T-1.2-8-ND (Continued)

TRF		T1	T2	T3	T4	T5	T6	T7	T8
kips	kN	in	in	in	in	in	in	in	in
185	823	0.000	0.000	0.023	0.023	0.033	0.016	0.000	0.000
183	813	0.000	0.000	0.026	0.024	0.033	0.017	0.000	0.000
181	803	0.000	0.000	0.030	0.025	0.034	0.018	0.000	0.000
180	799	0.000	0.000	0.031	0.027	0.034	0.019	0.000	0.000
178	792	0.000	0.000	0.032	0.027	0.035	0.020	0.000	0.000
172	767	0.000	0.000	0.033	0.029	0.036	0.026	0.000	0.000
176	785	0.000	0.000	0.034	0.029	0.036	0.030	0.000	0.000
179	796	0.000	0.000	0.040	0.036	0.043	0.048	0.000	0.000
182	809	0.000	0.000	0.045	0.042	0.051	0.059	0.000	0.000
181	804	0.000	0.000	0.046	0.043	0.052	0.059	0.000	0.000
184	819	0.000	0.000	0.050	0.048	0.058	0.067	0.000	0.000
184	820	0.000	0.000	0.058	0.059	0.070	0.080	0.002	0.004
181	805	0.000	0.000	0.066	0.068	0.079	0.091	0.009	0.013
183	813	0.000	0.000	0.071	0.073	0.085	0.097	0.012	0.017
183	813	0.000	0.000	0.076	0.079	0.092	0.103	0.016	0.021
185	823	0.000	0.000	0.085	0.090	0.103	0.113	0.023	0.030
173	771	0.000	0.084	0.091	0.094	0.106	0.118	0.026	0.034
176	782	0.000	0.095	0.096	0.098	0.111	0.123	0.029	0.038
177	788	0.000	0.107	0.102	0.105	0.118	0.129	0.033	0.043
178	793	0.001	0.115	0.108	0.111	0.124	0.135	0.037	0.047
179	795	0.002	0.127	0.117	0.119	0.133	0.143	0.045	0.053
177	789	0.002	0.127	0.117	0.120	0.133	0.144	0.045	0.054

Table A.63 Measurement of Tendon Slippage of 5SB15T-1.2-8-ND (Continued)

TRF		T1	T2	T3	T4	T5	T6	T7	T8
kips	kN	in	in	in	in	in	in	in	in
177	788	0.002	0.128	0.117	0.120	0.133	0.144	0.046	0.054
178	793	0.002	0.128	0.118	0.120	0.134	0.144	0.046	0.055
178	791	0.002	0.129	0.118	0.121	0.134	0.145	0.048	0.055
168	749	0.002	0.131	0.119	0.121	0.135	0.148	0.111	0.059
168	749	0.002	0.131	0.120	0.121	0.135	0.149	0.133	0.059
169	753	0.002	0.131	0.120	0.122	0.135	0.149	0.133	0.060
168	749	0.002	0.132	0.120	0.122	0.135	0.150	0.133	0.060
167	745	0.002	0.132	0.121	0.122	0.136	0.151	0.133	0.060
169	750	0.002	0.133	0.121	0.123	0.136	0.151	0.133	0.061
169	753	0.002	0.133	0.121	0.123	0.136	0.152	0.133	0.062
168	748	0.002	0.133	0.122	0.124	0.137	0.152	0.133	0.062
168	747	0.002	0.134	0.122	0.124	0.137	0.152	0.133	0.062
169	751	0.002	0.134	0.122	0.124	0.138	0.153	0.133	0.063
169	753	0.003	0.139	0.126	0.128	0.142	0.158	0.136	0.066
173	768	0.005	0.174	0.153	0.157	0.170	0.186	0.175	0.088
177	786	0.008	0.219	0.191	0.199	0.211	0.225	0.222	0.116
180	800	0.013	0.270	0.233	0.246	0.257	0.298	0.264	0.147
180	800	0.013	0.280	0.243	0.256	0.267	0.309	0.276	0.152
180	801	0.014	0.292	0.253	0.267	0.278	0.317	0.288	0.160
180	799	0.015	0.298	0.258	0.273	0.284	0.324	0.296	0.164
179	796	0.017	0.305	0.264	0.280	0.290	0.332	0.301	0.173
178	790	0.024	0.316	0.269	0.286	0.296	0.338	0.309	0.180

Table A.63 Measurement of Tendon Slippage of 5SB15T-1.2-8-ND (Continued)

TRF		T1	T2	T3	T4	T5	T6	T7	T8
kips	kN	in	in	in	in	in	in	in	in
177	787	0.028	0.327	0.278	0.295	0.304	0.347	0.323	0.188
178	791	0.031	0.339	0.289	0.306	0.315	0.358	0.336	0.197
178	794	0.033	0.347	0.295	0.315	0.323	0.365	0.341	0.203
178	790	0.035	0.354	0.301	0.325	0.329	0.373	0.347	0.214
178	790	0.037	0.364	0.312	0.366	0.339	0.383	0.358	0.225
177	787	0.045	0.404	0.348	0.404	0.377	0.419	0.397	0.258
176	781	0.052	0.434	0.379	0.435	0.405	0.450	0.430	0.281
175	780	0.061	0.464	0.411	0.464	0.431	0.475	0.454	0.303
174	774	0.067	0.494	0.439	0.497	0.460	0.507	0.481	0.325
172	766	0.072	0.530	0.475	0.531	0.492	0.541	0.510	0.355
171	759	0.074	0.546	0.487	0.547	0.506	0.554	0.524	0.368
168	749	0.074	0.547	0.489	0.549	0.507	0.560	0.527	0.370
166	739	0.074	0.555	0.493	0.553	0.511	0.560	0.527	0.372
164	727	0.074	0.564	0.497	0.558	0.516	0.568	0.533	0.375
125	556	0.075	0.614	0.517	0.645	0.551	0.620	0.624	0.450

Table A.64 Measurement of Strain Gauges of 5SB15T-1.2-8-ND

TRF		S1	S2	S3	S4	S11	S12	S13	S14
kips	kN	m/m	m/m	m/m	m/m	m/m	m/m	m/m	m/m
0	0	0.000	0.000	B.G.	B.G.	0.000	0.000	0.000	0.000
30	132	7.734	12.872	B.G.	B.G.	3.908	3.885	20.692	22.740
60	265	11.602	25.384	B.G.	B.G.	6.866	5.174	37.071	41.394
90	400	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.
120	533	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.
151	672	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.
151	670	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.
150	668	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.
172	766	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.
171	761	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.
172	765	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.
174	775	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.
174	774	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.
173	771	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.
175	779	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.
177	785	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.
181	807	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.
185	821	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.
185	825	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
125	556	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.

A.23 5SB15T-2.0-8-ND

Table A.65 Measurement of Load and Deflection Relationships of 5SB15T-2.0-8-ND

LC		Mid. Def.		W. Def.		E. Def.		W. Sett.		E. Sett.		Net Def.	
kips	kN	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm
0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
30	131	0.03	0.88	0.03	0.88	0.03	0.88	0.04	1.02	0.00	0.11	0.01	0.32
60	265	0.06	1.59	0.06	1.59	0.06	1.59	0.06	1.52	0.01	0.31	0.03	0.67
90	399	0.09	2.20	0.09	2.20	0.09	2.20	0.07	1.84	0.02	0.49	0.04	1.03
100	443	0.09	2.41	0.09	2.41	0.09	2.41	0.08	1.93	0.02	0.55	0.05	1.17
110	488	0.10	2.62	0.10	2.62	0.10	2.62	0.08	2.02	0.02	0.60	0.05	1.31
110	489	0.10	2.62	0.10	2.62	0.10	2.62	0.08	2.03	0.02	0.60	0.05	1.31
110	490	0.10	2.63	0.10	2.63	0.10	2.63	0.08	2.03	0.02	0.60	0.05	1.31
110	491	0.10	2.63	0.10	2.63	0.10	2.63	0.08	2.03	0.02	0.61	0.05	1.32
111	493	0.10	2.64	0.10	2.64	0.10	2.64	0.08	2.03	0.02	0.61	0.05	1.32
111	494	0.10	2.64	0.10	2.64	0.10	2.64	0.08	2.04	0.02	0.61	0.05	1.32
111	495	0.10	2.65	0.10	2.65	0.10	2.65	0.08	2.04	0.02	0.61	0.05	1.33
112	496	0.10	2.66	0.10	2.66	0.10	2.66	0.08	2.04	0.02	0.61	0.05	1.33
112	497	0.10	2.66	0.10	2.66	0.10	2.66	0.08	2.04	0.02	0.61	0.05	1.34
112	498	0.10	2.67	0.10	2.67	0.10	2.67	0.08	2.04	0.02	0.61	0.05	1.34
112	499	0.11	2.68	0.11	2.68	0.11	2.68	0.08	2.05	0.02	0.62	0.05	1.35
113	501	0.11	2.68	0.11	2.68	0.11	2.68	0.08	2.05	0.02	0.62	0.05	1.35
113	501	0.11	2.69	0.11	2.69	0.11	2.69	0.08	2.05	0.02	0.62	0.05	1.35
113	503	0.11	2.69	0.11	2.69	0.11	2.69	0.08	2.05	0.02	0.62	0.05	1.35

Table A.65 Measurement of Load and Deflection Relationships of 5SB15T-2.0-8-ND (Continued)

LC		Mid. Def.		W. Def.		E. Def.		W. Sett.		E. Sett.		Net Def.	
kips	kN	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm
113	504	0.11	2.70	0.11	2.70	0.11	2.70	0.08	2.05	0.02	0.62	0.05	1.36
114	505	0.11	2.70	0.11	2.70	0.11	2.70	0.08	2.06	0.02	0.62	0.05	1.36
114	506	0.11	2.70	0.11	2.70	0.11	2.70	0.08	2.06	0.02	0.62	0.05	1.36
115	513	0.11	2.75	0.11	2.75	0.11	2.75	0.08	2.07	0.02	0.63	0.06	1.40
122	543	0.12	3.08	0.12	3.08	0.12	3.08	0.08	2.14	0.03	0.66	0.07	1.67
123	547	0.13	3.27	0.13	3.27	0.13	3.27	0.09	2.16	0.03	0.66	0.07	1.86
123	547	0.13	3.34	0.13	3.34	0.13	3.34	0.09	2.17	0.03	0.66	0.08	1.92
127	565	0.15	3.84	0.15	3.84	0.15	3.84	0.09	2.21	0.03	0.66	0.09	2.40
127	565	0.15	3.85	0.15	3.85	0.15	3.85	0.09	2.21	0.03	0.66	0.10	2.41
131	583	0.17	4.38	0.17	4.38	0.17	4.38	0.09	2.25	0.03	0.66	0.11	2.92
131	583	0.17	4.39	0.17	4.39	0.17	4.39	0.09	2.25	0.03	0.66	0.12	2.93
134	598	0.19	4.90	0.19	4.90	0.19	4.90	0.09	2.29	0.03	0.66	0.13	3.43
135	599	0.19	4.91	0.19	4.91	0.19	4.91	0.09	2.29	0.03	0.66	0.14	3.43
137	609	0.21	5.41	0.21	5.41	0.21	5.41	0.09	2.33	0.03	0.66	0.15	3.91
137	610	0.21	5.43	0.21	5.43	0.21	5.43	0.09	2.33	0.03	0.66	0.16	3.94
140	621	0.23	5.94	0.23	5.94	0.23	5.94	0.09	2.35	0.03	0.66	0.17	4.44
140	621	0.23	5.96	0.23	5.96	0.23	5.96	0.09	2.35	0.03	0.66	0.18	4.45
145	643	0.29	7.34	0.29	7.34	0.29	7.34	0.10	2.43	0.03	0.66	0.23	5.80
150	666	0.36	9.09	0.36	9.09	0.36	9.09	0.10	2.51	0.03	0.66	0.30	7.50
155	688	0.43	11.03	0.43	11.03	0.43	11.03	0.10	2.59	0.03	0.66	0.37	9.40
158	702	0.51	13.05	0.51	13.05	0.51	13.05	0.11	2.68	0.03	0.66	0.45	11.38
160	710	0.56	14.30	0.56	14.30	0.56	14.30	0.11	2.74	0.03	0.66	0.50	12.60

Table A.65 Measurement of Load and Deflection Relationships of 5SB15T-2.0-8-ND (Continued)

LC		Mid. Def.		W. Def.		E. Def.		W. Sett.		E. Sett.		Net Def.	
kips	kN	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm
160	712	0.58	14.79	0.58	14.79	0.58	14.79	0.11	2.76	0.03	0.66	0.51	13.08
161	715	0.58	14.80	0.58	14.80	0.58	14.80	0.11	2.76	0.03	0.66	0.52	13.09
162	721	0.63	15.95	0.63	15.95	0.63	15.95	0.11	2.80	0.03	0.66	0.56	14.21
163	726	0.66	16.67	0.66	16.67	0.66	16.67	0.11	2.83	0.03	0.66	0.59	14.92
164	730	0.71	17.93	0.71	17.93	0.71	17.93	0.11	2.88	0.03	0.66	0.64	16.16
166	737	0.74	18.78	0.74	18.78	0.74	18.78	0.11	2.91	0.03	0.66	0.67	16.99
166	739	0.80	20.23	0.80	20.23	0.80	20.23	0.12	2.96	0.03	0.66	0.73	18.42
169	750	0.85	21.55	0.85	21.55	0.85	21.55	0.12	3.00	0.03	0.66	0.78	19.72
170	756	0.96	24.33	0.96	24.33	0.96	24.33	0.12	3.08	0.03	0.66	0.88	22.46
171	761	0.99	25.03	0.99	25.03	0.99	25.03	0.12	3.10	0.03	0.66	0.91	23.15
172	764	1.03	26.07	1.03	26.07	1.03	26.07	0.12	3.12	0.03	0.66	0.95	24.17
172	764	1.07	27.29	1.07	27.29	1.07	27.29	0.12	3.16	0.03	0.66	1.00	25.38
171	760	1.16	29.36	1.16	29.36	1.16	29.36	0.13	3.22	0.03	0.66	1.08	27.42
170	754	1.18	29.90	1.18	29.90	1.18	29.90	0.13	3.22	0.03	0.66	1.10	27.95
169	753	1.18	29.90	1.18	29.90	1.18	29.90	0.13	3.22	0.03	0.66	1.10	27.96
167	744	1.18	29.90	1.18	29.90	1.18	29.90	0.13	3.22	0.03	0.66	1.10	27.96
168	745	1.18	29.90	1.18	29.90	1.18	29.90	0.13	3.22	0.03	0.66	1.10	27.96
169	751	1.18	29.90	1.18	29.90	1.18	29.90	0.13	3.22	0.03	0.66	1.10	27.96
167	745	1.18	29.90	1.18	29.90	1.18	29.90	0.13	3.22	0.03	0.66	1.10	27.95
165	736	1.18	29.88	1.18	29.88	1.18	29.88	0.13	3.22	0.03	0.66	1.10	27.94
166	738	1.18	29.86	1.18	29.86	1.18	29.86	0.13	3.22	0.03	0.66	1.10	27.92
166	738	1.17	29.82	1.17	29.82	1.17	29.82	0.13	3.21	0.03	0.66	1.10	27.88

Table A.66 Measurement of Tendon Slippage of 5SB15T-2.0-8-ND

Load Cell		T1	T2	T3	T4	T5	T6	T7	T8
kips	kN	in	in	in	in	in	in	in	in
0	0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
30	131	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
60	265	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
90	399	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
100	443	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
110	488	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
110	489	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
110	490	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
110	491	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
111	493	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
111	494	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
111	495	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
112	496	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
112	497	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
112	498	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
112	499	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
113	501	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
113	501	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
113	503	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
113	504	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
114	505	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
114	506	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Table A.66 Measurement of Tendon Slippage of 5SB15T-2.0-8-ND (Continued)

Load Cell		T1	T2	T3	T4	T5	T6	T7	T8
kips	kN	in	in	in	in	in	in	in	in
115	513	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
122	543	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
123	547	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
123	547	0.000	0.000	0.000	0.000	-0.001	0.000	0.000	0.000
127	565	0.000	0.000	0.000	0.000	-0.001	0.000	0.000	0.000
127	565	0.000	0.000	0.000	0.000	-0.001	0.000	0.000	0.000
131	583	0.000	0.002	0.000	0.000	0.000	0.000	0.004	0.000
131	583	0.000	0.002	0.000	0.000	0.000	0.000	0.004	0.000
134	598	0.000	0.004	0.000	0.000	0.000	0.000	0.006	0.000
135	599	0.000	0.004	0.000	0.000	0.000	0.000	0.006	0.000
137	609	0.000	0.007	0.000	0.000	0.000	0.000	0.009	0.000
137	610	0.000	0.007	0.000	0.000	0.000	0.000	0.009	0.000
140	621	0.000	0.009	0.000	0.000	0.000	0.000	0.012	0.000
140	621	0.000	0.010	0.000	0.000	0.000	0.000	0.012	0.000
145	643	0.000	0.018	0.002	0.000	0.000	0.000	0.019	0.000
150	666	0.000	0.030	0.010	0.000	0.000	0.000	0.028	0.000
155	688	0.000	0.044	0.014	0.000	0.000	0.023	0.040	0.000
158	702	0.000	0.056	0.017	0.000	0.000	0.033	0.052	0.000
160	710	0.000	0.064	0.019	0.000	0.000	0.037	0.059	0.000
160	712	0.000	0.066	0.020	0.000	0.000	0.039	0.062	0.000
161	715	0.000	0.066	0.020	0.000	0.000	0.038	0.062	0.000
162	721	0.000	0.072	0.021	0.000	0.000	0.042	0.067	0.000

Table A.66 Measurement of Tendon Slippage of 5SB15T-2.0-8-ND (Continued)

Load Cell		T1	T2	T3	T4	T5	T6	T7	T8
kips	kN	in	in	in	in	in	in	in	in
163	726	0.000	0.076	0.022	0.000	0.000	0.043	0.071	0.000
164	730	0.000	0.082	0.023	0.000	0.000	0.045	0.076	0.000
166	737	0.000	0.087	0.025	0.000	0.000	0.048	0.080	0.000
166	739	0.000	0.093	0.026	0.000	0.000	0.049	0.086	0.000
169	750	0.000	0.099	0.028	0.000	0.000	0.052	0.091	0.000
170	756	0.000	0.110	0.031	0.000	0.000	0.055	0.099	0.000
171	761	0.000	0.113	0.031	0.000	0.000	0.056	0.102	0.000
172	764	0.000	0.117	0.032	0.000	0.000	0.058	0.105	0.000
172	764	0.000	0.122	0.034	0.000	0.000	0.060	0.109	0.000
171	760	0.000	0.129	0.036	0.000	0.000	0.063	0.117	0.000
170	754	0.000	0.132	0.036	0.000	0.000	0.064	0.119	0.000
169	753	0.000	0.132	0.036	0.000	0.000	0.064	0.119	0.000
167	744	0.000	0.132	0.036	0.000	0.000	0.064	0.119	0.000
168	745	0.000	0.132	0.036	0.000	0.000	0.064	0.119	0.000
169	751	0.000	0.132	0.036	0.000	0.000	0.064	0.119	0.000
167	745	0.000	0.132	0.036	0.000	0.000	0.064	0.119	0.000
165	736	0.000	0.132	0.036	0.000	0.000	0.064	0.119	0.000
166	738	0.000	0.132	0.036	0.000	0.000	0.064	0.119	0.000
166	738	0.000	0.132	0.036	0.000	0.000	0.064	0.119	0.000

Table A.67 Measurement of Strain Gauges of 5SB15T-2.0-8-ND

Load Cell		N1	N2	N3	N4	N11	N12	N13	N14
kips	kN	m/m	m/m	m/m	m/m	m/m	m/m	m/m	m/m
0	0	0.000	0.000	0.000	B.G.	0.000	B.G.	0.000	0.000
30	131	12.739	14.104	18.199	B.G.	13.649	B.G.	15.469	27.526
60	265	7.734	10.009	18.881	B.G.	61.876	B.G.	63.014	41.858
90	399	29.573	30.711	42.313	B.G.	58.464	B.G.	61.649	73.251
100	443	27.753	28.436	43.223	B.G.	74.843	B.G.	77.574	78.939
110	488	50.275	49.820	63.469	B.G.	48.227	B.G.	53.460	102.597
110	489	38.218	38.445	53.915	B.G.	70.976	B.G.	74.844	94.180
110	490	32.986	33.213	49.592	B.G.	81.213	B.G.	84.626	91.223
110	491	32.076	32.076	48.455	B.G.	83.943	B.G.	87.128	90.540
111	493	32.303	32.303	48.910	B.G.	84.398	B.G.	87.811	90.768
111	494	51.412	50.730	64.834	B.G.	48.682	B.G.	54.142	104.645
111	495	46.407	45.953	60.739	B.G.	58.919	B.G.	63.697	100.777
112	496	32.758	32.758	49.137	B.G.	85.080	B.G.	88.266	91.223
112	497	33.213	32.986	49.592	B.G.	84.625	B.G.	88.038	91.678
112	498	52.322	51.185	65.289	B.G.	49.592	B.G.	55.052	104.872
112	499	51.867	50.957	64.834	B.G.	50.274	B.G.	55.735	105.327
113	501	35.033	34.578	50.730	B.G.	82.805	B.G.	86.446	93.498
113	501	51.412	50.275	64.152	B.G.	52.322	B.G.	57.782	106.010
113	503	34.351	33.668	50.047	B.G.	84.625	B.G.	88.038	94.180
113	504	53.232	51.412	65.971	B.G.	49.592	B.G.	55.280	107.375
114	505	34.578	33.896	50.502	B.G.	84.853	B.G.	88.266	94.180
114	506	34.578	33.668	50.502	B.G.	85.535	B.G.	88.948	94.635

Table A.67 Measurement of Strain Gauges of 5SB15T-2.0-8-ND (Continued)

Load Cell		N1	N2	N3	N4	N11	N12	N13	N14
kips	kN	m/m	m/m	m/m	m/m	m/m	m/m	m/m	m/m
115	513	55.052	51.867	68.929	B.G.	50.957	B.G.	56.645	110.559
122	543	141.497	B.G.	197.460	B.G.	90.995	B.G.	101.005	131.716
123	547	228.853	B.G.	294.825	B.G.	179.033	B.G.	191.773	178.351
123	547	268.436	B.G.	338.275	B.G.	226.123	B.G.	238.863	221.119
127	565	526.862	B.G.	612.398	B.G.	389.232	B.G.	412.209	439.052
127	565	530.730	B.G.	616.720	B.G.	392.189	B.G.	415.394	441.327
131	583	721.137	B.G.	823.280	B.G.	573.497	B.G.	602.389	598.749
131	583	736.834	B.G.	837.611	B.G.	553.478	B.G.	584.190	610.806
134	598	873.782	B.G.	967.052	B.G.	659.943	B.G.	695.886	736.834
135	599	865.365	B.G.	960.682	B.G.	680.872	B.G.	715.223	730.465
137	609	983.431	B.G.	B.G.	B.G.	723.639	B.G.	763.678	837.157
137	610	967.052	B.G.	B.G.	B.G.	760.265	B.G.	798.711	831.242
140	621	1098.313	B.G.	B.G.	B.G.	818.729	B.G.	863.773	959.545
140	621	1082.161	B.G.	B.G.	B.G.	856.038	B.G.	899.033	951.356
145	643	1289.403	B.G.	B.G.	B.G.	B.G.	B.G.	1086.939	1170.882
150	666	1555.791	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	1373.119
155	688	1565.801	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	1509.612
158	702	1565.801	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	1664.304
160	710	1565.801	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	1726.863
160	712	1565.801	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	1742.332
161	715	1565.801	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	1742.332
162	721	1565.801	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	1724.815

Table A.67 Measurement of Strain Gauges of 5SB15T-2.0-8-ND (Continued)

Load Cell		N1	N2	N3	N4	N11	N12	N13	N14
kips	kN	m/m	m/m	m/m	m/m	m/m	m/m	m/m	m/m
163	726	1565.801	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	1832.872
164	730	1565.801	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	1856.986
166	737	1565.801	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	1856.986
166	739	1617.213	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	1856.986
169	750	1653.611	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	2005.308
170	756	1727.545	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	2074.920
171	761	1725.270	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	2097.668
172	764	1741.649	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	2120.872
172	764	1772.132	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	2152.948
171	760	1781.459	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	2194.806
170	754	1784.189	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	2206.180
169	753	1782.597	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	2201.403
167	744	1785.327	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	2201.403
168	745	1776.682	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	2201.403
169	751	1793.744	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	2201.403
167	745	1786.464	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	2201.403
165	736	1776.682	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	2201.403
166	738	1782.369	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	2201.403
166	738	1776.227	B.G.	B.G.	B.G.	B.G.	B.G.	B.G.	2201.403

A.24 5SB15M-1.2-8-ND

Table A.68 Measurement of Load and Deflection Relationships of 5SB15M-1.2-8-ND

SW.LC		SE. LC		TRF		Mid. Def.		SW. Def.		SE. Def.		SW. Sett.		SE. Sett.		Net Def.	
kips	kN	kips	kN	kips	kN	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
0	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
26	116	24	106	50	221	0.05	1.35	0.03	0.68	0.08	2.02	0.00	0.07	0.07	1.80	0.01	0.20
48	215	52	230	100	444	0.08	2.04	0.05	1.15	0.12	2.93	0.01	0.28	0.10	2.48	0.02	0.44
57	256	62	278	120	533	0.09	2.26	0.05	1.32	0.13	3.19	0.01	0.36	0.10	2.65	0.02	0.54
67	299	73	323	140	622	0.10	2.47	0.06	1.51	0.14	3.43	0.02	0.47	0.11	2.77	0.03	0.64
70	310	75	335	145	645	0.10	2.53	0.06	1.56	0.14	3.49	0.02	0.49	0.12	2.93	0.02	0.60
72	320	78	346	150	666	0.10	2.57	0.06	1.61	0.14	3.54	0.02	0.50	0.12	2.93	0.03	0.64
75	331	80	356	155	688	0.10	2.62	0.06	1.64	0.14	3.59	0.02	0.51	0.12	2.93	0.03	0.68
77	343	83	368	160	711	0.11	2.67	0.07	1.68	0.14	3.66	0.02	0.52	0.12	2.93	0.03	0.72
82	365	88	390	170	755	0.11	2.78	0.07	1.77	0.15	3.79	0.02	0.54	0.12	2.97	0.03	0.81
82	365	89	394	171	760	0.11	2.79	0.07	1.77	0.15	3.82	0.02	0.56	0.12	2.98	0.03	0.81
84	372	90	400	173	772	0.11	2.88	0.07	1.86	0.15	3.91	0.02	0.56	0.12	2.98	0.04	0.90
84	374	90	402	175	776	0.11	2.91	0.07	1.88	0.16	3.95	0.02	0.56	0.12	2.98	0.04	0.93
82	363	87	386	168	749	0.12	3.04	0.08	1.91	0.16	4.16	0.02	0.56	0.12	2.98	0.04	1.05
83	371	88	393	172	764	0.12	3.07	0.08	1.93	0.17	4.21	0.02	0.56	0.12	2.98	0.04	1.08
84	372	89	395	173	768	0.12	3.10	0.08	1.96	0.17	4.25	0.02	0.56	0.12	2.98	0.04	1.12
84	373	89	396	173	769	0.12	3.13	0.08	1.98	0.17	4.27	0.02	0.56	0.12	2.98	0.04	1.14
81	361	87	387	168	748	0.13	3.18	0.08	2.07	0.17	4.29	0.02	0.56	0.12	2.98	0.05	1.19
80	356	87	385	167	742	0.13	3.22	0.08	2.12	0.17	4.32	0.02	0.56	0.12	2.98	0.05	1.23

Table A.68 Measurement of Load and Deflection Relationships of 5SB15M-1.2-8-ND (Continued)

SW.LC		SE. LC		TRF		Mid. Def.		SW. Def.		SE. Def.		SW. Sett.		SE. Sett.		Net Def.	
kips	kN	kips	kN	kips	kN	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
81	359	87	389	168	748	0.13	3.36	0.09	2.25	0.18	4.47	0.02	0.56	0.12	2.98	0.05	1.37
83	369	89	397	172	766	0.14	3.59	0.10	2.45	0.19	4.73	0.02	0.56	0.12	2.98	0.06	1.60
84	373	91	403	175	777	0.15	3.83	0.10	2.65	0.20	5.01	0.02	0.56	0.12	2.98	0.07	1.84
86	382	93	412	179	794	0.16	4.04	0.11	2.86	0.21	5.23	0.02	0.56	0.12	2.98	0.08	2.06
88	389	94	420	182	810	0.17	4.29	0.12	3.07	0.22	5.51	0.02	0.56	0.12	2.98	0.09	2.31
89	396	96	426	185	821	0.18	4.52	0.13	3.28	0.23	5.77	0.02	0.56	0.12	2.98	0.10	2.54
92	407	98	437	190	844	0.19	4.93	0.14	3.62	0.25	6.24	0.02	0.56	0.12	2.98	0.12	2.94
94	416	100	444	194	861	0.21	5.29	0.15	3.90	0.26	6.68	0.02	0.56	0.12	2.98	0.13	3.31
94	417	100	444	194	861	0.21	5.30	0.15	3.91	0.26	6.69	0.02	0.56	0.12	2.98	0.13	3.31
93	413	99	441	192	854	0.21	5.33	0.16	3.96	0.26	6.71	0.02	0.56	0.12	2.98	0.13	3.35
93	416	100	443	193	859	0.22	5.49	0.16	4.09	0.27	6.89	0.02	0.56	0.12	2.98	0.14	3.51
94	419	100	446	195	865	0.22	5.68	0.17	4.22	0.28	7.14	0.02	0.56	0.12	2.98	0.15	3.70
94	420	99	442	194	862	0.24	5.98	0.17	4.41	0.30	7.56	0.02	0.56	0.12	2.98	0.16	4.00
95	423	100	445	195	868	0.24	6.14	0.18	4.49	0.31	7.79	0.02	0.56	0.12	2.98	0.16	4.15
95	424	100	446	196	870	0.25	6.31	0.18	4.65	0.31	7.97	0.02	0.56	0.12	2.98	0.17	4.32
95	425	100	445	196	870	0.26	6.52	0.19	4.82	0.32	8.23	0.02	0.56	0.12	2.98	0.18	4.54
97	430	101	449	198	879	0.27	6.84	0.20	5.09	0.34	8.58	0.02	0.56	0.12	2.98	0.19	4.85
98	434	101	450	199	884	0.29	7.26	0.21	5.36	0.36	9.16	0.02	0.56	0.12	2.98	0.21	5.27
97	432	101	448	198	881	0.29	7.49	0.22	5.53	0.37	9.45	0.02	0.56	0.12	2.98	0.22	5.51
96	428	100	445	196	873	0.30	7.53	0.22	5.58	0.37	9.48	0.02	0.56	0.12	2.98	0.22	5.55
97	433	100	444	197	877	0.32	8.13	0.24	6.16	0.40	10.10	0.02	0.56	0.12	2.98	0.24	6.14
98	436	100	445	198	881	0.32	8.23	0.24	6.20	0.40	10.26	0.02	0.56	0.12	2.98	0.25	6.25

Table A.68 Measurement of Load and Deflection Relationships of 5SB15M-1.2-8-ND (Continued)

SW.LC		SE. LC		TRF		Mid. Def.		SW. Def.		SE. Def.		SW. Sett.		SE. Sett.		Net Def.	
kips	kN	kips	kN	kips	kN	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
96	429	99	441	196	870	0.33	8.27	0.25	6.26	0.41	10.29	0.02	0.56	0.12	2.98	0.25	6.29
96	428	99	441	195	869	0.33	8.27	0.25	6.25	0.41	10.29	0.02	0.56	0.12	2.98	0.25	6.28
98	437	100	444	198	881	0.34	8.51	0.25	6.41	0.42	10.61	0.02	0.56	0.12	2.98	0.26	6.52
99	440	100	443	199	883	0.34	8.69	0.26	6.54	0.43	10.85	0.02	0.56	0.12	2.98	0.26	6.71
100	444	100	443	199	887	0.35	8.94	0.26	6.70	0.44	11.18	0.02	0.56	0.12	2.98	0.27	6.95
97	432	98	435	195	867	0.35	9.00	0.27	6.75	0.44	11.25	0.02	0.56	0.12	2.98	0.28	7.02
99	441	98	436	197	877	0.38	9.56	0.28	7.10	0.47	12.02	0.02	0.56	0.12	2.98	0.30	7.58
100	446	98	438	199	884	0.38	9.64	0.28	7.12	0.48	12.16	0.02	0.56	0.12	2.98	0.30	7.65
98	434	97	429	194	863	0.39	9.85	0.30	7.51	0.48	12.20	0.02	0.56	0.12	2.98	0.31	7.86
99	442	98	434	197	876	0.40	10.04	0.30	7.57	0.49	12.52	0.02	0.56	0.12	2.98	0.32	8.06
99	442	98	434	197	876	0.40	10.05	0.30	7.57	0.49	12.53	0.02	0.56	0.12	2.98	0.32	8.06
96	429	96	425	192	854	0.40	10.21	0.31	7.82	0.50	12.59	0.02	0.56	0.12	2.98	0.32	8.22
97	430	96	426	192	856	0.40	10.21	0.31	7.82	0.50	12.59	0.02	0.56	0.12	2.98	0.32	8.22
97	431	96	425	192	856	0.42	10.54	0.32	8.11	0.51	12.97	0.02	0.56	0.12	2.98	0.34	8.56
97	433	95	425	193	857	0.43	10.81	0.32	8.20	0.53	13.43	0.02	0.56	0.12	2.98	0.35	8.83
90	399	87	389	177	788	0.44	11.08	0.33	8.40	0.54	13.76	0.02	0.56	0.12	2.98	0.36	9.09
93	412	90	401	183	812	0.48	12.20	0.38	9.76	0.58	14.63	0.02	0.56	0.12	2.98	0.40	10.21
93	414	91	403	184	817	0.50	12.58	0.40	10.06	0.59	15.09	0.02	0.56	0.12	2.98	0.42	10.59
92	407	90	399	181	806	0.50	12.65	0.40	10.17	0.60	15.13	0.02	0.56	0.12	2.98	0.42	10.66
91	406	90	399	181	805	0.50	12.66	0.40	10.19	0.60	15.13	0.02	0.56	0.12	2.98	0.42	10.67
93	415	92	407	185	822	0.51	12.94	0.41	10.43	0.61	15.45	0.02	0.56	0.12	2.98	0.43	10.95
92	409	90	402	182	811	0.51	13.08	0.42	10.64	0.61	15.52	0.02	0.56	0.12	2.98	0.44	11.09

Table A.68 Measurement of Load and Deflection Relationships of 5SB15M-1.2-8-ND (Continued)

SW.LC		SE. LC		TRF		Mid. Def.		SW. Def.		SE. Def.		SW. Sett.		SE. Sett.		Net Def.	
kips	kN	kips	kN	kips	kN	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
93	414	92	407	185	821	0.52	13.15	0.42	10.68	0.62	15.62	0.02	0.56	0.12	2.98	0.44	11.17
93	412	91	406	184	818	0.53	13.42	0.43	10.96	0.63	15.89	0.02	0.56	0.12	2.98	0.45	11.44
88	392	86	384	175	776	0.54	13.78	0.45	11.46	0.63	16.11	0.02	0.56	0.12	2.98	0.46	11.80
87	386	85	380	172	767	0.54	13.80	0.45	11.50	0.63	16.11	0.02	0.56	0.12	2.98	0.47	11.82
87	388	86	381	173	769	0.54	13.81	0.45	11.50	0.63	16.11	0.02	0.56	0.12	2.98	0.47	11.82
88	391	87	386	175	777	0.55	14.02	0.46	11.69	0.64	16.35	0.02	0.56	0.12	2.98	0.47	12.03
87	388	86	383	173	771	0.55	14.06	0.46	11.72	0.65	16.39	0.02	0.56	0.12	2.98	0.48	12.07
87	386	86	383	173	769	0.56	14.13	0.46	11.79	0.65	16.47	0.02	0.56	0.12	2.98	0.48	12.14
74	329	78	347	152	675	0.64	16.22	0.62	15.77	0.66	16.67	0.02	0.56	0.12	2.98	0.56	14.24
73	326	78	345	151	671	0.64	16.23	0.62	15.79	0.66	16.68	0.02	0.56	0.12	2.98	0.56	14.25
74	329	78	347	152	676	0.64	16.22	0.62	15.77	0.66	16.68	0.02	0.56	0.12	2.98	0.56	14.24
74	329	78	346	152	675	0.64	16.23	0.62	15.79	0.66	16.68	0.02	0.56	0.12	2.98	0.56	14.25
74	328	78	346	151	674	0.64	16.23	0.62	15.78	0.66	16.68	0.02	0.56	0.12	2.98	0.56	14.24
74	327	78	346	151	673	0.64	16.23	0.62	15.78	0.66	16.68	0.02	0.56	0.12	2.98	0.56	14.24
74	327	78	346	151	673	0.64	16.23	0.62	15.79	0.66	16.68	0.02	0.56	0.12	2.98	0.56	14.25
74	328	78	345	151	674	0.64	16.23	0.62	15.78	0.66	16.68	0.02	0.56	0.12	2.98	0.56	14.24
74	327	78	345	151	673	0.64	16.23	0.62	15.79	0.66	16.68	0.02	0.56	0.12	2.98	0.56	14.25
73	327	78	346	151	672	0.64	16.23	0.62	15.78	0.66	16.68	0.02	0.56	0.12	2.98	0.56	14.24
74	327	78	346	151	673	0.64	16.23	0.62	15.79	0.66	16.68	0.02	0.56	0.12	2.98	0.56	14.24
74	328	78	345	151	673	0.64	16.23	0.62	15.78	0.66	16.68	0.02	0.56	0.12	2.98	0.56	14.24
74	327	78	345	151	672	0.64	16.23	0.62	15.78	0.66	16.67	0.02	0.56	0.12	2.98	0.56	14.24
73	326	78	345	151	672	0.64	16.23	0.62	15.79	0.66	16.67	0.02	0.56	0.12	2.98	0.56	14.24

Table A.69 Measurement of Rosette LVDTs of 5SB15M-1.2-8-ND

TRF		SWD1	SWD2	SWV1	SWV2	SWH1	SWH2	SED1	SED2	SEV1	SEV2	SEH1	SEH2
kips	kN	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in
0	0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
50	221	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
100	444	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
120	533	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
140	622	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
145	645	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
150	666	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
155	688	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
160	711	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
170	755	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
171	760	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
173	772	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
175	776	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
168	749	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
172	764	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
173	768	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
173	769	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
168	748	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
167	742	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
168	748	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
172	766	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
175	777	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Table A.69 Measurement of Rosette LVDTs of 5SB15M-1.2-8-ND (Continued)

TRF		SWD1	SWD2	SWV1	SWV2	SWH1	SWH2	SED1	SED2	SEV1	SEV2	SEH1	SEH2
kips	kN	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in
179	794	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
182	810	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
185	821	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
190	844	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
194	861	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
194	861	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
192	854	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
193	859	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
195	865	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
194	862	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
195	868	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
196	870	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
196	870	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
198	879	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
199	884	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
198	881	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
196	873	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
197	877	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-0.001	0.000	0.000
198	881	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-0.001	0.000	-0.001	0.000	0.000
196	870	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-0.001	0.000	-0.001	0.000	0.000
195	869	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-0.001	0.000	-0.001	0.000	0.000
198	881	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-0.001	0.000	-0.001	0.000	-0.001

Table A.69 Measurement of Rosette LVDTs of 5SB15M-1.2-8-ND (Continued)

TRF		SWD1	SWD2	SWV1	SWV2	SWH1	SWH2	SED1	SED2	SEV1	SEV2	SEH1	SEH2
kips	kN	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in
199	883	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-0.001	0.000	-0.001	0.000	-0.001
199	887	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-0.001	0.000	-0.002	0.000	-0.001
195	867	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-0.001	0.000	-0.002	0.000	-0.001
197	877	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-0.001	0.000	-0.002	0.001	-0.001
199	884	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-0.001	0.000	-0.002	0.001	-0.001
194	863	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-0.001	0.000	-0.002	0.001	-0.001
197	876	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-0.001	0.000	-0.002	0.001	-0.001
197	876	0.000	0.000	0.000	-0.001	0.000	0.000	0.000	-0.002	0.000	-0.002	0.001	-0.001
192	854	0.000	0.000	0.000	-0.001	0.000	0.000	0.000	-0.002	0.000	-0.002	0.001	-0.001
192	856	0.000	0.000	0.000	-0.001	0.000	-0.001	0.000	-0.002	0.000	-0.002	0.001	-0.001
192	856	0.000	-0.001	0.000	0.000	0.000	0.000	0.000	-0.002	0.000	-0.002	0.001	-0.001
193	857	0.000	-0.001	0.000	0.000	0.000	-0.001	0.000	-0.003	-0.001	-0.002	0.000	-0.001
177	788	0.000	-0.001	0.000	0.000	0.000	-0.001	0.000	-0.003	-0.001	-0.002	0.000	-0.001
183	812	0.000	-0.002	0.000	0.000	-0.001	-0.002	0.000	-0.004	-0.001	-0.002	-0.001	-0.001
184	817	0.000	-0.002	0.000	-0.001	-0.002	-0.002	0.000	-0.004	-0.001	-0.002	-0.001	-0.001
181	806	0.000	-0.002	0.000	-0.001	-0.002	-0.002	0.000	-0.004	-0.001	-0.002	-0.001	-0.001
181	805	0.000	-0.002	0.000	-0.001	-0.002	-0.002	0.000	-0.004	-0.001	-0.002	-0.001	-0.001
185	822	0.000	-0.003	0.000	-0.001	-0.002	-0.002	0.000	-0.004	-0.002	-0.002	-0.001	-0.001
182	811	0.000	-0.003	0.000	-0.001	-0.002	-0.002	0.000	-0.004	-0.002	-0.002	-0.001	-0.001
185	821	0.000	-0.003	0.000	-0.001	-0.002	-0.002	0.000	-0.004	-0.002	-0.002	-0.001	-0.001
184	818	0.000	-0.003	0.000	-0.001	-0.002	-0.002	0.000	-0.004	-0.002	-0.002	-0.002	-0.001
175	776	0.000	-0.003	0.000	-0.001	-0.002	-0.002	0.000	-0.004	-0.002	-0.002	-0.002	-0.001

Table A.69 Measurement of Rosette LVDTs of 5SB15M-1.2-8-ND (Continued)

TRF		SWD1	SWD2	SWV1	SWV2	SWH1	SWH2	SED1	SED2	SEV1	SEV2	SEH1	SEH2
kips	kN	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in
172	767	0.000	-0.003	0.000	-0.001	-0.002	-0.002	0.000	-0.004	-0.002	-0.002	-0.002	-0.001
173	769	0.000	-0.003	0.000	-0.001	-0.002	-0.002	0.000	-0.004	-0.002	-0.002	-0.002	-0.001
175	777	0.000	-0.003	0.000	-0.001	-0.003	-0.002	0.000	-0.004	-0.002	-0.002	-0.002	-0.001
173	771	0.000	-0.003	0.000	-0.001	-0.003	-0.002	0.000	-0.004	-0.002	-0.002	-0.002	-0.001
173	769	0.000	-0.002	0.000	0.000	-0.003	-0.002	0.000	-0.004	-0.002	-0.001	-0.002	-0.001
152	675	0.000	-0.002	0.000	0.000	-0.003	-0.002	0.000	-0.004	-0.002	-0.001	-0.002	-0.001
151	671	0.000	-0.002	0.000	0.000	-0.003	-0.002	0.000	-0.004	-0.002	-0.001	-0.002	-0.001
152	676	0.000	-0.002	0.000	0.000	-0.003	-0.002	0.000	-0.004	-0.002	-0.001	-0.002	-0.001
152	675	0.000	-0.002	0.000	0.000	-0.003	-0.002	0.000	-0.004	-0.002	-0.001	-0.002	-0.001
151	674	0.000	-0.002	0.000	0.000	-0.003	-0.002	0.000	-0.004	-0.002	-0.001	-0.002	-0.001
151	673	0.000	-0.002	0.000	0.000	-0.003	-0.002	0.000	-0.004	-0.002	-0.001	-0.002	-0.001
151	673	0.000	-0.002	0.000	0.000	-0.003	-0.002	0.000	-0.004	-0.002	-0.001	-0.002	-0.001
151	674	0.000	-0.002	0.000	0.000	-0.003	-0.002	0.000	-0.004	-0.002	-0.001	-0.002	-0.001
151	673	0.000	-0.002	0.000	0.000	-0.003	-0.002	0.000	-0.004	-0.002	-0.001	-0.002	-0.001
151	672	0.000	-0.002	0.000	0.000	-0.003	-0.002	0.000	-0.004	-0.002	-0.001	-0.002	-0.001
151	673	0.000	-0.002	0.000	0.000	-0.003	-0.002	0.000	-0.004	-0.002	-0.001	-0.002	-0.001
151	673	0.000	-0.002	0.000	0.000	-0.003	-0.002	0.000	-0.004	-0.002	-0.001	-0.002	-0.001
151	672	0.000	-0.002	0.000	0.000	-0.003	-0.002	0.000	-0.004	-0.002	-0.001	-0.002	-0.001
151	672	0.000	-0.002	0.000	0.000	-0.003	-0.002	0.000	-0.004	-0.002	-0.001	-0.002	-0.001

Table A.70 Measurement of Tendon Slippage of 5SB15M-1.2-8-ND

TRF		T1	T2	T3	T4	T5	T6	T7	T8
kips	kN	in	in	in	in	in	in	in	in
0	0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
50	221	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
100	444	0.000	0.000	0.000	0.003	0.001	0.000	0.000	0.000
120	533	0.000	0.000	0.000	0.009	0.002	0.000	0.000	0.000
140	622	0.000	0.000	0.000	0.015	0.006	0.000	0.000	0.000
145	645	0.000	0.000	0.001	0.019	0.008	0.000	0.000	0.000
150	666	0.000	0.000	0.001	0.020	0.008	0.001	0.000	0.000
155	688	0.000	0.000	0.003	0.022	0.010	0.001	0.000	0.000
160	711	0.000	0.001	0.004	0.025	0.011	0.005	0.000	0.000
170	755	0.000	0.000	0.007	0.033	0.023	0.007	0.000	0.000
171	760	0.000	0.000	0.007	0.035	0.026	0.007	0.000	0.000
173	772	0.000	0.000	0.014	0.044	0.047	0.009	0.000	0.000
175	776	0.000	0.000	0.022	0.047	0.050	0.011	0.000	0.000
168	749	0.000	0.000	0.030	0.052	0.056	0.033	0.000	0.000
172	764	0.000	0.000	0.031	0.054	0.057	0.035	0.000	0.000
173	768	0.000	0.001	0.034	0.055	0.059	0.038	0.000	0.000
173	769	0.000	0.001	0.036	0.056	0.060	0.039	0.000	0.000
168	748	0.000	0.000	0.046	0.058	0.061	0.040	0.000	0.000
167	742	0.000	0.000	0.050	0.060	0.062	0.041	0.000	0.000
168	748	0.000	0.002	0.061	0.066	0.068	0.045	0.000	0.002
172	766	0.000	0.007	0.071	0.076	0.077	0.051	0.004	0.004
175	777	0.002	0.013	0.080	0.087	0.089	0.060	0.010	0.008

Table A.70 Measurement of Tendon Slippage of 5SB15M-1.2-8-ND (Continued)

TRF		T1	T2	T3	T4	T5	T6	T7	T8
kips	kN	in	in	in	in	in	in	in	in
179	794	0.005	0.017	0.088	0.094	0.097	0.070	0.015	0.011
182	810	0.008	0.024	0.099	0.103	0.106	0.084	0.021	0.015
185	821	0.010	0.030	0.107	0.109	0.113	0.094	0.033	0.019
190	844	0.015	0.041	0.123	0.122	0.128	0.112	0.053	0.027
194	861	0.017	0.051	0.136	0.135	0.142	0.126	0.075	0.034
194	861	0.018	0.053	0.139	0.137	0.145	0.127	0.077	0.034
192	854	0.018	0.053	0.139	0.138	0.145	0.127	0.077	0.035
193	859	0.018	0.056	0.143	0.144	0.152	0.135	0.086	0.037
195	865	0.019	0.063	0.154	0.153	0.162	0.144	0.097	0.041
194	862	0.022	0.071	0.163	0.164	0.174	0.157	0.125	0.050
195	868	0.023	0.077	0.172	0.172	0.182	0.165	0.136	0.054
196	870	0.024	0.093	0.177	0.177	0.189	0.172	0.141	0.058
196	870	0.025	0.093	0.183	0.184	0.197	0.180	0.144	0.062
198	879	0.028	0.097	0.196	0.196	0.210	0.195	0.155	0.068
199	884	0.031	0.113	0.213	0.215	0.230	0.214	0.168	0.073
198	881	0.034	0.134	0.222	0.223	0.239	0.224	0.177	0.076
196	873	0.034	0.134	0.222	0.224	0.240	0.225	0.177	0.077
197	877	0.036	0.137	0.240	0.246	0.259	0.246	0.189	0.084
198	881	0.038	0.153	0.246	0.253	0.266	0.254	0.196	0.086
196	870	0.038	0.153	0.246	0.253	0.266	0.254	0.196	0.087
195	869	0.038	0.153	0.246	0.253	0.266	0.254	0.196	0.087
198	881	0.039	0.153	0.255	0.264	0.277	0.268	0.209	0.091

Table A.70 Measurement of Tendon Slippage of 5SB15M-1.2-8-ND (Continued)

TRF		T1	T2	T3	T4	T5	T6	T7	T8
kips	kN	in	in	in	in	in	in	in	in
199	883	0.040	0.154	0.263	0.272	0.286	0.279	0.217	0.095
199	887	0.043	0.169	0.270	0.283	0.297	0.292	0.227	0.101
195	867	0.043	0.169	0.270	0.283	0.297	0.292	0.227	0.101
197	877	0.049	0.171	0.291	0.309	0.323	0.323	0.250	0.112
199	884	0.052	0.180	0.294	0.316	0.330	0.330	0.255	0.114
194	863	0.052	0.180	0.294	0.316	0.330	0.330	0.255	0.114
197	876	0.054	0.180	0.301	0.327	0.342	0.342	0.260	0.117
197	876	0.060	0.180	0.306	0.330	0.345	0.346	0.263	0.119
192	854	0.060	0.180	0.306	0.330	0.345	0.346	0.263	0.119
192	856	0.060	0.180	0.306	0.331	0.345	0.346	0.263	0.119
192	856	0.060	0.187	0.316	0.345	0.360	0.363	0.273	0.123
193	857	0.064	0.193	0.331	0.366	0.382	0.387	0.294	0.153
177	788	0.064	0.193	0.331	0.366	0.382	0.387	0.294	0.153
183	812	0.089	0.198	0.346	0.390	0.408	0.413	0.312	0.153
184	817	0.099	0.211	0.359	0.406	0.426	0.431	0.326	0.153
181	806	0.099	0.210	0.359	0.407	0.427	0.431	0.326	0.153
181	805	0.100	0.210	0.359	0.407	0.426	0.431	0.326	0.153
185	822	0.110	0.211	0.363	0.416	0.436	0.441	0.331	0.153
182	811	0.112	0.213	0.366	0.418	0.439	0.444	0.334	0.153
185	821	0.114	0.214	0.370	0.423	0.444	0.450	0.338	0.154
184	818	0.116	0.220	0.382	0.439	0.462	0.469	0.355	0.183
175	776	0.120	0.223	0.384	0.442	0.465	0.472	0.358	0.183

Table A.70 Measurement of Tendon Slippage of 5SB15M-1.2-8-ND (Continued)

TRF		T1	T2	T3	T4	T5	T6	T7	T8
kips	kN	in	in	in	in	in	in	in	in
172	767	0.120	0.223	0.384	0.442	0.465	0.472	0.358	0.183
173	769	0.120	0.223	0.384	0.443	0.465	0.472	0.358	0.183
175	777	0.120	0.226	0.392	0.454	0.479	0.484	0.365	0.183
173	771	0.120	0.226	0.392	0.454	0.479	0.484	0.365	0.183
173	769	0.116	0.231	0.411	0.474	0.498	0.500	0.378	0.183
152	675	0.116	0.231	0.411	0.474	0.498	0.500	0.378	0.183
151	671	0.116	0.231	0.411	0.474	0.498	0.500	0.378	0.183
152	676	0.116	0.231	0.411	0.474	0.498	0.500	0.378	0.183
152	675	0.116	0.231	0.411	0.474	0.498	0.501	0.378	0.183
151	674	0.116	0.231	0.411	0.474	0.498	0.501	0.378	0.183
151	673	0.116	0.231	0.411	0.474	0.498	0.500	0.378	0.183
151	673	0.116	0.231	0.411	0.475	0.498	0.500	0.378	0.183
151	674	0.116	0.231	0.411	0.475	0.498	0.500	0.378	0.183
151	673	0.116	0.231	0.411	0.475	0.498	0.500	0.378	0.183
151	672	0.116	0.231	0.411	0.475	0.498	0.501	0.378	0.183
151	673	0.116	0.231	0.411	0.475	0.498	0.500	0.378	0.183
151	673	0.117	0.231	0.411	0.475	0.498	0.500	0.378	0.183
151	672	0.117	0.231	0.411	0.475	0.498	0.500	0.378	0.183
151	672	0.117	0.231	0.411	0.475	0.498	0.501	0.378	0.183

Table A.71 Measurement of Strain Gauges of 5SB15M-1.2-8-ND

TRF		CS1	CS2	CS3	NS1
kips	kN	m/m	m/m	m/m	m/m
0	0	0.000	0.000	0.000	0.000
50	221	0.228	-0.910	0.227	0.227
100	444	13.649	-5.460	4.777	3.867
120	533	16.152	-10.465	5.005	4.094
140	622	22.521	-8.417	6.597	5.459
145	645	28.891	-1.365	9.782	8.417
150	666	32.986	-1.592	10.464	9.327
155	688	32.758	-3.640	10.237	9.782
160	711	34.351	-3.412	10.692	31.848
170	755	35.261	-5.232	10.237	40.038
171	760	35.716	-4.322	10.237	42.767
173	772	36.171	-5.915	10.692	63.924
175	776	35.488	-5.460	10.464	73.933
168	749	32.986	-5.232	8.417	345.554
172	764	33.441	-4.550	8.417	378.312
173	768	32.986	-4.095	8.417	407.886
173	769	32.986	-6.142	8.417	422.445
168	748	32.076	-8.872	8.872	428.360
167	742	31.848	-6.142	8.872	436.777
168	748	30.938	-7.507	9.327	495.241
172	766	31.848	-5.915	10.237	649.933
175	777	32.303	-4.322	11.147	777.782

TRF		CS1	CS2	CS3	NS1
kips	kN	m/m	m/m	m/m	m/m
179	794	32.986	-2.502	12.284	843.071
182	810	34.351	-0.455	12.967	886.066
185	821	34.123	-0.455	13.194	893.346
190	844	35.488	1.365	13.422	887.203
194	861	34.806	1.820	12.739	841.478
194	861	34.351	1.592	12.284	837.156
192	854	34.123	2.047	12.512	831.241
193	859	33.441	-1.820	12.512	813.952
195	865	33.441	-0.910	11.602	795.753
194	862	31.621	-1.592	10.919	770.957
195	868	33.441	0.910	11.602	777.327
196	870	33.213	-1.820	11.602	773.687
196	870	32.531	-3.412	15.014	765.952
198	879	33.896	-4.095	22.294	767.772
199	884	35.488	-3.867	29.801	768.227
198	881	35.716	-2.047	29.573	750.711
196	873	35.716	-2.730	29.346	749.118
197	877	36.398	-2.957	-101.915	765.497
198	881	36.171	-5.005	-136.493	768.455
196	870	36.171	-3.867	-139.450	763.450
195	869	36.626	-3.640	-142.863	761.858
198	881	37.991	-3.867	-189.043	766.635

Table A.71 Measurement of Strain Gauges of 5SB15M-1.2-8-ND (Continued)

TRF		CS1	CS2	CS3	NS1
kips	kN	m/m	m/m	m/m	m/m
199	883	38.673	-3.640	-219.526	757.308
199	887	39.355	-2.730	-250.010	749.573
195	867	39.128	-4.322	-252.285	741.384
197	877	41.630	-0.683	-312.341	715.905
199	884	42.085	2.047	-323.261	715.677
194	863	41.630	2.275	-325.308	700.663
197	876	42.085	10.009	-356.247	708.398
197	876	42.313	10.009	-356.929	707.943
192	854	42.085	11.602	-359.204	692.474
192	856	41.858	10.692	-359.886	692.246
192	856	43.223	23.431	-385.138	685.649
193	857	21.156	120.796	-482.048	689.289
177	788	8.872	158.332	-508.664	655.621
183	812	-13.877	843.299	-639.014	670.407
184	817	-35.033	955.223	-687.924	664.948
181	806	-37.308	965.687	-691.109	655.393
181	805	-38.673	969.782	-693.157	650.616
185	822	-48.455	1032.796	-728.417	661.080
182	811	-48.682	1035.526	-737.289	651.071
185	821	-50.730	1053.725	-752.758	654.256
184	818	-56.417	1069.877	-776.417	639.696
175	776	-58.464	999.355	-786.882	622.635

TRF		CS1	CS2	CS3	NS1
kips	kN	m/m	m/m	m/m	m/m
172	767	-56.872	999.583	-786.882	613.308
173	769	-57.327	998.900	-786.882	614.900
175	777	-70.294	987.754	-793.251	616.493
173	771	-70.976	986.161	-793.706	609.895
173	769	-80.758	961.137	-803.033	601.023
152	675	-80.758	765.953	-810.085	472.948
151	671	-80.076	761.858	-810.768	464.303
152	676	-80.076	761.403	-811.223	466.805
152	675	-80.531	759.810	-811.223	465.895
151	674	-80.303	759.810	-811.223	464.758
151	673	-80.303	759.355	-811.450	463.848
151	673	-80.758	757.536	-811.450	463.166
151	674	-80.303	758.673	-811.450	462.483
151	673	-82.806	755.716	-812.360	460.436
151	672	-82.578	755.716	-812.815	459.526
151	673	-82.578	755.488	-812.815	459.298
151	673	-82.578	755.488	-812.588	459.071
151	672	-83.488	754.578	-813.270	457.706
151	672	-83.488	753.896	-813.043	457.251

A.25 5SB15M-2.0-8-ND

Table A.72 Measurement of Load and Deflection Relationships of 5SB15M-2.0-8-ND

LC		Mid. Def.		W. Def.		E. Def.		W. Sett.		E. Sett.		Net Def.	
kips	kN	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm
0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
30	135	0.04	0.91	0.03	0.75	0.04	1.08	0.02	0.53	0.03	0.77	0.01	0.26
60	265	0.06	1.58	0.06	1.44	0.07	1.73	0.04	0.95	0.04	1.13	0.02	0.54
90	400	0.09	2.21	0.08	2.08	0.09	2.33	0.05	1.35	0.06	1.43	0.03	0.81
100	443	0.10	2.43	0.09	2.31	0.10	2.54	0.06	1.46	0.06	1.53	0.04	0.93
110	488	0.10	2.66	0.10	2.54	0.11	2.77	0.06	1.58	0.06	1.63	0.04	1.05
120	532	0.12	2.92	0.11	2.81	0.12	3.04	0.07	1.69	0.07	1.73	0.05	1.21
130	576	0.13	3.37	0.13	3.27	0.14	3.48	0.07	1.80	0.07	1.81	0.06	1.57
135	599	0.15	3.79	0.14	3.68	0.15	3.90	0.07	1.86	0.07	1.85	0.08	1.93
137	607	0.16	4.16	0.16	4.05	0.17	4.27	0.07	1.89	0.07	1.87	0.09	2.28
136	607	0.16	4.17	0.16	4.04	0.17	4.29	0.07	1.90	0.07	1.87	0.09	2.28
138	612	0.17	4.30	0.16	4.18	0.17	4.41	0.07	1.90	0.07	1.87	0.09	2.41
140	622	0.18	4.56	0.17	4.44	0.18	4.69	0.08	1.93	0.07	1.88	0.10	2.66
145	644	0.21	5.22	0.20	5.10	0.21	5.35	0.08	1.98	0.08	1.91	0.13	3.28
148	657	0.23	5.83	0.22	5.70	0.23	5.96	0.08	2.01	0.08	1.94	0.15	3.86
146	651	0.23	5.95	0.23	5.81	0.24	6.08	0.08	2.02	0.08	1.94	0.16	3.97
144	642	0.24	5.99	0.23	5.85	0.24	6.13	0.08	2.02	0.08	1.94	0.16	4.01
146	650	0.24	6.19	0.24	6.04	0.25	6.34	0.08	2.02	0.08	1.94	0.17	4.21
148	660	0.25	6.44	0.25	6.29	0.26	6.60	0.08	2.03	0.08	1.95	0.18	4.46

Table A.72 Measurement of Load and Deflection Relationships of 5SB15M-2.0-8-ND (Continued)

LC		Mid. Def.		W. Def.		E. Def.		W. Sett.		E. Sett.		Net Def.	
kips	kN	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm
150	665	0.26	6.69	0.26	6.52	0.27	6.86	0.08	2.05	0.08	1.95	0.18	4.69
151	671	0.28	7.22	0.28	7.06	0.29	7.38	0.08	2.07	0.08	1.97	0.20	5.20
153	681	0.31	7.76	0.30	7.58	0.31	7.94	0.08	2.11	0.08	1.98	0.22	5.71
155	691	0.34	8.62	0.33	8.43	0.35	8.80	0.08	2.15	0.08	1.99	0.26	6.55
158	701	0.38	9.74	0.38	9.56	0.39	9.92	0.09	2.19	0.08	2.00	0.30	7.64
160	712	0.43	11.00	0.43	10.81	0.44	11.19	0.09	2.24	0.08	2.01	0.35	8.87
162	719	0.47	11.94	0.46	11.75	0.48	12.14	0.09	2.28	0.08	2.02	0.39	9.80
163	726	0.51	12.92	0.50	12.74	0.52	13.10	0.09	2.31	0.08	2.02	0.42	10.76
166	739	0.59	15.02	0.58	14.81	0.60	15.22	0.09	2.38	0.08	2.03	0.50	12.81
167	743	0.64	16.24	0.63	16.04	0.65	16.45	0.10	2.44	0.08	2.02	0.55	14.01
168	748	0.67	16.89	0.66	16.66	0.67	17.12	0.10	2.48	0.08	2.03	0.58	14.64
169	751	0.70	17.66	0.69	17.44	0.70	17.89	0.10	2.49	0.08	2.03	0.61	15.40
170	755	0.73	18.54	0.72	18.31	0.74	18.76	0.10	2.51	0.08	2.02	0.64	16.27
171	761	0.78	19.70	0.77	19.48	0.78	19.92	0.10	2.55	0.08	1.99	0.69	17.43
172	764	0.81	20.56	0.80	20.35	0.82	20.78	0.10	2.58	0.08	1.98	0.72	18.28
172	767	0.83	21.16	0.82	20.92	0.84	21.40	0.10	2.60	0.08	1.97	0.74	18.88
173	768	0.85	21.62	0.84	21.36	0.86	21.89	0.10	2.61	0.08	1.97	0.76	19.34
173	770	0.87	22.01	0.86	21.74	0.88	22.28	0.10	2.62	0.08	1.97	0.78	19.72
173	771	0.88	22.38	0.87	22.13	0.89	22.63	0.10	2.63	0.08	1.96	0.79	20.09
174	772	0.89	22.65	0.88	22.39	0.90	22.91	0.10	2.63	0.08	1.95	0.80	20.36
174	774	0.91	23.08	0.90	22.83	0.92	23.33	0.10	2.64	0.08	1.94	0.82	20.79
174	775	0.93	23.58	0.92	23.28	0.94	23.88	0.10	2.65	0.08	1.93	0.84	21.29

Table A.72 Measurement of Load and Deflection Relationships of 5SB15M-2.0-8-ND (Continued)

LC		Mid. Def.		W. Def.		E. Def.		W. Sett.		E. Sett.		Net Def.	
kips	kN	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm
174	776	0.94	23.85	0.93	23.56	0.95	24.14	0.10	2.66	0.08	1.94	0.85	21.56
175	776	0.95	24.17	0.94	23.88	0.96	24.47	0.10	2.66	0.08	1.95	0.86	21.87
175	778	0.97	24.58	0.96	24.29	0.98	24.88	0.11	2.67	0.08	1.94	0.88	22.28
175	780	0.99	25.02	0.97	24.72	1.00	25.32	0.11	2.68	0.08	1.93	0.89	22.72
176	781	1.00	25.36	0.99	25.05	1.01	25.68	0.11	2.68	0.08	1.96	0.91	23.04
176	782	1.02	25.79	1.00	25.46	1.03	26.11	0.11	2.69	0.08	2.00	0.92	23.44
176	783	1.04	26.32	1.02	25.98	1.05	26.65	0.11	2.70	0.08	1.98	0.94	23.97
176	783	1.05	26.67	1.04	26.31	1.06	27.02	0.11	2.70	0.08	2.00	0.96	24.32
176	783	1.07	27.10	1.05	26.71	1.08	27.49	0.11	2.71	0.08	1.99	0.97	24.75
176	785	1.08	27.53	1.07	27.11	1.10	27.95	0.11	2.72	0.08	1.99	0.99	25.18
177	785	1.10	27.83	1.08	27.45	1.11	28.21	0.11	2.73	0.08	2.01	1.00	25.46
177	785	1.11	28.18	1.09	27.79	1.12	28.57	0.11	2.74	0.08	2.03	1.02	25.79
177	786	1.13	28.63	1.11	28.19	1.14	29.07	0.11	2.75	0.08	2.04	1.03	26.24
177	785	1.14	29.04	1.13	28.60	1.16	29.49	0.11	2.77	0.08	2.03	1.05	26.65
177	786	1.16	29.48	1.14	29.00	1.18	29.97	0.11	2.77	0.09	2.17	1.06	27.01
177	786	1.18	29.85	1.16	29.35	1.19	30.35	0.11	2.78	0.09	2.20	1.08	27.36
177	785	1.19	30.23	1.17	29.75	1.21	30.71	0.11	2.79	0.08	2.04	1.10	27.82
176	784	1.20	30.58	1.18	30.10	1.22	31.06	0.11	2.80	0.08	2.02	1.11	28.17
176	783	1.22	30.90	1.20	30.39	1.24	31.40	0.11	2.80	0.08	2.14	1.12	28.43
176	781	1.23	31.25	1.21	30.72	1.25	31.79	0.11	2.81	0.08	2.15	1.13	28.77
174	774	1.24	31.53	1.22	31.01	1.26	32.04	0.11	2.83	0.08	2.07	1.14	29.08
174	774	1.25	31.68	1.23	31.18	1.27	32.19	0.11	2.83	0.08	2.09	1.15	29.23

Table A.72 Measurement of Load and Deflection Relationships of 5SB15M-2.0-8-ND (Continued)

LC		Mid. Def.		W. Def.		E. Def.		W. Sett.		E. Sett.		Net Def.	
kips	kN	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm
174	773	1.25	31.84	1.23	31.32	1.27	32.35	0.11	2.83	0.08	2.05	1.16	29.40
174	773	1.26	32.03	1.24	31.49	1.28	32.58	0.11	2.83	0.09	2.24	1.16	29.50
173	772	1.26	32.04	1.24	31.50	1.28	32.59	0.11	2.83	0.09	2.36	1.16	29.45
174	772	1.27	32.18	1.25	31.65	1.29	32.71	0.11	2.83	0.09	2.33	1.17	29.60
173	770	1.27	32.29	1.25	31.76	1.29	32.83	0.11	2.84	0.07	1.86	1.18	29.94
172	766	1.28	32.47	1.26	31.94	1.30	32.99	0.11	2.84	0.07	1.83	1.19	30.13
172	764	1.28	32.50	1.26	31.97	1.30	33.02	0.11	2.84	0.07	1.83	1.19	30.16
171	763	1.28	32.52	1.26	31.99	1.30	33.04	0.11	2.84	0.07	1.82	1.19	30.18
171	761	1.28	32.54	1.26	32.02	1.30	33.07	0.11	2.84	0.07	1.84	1.19	30.20
169	752	1.28	32.59	1.26	32.08	1.30	33.10	0.11	2.84	0.07	1.80	1.19	30.26
168	748	1.28	32.61	1.26	32.10	1.30	33.13	0.11	2.84	0.07	1.80	1.19	30.29
109	485	1.34	34.10	1.31	33.36	1.37	34.84	0.10	2.61	0.05	1.30	1.27	32.14
107	475	1.34	34.09	1.31	33.34	1.37	34.84	0.10	2.61	0.05	1.26	1.27	32.15
105	468	1.34	34.10	1.31	33.36	1.37	34.84	0.10	2.61	0.05	1.23	1.27	32.18
105	468	1.34	34.10	1.31	33.36	1.37	34.84	0.10	2.61	0.05	1.22	1.27	32.18
105	467	1.34	34.10	1.31	33.36	1.37	34.84	0.10	2.61	0.05	1.23	1.27	32.18
105	466	1.34	34.10	1.31	33.36	1.37	34.84	0.10	2.61	0.05	1.23	1.27	32.18
105	465	1.34	34.09	1.31	33.35	1.37	34.84	0.10	2.61	0.05	1.23	1.27	32.17
105	465	1.34	34.10	1.31	33.36	1.37	34.84	0.10	2.61	0.05	1.23	1.27	32.18
104	465	1.34	34.10	1.31	33.36	1.37	34.84	0.10	2.61	0.05	1.22	1.27	32.18
104	464	1.34	34.10	1.31	33.36	1.37	34.84	0.10	2.61	0.05	1.23	1.27	32.18
104	463	1.34	34.10	1.31	33.35	1.37	34.84	0.10	2.61	0.05	1.23	1.27	32.18

Table A.73 Measurement of Rosette LVDTs of 5SB15M-2.0-8-ND

LC		NWD1	NWD2	NWV1	NWV2	NWH1	NWH2	NED1	NED2	NEV1	NEV2	NEH1	NEH2
kips	kN	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in
0	0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
30	135	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000
60	265	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001	0.0000	0.0000	0.0000	0.0000	-0.0001
90	400	0.0000	0.0001	0.0000	0.0000	0.0000	0.0000	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000
100	443	-0.0001	0.0001	0.0000	0.0000	0.0000	0.0000	0.0001	0.0000	0.0000	-0.0001	0.0000	0.0000
110	488	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001	0.0000	0.0000	-0.0001	0.0000	0.0000
120	532	0.0000	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	-0.0001	0.0000	0.0000
130	576	0.0000	0.0001	0.0000	0.0000	0.0000	0.0000	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000
135	599	0.0000	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	-0.0001
137	607	-0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	-0.0001	0.0000	0.0000
136	607	-0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	-0.0001	0.0000	0.0000
138	612	0.0000	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	-0.0001	0.0000	0.0000
140	622	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
145	644	0.0000	0.0001	0.0000	0.0000	0.0000	0.0000	0.0001	0.0000	0.0000	-0.0001	0.0000	0.0000
148	657	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001	0.0000	0.0000	-0.0001	0.0000	0.0000
146	651	0.0000	0.0001	0.0000	0.0000	0.0000	0.0000	0.0001	0.0000	0.0000	-0.0001	0.0000	0.0000
144	642	0.0000	0.0001	0.0000	0.0000	0.0000	0.0000	0.0001	0.0000	0.0000	-0.0001	0.0000	0.0000
146	650	0.0000	0.0001	0.0000	0.0000	0.0000	0.0000	0.0001	0.0000	0.0000	-0.0001	0.0000	0.0000
148	660	-0.0001	0.0001	0.0000	0.0000	0.0000	0.0000	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000
150	665	-0.0001	0.0001	0.0000	0.0000	0.0000	0.0000	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000
151	671	-0.0001	0.0001	0.0000	0.0000	0.0000	0.0000	0.0002	0.0000	0.0000	-0.0001	0.0000	0.0000
153	681	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001	0.0000	0.0000	-0.0001	0.0000	0.0000

Table A.73 Measurement of Rosette LVDTs of 5SB15M-2.0-8-ND (Continued)

LC		NWD1	NWD2	NWV1	NWV2	NWH1	NWH2	NED1	NED2	NEV1	NEV2	NEH1	NEH2
kips	kN	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in
155	691	0.0000	0.0001	0.0000	0.0000	0.0000	0.0000	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000
158	701	-0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001	0.0000	0.0000	0.0000	0.0000	-0.0001
160	712	-0.0001	0.0001	0.0000	0.0000	0.0000	0.0000	0.0001	0.0000	0.0000	-0.0001	0.0000	0.0000
162	719	-0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001	0.0000	0.0000	-0.0001	0.0000	0.0000
163	726	-0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000
166	739	-0.0001	0.0001	0.0000	0.0000	0.0000	0.0000	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000
167	743	-0.0001	-0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	-0.0001
168	748	0.0000	-0.0001	0.0000	0.0000	0.0000	0.0000	0.0001	0.0000	0.0000	-0.0001	0.0000	0.0000
169	751	-0.0001	0.0001	0.0000	0.0000	0.0000	0.0000	0.0001	0.0000	0.0000	-0.0001	0.0000	0.0000
170	755	-0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000
171	761	-0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000
172	764	-0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001	0.0000	0.0000	-0.0001	0.0000	0.0000
172	767	-0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001	0.0000	0.0000	-0.0001	0.0000	0.0000
173	768	-0.0001	0.0001	0.0000	0.0000	0.0000	0.0000	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000
173	770	-0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0002	0.0000	0.0000	0.0000	0.0000	0.0000
173	771	-0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0002	0.0000	0.0000	-0.0001	0.0000	0.0000
174	772	-0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0002	0.0000	0.0000	-0.0001	0.0000	0.0000
174	774	-0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0002	0.0000	0.0000	-0.0001	0.0000	0.0000
174	775	-0.0001	0.0001	0.0000	0.0000	0.0000	0.0000	0.0002	0.0000	0.0000	-0.0001	0.0000	0.0000
174	776	-0.0001	0.0001	0.0000	0.0000	0.0000	0.0000	0.0002	0.0000	0.0000	-0.0001	0.0000	0.0000
175	776	-0.0001	0.0001	0.0000	0.0000	0.0000	0.0000	0.0001	0.0000	0.0000	-0.0001	0.0000	0.0002
175	778	-0.0001	-0.0001	0.0000	0.0000	0.0000	0.0000	0.0001	0.0000	0.0000	0.0000	0.0000	0.0002

Table A.73 Measurement of Rosette LVDTs of 5SB15M-2.0-8-ND (Continued)

LC		NWD1	NWD2	NWV1	NWV2	NWH1	NWH2	NED1	NED2	NEV1	NEV2	NEH1	NEH2
kips	kN	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in
175	780	-0.0001	0.0001	0.0000	0.0000	0.0000	0.0000	0.0001	0.0000	0.0000	0.0000	0.0000	0.0002
176	781	-0.0001	0.0001	0.0000	0.0000	0.0000	0.0000	0.0001	0.0000	0.0000	-0.0001	0.0000	0.0002
176	782	-0.0001	-0.0001	0.0000	0.0000	0.0000	0.0000	0.0001	0.0000	0.0000	-0.0001	0.0000	0.0002
176	783	-0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001	0.0000	0.0000	-0.0001	0.0000	0.0002
176	783	-0.0001	-0.0001	0.0000	0.0000	0.0000	0.0000	0.0001	-0.0001	0.0000	-0.0001	0.0000	0.0002
176	783	-0.0001	0.0001	0.0000	0.0000	0.0000	0.0000	0.0001	-0.0001	0.0000	-0.0001	0.0000	0.0002
176	785	-0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001	-0.0001	0.0000	-0.0001	0.0000	0.0002
177	785	-0.0001	-0.0001	0.0000	0.0000	0.0000	0.0000	0.0001	-0.0001	0.0000	0.0000	0.0000	0.0002
177	785	-0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001	-0.0001	0.0000	0.0000	0.0000	0.0002
177	786	-0.0001	0.0001	0.0000	0.0000	0.0000	0.0000	0.0001	-0.0001	0.0000	-0.0001	0.0000	0.0002
177	785	-0.0001	-0.0001	0.0000	0.0000	0.0000	0.0000	0.0001	-0.0001	0.0000	-0.0001	0.0000	0.0002
177	786	-0.0001	0.0001	0.0000	0.0000	0.0000	0.0000	0.0001	-0.0001	0.0000	-0.0001	0.0000	0.0002
177	786	-0.0001	0.0001	0.0000	0.0000	0.0000	0.0000	0.0001	-0.0001	0.0000	-0.0001	0.0000	0.0002
177	785	-0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0002	-0.0001	0.0000	-0.0001	0.0000	0.0002
176	784	-0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001	-0.0001	0.0000	-0.0001	0.0000	0.0002
176	783	-0.0001	0.0001	0.0000	0.0000	0.0000	0.0000	0.0001	-0.0001	0.0000	-0.0001	0.0000	0.0002
176	781	-0.0001	0.0001	0.0000	0.0000	0.0000	0.0000	0.0001	-0.0001	0.0000	0.0000	0.0000	0.0002
174	774	-0.0001	0.0001	0.0000	0.0000	0.0000	0.0000	0.0002	-0.0001	0.0000	0.0000	0.0000	0.0002
174	774	-0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0002	-0.0001	0.0000	0.0000	0.0000	0.0002
174	773	-0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001	-0.0001	0.0000	-0.0001	0.0000	0.0002
174	773	-0.0001	0.0001	0.0000	0.0000	0.0000	0.0000	0.0001	-0.0001	0.0000	-0.0001	0.0000	0.0002
173	772	-0.0001	0.0001	0.0000	0.0000	0.0000	0.0000	0.0001	-0.0001	0.0000	-0.0001	0.0000	0.0002

Table A.73 Measurement of Rosette LVDTs of 5SB15M-2.0-8-ND (Continued)

LC		NWD1	NWD2	NWV1	NWV2	NWH1	NWH2	NED1	NED2	NEV1	NEV2	NEH1	NEH2
kips	kN	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in
174	772	-0.0001	-0.0001	0.0000	0.0000	0.0000	0.0000	0.0001	-0.0001	0.0000	0.0000	0.0000	0.0002
173	770	-0.0001	0.0001	0.0000	0.0000	0.0000	0.0000	0.0001	-0.0001	0.0000	-0.0001	0.0000	0.0002
172	766	-0.0001	-0.0001	0.0000	0.0000	0.0000	0.0000	0.0001	-0.0002	0.0000	-0.0001	0.0000	0.0002
172	764	-0.0001	-0.0001	0.0000	0.0000	0.0000	0.0000	0.0001	-0.0001	0.0000	-0.0001	0.0000	0.0002
171	763	-0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001	-0.0001	0.0000	0.0000	0.0000	0.0002
171	761	-0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001	-0.0002	0.0000	-0.0001	0.0000	0.0002
169	752	-0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001	-0.0002	0.0000	-0.0001	0.0000	0.0002
168	748	-0.0001	0.0001	0.0000	0.0000	0.0000	0.0000	0.0001	-0.0002	0.0000	-0.0001	0.0000	0.0002
109	485	-0.0001	0.0000	0.0000	0.0003	0.0000	-0.0002	0.0001	-0.0002	-0.0001	-0.0001	-0.0008	0.0001
107	475	-0.0001	0.0000	0.0001	0.0003	0.0000	-0.0002	0.0001	-0.0002	-0.0001	-0.0001	-0.0008	0.0000
105	468	-0.0001	-0.0001	0.0000	0.0002	0.0000	-0.0002	0.0001	-0.0002	-0.0001	-0.0001	-0.0008	0.0001
105	468	-0.0001	-0.0001	0.0000	0.0003	0.0000	-0.0002	0.0001	-0.0002	-0.0001	-0.0001	-0.0008	0.0001
105	467	-0.0001	0.0000	0.0000	0.0003	0.0000	-0.0002	0.0001	-0.0002	-0.0001	-0.0001	-0.0008	0.0001
105	466	-0.0001	0.0000	0.0000	0.0003	0.0000	-0.0002	0.0001	-0.0002	-0.0001	-0.0001	-0.0008	0.0000
105	465	-0.0001	0.0000	0.0000	0.0003	0.0000	-0.0002	0.0001	-0.0002	-0.0001	-0.0001	-0.0008	0.0001
105	465	-0.0001	0.0000	0.0000	0.0003	0.0000	-0.0002	0.0001	-0.0002	-0.0001	0.0000	-0.0008	0.0001
104	465	-0.0001	0.0000	0.0000	0.0002	0.0000	-0.0002	0.0001	-0.0002	-0.0001	0.0000	-0.0008	0.0001
104	464	-0.0001	0.0000	0.0000	0.0002	0.0000	-0.0002	0.0001	-0.0002	-0.0001	-0.0001	-0.0008	0.0001
104	463	-0.0001	0.0000	0.0000	0.0002	0.0000	-0.0002	0.0001	-0.0002	-0.0001	-0.0001	-0.0008	0.0001

Table A.74 Measurement of Tendon Slippage of 5SB15M-2.0-8-ND

Load Cell		T1	T2	T3	T4	T5	T6	T7	T8
kips	kN	in	in	in	in	in	in	in	in
0	0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
30	135	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
60	265	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
90	400	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
100	443	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
110	488	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
120	532	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
130	576	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
135	599	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
137	607	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
136	607	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
138	612	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
140	622	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
145	644	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
148	657	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
146	651	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
144	642	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
146	650	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
148	660	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
150	665	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
151	671	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
153	681	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Table A.74 Measurement of Tendon Slippage of 5SB15M-2.0-8-ND (Continued)

Load Cell		T1	T2	T3	T4	T5	T6	T7	T8
kips	kN	in	in	in	in	in	in	in	in
155	691	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
158	701	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
160	712	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
162	719	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
163	726	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
166	739	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
167	743	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
168	748	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
169	751	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
170	755	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
171	761	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
172	764	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
172	767	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
173	768	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
173	770	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
173	771	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
174	772	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
174	774	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
174	775	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
174	776	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
175	776	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
175	778	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Table A.74 Measurement of Tendon Slippage of 5SB15M-2.0-8-ND (Continued)

Load Cell		T1	T2	T3	T4	T5	T6	T7	T8
kips	kN	in	in	in	in	in	in	in	in
175	780	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
176	781	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
176	782	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
176	783	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
176	783	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
176	783	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
176	785	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
177	785	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
177	785	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
177	786	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
177	785	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
177	786	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
177	786	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
177	785	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
176	784	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
176	783	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
176	781	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
174	774	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
174	774	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
174	773	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
174	773	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
173	772	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Table A.74 Measurement of Tendon Slippage of 5SB15M-2.0-8-ND (Continued)

Load Cell		T1	T2	T3	T4	T5	T6	T7	T8
kips	kN	in	in	in	in	in	in	in	in
174	772	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
173	770	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
172	766	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
172	764	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
171	763	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
171	761	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
169	752	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
168	748	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
109	485	0.002	0.000	0.001	0.002	0.000	0.000	0.001	0.000
107	475	0.002	0.000	0.001	0.002	0.000	0.000	0.001	0.000
105	468	0.002	0.000	0.001	0.002	0.000	0.000	0.001	0.000
105	468	0.001	0.000	0.001	0.002	0.000	0.000	0.001	0.000
105	467	0.002	0.000	0.001	0.002	0.000	0.000	0.001	0.000
105	466	0.002	0.000	0.001	0.002	0.000	0.000	0.001	0.000
105	465	0.002	0.001	0.001	0.002	0.000	0.000	0.001	0.000
105	465	0.002	0.000	0.001	0.002	0.000	0.000	0.001	0.000
104	465	0.002	0.000	0.001	0.002	0.000	0.000	0.001	0.000
104	464	0.002	0.000	0.001	0.002	0.000	0.000	0.001	0.000
104	463	0.002	0.000	0.001	0.002	0.000	0.000	0.001	0.000

Table A.75 Measurement of Strain Gauges of 5SB15M-2.0-8-ND

TRF		CN1	CN2	CN3	CN4	CN5	NN1
kips	kN	m/m	m/m	m/m	m/m	m/m	m/m
0	0	0.00	0.00	0.00	0.00	0.00	0.00
30	135	7.05	6.37	10.24	3.64	0.68	6.14
60	265	7.51	6.82	12.28	5.23	-0.46	7.96
90	400	6.82	6.37	11.83	6.83	-2.28	9.33
100	443	6.60	6.14	11.83	7.05	-2.28	9.33
110	488	7.28	6.60	12.51	6.83	-3.41	9.78
120	532	6.60	5.46	11.15	5.01	-4.78	9.78
130	576	7.05	7.05	10.92	1.59	-0.46	10.92
135	599	7.51	7.28	10.01	-1.36	2.73	10.69
137	607	8.64	8.64	10.92	-2.05	4.55	12.06
136	607	8.64	8.64	10.92	-2.27	4.55	11.83
138	612	8.19	7.96	10.46	-1.59	5.23	11.60
140	622	8.42	8.64	10.46	-2.96	6.37	11.83
145	644	10.01	10.24	10.92	-3.41	9.78	12.97
148	657	9.78	9.78	10.46	-4.55	10.92	13.20
146	651	10.24	10.69	11.37	-4.55	11.15	13.65
144	642	10.24	10.46	11.37	-4.55	10.92	13.42
146	650	10.46	10.69	11.37	-4.32	11.15	13.88
148	660	10.46	10.92	11.60	-4.55	10.69	13.88
150	665	10.46	10.69	11.37	-5.23	10.47	14.10
151	671	10.24	10.24	10.46	-6.60	8.87	14.10
153	681	8.64	8.64	10.01	-7.73	4.10	13.65

TRF		CN1	CN2	CN3	CN4	CN5	NN1
kips	kN	m/m	m/m	m/m	m/m	m/m	m/m
155	691	7.05	6.60	9.10	-11.15	-3.41	14.33
158	701	4.10	3.64	7.05	-16.38	-19.11	14.33
160	712	-0.23	-1.82	5.69	-21.38	-45.73	14.33
162	719	-4.78	-6.60	3.87	-25.48	-65.29	14.10
163	726	-8.19	-11.15	3.41	-27.53	-88.95	14.56
166	739	-16.38	-19.79	2.28	-32.76	-138.09	15.70
167	743	-21.61	-25.02	0.68	-35.94	-161.29	15.24
168	748	-23.20	-27.30	1.37	-35.26	-172.66	16.15
169	751	-25.02	-29.35	1.59	-36.40	-188.13	16.83
170	755	-28.66	-33.44	0.23	-36.85	-206.33	16.83
171	761	-32.30	-38.22	0.46	-37.31	-235.22	17.74
172	764	-37.31	-43.68	-1.59	-38.67	-257.97	16.83
172	767	-38.22	-44.82	-0.68	-37.76	-271.17	18.20
173	768	-40.72	-48.00	-1.37	-37.08	-285.04	17.97
173	770	-42.31	-49.37	-0.91	-36.17	-295.96	18.65
173	771	-44.13	-51.87	-1.59	-35.49	-307.79	19.11
174	772	-45.50	-53.23	-2.05	-34.81	-315.53	18.88
174	774	-48.00	-56.19	-2.28	-34.12	-328.04	18.88
174	775	-50.96	-59.15	-3.41	-32.76	-342.82	18.65
174	776	-53.23	-61.65	-4.78	-32.53	-352.38	17.97
175	776	-56.42	-65.06	-6.14	-31.62	-361.71	17.06
175	778	-57.10	-66.65	-5.69	-30.26	-373.99	17.52

Table A.75 Measurement of Strain Gauges of 5SB15M-2.0-8-ND (Continued)

TRF		CN1	CN2	CN3	CN4	CN5	NN1
kips	kN	m/m	m/m	m/m	m/m	m/m	m/m
175	780	-59.83	-69.61	-6.14	-28.44	-386.73	17.97
176	781	-61.42	-71.43	-6.37	-25.48	-396.51	17.52
176	782	-64.61	-74.39	-7.05	-21.84	-411.53	17.52
176	783	-67.34	-77.57	-7.05	-15.01	-430.64	18.43
176	783	-69.61	-80.30	-7.28	-11.37	-444.74	18.20
176	783	-71.89	-82.58	-7.51	-7.73	-457.48	18.43
176	785	-74.16	-85.76	-7.74	-3.64	-473.86	19.11
177	785	-77.35	-89.40	-8.19	-1.14	-490.01	19.34
177	785	-82.12	-94.41	-10.01	1.37	-512.30	18.43
177	786	-86.67	-99.41	-10.24	5.01	-535.96	17.74
177	785	-91.00	-104.65	-10.47	9.33	-563.49	18.43
177	786	-96.46	-110.33	-10.92	14.33	-593.52	18.20
177	786	-100.55	-115.56	-10.69	20.25	-618.31	18.65
177	785	-104.87	-120.80	-10.69	30.71	-648.11	19.11
176	784	-108.97	-125.80	-10.69	40.27	-671.32	19.34
176	783	-113.52	-130.58	-10.24	47.32	-697.48	19.56
176	781	-117.61	-135.58	-10.01	57.10	-720.46	19.34
174	774	-121.71	-140.13	-8.87	77.57	-745.25	19.56
174	774	-123.53	-141.95	-9.33	82.58	-754.81	19.34
174	773	-126.26	-144.46	-9.78	84.17	-765.95	19.11
174	773	-128.53	-147.41	-9.78	87.36	-779.83	19.11
173	772	-128.76	-147.64	-9.78	87.58	-781.42	19.34
174	772	-130.35	-149.92	-8.87	90.77	-793.93	19.56
173	770	-132.17	-151.96	-8.42	93.04	-804.17	19.56
172	766	-135.13	-154.92	-7.96	97.14	-819.19	19.56
172	764	-135.36	-154.92	-7.74	97.82	-819.87	19.34
171	763	-135.13	-154.92	-7.74	98.73	-820.55	19.56
171	761	-134.90	-154.92	-7.51	99.64	-819.87	19.34
169	752	-130.35	-149.92	-5.01	101.69	-793.02	18.88
168	748	-131.03	-150.37	-5.46	103.05	-794.62	18.65
109	485	-154.24	-176.76	2.96	144.23	-887.20	17.52
107	475	-157.65	-180.63	4.55	146.73	-896.99	17.06
105	468	-158.33	-181.08	4.32	147.64	-899.03	16.83
105	468	-158.11	-181.31	4.32	148.10	-899.03	16.38
105	467	-158.33	-181.76	4.10	148.10	-899.03	16.38
105	466	-158.56	-181.54	4.32	147.87	-899.49	16.38
105	465	-158.79	-181.54	4.55	147.64	-899.49	16.38
105	465	-158.11	-181.76	4.78	147.87	-899.26	16.38
104	465	-158.11	-181.31	4.55	147.64	-899.49	16.83
104	464	-158.56	-181.54	4.55	147.87	-899.03	16.61
104	463	-158.33	-181.08	5.01	147.64	-899.03	16.83

A.26 5SB15N-1.2-8-ND

Table A.76 Measurement of Load and Deflection Relationships of 5SB15N-1.2-8-ND

SW.LC		SE. LC		TRF		Mid. Def.		SW. Def.		SE. Def.		SW. Sett.		SE. Sett.		Net Def.	
kips	kN	kips	kN	kips	kN	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
0	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
19	84	11	48	30	131	0.03	0.87	0.01	0.24	0.06	1.49	0.01	0.13	0.06	1.43	0.00	0.09
35	157	24	108	60	265	0.05	1.32	0.02	0.53	0.08	2.12	0.01	0.31	0.08	1.97	0.01	0.19
44	198	35	156	80	354	0.06	1.61	0.03	0.70	0.10	2.53	0.01	0.36	0.09	2.31	0.01	0.28
47	210	38	167	85	377	0.07	1.68	0.03	0.75	0.10	2.61	0.02	0.39	0.09	2.37	0.01	0.30
53	234	43	193	96	427	0.07	1.82	0.03	0.86	0.11	2.78	0.02	0.46	0.10	2.50	0.01	0.34
60	269	51	226	111	494	0.08	1.98	0.04	0.98	0.12	2.98	0.02	0.49	0.10	2.64	0.02	0.42
73	323	62	275	135	599	0.09	2.22	0.05	1.18	0.13	3.26	0.02	0.59	0.11	2.81	0.02	0.52
80	354	68	303	148	656	0.09	2.34	0.05	1.28	0.13	3.40	0.02	0.60	0.11	2.89	0.02	0.60
85	376	73	323	157	699	0.10	2.43	0.05	1.36	0.14	3.50	0.02	0.60	0.11	2.92	0.03	0.67
90	400	80	357	170	757	0.10	2.54	0.06	1.52	0.14	3.56	0.02	0.60	0.12	2.93	0.03	0.77
97	431	89	397	186	828	0.11	2.73	0.07	1.77	0.15	3.69	0.02	0.60	0.12	2.93	0.04	0.97
98	437	90	402	189	840	0.11	2.82	0.07	1.82	0.15	3.83	0.02	0.60	0.12	2.93	0.04	1.06
96	428	89	397	185	825	0.11	2.85	0.07	1.87	0.15	3.82	0.02	0.60	0.12	2.93	0.04	1.08
94	416	87	388	181	804	0.11	2.89	0.08	1.92	0.15	3.86	0.02	0.60	0.12	2.93	0.04	1.13
91	407	85	377	176	784	0.12	2.97	0.08	1.92	0.16	4.01	0.02	0.60	0.12	2.93	0.05	1.20
92	410	85	379	177	789	0.12	3.17	0.08	2.01	0.17	4.33	0.02	0.60	0.12	2.93	0.06	1.40
93	415	87	386	180	802	0.13	3.42	0.08	2.14	0.19	4.70	0.02	0.60	0.12	2.93	0.07	1.65
94	417	87	388	181	805	0.14	3.68	0.09	2.21	0.20	5.14	0.02	0.60	0.12	2.93	0.08	1.91

Table A.76 Measurement of Load and Deflection Relationships of 5SB15N-1.2-8-ND (Continued)

SW.LC		SE. LC		TRF		Mid. Def.		SW. Def.		SE. Def.		SW. Sett.		SE. Sett.		Net Def.	
kips	kN	kips	kN	kips	kN	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
94	417	88	390	182	807	0.16	4.01	0.09	2.32	0.22	5.71	0.02	0.60	0.12	2.93	0.09	2.25
95	420	88	390	182	811	0.17	4.41	0.09	2.38	0.25	6.44	0.02	0.60	0.12	2.93	0.10	2.65
95	422	88	392	183	814	0.18	4.66	0.10	2.44	0.27	6.88	0.02	0.60	0.12	2.93	0.11	2.90
95	421	88	393	183	814	0.18	4.66	0.10	2.44	0.27	6.89	0.02	0.60	0.12	2.93	0.11	2.90
95	422	89	395	184	817	0.19	4.82	0.10	2.46	0.28	7.17	0.02	0.60	0.12	2.93	0.12	3.05
95	423	89	395	184	817	0.19	4.82	0.10	2.47	0.28	7.18	0.02	0.60	0.12	2.93	0.12	3.06
95	424	89	394	184	818	0.19	4.82	0.10	2.46	0.28	7.18	0.02	0.60	0.12	2.93	0.12	3.06
95	421	89	396	184	817	0.19	4.92	0.10	2.48	0.29	7.37	0.02	0.60	0.12	2.93	0.12	3.16
95	422	89	396	184	818	0.19	4.93	0.10	2.48	0.29	7.38	0.02	0.60	0.12	2.93	0.12	3.16
95	422	89	397	184	819	0.20	5.01	0.10	2.49	0.30	7.53	0.02	0.60	0.12	2.93	0.13	3.24
95	423	89	397	184	820	0.20	5.01	0.10	2.48	0.30	7.54	0.02	0.60	0.12	2.93	0.13	3.24
95	423	90	399	185	822	0.20	5.13	0.10	2.49	0.31	7.77	0.02	0.60	0.12	2.93	0.13	3.36
95	423	90	400	185	822	0.20	5.13	0.10	2.48	0.31	7.78	0.02	0.60	0.12	2.93	0.13	3.37
95	423	90	400	185	823	0.21	5.25	0.10	2.49	0.32	8.00	0.02	0.60	0.12	2.93	0.14	3.48
95	423	90	400	185	823	0.21	5.25	0.10	2.50	0.32	8.01	0.02	0.60	0.12	2.93	0.14	3.49
95	424	90	400	185	824	0.21	5.26	0.10	2.49	0.32	8.02	0.02	0.60	0.12	2.93	0.14	3.49
95	423	90	401	185	825	0.21	5.30	0.10	2.50	0.32	8.11	0.02	0.60	0.12	2.93	0.14	3.54
95	425	90	401	186	826	0.22	5.52	0.10	2.50	0.34	8.54	0.02	0.60	0.12	2.93	0.15	3.75
94	417	87	386	180	803	0.22	5.67	0.10	2.50	0.35	8.84	0.02	0.60	0.12	2.93	0.15	3.90
93	413	85	379	178	792	0.23	5.73	0.10	2.50	0.35	8.96	0.02	0.60	0.12	2.93	0.16	3.96
93	413	85	377	178	790	0.23	5.75	0.10	2.50	0.35	8.99	0.02	0.60	0.12	2.93	0.16	3.98
93	412	84	376	177	788	0.23	5.76	0.10	2.50	0.35	9.02	0.02	0.60	0.12	2.93	0.16	3.99

Table A.76 Measurement of Load and Deflection Relationships of 5SB15N-1.2-8-ND (Continued)

SW.LC		SE. LC		TRF		Mid. Def.		SW. Def.		SE. Def.		SW. Sett.		SE. Sett.		Net Def.	
kips	kN	kips	kN	kips	kN	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
93	415	84	374	177	789	0.24	6.03	0.10	2.49	0.38	9.57	0.02	0.60	0.12	2.93	0.17	4.27
94	416	84	374	178	790	0.24	6.04	0.10	2.49	0.38	9.58	0.02	0.60	0.12	2.93	0.17	4.27
93	415	83	370	177	785	0.25	6.28	0.10	2.49	0.40	10.06	0.02	0.60	0.12	2.93	0.18	4.51
94	416	82	366	176	782	0.26	6.51	0.10	2.49	0.41	10.53	0.02	0.60	0.12	2.93	0.19	4.74
93	416	81	359	174	775	0.27	6.97	0.10	2.49	0.45	11.45	0.02	0.60	0.12	2.93	0.20	5.20
93	415	80	354	173	769	0.28	7.21	0.10	2.48	0.47	11.93	0.02	0.60	0.12	2.93	0.21	5.44
93	412	79	352	172	764	0.29	7.31	0.10	2.45	0.48	12.17	0.02	0.60	0.12	2.93	0.22	5.54
92	411	78	349	171	760	0.29	7.43	0.10	2.42	0.49	12.45	0.02	0.60	0.12	2.93	0.22	5.67
92	411	78	346	170	758	0.30	7.52	0.09	2.39	0.50	12.64	0.02	0.60	0.12	2.93	0.23	5.75
93	413	77	341	169	754	0.31	8.00	0.09	2.33	0.54	13.67	0.02	0.60	0.12	2.93	0.25	6.23
93	412	77	341	169	753	0.32	8.01	0.09	2.32	0.54	13.70	0.02	0.60	0.12	2.93	0.25	6.24
93	412	77	341	169	753	0.32	8.02	0.09	2.32	0.54	13.72	0.02	0.60	0.12	2.93	0.25	6.26
93	413	77	341	169	754	0.32	8.03	0.09	2.32	0.54	13.75	0.02	0.60	0.12	2.93	0.25	6.27
93	414	77	341	170	754	0.32	8.04	0.09	2.32	0.54	13.77	0.02	0.60	0.12	2.93	0.25	6.28
93	413	77	341	170	754	0.32	8.11	0.09	2.32	0.55	13.91	0.02	0.60	0.12	2.93	0.25	6.35
93	412	77	341	169	754	0.32	8.12	0.09	2.32	0.55	13.93	0.02	0.60	0.12	2.93	0.25	6.36
93	413	76	339	169	752	0.32	8.16	0.09	2.31	0.55	14.00	0.02	0.60	0.12	2.93	0.25	6.39
93	413	76	339	169	752	0.32	8.17	0.09	2.31	0.55	14.03	0.02	0.60	0.12	2.93	0.25	6.40
93	412	77	340	169	752	0.32	8.18	0.09	2.31	0.55	14.04	0.02	0.60	0.12	2.93	0.25	6.41
92	411	76	339	169	750	0.34	8.55	0.09	2.28	0.58	14.82	0.02	0.60	0.12	2.93	0.27	6.78
92	408	75	333	167	741	0.34	8.68	0.09	2.25	0.59	15.11	0.02	0.60	0.12	2.93	0.27	6.92
91	404	75	331	165	735	0.34	8.67	0.09	2.23	0.59	15.11	0.02	0.60	0.12	2.93	0.27	6.91

Table A.77 Measurement of Rosette LVDTs of 5SB15N-1.2-8-ND

TRF		SWD1	SWD2	SWV1	SWV2	SWH1	SWH2	SED1	SED2	SEV1	SEV2	SEH1	SEH2
kips	kN	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in
0	0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
30	131	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
60	265	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
80	354	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
85	377	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
96	427	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
111	494	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
135	599	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
148	656	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
157	699	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
170	757	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
186	828	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
189	840	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
185	825	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
181	804	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
176	784	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
177	789	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
180	802	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-0.001
181	805	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-0.001
182	807	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-0.001	0.000	0.000	0.000	-0.002
182	811	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.003	0.000	0.003	0.000	0.001
183	814	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.006	0.000	0.005	0.000	0.005

Table A.77 Measurement of Rosette LVDTs of 5SB15N-1.2-8-ND (Continued)

TRF		SWD1	SWD2	SWV1	SWV2	SWH1	SWH2	SED1	SED2	SEV1	SEV2	SEH1	SEH2
kips	kN	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in
183	814	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.006	0.000	0.006	0.000	0.005
184	817	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.007	0.000	0.006	0.000	0.007
184	817	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.007	0.000	0.006	0.000	0.007
184	818	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.007	0.000	0.006	0.000	0.007
184	817	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.007	0.000	0.007	0.000	0.008
184	818	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.007	0.000	0.007	0.000	0.009
184	819	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.007	0.000	0.007	0.000	0.009
184	820	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.008	0.000	0.007	0.000	0.009
185	822	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.007	0.000	0.007	0.000	0.009
185	822	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.007	0.000	0.007	0.000	0.009
185	823	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.007	0.000	0.007	0.000	0.008
185	823	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.007	0.000	0.007	0.000	0.008
185	824	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.007	0.000	0.007	0.000	0.008
185	825	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.007	0.000	0.007	0.000	0.008
186	826	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.008	0.000	0.008	0.000	0.008
180	803	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.008	0.000	0.008	0.000	0.008
178	792	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.008	0.000	0.008	0.000	0.008
178	790	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.008	0.000	0.008	0.000	0.008
177	788	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.008	0.000	0.008	0.000	0.008
177	789	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.008	0.000	0.008	0.000	0.008
178	790	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.008	0.000	0.008	0.000	0.008
177	785	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.009	0.000	0.009	0.000	0.008

Table A.77 Measurement of Rosette LVDTs of 5SB15N-1.2-8-ND (Continued)

TRF		SWD1	SWD2	SWV1	SWV2	SWH1	SWH2	SED1	SED2	SEV1	SEV2	SEH1	SEH2
kips	kN	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in
176	782	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.010	0.000	0.010	0.000	0.009
174	775	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.012	0.000	0.012	0.000	0.010
173	769	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.012	0.000	0.012	0.000	0.010
172	764	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.012	0.000	0.012	0.000	0.010
171	760	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.012	0.000	0.012	0.000	0.010
170	758	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.012	0.000	0.012	0.000	0.010
169	754	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.012	0.000	0.012	0.000	0.010
169	753	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.012	0.000	0.012	0.000	0.010
169	753	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.012	0.000	0.012	0.000	0.010
169	754	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.012	0.000	0.012	0.000	0.010
170	754	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.012	0.000	0.012	0.000	0.010
170	754	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.012	0.000	0.012	0.000	0.010
169	754	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.012	0.000	0.012	0.000	0.010
169	752	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.012	0.000	0.012	0.000	0.010
169	752	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.012	0.000	0.012	0.000	0.010
169	752	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.012	0.000	0.012	0.000	0.010
169	750	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.012	0.000	0.012	0.000	0.010
167	741	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.012	0.000	0.012	0.000	0.010
165	735	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.012	0.000	0.012	0.000	0.010

Table A.78 Measurement of Tendon Slippage of 5SB15N-1.2-8-ND

TRF		T1	T2	T3	T4	T5	T6	T7	T8
kips	kN	in	in	in	in	in	in	in	in
0	0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
30	131	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
60	265	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
80	354	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
85	377	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
96	427	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
111	494	0.000	0.000	0.000	0.001	0.001	0.000	0.000	0.000
135	599	0.000	0.000	0.000	0.004	0.004	0.000	0.000	0.000
148	656	0.000	0.000	0.001	0.010	0.007	0.001	0.000	0.000
157	699	0.000	0.000	0.003	0.021	0.011	0.001	0.000	0.000
170	757	0.000	0.000	0.032	0.031	0.025	0.007	0.000	0.000
186	828	0.000	0.000	0.042	0.071	0.055	0.038	0.000	0.000
189	840	0.000	0.000	0.044	0.082	0.065	0.041	0.000	0.000
185	825	0.000	0.000	0.044	0.084	0.066	0.041	0.000	0.000
181	804	0.000	0.000	0.044	0.087	0.069	0.045	0.000	0.000
176	784	0.000	0.000	0.045	0.090	0.073	0.049	0.001	0.000
177	789	0.000	0.001	0.046	0.096	0.079	0.056	0.006	0.000
180	802	0.000	0.001	0.050	0.104	0.085	0.064	0.012	0.002
181	805	0.000	0.001	0.056	0.113	0.092	0.073	0.021	0.010
182	807	0.000	0.001	0.063	0.123	0.101	0.084	0.033	0.019
182	811	0.000	0.001	0.069	0.136	0.111	0.099	0.046	0.028
183	814	0.000	0.002	0.074	0.146	0.118	0.107	0.053	0.034

Table A.78 Measurement of Tendon Slippage of 5SB15N-1.2-8-ND (Continued)

TRF		T1	T2	T3	T4	T5	T6	T7	T8
kips	kN	in	in	in	in	in	in	in	in
183	814	0.000	0.002	0.074	0.146	0.119	0.107	0.053	0.034
184	817	0.000	0.002	0.076	0.152	0.123	0.113	0.058	0.037
184	817	0.000	0.002	0.076	0.152	0.123	0.113	0.058	0.037
184	818	0.000	0.002	0.076	0.153	0.123	0.113	0.058	0.037
184	817	0.000	0.002	0.079	0.157	0.127	0.117	0.060	0.040
184	818	0.000	0.002	0.079	0.157	0.127	0.117	0.060	0.040
184	819	0.000	0.002	0.082	0.160	0.130	0.121	0.063	0.041
184	820	0.000	0.002	0.082	0.160	0.130	0.121	0.063	0.041
185	822	0.000	0.003	0.084	0.165	0.134	0.126	0.068	0.044
185	822	0.000	0.003	0.084	0.165	0.134	0.126	0.068	0.044
185	823	0.000	0.003	0.087	0.169	0.138	0.131	0.071	0.047
185	823	0.000	0.003	0.087	0.169	0.138	0.131	0.071	0.047
185	824	0.000	0.003	0.087	0.170	0.138	0.131	0.071	0.047
185	825	0.000	0.003	0.088	0.172	0.140	0.134	0.072	0.048
186	826	0.000	0.004	0.094	0.179	0.146	0.141	0.081	0.053
180	803	0.000	0.004	0.094	0.180	0.147	0.144	0.104	0.056
178	792	0.000	0.004	0.095	0.181	0.148	0.145	0.110	0.057
178	790	0.000	0.004	0.095	0.181	0.148	0.145	0.114	0.058
177	788	0.000	0.004	0.095	0.181	0.148	0.146	0.114	0.058
177	789	0.000	0.004	0.099	0.186	0.153	0.152	0.126	0.065
178	790	0.000	0.004	0.099	0.186	0.153	0.152	0.126	0.065
177	785	0.000	0.004	0.103	0.192	0.159	0.159	0.137	0.072

Table A.78 Measurement of Tendon Slippage of 5SB15N-1.2-8-ND (Continued)

TRF		T1	T2	T3	T4	T5	T6	T7	T8
kips	kN	in	in	in	in	in	in	in	in
176	782	0.000	0.005	0.107	0.197	0.164	0.165	0.147	0.077
174	775	0.000	0.005	0.113	0.204	0.169	0.173	0.162	0.084
173	769	0.000	0.005	0.114	0.205	0.170	0.175	0.165	0.084
172	764	0.000	0.005	0.114	0.205	0.171	0.176	0.166	0.084
171	760	0.000	0.005	0.115	0.206	0.171	0.177	0.170	0.084
170	758	0.000	0.005	0.115	0.206	0.171	0.177	0.170	0.084
169	754	0.000	0.005	0.118	0.210	0.175	0.183	0.184	0.088
169	753	0.000	0.005	0.118	0.210	0.175	0.183	0.184	0.089
169	753	0.000	0.005	0.118	0.210	0.175	0.183	0.184	0.089
169	754	0.000	0.005	0.118	0.210	0.175	0.183	0.184	0.089
170	754	0.000	0.005	0.118	0.210	0.175	0.183	0.184	0.089
170	754	0.000	0.006	0.119	0.212	0.176	0.185	0.185	0.089
169	754	0.000	0.006	0.119	0.212	0.176	0.185	0.185	0.089
169	752	0.000	0.006	0.119	0.212	0.177	0.186	0.188	0.091
169	752	0.000	0.006	0.119	0.212	0.177	0.186	0.188	0.091
169	752	0.000	0.006	0.119	0.213	0.177	0.186	0.188	0.091
169	750	0.000	0.008	0.126	0.220	0.183	0.195	0.198	0.096
167	741	0.000	0.009	0.136	0.231	0.190	0.204	0.211	0.101
165	735	0.000	0.009	0.136	0.231	0.190	0.204	0.211	0.101

A.27 5SB15N-2.0-8-ND

Table A.79 Measurement of Load and Deflection Relationships of 5SB15N-2.0-8-ND

LC		Mid. Def.		W. Def.		E. Def.		W. Sett.		E. Sett.		Net Def.	
kips	kN	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm
0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
30	132	0.04	1.02	0.06	1.56	0.02	0.47	0.05	1.36	0.01	0.26	0.01	0.21
60	265	0.07	1.80	0.10	2.54	0.04	1.06	0.08	2.10	0.02	0.60	0.02	0.45
90	399	0.10	2.49	0.13	3.30	0.07	1.68	0.10	2.59	0.04	0.94	0.03	0.72
120	533	0.13	3.20	0.16	4.04	0.09	2.37	0.12	3.00	0.05	1.28	0.04	1.06
130	577	0.14	3.52	0.17	4.37	0.11	2.68	0.12	3.13	0.05	1.39	0.05	1.26
130	578	0.14	3.54	0.17	4.38	0.11	2.70	0.12	3.13	0.05	1.39	0.05	1.28
129	572	0.14	3.57	0.17	4.41	0.11	2.72	0.12	3.13	0.05	1.39	0.05	1.31
128	567	0.14	3.58	0.17	4.42	0.11	2.73	0.12	3.13	0.05	1.38	0.05	1.32
127	566	0.14	3.58	0.17	4.44	0.11	2.73	0.12	3.13	0.05	1.38	0.05	1.33
130	579	0.15	3.78	0.18	4.64	0.11	2.91	0.12	3.15	0.05	1.38	0.06	1.51
131	581	0.15	3.79	0.18	4.65	0.12	2.93	0.12	3.15	0.05	1.38	0.06	1.52
134	595	0.16	4.03	0.19	4.90	0.12	3.16	0.13	3.19	0.06	1.40	0.07	1.74
137	611	0.17	4.36	0.21	5.24	0.14	3.47	0.13	3.24	0.06	1.43	0.08	2.02
140	621	0.18	4.61	0.22	5.51	0.15	3.71	0.13	3.29	0.06	1.44	0.09	2.24
139	620	0.18	4.62	0.22	5.52	0.15	3.72	0.13	3.29	0.06	1.44	0.09	2.25
139	620	0.18	4.63	0.22	5.53	0.15	3.73	0.13	3.29	0.06	1.44	0.09	2.26
140	621	0.18	4.64	0.22	5.54	0.15	3.74	0.13	3.29	0.06	1.44	0.09	2.27
140	621	0.18	4.65	0.22	5.55	0.15	3.75	0.13	3.29	0.06	1.44	0.09	2.28

Table A.79 Measurement of Load and Deflection Relationships of 5SB15N-2.0-8-ND (Continued)

LC		Mid. Def.		W. Def.		E. Def.		W. Sett.		E. Sett.		Net Def.	
kips	kN	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm
139	620	0.18	4.67	0.22	5.56	0.15	3.77	0.13	3.30	0.06	1.44	0.09	2.30
140	624	0.20	4.99	0.23	5.89	0.16	4.09	0.13	3.33	0.06	1.44	0.10	2.60
140	624	0.20	4.99	0.23	5.89	0.16	4.09	0.13	3.33	0.06	1.45	0.10	2.61
139	617	0.20	5.17	0.24	6.07	0.17	4.26	0.13	3.34	0.06	1.44	0.11	2.78
142	632	0.22	5.69	0.26	6.62	0.19	4.76	0.13	3.39	0.06	1.44	0.13	3.28
148	660	0.27	6.86	0.31	7.83	0.23	5.89	0.14	3.52	0.06	1.43	0.17	4.39
152	677	0.31	7.84	0.35	8.85	0.27	6.82	0.14	3.62	0.06	1.42	0.21	5.31
155	689	0.34	8.66	0.38	9.73	0.30	7.58	0.15	3.72	0.05	1.39	0.24	6.10
156	693	0.36	9.14	0.40	10.24	0.32	8.04	0.15	3.76	0.05	1.37	0.26	6.58
155	692	0.36	9.16	0.40	10.27	0.32	8.05	0.15	3.77	0.05	1.37	0.26	6.59
154	683	0.36	9.20	0.41	10.31	0.32	8.09	0.15	3.77	0.05	1.35	0.26	6.64
153	682	0.36	9.22	0.41	10.34	0.32	8.10	0.15	3.77	0.05	1.34	0.26	6.66
156	692	0.38	9.55	0.42	10.68	0.33	8.41	0.15	3.80	0.05	1.34	0.27	6.98
156	693	0.38	9.55	0.42	10.68	0.33	8.42	0.15	3.80	0.05	1.34	0.27	6.98
156	692	0.38	9.57	0.42	10.71	0.33	8.42	0.15	3.80	0.05	1.34	0.28	7.00
155	691	0.38	9.57	0.42	10.71	0.33	8.42	0.15	3.80	0.05	1.33	0.28	7.00
154	686	0.38	9.57	0.42	10.72	0.33	8.43	0.15	3.80	0.05	1.33	0.28	7.01
154	685	0.38	9.58	0.42	10.72	0.33	8.43	0.15	3.80	0.05	1.33	0.28	7.01
157	699	0.40	10.22	0.45	11.41	0.36	9.04	0.15	3.87	0.05	1.30	0.30	7.64
158	702	0.43	10.92	0.48	12.16	0.38	9.69	0.15	3.93	0.05	1.27	0.33	8.32
159	707	0.45	11.55	0.50	12.82	0.40	10.28	0.16	3.98	0.05	1.26	0.35	8.93
158	703	0.46	11.63	0.51	12.90	0.41	10.36	0.16	3.99	0.05	1.25	0.35	9.01

Table A.79 Measurement of Load and Deflection Relationships of 5SB15N-2.0-8-ND (Continued)

LC		Mid. Def.		W. Def.		E. Def.		W. Sett.		E. Sett.		Net Def.	
kips	kN	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm
160	712	0.49	12.46	0.54	13.77	0.44	11.14	0.16	4.06	0.05	1.22	0.39	9.81
161	715	0.51	13.05	0.57	14.40	0.46	11.70	0.16	4.12	0.05	1.20	0.41	10.39
162	719	0.54	13.80	0.60	15.18	0.49	12.42	0.16	4.17	0.05	1.17	0.44	11.13
163	724	0.58	14.79	0.64	16.23	0.53	13.34	0.17	4.26	0.04	1.13	0.48	12.09
163	725	0.60	15.19	0.66	16.67	0.54	13.72	0.17	4.30	0.04	1.11	0.49	12.49
164	729	0.63	16.06	0.69	17.57	0.57	14.55	0.17	4.37	0.04	1.08	0.53	13.34
166	738	0.71	17.92	0.77	19.50	0.64	16.35	0.18	4.51	0.04	1.05	0.60	15.14
168	748	0.80	20.41	0.87	22.04	0.74	18.79	0.18	4.60	0.04	1.03	0.69	17.59
169	752	0.89	22.69	0.96	24.32	0.83	21.06	0.18	4.61	0.04	1.03	0.78	19.87
170	758	0.97	24.59	1.03	26.22	0.90	22.97	0.18	4.60	0.04	1.04	0.86	21.77
171	759	1.04	26.49	1.11	28.09	0.98	24.88	0.18	4.59	0.04	1.04	0.93	23.67
171	760	1.12	28.42	1.18	30.00	1.06	26.85	0.18	4.57	0.04	1.04	1.01	25.62
172	767	1.16	29.51	1.22	31.05	1.10	27.97	0.18	4.57	0.04	1.04	1.05	26.71
172	767	1.19	30.18	1.25	31.69	1.13	28.66	0.18	4.57	0.04	1.04	1.08	27.37
173	770	1.20	30.39	1.26	31.89	1.14	28.88	0.18	4.56	0.04	1.04	1.09	27.58
175	776	1.24	31.59	1.30	33.06	1.19	30.11	0.18	4.56	0.04	1.04	1.13	28.78
176	781	1.28	32.59	1.34	34.03	1.23	31.15	0.18	4.56	0.04	1.04	1.17	29.79
176	781	1.31	33.28	1.37	34.72	1.25	31.83	0.18	4.56	0.04	1.04	1.20	30.48
174	775	1.37	34.72	1.43	36.28	1.31	33.16	0.18	4.55	0.04	1.04	1.26	31.92
173	768	1.42	35.97	1.48	37.55	1.35	34.39	0.18	4.55	0.04	1.04	1.31	33.18
168	749	1.44	36.68	1.50	38.13	1.39	35.23	0.18	4.55	0.04	1.04	1.33	33.89

Table A.80 Measurement of Rosette LVDTs of 5SB15N-2.0-8-ND

LC		NWD1	NWD2	NWV1	NWV2	NWH1	NWH2	NED1	NED2	NEV1	NEV2	NEH1	NEH2
kips	kN	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in
0	0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
30	132	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
60	265	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
90	399	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
120	533	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
130	577	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
130	578	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
129	572	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
128	567	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
127	566	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
130	579	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
131	581	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
134	595	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
137	611	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
140	621	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
139	620	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
139	620	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
140	621	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
140	621	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
139	620	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
140	624	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
140	624	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Table A.80 Measurement of Rosette LVDTs of 5SB15N-2.0-8-ND (Continued)

LC		NWD1	NWD2	NWV1	NWV2	NWH1	NWH2	NED1	NED2	NEV1	NEV2	NEH1	NEH2
kips	kN	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in
139	617	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
142	632	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
148	660	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
152	677	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
155	689	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
156	693	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
155	692	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
154	683	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
153	682	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
156	692	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
156	693	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
156	692	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
155	691	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
154	686	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
154	685	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
157	699	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
158	702	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
159	707	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
158	703	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
160	712	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
161	715	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
162	719	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Table A.80 Measurement of Rosette LVDTs of 5SB15N-2.0-8-ND (Continued)

LC		NWD1	NWD2	NWV1	NWV2	NWH1	NWH2	NED1	NED2	NEV1	NEV2	NEH1	NEH2
kips	kN	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in	in/in
163	724	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
163	725	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
164	729	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
166	738	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
168	748	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
169	752	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
170	758	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
171	759	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
171	760	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
172	767	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
172	767	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
173	770	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
175	776	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
176	781	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
176	781	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
174	775	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
173	768	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
168	749	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Table A.81 Measurement of Tendon Slippage of 5SB15N-2.0-8-ND

Load Cell		T1	T2	T3	T4	T5	T6	T7	T8
kips	kN	in	in	in	in	in	in	in	in
0	0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
30	132	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
60	265	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
90	399	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
120	533	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
130	577	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
130	578	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
129	572	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
128	567	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
127	566	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
130	579	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
131	581	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
134	595	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
137	611	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
140	621	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
139	620	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
139	620	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
140	621	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
140	621	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
139	620	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
140	624	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
140	624	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Table A.81 Measurement of Tendon Slippage of 5SB15N-2.0-8-ND (Continued)

Load Cell		T1	T2	T3	T4	T5	T6	T7	T8
kips	kN	in	in	in	in	in	in	in	in
139	617	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
142	632	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
148	660	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000
152	677	0.005	0.000	0.000	0.000	0.000	0.000	0.000	0.000
155	689	0.009	0.000	0.000	0.000	0.000	0.000	0.000	0.000
156	693	0.010	0.000	0.000	0.000	0.000	0.000	0.000	0.000
155	692	0.010	0.000	0.000	0.000	0.000	0.000	0.000	0.000
154	683	0.010	0.000	0.000	0.000	0.000	0.000	0.000	0.000
153	682	0.010	0.000	0.000	0.000	0.000	0.000	0.000	0.000
156	692	0.011	0.000	0.000	0.000	0.000	0.000	0.000	0.000
156	693	0.010	0.000	0.000	0.000	0.000	0.000	0.000	0.000
156	692	0.010	0.000	0.000	0.000	0.000	0.000	0.000	0.000
155	691	0.010	0.000	0.000	0.000	0.000	0.000	0.001	0.000
154	686	0.012	0.000	0.000	0.000	0.000	0.000	0.000	0.000
154	685	0.012	0.000	0.000	0.000	0.000	0.000	0.000	0.000
157	699	0.013	0.000	0.000	0.000	0.000	0.000	0.001	0.000
158	702	0.016	0.000	0.000	0.000	0.000	0.000	0.001	0.000
159	707	0.018	0.000	0.000	0.000	0.000	0.000	0.001	0.000
158	703	0.019	0.000	0.000	0.000	0.000	0.000	0.001	0.000
160	712	0.020	0.000	0.000	0.000	0.000	0.000	0.001	0.001
161	715	0.022	0.000	0.000	0.000	0.000	0.000	0.001	0.002
162	719	0.024	0.000	0.000	0.000	0.000	0.000	0.001	0.004

Table A.81 Measurement of Tendon Slippage of 5SB15N-2.0-8-ND (Continued)

Load Cell		T1	T2	T3	T4	T5	T6	T7	T8
kips	kN	in	in	in	in	in	in	in	in
163	724	0.027	0.000	0.000	0.000	0.000	0.000	0.001	0.007
163	725	0.027	0.000	0.000	0.000	0.000	0.000	0.001	0.009
164	729	0.028	0.000	0.000	0.000	0.000	0.000	0.001	0.012
166	738	0.032	0.000	0.000	0.000	0.000	0.000	0.001	0.017
168	748	0.035	0.000	0.000	0.000	0.000	0.000	0.001	0.025
169	752	0.038	0.000	0.000	0.000	0.000	0.000	0.001	0.031
170	758	0.039	0.000	0.000	0.000	0.000	0.000	0.001	0.034
171	759	0.042	0.000	0.000	0.000	0.000	0.000	0.001	0.039
171	760	0.044	0.000	0.000	0.000	0.000	0.000	0.001	0.043
172	767	0.045	0.000	0.000	0.000	0.000	0.000	0.001	0.046
172	767	0.045	0.000	0.000	0.000	0.000	0.000	0.001	0.047
173	770	0.045	0.000	0.000	0.000	0.000	0.000	0.001	0.047
175	776	0.048	0.000	0.000	0.000	0.000	0.000	0.002	0.049
176	781	0.048	0.000	0.000	0.000	0.000	0.000	0.002	0.051
176	781	0.048	0.000	0.000	0.000	0.000	0.000	0.002	0.054
174	775	0.051	0.000	0.000	0.000	0.000	0.000	0.003	0.057
173	768	0.051	0.000	0.000	0.000	0.000	0.000	0.003	0.058
168	749	0.054	0.000	0.000	0.000	0.000	0.000	0.003	0.058

A.28 5SB15T-1.2-14-D

Table A.82 Measurement of Load and Deflection Relationships of 5SB15T-1.2-14-D

SW.LC		SE. LC		TRF		Mid. Def.		SW. Def.		SE. Def.		SW. Sett.		SE. Sett.		Net Def.	
kips	kN	kips	kN	kips	kN	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
0	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
18	79	12	53	30	132	0.03	0.83	0.02	0.53	0.04	1.13	0.01	0.30	0.04	1.07	0.01	0.15
34	150	26	116	60	265	0.05	1.32	0.03	0.86	0.07	1.78	0.02	0.43	0.06	1.64	0.01	0.29
49	219	41	180	90	399	0.07	1.68	0.04	1.13	0.09	2.22	0.02	0.48	0.08	2.00	0.02	0.43
66	294	54	240	120	534	0.08	1.97	0.05	1.39	0.10	2.55	0.02	0.56	0.09	2.24	0.02	0.57
83	369	67	297	150	666	0.09	2.25	0.07	1.65	0.11	2.84	0.02	0.63	0.10	2.43	0.03	0.72
99	443	80	357	180	799	0.10	2.49	0.07	1.88	0.12	3.11	0.03	0.68	0.10	2.62	0.03	0.84
116	514	95	423	211	937	0.11	2.75	0.08	2.10	0.13	3.41	0.03	0.73	0.11	2.81	0.04	0.99
132	585	109	484	240	1069	0.12	2.98	0.09	2.29	0.14	3.68	0.03	0.78	0.12	2.97	0.04	1.11
147	654	123	545	270	1199	0.13	3.20	0.10	2.46	0.16	3.94	0.03	0.78	0.12	3.13	0.05	1.24
158	702	132	587	290	1289	0.13	3.36	0.10	2.59	0.16	4.13	0.03	0.79	0.13	3.24	0.05	1.34
165	735	139	618	304	1353	0.14	3.47	0.11	2.68	0.17	4.26	0.03	0.79	0.13	3.31	0.06	1.41
169	751	142	633	311	1384	0.14	3.50	0.11	2.70	0.17	4.30	0.03	0.79	0.13	3.34	0.06	1.43
173	770	146	651	320	1421	0.14	3.57	0.11	2.77	0.17	4.38	0.03	0.80	0.13	3.37	0.06	1.48
174	775	148	656	322	1431	0.15	3.69	0.11	2.89	0.18	4.49	0.03	0.80	0.13	3.37	0.06	1.60
174	774	148	657	322	1431	0.15	3.71	0.11	2.92	0.18	4.51	0.03	0.80	0.13	3.37	0.06	1.63
178	793	152	677	330	1470	0.15	3.85	0.12	3.06	0.18	4.64	0.03	0.80	0.13	3.37	0.07	1.76
179	796	153	680	332	1476	0.15	3.86	0.12	3.08	0.18	4.65	0.03	0.80	0.13	3.37	0.07	1.78
186	829	161	714	347	1543	0.16	4.11	0.13	3.34	0.19	4.89	0.03	0.80	0.13	3.37	0.08	2.03

Table A.82 Measurement of Load and Deflection Relationships of 5SB15T-1.2-14-D (Continued)

SW.LC		SE. LC		TRF		Mid. Def.		SW. Def.		SE. Def.		SW. Sett.		SE. Sett.		Net Def.	
kips	kN	kips	kN	kips	kN	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
179	798	156	694	336	1493	0.17	4.26	0.14	3.59	0.19	4.93	0.03	0.80	0.13	3.37	0.09	2.17
178	791	155	689	333	1479	0.17	4.27	0.14	3.60	0.19	4.93	0.03	0.80	0.13	3.37	0.09	2.18
177	788	154	686	331	1474	0.17	4.26	0.14	3.60	0.19	4.93	0.03	0.80	0.13	3.37	0.09	2.18
177	790	155	689	332	1478	0.17	4.27	0.14	3.61	0.19	4.93	0.03	0.80	0.13	3.37	0.09	2.18
179	794	156	694	335	1488	0.17	4.34	0.15	3.69	0.20	4.98	0.03	0.80	0.13	3.37	0.09	2.25
180	803	158	704	339	1507	0.17	4.39	0.15	3.76	0.20	5.02	0.03	0.80	0.13	3.37	0.09	2.30
181	806	160	710	341	1516	0.18	4.48	0.15	3.87	0.20	5.09	0.03	0.80	0.13	3.37	0.09	2.39
182	808	160	712	342	1521	0.18	4.50	0.15	3.89	0.20	5.12	0.03	0.80	0.13	3.37	0.10	2.42
182	808	160	712	342	1519	0.18	4.52	0.15	3.90	0.20	5.14	0.03	0.80	0.13	3.37	0.10	2.43
181	804	159	708	340	1512	0.18	4.52	0.15	3.90	0.20	5.14	0.03	0.80	0.13	3.37	0.10	2.43
181	803	159	707	339	1510	0.18	4.52	0.15	3.90	0.20	5.13	0.03	0.80	0.13	3.37	0.10	2.43
181	806	160	710	341	1515	0.18	4.52	0.15	3.91	0.20	5.13	0.03	0.80	0.13	3.37	0.10	2.43
182	808	160	713	342	1521	0.18	4.54	0.15	3.93	0.20	5.15	0.03	0.80	0.13	3.37	0.10	2.45
182	807	160	712	342	1519	0.18	4.69	0.16	4.09	0.21	5.28	0.03	0.80	0.13	3.37	0.10	2.60
182	810	161	714	343	1524	0.18	4.69	0.16	4.10	0.21	5.28	0.03	0.80	0.13	3.37	0.10	2.60
183	816	162	722	346	1538	0.19	4.78	0.16	4.18	0.21	5.37	0.03	0.80	0.13	3.37	0.11	2.69
183	816	162	722	346	1538	0.19	4.80	0.17	4.21	0.21	5.39	0.03	0.80	0.13	3.37	0.11	2.71
171	760	157	697	328	1457	0.20	5.13	0.20	5.07	0.20	5.19	0.03	0.80	0.13	3.37	0.12	3.04
167	742	153	681	320	1423	0.20	5.10	0.20	5.09	0.20	5.12	0.03	0.80	0.13	3.37	0.12	3.02
171	759	159	708	330	1467	0.21	5.31	0.22	5.55	0.20	5.07	0.03	0.80	0.13	3.37	0.13	3.22
170	757	159	707	329	1465	0.21	5.32	0.22	5.56	0.20	5.08	0.03	0.80	0.13	3.37	0.13	3.23
171	763	162	720	333	1483	0.22	5.52	0.23	5.95	0.20	5.08	0.03	0.80	0.13	3.37	0.14	3.43

Table A.82 Measurement of Load and Deflection Relationships of 5SB15T-1.2-14-D (Continued)

SW.LC		SE. LC		TRF		Mid. Def.		SW. Def.		SE. Def.		SW. Sett.		SE. Sett.		Net Def.	
kips	kN	kips	kN	kips	kN	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
170	757	162	719	332	1476	0.22	5.61	0.24	6.15	0.20	5.08	0.03	0.80	0.13	3.37	0.14	3.53
170	755	161	718	331	1473	0.22	5.63	0.24	6.17	0.20	5.08	0.03	0.80	0.13	3.37	0.14	3.54
168	749	161	717	329	1466	0.22	5.71	0.25	6.35	0.20	5.07	0.03	0.80	0.13	3.37	0.14	3.62
168	745	161	714	328	1459	0.23	5.72	0.25	6.38	0.20	5.07	0.03	0.80	0.13	3.37	0.14	3.64
167	743	160	711	327	1454	0.23	5.73	0.25	6.40	0.20	5.07	0.03	0.80	0.13	3.37	0.14	3.65
166	738	158	705	324	1443	0.23	5.75	0.25	6.41	0.20	5.09	0.03	0.80	0.13	3.37	0.14	3.66
161	716	151	673	312	1388	0.24	5.97	0.25	6.41	0.22	5.53	0.03	0.80	0.13	3.37	0.15	3.88
160	711	150	668	310	1379	0.23	5.97	0.25	6.41	0.22	5.53	0.03	0.80	0.13	3.37	0.15	3.88
159	708	155	691	315	1399	0.27	6.79	0.30	7.58	0.24	5.99	0.03	0.80	0.13	3.37	0.19	4.70
159	707	155	690	314	1397	0.27	6.80	0.30	7.61	0.24	6.00	0.03	0.80	0.13	3.37	0.19	4.72
157	697	158	701	314	1398	0.29	7.29	0.34	8.55	0.24	6.04	0.03	0.80	0.13	3.37	0.20	5.20
157	697	158	701	314	1398	0.29	7.30	0.34	8.56	0.24	6.03	0.03	0.80	0.13	3.37	0.21	5.21
156	696	159	706	315	1402	0.29	7.49	0.35	8.94	0.24	6.04	0.03	0.80	0.13	3.37	0.21	5.40
153	682	163	725	316	1408	0.35	8.81	0.43	10.93	0.26	6.69	0.03	0.80	0.13	3.37	0.26	6.73
153	682	163	725	317	1408	0.35	8.82	0.43	10.95	0.26	6.70	0.03	0.80	0.13	3.37	0.27	6.74
152	678	165	732	317	1410	0.36	9.21	0.45	11.55	0.27	6.88	0.03	0.80	0.13	3.37	0.28	7.13
150	668	164	729	314	1397	0.37	9.45	0.47	11.91	0.28	6.99	0.03	0.80	0.13	3.37	0.29	7.36
150	668	164	731	315	1399	0.37	9.49	0.47	11.98	0.28	7.01	0.03	0.80	0.13	3.37	0.29	7.41
150	668	165	732	315	1400	0.37	9.51	0.47	12.01	0.28	7.02	0.03	0.80	0.13	3.37	0.29	7.42
150	665	164	730	314	1395	0.37	9.52	0.47	12.03	0.28	7.01	0.03	0.80	0.13	3.37	0.29	7.43
149	664	164	729	313	1392	0.38	9.53	0.47	12.05	0.28	7.01	0.03	0.80	0.13	3.37	0.29	7.44
149	664	164	730	313	1394	0.38	9.54	0.48	12.07	0.28	7.01	0.03	0.80	0.13	3.37	0.29	7.45

Table A.82 Measurement of Load and Deflection Relationships of 5SB15T-1.2-14-D (Continued)

SW.LC		SE. LC		TRF		Mid. Def.		SW. Def.		SE. Def.		SW. Sett.		SE. Sett.		Net Def.	
kips	kN	kips	kN	kips	kN	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
149	665	165	732	314	1396	0.38	9.57	0.48	12.13	0.28	7.01	0.03	0.80	0.13	3.37	0.29	7.48
149	663	164	731	313	1394	0.38	9.59	0.48	12.17	0.28	7.01	0.03	0.80	0.13	3.37	0.30	7.50
148	660	164	730	312	1390	0.38	9.60	0.48	12.19	0.28	7.01	0.03	0.80	0.13	3.37	0.30	7.51
147	654	164	728	311	1383	0.38	9.68	0.49	12.36	0.28	7.01	0.03	0.80	0.13	3.37	0.30	7.59
146	652	164	727	310	1379	0.38	9.69	0.49	12.38	0.28	7.00	0.03	0.80	0.13	3.37	0.30	7.60
146	650	163	726	309	1376	0.38	9.70	0.49	12.39	0.28	7.01	0.03	0.80	0.13	3.37	0.30	7.61
146	649	163	725	309	1375	0.38	9.71	0.49	12.41	0.28	7.01	0.03	0.80	0.13	3.37	0.30	7.62
146	648	164	728	309	1376	0.38	9.76	0.49	12.51	0.28	7.01	0.03	0.80	0.13	3.37	0.30	7.67
145	646	164	728	309	1373	0.38	9.78	0.49	12.55	0.28	7.01	0.03	0.80	0.13	3.37	0.30	7.69
145	644	163	725	308	1369	0.39	9.79	0.49	12.56	0.28	7.01	0.03	0.80	0.13	3.37	0.30	7.70
144	642	163	724	307	1367	0.39	9.79	0.50	12.58	0.28	7.01	0.03	0.80	0.13	3.37	0.30	7.71
145	644	163	727	308	1371	0.39	9.81	0.50	12.61	0.28	7.01	0.03	0.80	0.13	3.37	0.30	7.72
145	646	164	729	309	1375	0.39	9.83	0.50	12.65	0.28	7.01	0.03	0.80	0.13	3.37	0.30	7.74
145	643	164	727	308	1371	0.39	9.84	0.50	12.67	0.28	7.01	0.03	0.80	0.13	3.37	0.31	7.75
142	630	165	732	306	1363	0.41	10.34	0.54	13.61	0.28	7.07	0.03	0.80	0.13	3.37	0.32	8.25
141	627	164	729	305	1357	0.41	10.34	0.54	13.62	0.28	7.07	0.03	0.80	0.13	3.37	0.33	8.26
138	616	164	729	302	1345	0.42	10.71	0.56	14.18	0.28	7.24	0.03	0.80	0.13	3.37	0.34	8.62
131	581	162	719	292	1299	0.43	11.03	0.59	14.96	0.28	7.11	0.03	0.80	0.13	3.37	0.35	8.95
131	584	163	724	294	1307	0.44	11.08	0.59	15.06	0.28	7.11	0.03	0.80	0.13	3.37	0.35	8.99
130	578	162	722	292	1300	0.44	11.12	0.60	15.16	0.28	7.08	0.03	0.80	0.13	3.37	0.36	9.03
128	570	161	717	289	1286	0.44	11.12	0.60	15.20	0.28	7.03	0.03	0.80	0.13	3.37	0.36	9.03
126	560	160	713	286	1273	0.44	11.16	0.60	15.35	0.27	6.97	0.03	0.80	0.13	3.37	0.36	9.08

Table A.83 Measurement of Tendon Slippage of 5SB15T-1.2-14-D

TRF		T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12	T13	T14
kips	kN	in	in	in	in	in	in	in	in	in	in	in	in	in	in
0	0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
30	132	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
60	265	0.000	0.000	0.000	0.000	0.000	-0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
90	399	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-0.001	0.000	0.000	0.000
120	534	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
150	666	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-0.001	0.000	0.000	0.000
180	799	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.002	0.001	0.000	-0.001	0.000	0.000	0.000
211	937	0.000	0.000	0.000	0.000	0.000	0.001	0.007	0.004	0.003	0.000	0.000	0.000	0.000	0.000
240	1069	0.000	0.000	0.000	0.000	0.001	0.001	0.015	0.004	0.007	0.001	0.000	0.000	0.000	0.000
270	1199	0.000	0.000	0.000	0.000	0.001	0.002	0.028	0.005	0.010	0.001	0.000	0.000	0.000	0.000
290	1289	0.000	0.000	0.000	0.001	0.003	0.003	0.040	0.010	0.014	0.001	0.000	0.000	0.000	0.000
304	1353	0.000	0.000	0.000	0.001	0.005	0.004	0.046	0.012	0.018	0.002	0.000	0.000	0.000	0.000
311	1384	0.000	0.000	0.000	0.001	0.006	0.005	0.051	0.014	0.018	0.002	-0.001	0.000	0.000	0.000
320	1421	0.000	0.000	0.000	0.001	0.007	0.007	0.057	0.029	0.020	0.002	0.000	0.000	0.000	0.000
322	1431	0.000	0.000	0.000	0.002	0.012	0.021	0.071	0.062	0.044	0.005	0.001	0.000	0.000	0.000
322	1431	0.000	0.000	0.000	0.002	0.017	0.025	0.072	0.065	0.049	0.007	0.000	0.000	0.000	0.000
330	1470	0.000	0.000	0.000	0.011	0.074	0.035	0.075	0.069	0.059	0.013	0.001	0.000	0.000	0.000
332	1476	0.000	0.000	0.000	0.012	0.075	0.035	0.075	0.069	0.059	0.014	0.001	0.000	0.000	0.000
347	1543	0.000	0.000	0.000	0.067	0.086	0.040	0.080	0.077	0.070	0.028	0.000	0.000	0.000	0.000
336	1493	0.000	0.000	0.000	0.091	0.092	0.048	0.084	0.080	0.075	0.032	0.000	0.000	0.000	0.000
333	1479	0.000	0.000	0.001	0.093	0.093	0.049	0.085	0.081	0.075	0.033	0.000	0.000	0.000	0.000
331	1474	0.000	0.000	0.001	0.093	0.093	0.049	0.085	0.081	0.075	0.033	0.000	0.000	0.000	0.000

Table A.83 Measurement of Tendon Slippage of 5SB15T-1.2-14-D (Continued)

TRF		T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12	T13	T14
kips	kN	in	in	in	in	in	in	in	in	in	in	in	in	in	in
332	1478	0.000	0.000	0.002	0.094	0.093	0.050	0.086	0.082	0.076	0.034	0.000	0.000	0.000	0.000
335	1488	0.000	0.000	0.002	0.099	0.095	0.052	0.088	0.084	0.078	0.036	0.000	0.000	0.000	0.000
339	1507	0.000	0.000	0.008	0.102	0.095	0.053	0.089	0.085	0.080	0.039	0.000	0.000	0.000	0.000
341	1516	0.000	0.000	0.014	0.106	0.099	0.056	0.091	0.087	0.085	0.047	0.000	0.000	0.000	0.000
342	1521	0.000	0.000	0.014	0.108	0.099	0.056	0.092	0.088	0.085	0.049	0.001	0.000	0.000	0.000
342	1519	0.000	0.000	0.015	0.108	0.100	0.057	0.092	0.088	0.085	0.049	0.001	0.000	0.000	0.000
340	1512	0.000	0.000	0.015	0.108	0.100	0.057	0.093	0.088	0.085	0.050	0.001	0.000	0.000	0.000
339	1510	0.000	0.000	0.015	0.108	0.101	0.058	0.093	0.088	0.085	0.051	0.001	0.000	0.000	0.000
341	1515	0.000	0.000	0.017	0.108	0.101	0.058	0.093	0.088	0.085	0.051	0.001	0.000	0.000	0.000
342	1521	0.000	0.000	0.017	0.110	0.101	0.058	0.093	0.089	0.085	0.052	0.001	0.000	0.000	0.000
342	1519	0.000	0.000	0.023	0.117	0.107	0.065	0.098	0.096	0.091	0.067	0.004	0.000	0.000	0.000
343	1524	0.000	0.000	0.023	0.117	0.108	0.065	0.099	0.096	0.091	0.068	0.004	0.000	0.000	0.000
346	1538	0.000	0.000	0.027	0.119	0.109	0.066	0.099	0.098	0.093	0.072	0.005	0.000	0.000	0.000
346	1538	0.000	0.000	0.031	0.122	0.110	0.067	0.100	0.099	0.095	0.075	0.005	0.000	0.000	0.000
328	1457	0.016	0.009	0.054	0.139	0.115	0.069	0.100	0.099	0.095	0.075	0.005	0.000	0.000	0.000
320	1423	0.017	0.010	0.056	0.140	0.116	0.069	0.101	0.099	0.095	0.075	0.005	0.000	0.000	0.000
330	1467	0.029	0.021	0.076	0.146	0.117	0.070	0.101	0.099	0.096	0.075	0.005	0.000	0.000	0.000
329	1465	0.029	0.022	0.077	0.146	0.117	0.070	0.101	0.099	0.096	0.075	0.005	0.000	0.000	0.000
333	1483	0.036	0.029	0.098	0.150	0.117	0.070	0.102	0.100	0.096	0.075	0.007	0.000	0.000	0.000
332	1476	0.040	0.032	0.106	0.152	0.117	0.070	0.101	0.100	0.096	0.077	0.008	0.000	0.000	0.000
331	1473	0.041	0.033	0.107	0.152	0.117	0.070	0.101	0.100	0.096	0.077	0.009	0.000	0.000	0.000
329	1466	0.045	0.037	0.117	0.152	0.117	0.070	0.101	0.100	0.096	0.077	0.011	0.000	0.000	0.000

Table A.83 Measurement of Tendon Slippage of 5SB15T-1.2-14-D (Continued)

TRF		T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12	T13	T14
kips	kN	in	in	in	in	in	in	in	in	in	in	in	in	in	in
328	1459	0.046	0.037	0.119	0.153	0.117	0.070	0.101	0.100	0.096	0.077	0.012	0.000	0.000	0.000
327	1454	0.047	0.038	0.121	0.153	0.117	0.070	0.101	0.100	0.096	0.078	0.019	0.001	0.000	0.001
324	1443	0.047	0.039	0.123	0.153	0.117	0.070	0.102	0.100	0.096	0.078	0.043	0.003	0.000	0.006
312	1388	0.049	0.041	0.125	0.153	0.117	0.070	0.101	0.101	0.100	0.081	0.060	0.015	0.001	0.016
310	1379	0.049	0.042	0.125	0.153	0.117	0.070	0.102	0.101	0.100	0.081	0.061	0.015	0.002	0.017
315	1399	0.079	0.065	0.190	0.154	0.120	0.073	0.106	0.111	0.116	0.093	0.082	0.028	0.017	0.033
314	1397	0.079	0.067	0.192	0.154	0.120	0.073	0.106	0.111	0.116	0.093	0.082	0.028	0.017	0.033
314	1398	0.100	0.084	0.243	0.154	0.120	0.074	0.108	0.113	0.119	0.095	0.089	0.029	0.021	0.036
314	1398	0.101	0.084	0.244	0.154	0.120	0.074	0.108	0.113	0.119	0.095	0.089	0.029	0.021	0.036
315	1402	0.113	0.092	0.266	0.154	0.120	0.074	0.109	0.114	0.121	0.096	0.092	0.029	0.022	0.039
316	1408	0.156	0.132	0.412	0.153	0.122	0.078	0.113	0.123	0.132	0.106	0.117	0.036	0.033	0.059
317	1408	0.156	0.132	0.413	0.153	0.122	0.078	0.113	0.123	0.132	0.106	0.117	0.036	0.033	0.059
317	1410	0.164	0.141	0.448	0.154	0.123	0.079	0.113	0.125	0.135	0.109	0.124	0.038	0.038	0.065
314	1397	0.173	0.147	0.470	0.156	0.123	0.079	0.114	0.126	0.136	0.110	0.129	0.040	0.042	0.070
315	1399	0.174	0.149	0.473	0.156	0.123	0.079	0.114	0.126	0.136	0.110	0.129	0.040	0.042	0.070
315	1400	0.174	0.149	0.475	0.156	0.123	0.079	0.114	0.126	0.137	0.110	0.130	0.040	0.043	0.070
314	1395	0.174	0.149	0.476	0.156	0.123	0.079	0.114	0.126	0.137	0.110	0.130	0.040	0.043	0.070
313	1392	0.174	0.149	0.476	0.156	0.123	0.079	0.114	0.126	0.137	0.110	0.130	0.040	0.043	0.070
313	1394	0.174	0.149	0.477	0.156	0.123	0.079	0.114	0.126	0.137	0.111	0.131	0.040	0.043	0.070
314	1396	0.174	0.149	0.481	0.156	0.123	0.079	0.114	0.126	0.137	0.111	0.131	0.040	0.043	0.070
313	1394	0.174	0.149	0.483	0.156	0.123	0.079	0.114	0.126	0.137	0.111	0.131	0.040	0.043	0.070
312	1390	0.174	0.149	0.484	0.156	0.123	0.080	0.114	0.126	0.137	0.111	0.131	0.040	0.043	0.070

Table A.83 Measurement of Tendon Slippage of 5SB15T-1.2-14-D (Continued)

TRF		T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12	T13	T14
kips	kN	in	in	in	in	in	in	in	in	in	in	in	in	in	in
311	1383	0.179	0.150	0.490	0.156	0.123	0.080	0.114	0.127	0.137	0.111	0.131	0.041	0.045	0.072
310	1379	0.179	0.150	0.491	0.156	0.123	0.080	0.114	0.127	0.137	0.111	0.132	0.042	0.045	0.072
309	1376	0.178	0.150	0.492	0.156	0.123	0.080	0.114	0.127	0.137	0.111	0.132	0.042	0.045	0.072
309	1375	0.179	0.150	0.493	0.156	0.123	0.080	0.114	0.127	0.137	0.111	0.132	0.042	0.045	0.072
309	1376	0.178	0.154	0.497	0.156	0.123	0.080	0.114	0.127	0.137	0.111	0.132	0.042	0.045	0.072
309	1373	0.179	0.154	0.499	0.156	0.123	0.080	0.114	0.127	0.137	0.111	0.132	0.042	0.046	0.073
308	1369	0.179	0.154	0.500	0.156	0.123	0.080	0.114	0.127	0.137	0.111	0.132	0.042	0.046	0.073
307	1367	0.179	0.154	0.501	0.156	0.123	0.080	0.114	0.127	0.137	0.111	0.132	0.042	0.046	0.073
308	1371	0.179	0.154	0.502	0.156	0.123	0.080	0.114	0.127	0.137	0.111	0.133	0.042	0.046	0.073
309	1375	0.179	0.154	0.504	0.156	0.123	0.080	0.114	0.127	0.137	0.111	0.133	0.042	0.046	0.073
308	1371	0.179	0.154	0.506	0.156	0.123	0.080	0.114	0.127	0.137	0.111	0.133	0.042	0.046	0.073
306	1363	0.192	0.162	0.542	0.160	0.123	0.080	0.115	0.128	0.139	0.113	0.140	0.042	0.054	0.081
305	1357	0.192	0.162	0.543	0.160	0.123	0.080	0.115	0.128	0.139	0.113	0.140	0.042	0.054	0.081
302	1345	0.205	0.168	0.562	0.161	0.124	0.081	0.115	0.129	0.142	0.115	0.144	0.046	0.061	0.086
292	1299	0.210	0.176	0.593	0.163	0.124	0.081	0.116	0.129	0.143	0.115	0.146	0.046	0.063	0.088
294	1307	0.211	0.176	0.596	0.165	0.124	0.081	0.116	0.129	0.142	0.115	0.146	0.046	0.063	0.088
292	1300	0.210	0.176	0.599	0.166	0.124	0.081	0.116	0.129	0.143	0.115	0.146	0.046	0.063	0.088
289	1286	0.210	0.177	0.601	0.166	0.124	0.081	0.116	0.129	0.143	0.115	0.146	0.046	0.063	0.088
286	1273	0.214	0.183	0.611	0.167	0.124	0.081	0.116	0.129	0.143	0.115	0.146	0.046	0.063	0.088

Table A.84 Measurement of Strain Gauges of 5SB15T-1.2-14-D

TRF		S1	S2	S3	S4	S11	S12	S13	S14
kips	kN	m/m	m/m	m/m	m/m	m/m	m/m	m/m	m/m
0	0	0.00	0.00	0.00	0.00	0.00	0.00	B.G.	B.G.
30	132	-1.37	-10.46	-15.70	-18.65	-8.19	-7.28	B.G.	B.G.
60	265	12.06	3.41	-11.37	-14.79	9.33	-1.82	B.G.	B.G.
90	399	13.19	0.68	-19.34	-24.34	11.15	-5.69	B.G.	B.G.
120	534	59.37	80.76	-26.62	-35.49	13.65	-11.60	B.G.	B.G.
150	666	55.05	70.52	-40.49	-51.87	39.58	35.03	B.G.	B.G.
180	799	101.01	141.73	-48.46	-67.34	80.53	108.06	B.G.	B.G.
211	937	415.85	554.62	359.66	-73.71	104.42	176.53	B.G.	B.G.
240	1069	597.84	808.04	963.41	285.27	137.18	169.02	B.G.	B.G.
270	1199	787.34	1174.29	1601.97	1052.13	175.62	240.23	B.G.	B.G.
290	1289	1074.88	1583.09	2102.90	1557.84	252.06	384.00	B.G.	B.G.
304	1353	1189.31	1753.48	2349.27	1785.56	317.35	463.85	B.G.	B.G.
311	1384	1300.10	1899.53	2518.07	1936.15	385.37	598.52	B.G.	B.G.
320	1421	1431.36	2078.10	2756.47	2187.98	643.34	1087.62	B.G.	B.G.
322	1431	1624.04	2386.35	3195.98	2660.70	1436.13	2070.83	B.G.	B.G.
322	1431	1649.74	2434.58	3255.13	2716.66	1474.81	2132.25	B.G.	B.G.
330	1470	1633.14	2406.37	3220.32	2692.55	1474.35	2148.63	B.G.	B.G.
332	1476	1632.91	2405.46	3220.10	2693.69	1472.99	2151.58	B.G.	B.G.
347	1543	1664.08	2424.34	3229.19	2738.73	1536.00	2248.27	B.G.	B.G.
336	1493	1716.17	2464.15	3238.52	2761.48	1532.13	2243.94	B.G.	B.G.
333	1479	1732.78	2485.99	3261.27	2791.05	1548.74	2258.28	B.G.	B.G.
331	1474	1734.60	2488.72	3264.23	2794.69	1550.10	2259.87	B.G.	B.G.

Table A.84 Measurement of Strain Gauges of 5SB15T-1.2-14-D (Continued)

TRF		S1	S2	S3	S4	S11	S12	S13	S14
kips	kN	m/m	m/m	m/m	m/m	m/m	m/m	m/m	m/m
332	1478	1742.56	2499.41	3270.14	2800.61	1555.79	2259.19	B.G.	B.G.
335	1488	1762.12	2521.71	3296.08	2831.55	1572.63	2289.21	B.G.	B.G.
339	1507	1773.27	2532.85	3304.72	2845.42	1582.64	2303.55	B.G.	B.G.
341	1516	1778.96	2565.84	3318.14	2873.18	1571.49	2308.55	B.G.	B.G.
342	1521	1773.73	2563.56	3313.14	2871.13	1558.29	2299.91	B.G.	B.G.
342	1519	1780.78	2576.08	3325.42	2883.87	1568.30	2312.19	B.G.	B.G.
340	1512	1780.78	2586.31	3336.34	2897.52	1571.49	2317.42	B.G.	B.G.
339	1510	1781.23	2592.00	3339.53	2898.66	1571.72	2320.38	B.G.	B.G.
341	1515	1780.55	2591.09	3329.74	2892.74	1555.79	2318.79	B.G.	B.G.
342	1521	1786.46	2589.73	3324.51	2890.92	1565.35	2346.54	B.G.	B.G.
342	1519	1794.65	2586.54	3317.92	2901.16	1605.16	2415.47	B.G.	B.G.
343	1524	1792.83	2581.99	3306.77	2890.92	1599.24	2407.05	B.G.	B.G.
346	1538	1784.19	2563.56	3295.62	2890.47	1615.85	2435.49	B.G.	B.G.
346	1538	1775.55	2559.92	3295.85	2899.79	1606.29	2432.76	B.G.	B.G.
328	1457	1783.51	2564.70	3314.96	3057.90	1601.74	2434.58	B.G.	B.G.
320	1423	1788.51	2570.39	3323.15	3109.54	1604.47	2437.76	B.G.	B.G.
330	1467	1797.16	2590.41	3328.15	3024.23	1607.20	2443.45	B.G.	B.G.
329	1465	1797.38	2590.64	3328.38	3024.68	1606.98	2444.13	B.G.	B.G.
333	1483	1797.61	2593.37	3330.65	2961.90	1594.69	2441.86	B.G.	B.G.
332	1476	1797.38	2593.59	3334.52	2971.91	1591.28	2443.00	B.G.	B.G.
331	1473	1797.84	2594.05	3335.43	2978.05	1591.28	2443.22	B.G.	B.G.
329	1466	1799.20	2595.64	3338.62	2993.75	1590.37	2443.22	B.G.	B.G.

Table A.84 Measurement of Strain Gauges of 5SB15T-1.2-14-D (Continued)

TRF		S1	S2	S3	S4	S11	S12	S13	S14
kips	kN	m/m	m/m	m/m	m/m	m/m	m/m	m/m	m/m
328	1459	1799.20	2595.87	3339.30	3003.30	1589.69	2443.45	B.G.	B.G.
327	1454	1797.61	2595.87	3340.44	3013.76	1588.10	2443.91	B.G.	B.G.
324	1443	1778.50	2586.31	3344.08	3068.59	1554.65	2471.66	B.G.	B.G.
312	1388	1726.86	2585.40	3354.31	3134.79	1546.92	2512.61	B.G.	B.G.
310	1379	1702.98	2583.81	3355.91	3138.43	1529.63	2515.79	B.G.	B.G.
315	1399	1645.88	2580.17	3372.74	3202.12	1583.77	2576.99	B.G.	B.G.
314	1397	1649.97	2580.85	3373.19	3205.99	1589.01	2579.72	B.G.	B.G.
314	1398	1677.73	2583.36	3373.19	3203.03	1642.24	2608.15	B.G.	B.G.
314	1398	1677.50	2583.36	3372.97	3201.44	1642.92	2608.38	B.G.	B.G.
315	1402	1685.23	2583.81	3372.74	3189.39	1674.77	2629.31	B.G.	B.G.
316	1408	1778.28	B.G.	3356.82	3106.58	1877.01	2755.11	B.G.	B.G.
317	1408	1778.50	B.G.	3357.27	3105.21	1878.37	2755.79	B.G.	B.G.
317	1410	1789.88	B.G.	3353.40	3077.46	1896.34	2761.71	B.G.	B.G.
314	1397	1808.99	B.G.	3357.73	3094.75	1914.31	2779.68	B.G.	B.G.
315	1399	1807.85	B.G.	3357.50	3090.66	1912.72	2779.45	B.G.	B.G.
315	1400	1810.58	B.G.	3357.95	3093.84	1915.00	2779.91	B.G.	B.G.
314	1395	1814.22	B.G.	3358.64	3100.66	1919.09	2781.04	B.G.	B.G.
313	1392	1815.58	B.G.	3358.86	3104.53	1920.68	2781.73	B.G.	B.G.
313	1394	1814.45	B.G.	3358.64	3100.44	1919.09	2781.27	B.G.	B.G.
314	1396	1813.08	B.G.	3358.41	3096.80	1917.50	2780.82	B.G.	B.G.
313	1394	1815.81	B.G.	3358.64	3102.94	1920.00	2781.27	B.G.	B.G.
312	1390	1821.04	B.G.	3360.00	3117.04	1924.55	2782.64	B.G.	B.G.

Table A.84 Measurement of Strain Gauges of 5SB15T-1.2-14-D (Continued)

TRF		S1	S2	S3	S4	S11	S12	S13	S14
kips	kN	m/m	m/m	m/m	m/m	m/m	m/m	m/m	m/m
311	1383	1813.99	B.G.	3360.68	3119.32	1922.50	2783.77	B.G.	B.G.
310	1379	1816.04	B.G.	3361.14	3125.23	1925.23	2785.82	B.G.	B.G.
309	1376	1817.40	B.G.	3361.59	3129.33	1926.83	2786.96	B.G.	B.G.
309	1375	1817.86	B.G.	3361.82	3131.83	1927.05	2787.64	B.G.	B.G.
309	1376	1816.27	B.G.	3361.59	3129.78	1925.01	2787.41	B.G.	B.G.
309	1373	1818.31	B.G.	3362.28	3136.15	1926.83	2788.32	B.G.	B.G.
308	1369	1820.59	B.G.	3362.73	3142.29	1928.65	2789.01	B.G.	B.G.
307	1367	1820.59	B.G.	3363.19	3143.66	1928.87	2789.92	B.G.	B.G.
308	1371	1816.27	B.G.	3362.28	3135.02	1924.55	2789.46	B.G.	B.G.
309	1375	1814.67	B.G.	3362.50	3134.11	1922.73	2789.23	B.G.	B.G.
308	1371	1817.40	B.G.	3362.96	3140.25	1925.01	2789.92	B.G.	B.G.
306	1363	1817.18	B.G.	3367.05	3152.76	1925.46	2794.01	B.G.	B.G.
305	1357	1821.27	B.G.	3367.51	3159.58	1929.33	2794.69	B.G.	B.G.
302	1345	1842.65	B.G.	3368.19	3165.95	1943.20	2803.56	B.G.	B.G.
292	1299	1860.63	B.G.	3374.10	3226.92	1957.54	2816.76	B.G.	B.G.
294	1307	1854.48	B.G.	3373.42	3218.05	1953.44	2814.71	B.G.	B.G.
292	1300	1859.94	B.G.	3374.79	3234.88	1958.45	2816.30	B.G.	B.G.
289	1286	1871.09	B.G.	3378.65	3273.33	1967.55	2819.03	B.G.	B.G.
286	1273	1870.18	B.G.	3379.56	3271.74	1967.77	2820.17	B.G.	B.G.

A.29 5SB15T-2.0-14-D

Table A.85 Measurement of Load and Deflection Relationships of 5SB15T-2.0-14-D

LC		Mid. Def.		W. Def.		E. Def.		W. Sett.		E. Sett.		Net Def.	
kips	kN	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm
0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.00
30	132	0.04	1.07	0.03	0.71	0.06	1.41	0.02	0.51	0.04	0.93	0.013	0.34
60	266	0.07	1.82	0.05	1.35	0.09	2.34	0.03	0.85	0.06	1.46	0.027	0.69
99	443	0.10	2.66	0.08	2.02	0.13	3.41	0.04	1.14	0.08	1.98	0.045	1.16
119	530	0.12	3.00	0.09	2.27	0.15	3.86	0.05	1.23	0.09	2.17	0.054	1.37
140	621	0.13	3.37	0.10	2.55	0.17	4.33	0.05	1.34	0.09	2.35	0.063	1.59
160	710	0.15	3.72	0.11	2.86	0.19	4.73	0.06	1.43	0.10	2.51	0.072	1.82
165	735	0.15	3.81	0.12	2.94	0.19	4.83	0.06	1.46	0.10	2.55	0.074	1.88
172	766	0.15	3.94	0.12	3.06	0.20	4.97	0.06	1.50	0.10	2.60	0.077	1.97
177	787	0.16	4.03	0.12	3.14	0.20	5.08	0.06	1.52	0.10	2.64	0.080	2.03
180	801	0.16	4.08	0.13	3.20	0.20	5.16	0.06	1.54	0.11	2.67	0.082	2.08
180	803	0.16	4.11	0.13	3.21	0.20	5.16	0.06	1.54	0.11	2.67	0.082	2.08
185	821	0.16	4.19	0.13	3.29	0.21	5.26	0.06	1.56	0.11	2.70	0.084	2.14
190	844	0.17	4.31	0.13	3.40	0.21	5.38	0.06	1.58	0.11	2.73	0.088	2.23
194	862	0.18	4.62	0.15	3.73	0.22	5.70	0.06	1.61	0.11	2.78	0.099	2.52
199	885	0.19	4.92	0.16	4.05	0.24	6.03	0.06	1.63	0.11	2.82	0.111	2.81
198	882	0.20	5.15	0.17	4.29	0.25	6.30	0.06	1.64	0.11	2.84	0.120	3.05
199	883	0.20	5.15	0.17	4.29	0.25	6.30	0.06	1.64	0.11	2.84	0.120	3.06
199	886	0.20	5.18	0.17	4.29	0.25	6.31	0.06	1.64	0.11	2.85	0.120	3.06

Table A.85 Measurement of Load and Deflection Relationships of 5SB15T-2.0-14-D (Continued)

LC		Mid. Def.		W. Def.		E. Def.		W. Sett.		E. Sett.		Net Def.	
kips	kN	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm
201	892	0.20	5.20	0.17	4.33	0.25	6.34	0.06	1.65	0.11	2.85	0.122	3.09
205	912	0.21	5.41	0.18	4.53	0.26	6.58	0.07	1.66	0.11	2.88	0.129	3.28
205	912	0.21	5.43	0.18	4.54	0.26	6.60	0.07	1.66	0.11	2.88	0.130	3.30
210	934	0.22	5.70	0.19	4.81	0.27	6.89	0.07	1.68	0.11	2.92	0.140	3.55
210	935	0.23	5.75	0.19	4.86	0.27	6.93	0.07	1.69	0.12	2.92	0.141	3.59
211	937	0.23	5.75	0.19	4.87	0.27	6.95	0.07	1.69	0.12	2.92	0.142	3.60
210	936	0.23	5.75	0.19	4.88	0.27	6.97	0.07	1.69	0.12	2.93	0.142	3.62
210	936	0.23	5.85	0.19	4.95	0.28	7.06	0.07	1.69	0.12	2.93	0.146	3.70
215	955	0.24	6.16	0.21	5.26	0.29	7.40	0.07	1.70	0.12	2.97	0.157	4.00
215	956	0.24	6.18	0.21	5.28	0.29	7.43	0.07	1.71	0.12	2.97	0.158	4.02
220	980	0.26	6.57	0.22	5.67	0.31	7.85	0.07	1.72	0.12	3.01	0.173	4.39
230	1022	0.29	7.46	0.26	6.55	0.35	8.86	0.07	1.77	0.12	3.12	0.207	5.26
235	1044	0.32	8.03	0.28	7.09	0.37	9.49	0.07	1.78	0.12	3.17	0.229	5.81
240	1068	0.34	8.63	0.30	7.68	0.40	10.15	0.07	1.79	0.13	3.22	0.252	6.41
245	1088	0.36	9.21	0.33	8.27	0.43	10.82	0.07	1.80	0.13	3.27	0.276	7.00
250	1111	0.39	9.89	0.35	8.93	0.46	11.56	0.07	1.82	0.13	3.33	0.302	7.67
255	1132	0.42	10.57	0.38	9.60	0.48	12.31	0.07	1.82	0.13	3.39	0.329	8.35
260	1156	0.45	11.38	0.41	10.40	0.52	13.22	0.07	1.83	0.14	3.45	0.361	9.17
265	1177	0.48	12.25	0.44	11.24	0.56	14.15	0.07	1.83	0.14	3.51	0.395	10.02
270	1200	0.53	13.41	0.49	12.33	0.61	15.40	0.07	1.83	0.14	3.59	0.439	11.15
275	1222	0.58	14.76	0.54	13.64	0.66	16.88	0.07	1.83	0.14	3.68	0.492	12.51
280	1243	0.65	16.47	0.59	15.06	0.73	18.49	0.07	1.83	0.15	3.78	0.550	13.97

Table A.85 Measurement of Load and Deflection Relationships of 5SB15T-2.0-14-D (Continued)

LC		Mid. Def.		W. Def.		E. Def.		W. Sett.		E. Sett.		Net Def.	
kips	kN	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm
285	1266	0.73	18.54	0.67	16.97	0.81	20.60	0.07	1.83	0.15	3.88	0.627	15.93
290	1289	0.81	20.50	0.74	18.83	0.89	22.66	0.07	1.83	0.16	3.97	0.703	17.85
293	1301	0.90	22.86	0.83	21.04	0.99	25.08	0.07	1.83	0.16	4.04	0.792	20.13
294	1306	1.00	25.51	0.93	23.56	1.10	27.84	0.07	1.83	0.16	4.12	0.895	22.73
294	1306	1.01	25.70	0.93	23.74	1.10	28.04	0.07	1.83	0.16	4.13	0.902	22.91
296	1315	1.03	26.27	0.96	24.29	1.13	28.64	0.07	1.83	0.16	4.15	0.924	23.48
299	1328	1.11	28.24	0.99	25.13	1.16	29.54	0.07	1.83	0.16	4.17	0.958	24.33
299	1330	1.18	29.88	1.05	26.54	1.22	31.05	0.07	1.83	0.17	4.20	1.015	25.78
292	1301	1.18	29.89	1.04	26.45	1.22	31.02	0.07	1.83	0.16	4.19	1.013	25.73
288	1279	1.18	29.93	1.04	26.36	1.22	30.92	0.07	1.83	0.16	4.18	1.009	25.64
289	1287	1.18	29.98	1.04	26.44	1.22	30.94	0.07	1.83	0.16	4.18	1.011	25.68
296	1315	1.20	30.40	1.06	26.83	1.23	31.37	0.07	1.83	0.17	4.21	1.027	26.08
300	1333	1.24	31.39	1.09	27.76	1.27	32.32	0.07	1.83	0.17	4.23	1.063	27.01
301	1340	1.30	33.05	1.15	29.28	1.33	33.90	0.07	1.83	0.17	4.26	1.124	28.55
303	1347	1.38	35.04	1.23	31.18	1.41	35.87	0.07	1.83	0.17	4.29	1.199	30.46
302	1343	1.41	35.93	1.26	32.01	1.45	36.81	0.07	1.83	0.17	4.29	1.234	31.35
299	1330	1.43	36.30	1.27	32.35	1.47	37.22	0.07	1.83	0.17	4.28	1.249	31.73
299	1328	1.47	37.23	1.31	33.24	1.51	38.25	0.07	1.83	0.17	4.28	1.287	32.68
298	1324	1.47	37.46	1.32	33.47	1.52	38.49	0.07	1.83	0.17	4.29	1.296	32.92
295	1313	1.48	37.50	1.32	33.50	1.52	38.52	0.07	1.83	0.17	4.29	1.297	32.95
297	1323	1.50	38.05	1.34	34.01	1.54	39.07	0.07	1.83	0.17	4.30	1.318	33.48
296	1317	1.53	38.96	1.37	34.91	1.57	39.97	0.07	1.83	0.17	4.29	1.354	34.38

Table A.85 Measurement of Load and Deflection Relationships of 5SB15T-2.0-14-D (Continued)

LC		Mid. Def.		W. Def.		E. Def.		W. Sett.		E. Sett.		Net Def.	
kips	kN	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm
295	1311	1.58	40.18	1.42	36.01	1.62	41.17	0.07	1.83	0.17	4.29	1.399	35.53
294	1310	1.58	40.21	1.42	36.05	1.62	41.20	0.07	1.83	0.17	4.29	1.400	35.57
295	1312	1.59	40.31	1.42	36.15	1.63	41.31	0.07	1.83	0.17	4.29	1.404	35.67
295	1311	1.61	40.98	1.45	36.78	1.65	41.98	0.07	1.83	0.17	4.29	1.430	36.32
293	1305	1.64	41.65	1.47	37.39	1.68	42.65	0.07	1.83	0.17	4.30	1.455	36.96
293	1302	1.66	42.26	1.49	37.94	1.70	43.30	0.07	1.83	0.17	4.31	1.478	37.55
292	1299	1.70	43.11	1.52	38.73	1.74	44.14	0.07	1.83	0.17	4.32	1.510	38.36
286	1272	1.73	44.00	1.55	39.48	1.77	44.92	0.07	1.83	0.17	4.31	1.540	39.13
286	1270	1.73	44.05	1.55	39.48	1.77	44.94	0.07	1.83	0.17	4.32	1.541	39.14
284	1262	1.74	44.14	1.56	39.59	1.77	45.05	0.07	1.83	0.17	4.31	1.545	39.25
284	1262	1.76	44.78	1.58	40.14	1.80	45.69	0.07	1.83	0.17	4.32	1.569	39.84
283	1259	1.76	44.81	1.58	40.17	1.80	45.71	0.07	1.83	0.17	4.32	1.570	39.87
283	1257	1.78	45.09	1.59	40.47	1.81	46.02	0.07	1.83	0.17	4.32	1.582	40.17
282	1257	1.78	45.12	1.59	40.51	1.81	46.06	0.07	1.83	0.17	4.32	1.583	40.21
275	1225	1.78	45.30	1.61	40.78	1.82	46.30	0.07	1.83	0.17	4.30	1.594	40.48
275	1221	1.79	45.40	1.61	40.82	1.82	46.35	0.07	1.83	0.17	4.30	1.595	40.52
274	1217	1.79	45.44	1.61	40.83	1.83	46.38	0.07	1.83	0.17	4.30	1.596	40.54
273	1215	1.79	45.45	1.61	40.86	1.83	46.40	0.07	1.83	0.17	4.30	1.597	40.57
274	1218	1.79	45.52	1.61	40.91	1.83	46.48	0.07	1.83	0.17	4.30	1.600	40.63
270	1200	1.81	45.90	1.62	41.24	1.84	46.84	0.07	1.83	0.17	4.30	1.613	40.98
270	1200	1.81	45.90	1.62	41.25	1.84	46.84	0.07	1.83	0.17	4.30	1.613	40.98
269	1198	1.81	45.90	1.62	41.24	1.84	46.84	0.07	1.83	0.17	4.30	1.613	40.98

Table A.86 Measurement of Tendon Slippage of 5SB15T-2.0-14-D

TRF		T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12	T13	T14
kips	kN	in	in	in	in	in	in	in	in	in	in	in	in	in	in
0	0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
30	132	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-0.001
60	266	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-0.001
99	443	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-0.001
119	530	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
140	621	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
160	710	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
165	735	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
172	766	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
177	787	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-0.001
180	801	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-0.001
180	803	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-0.001
185	821	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
190	844	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
194	862	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000
199	885	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-0.001
198	882	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
199	883	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
199	886	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
201	892	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
205	912	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
205	912	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Table A.86 Measurement of Tendon Slippage of 5SB15T-2.0-14-D (Continued)

TRF		T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12	T13	T14
kips	kN	in	in	in	in	in	in	in	in	in	in	in	in	in	in
210	934	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-0.001
210	935	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-0.001
211	937	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
210	936	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
210	936	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
215	955	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-0.001
215	956	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-0.001
220	980	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-0.001
230	1022	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
235	1044	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
240	1068	0.001	0.006	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000	-0.001
245	1088	0.001	0.010	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
250	1111	0.001	0.014	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-0.001
255	1132	0.001	0.017	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-0.001
260	1156	0.001	0.020	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
265	1177	0.001	0.024	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
270	1200	0.001	0.030	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
275	1222	0.001	0.036	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
280	1243	0.001	0.042	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-0.001
285	1266	0.001	0.050	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-0.001
290	1289	0.001	0.054	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
293	1301	0.001	0.060	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-0.001

Table A.86 Measurement of Tendon Slippage of 5SB15T-2.0-14-D (Continued)

TRF		T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12	T13	T14
kips	kN	in	in	in	in	in	in	in	in	in	in	in	in	in	in
294	1306	0.001	0.067	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
294	1306	0.001	0.069	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000
296	1315	0.001	0.069	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
299	1328	0.001	0.070	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
299	1330	0.001	0.071	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
292	1301	0.001	0.071	0.000	0.000	0.001	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000
288	1279	0.001	0.073	0.000	0.000	0.001	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000
289	1287	0.001	0.073	0.000	0.000	0.001	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000
296	1315	0.001	0.073	0.000	0.000	0.001	0.000	-0.001	0.000	0.000	0.000	0.000	0.000	0.000	-0.001
300	1333	0.001	0.074	0.000	0.000	0.001	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000
301	1340	0.001	0.076	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-0.001
303	1347	0.001	0.076	0.000	0.000	0.001	0.000	-0.001	0.000	0.001	0.000	0.000	0.000	0.000	-0.001
302	1343	0.001	0.077	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
299	1330	0.001	0.077	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
299	1328	0.001	0.077	0.000	0.000	0.001	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000
298	1324	0.001	0.077	0.000	0.000	0.001	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000
295	1313	0.001	0.077	0.000	0.000	0.001	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000	-0.001
297	1323	0.001	0.079	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
296	1317	0.001	0.079	0.000	0.000	0.001	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000
295	1311	0.001	0.081	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
294	1310	0.001	0.081	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
295	1312	0.001	0.081	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-0.001

Table A.86 Measurement of Tendon Slippage of 5SB15T-2.0-14-D (Continued)

TRF		T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12	T13	T14
kips	kN	in	in	in	in	in	in	in	in	in	in	in	in	in	in
295	1311	0.001	0.081	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
293	1305	0.001	0.081	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
293	1302	0.001	0.083	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
292	1299	0.001	0.084	0.000	0.000	0.001	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000
286	1272	0.001	0.087	0.000	0.000	0.001	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000
286	1270	0.001	0.087	0.000	0.000	0.001	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000
284	1262	0.001	0.087	0.000	0.000	0.001	0.000	0.000	0.000	0.001	0.001	0.000	0.000	0.000	-0.001
284	1262	0.001	0.087	0.000	0.000	0.001	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000
283	1259	0.001	0.087	0.000	0.000	0.001	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000
283	1257	0.001	0.087	0.000	0.000	0.001	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000
282	1257	0.001	0.087	0.000	0.000	0.001	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000
275	1225	0.000	0.089	0.000	0.001	0.001	0.000	0.000	0.001	0.001	0.001	0.000	0.000	0.000	0.000
275	1221	0.000	0.089	0.000	0.001	0.001	0.000	0.000	0.001	0.001	0.001	0.000	0.000	0.000	0.000
274	1217	0.000	0.089	0.000	0.001	0.001	0.000	0.000	0.001	0.001	0.001	0.000	0.000	0.000	0.000
273	1215	0.000	0.089	0.000	0.001	0.001	0.000	0.000	0.001	0.001	0.001	0.000	0.000	0.000	0.000
274	1218	0.000	0.089	0.000	0.000	0.001	0.000	0.000	0.001	0.001	0.001	0.000	0.000	0.000	0.000
270	1200	0.001	0.089	0.000	0.000	0.001	0.000	0.000	0.001	0.001	0.001	0.000	0.000	0.000	0.000
270	1200	0.001	0.089	0.000	0.000	0.001	0.000	0.000	0.001	0.001	0.001	0.000	0.000	0.000	-0.001
269	1198	0.001	0.089	0.000	0.000	0.001	0.000	0.000	0.001	0.001	0.001	0.000	0.000	0.000	-0.001

Table A.87 Measurement of Strain Gauges of 5SB15T-2.0-14-D

Load Cell		N1	N2	N3	N4	N5	N6	N11	N12	N13	N14	N15	N16
kips	kN	m/m	m/m	m/m	m/m	m/m	m/m	m/m	m/m	m/m	m/m	m/m	m/m
0	0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
30	132	71.885	13.194	16.607	131.943	27.981	32.303	9.555	-66.199	107.375	25.933	35.261	40.493
60	266	171.071	20.474	29.346	63.924	51.640	59.829	14.105	-111.242	-10.009	45.042	61.422	71.204
99	443	208.606	29.573	45.270	72.796	83.033	94.862	18.654	-105.100	-9.099	70.066	92.588	108.284
119	530	208.834	35.260	54.370	84.626	99.185	113.971	22.294	-96.455	2.048	82.806	109.195	128.303
140	621	213.611	39.355	62.104	B.G.	115.791	132.625	23.204	-90.313	9.327	96.455	123.754	145.593
160	710	219.071	44.360	70.294	B.G.	132.853	152.644	25.706	-83.943	17.972	110.104	140.816	166.521
165	735	220.208	45.952	73.024	B.G.	138.768	158.786	27.071	-81.441	20.702	114.881	146.958	174.256
172	766	221.573	48.455	76.664	B.G.	145.820	167.431	28.436	-78.256	25.024	120.341	154.010	183.356
177	787	222.256	50.047	78.938	B.G.	151.280	174.256	29.119	-76.436	27.526	124.663	159.242	190.635
180	801	222.938	51.185	80.758	B.G.	156.284	179.943	30.029	-74.616	29.801	128.076	164.247	196.550
180	803	222.938	51.412	80.986	B.G.	156.512	180.625	30.029	-74.161	30.029	128.531	164.702	197.460
185	821	222.938	53.004	83.943	B.G.	164.019	189.725	31.166	-71.659	34.124	133.990	174.029	211.109
190	844	224.758	55.962	88.265	B.G.	175.166	217.706	32.759	-67.792	38.673	139.450	185.631	262.066
194	862	226.578	58.692	90.995	B.G.	201.100	B.G.	35.033	-63.924	43.223	144.000	188.133	700.891
199	885	227.488	60.057	93.043	B.G.	444.967	B.G.	36.171	-61.877	45.043	145.820	196.778	1013.915
198	882	229.080	59.829	92.133	B.G.	516.171	B.G.	36.171	-62.104	44.816	146.275	200.417	1104.000
199	883	229.990	60.057	92.133	B.G.	516.398	B.G.	36.171	-62.104	44.588	146.047	200.872	1105.593
199	886	230.218	60.739	93.270	B.G.	518.673	B.G.	36.626	-60.967	45.726	146.957	202.692	1129.706
201	892	230.218	60.739	93.725	B.G.	519.128	B.G.	36.626	-60.967	45.726	147.185	203.147	1138.578
205	912	230.673	61.421	95.090	B.G.	543.242	B.G.	36.398	-61.195	45.953	147.867	211.792	1253.915
205	912	231.355	61.421	95.318	B.G.	546.427	B.G.	36.171	-61.195	45.953	148.322	212.929	1261.877

Table A.87 Measurement of Strain Gauges of 5SB15T-2.0-14-D (Continued)

Load Cell		N1	N2	N3	N4	N5	N6	N11	N12	N13	N14	N15	N16
kips	kN	m/m	m/m	m/m	m/m	m/m	m/m	m/m	m/m	m/m	m/m	m/m	m/m
210	934	285.270	63.014	97.820	B.G.	642.882	B.G.	37.536	-124.436	21.384	150.142	242.048	1422.711
210	935	226.351	63.014	98.047	B.G.	654.711	B.G.	37.308	-57.555	51.185	150.369	246.825	1441.365
211	937	226.351	63.014	98.047	B.G.	657.441	B.G.	37.081	-57.782	51.185	150.597	247.735	1443.640
210	936	226.123	62.559	97.592	B.G.	658.123	B.G.	36.626	-58.010	51.868	150.824	248.872	1445.232
210	936	225.896	62.786	98.047	B.G.	666.085	B.G.	36.853	-57.782	52.095	151.734	251.375	1460.019
215	955	226.123	65.289	103.735	B.G.	774.370	B.G.	38.901	-54.370	56.190	155.602	303.015	1619.261
215	956	226.806	65.516	102.825	B.G.	780.739	B.G.	39.128	-54.142	56.417	155.829	306.654	1629.043
220	980	226.806	65.516	102.597	B.G.	B.G.	B.G.	38.673	-53.915	56.872	155.147	406.067	B.G.
230	1022	231.355	71.886	112.607	B.G.	B.G.	B.G.	43.451	-22.522	120.342	167.659	691.792	B.G.
235	1044	232.720	75.298	130.578	B.G.	B.G.	B.G.	44.588	-2.730	163.792	171.753	829.195	B.G.
240	1068	294.142	76.437	122.388	B.G.	B.G.	B.G.	45.043	-29.346	99.868	176.531	989.574	B.G.
245	1088	325.080	84.627	136.948	B.G.	B.G.	B.G.	43.451	-32.531	95.318	179.943	1122.200	B.G.
250	1111	347.374	93.271	171.526	B.G.	B.G.	B.G.	45.043	-27.299	103.508	189.042	1268.929	B.G.
255	1132	399.469	136.267	235.450	B.G.	B.G.	B.G.	47.545	-16.607	123.981	201.099	1400.873	B.G.
260	1156	462.256	188.134	326.900	B.G.	B.G.	B.G.	48.228	-7.280	144.455	235.678	1535.546	B.G.
265	1177	517.081	243.641	421.990	B.G.	B.G.	B.G.	49.593	7.734	175.394	292.322	1648.152	B.G.
270	1200	570.540	308.475	B.G.	B.G.	B.G.	B.G.	49.820	23.431	210.654	384.000	1760.531	B.G.
275	1222	650.616	382.181	B.G.	B.G.	B.G.	B.G.	53.460	45.270	254.332	472.265	1852.891	B.G.
280	1243	704.303	440.646	B.G.	B.G.	B.G.	B.G.	56.190	63.605	300.057	558.028	1946.389	B.G.
285	1266	747.299	511.622	B.G.	B.G.	B.G.	B.G.	59.830	84.682	355.575	660.625	2059.451	B.G.
290	1289	826.919	609.442	B.G.	B.G.	B.G.	B.G.	61.650	102.748	386.183	798.711	2230.977	B.G.
293	1301	884.474	B.G.	B.G.	B.G.	B.G.	B.G.	61.877	118.624	413.080	917.005	2401.820	B.G.

Table A.87 Measurement of Strain Gauges of 5SB15T-2.0-14-D (Continued)

Load Cell		N1	N2	N3	N4	N5	N6	N11	N12	N13	N14	N15	N16
kips	kN	m/m	m/m	m/m	m/m	m/m	m/m	m/m	m/m	m/m	m/m	m/m	m/m
294	1306	892.436	B.G.	B.G.	B.G.	B.G.	B.G.	66.427	150.376	466.875	1024.834	2738.275	B.G.
294	1306	851.261	B.G.	B.G.	B.G.	B.G.	B.G.	66.882	155.303	475.223	1030.976	2751.242	B.G.
296	1315	894.256	B.G.	B.G.	B.G.	B.G.	B.G.	92.588	163.241	488.671	1055.545	2817.214	B.G.
299	1328	921.327	B.G.	B.G.	B.G.	B.G.	B.G.	92.133	168.990	498.410	1138.578	2879.091	B.G.
299	1330	924.284	B.G.	B.G.	B.G.	B.G.	B.G.	93.725	174.738	508.149	1197.725	2879.091	B.G.
292	1301	923.147	B.G.	B.G.	B.G.	B.G.	B.G.	92.588	175.559	509.540	1195.223	2879.091	B.G.
288	1279	874.464	B.G.	B.G.	B.G.	B.G.	B.G.	91.451	213.607	574.001	1199.090	2879.091	B.G.
289	1287	874.464	B.G.	B.G.	B.G.	B.G.	B.G.	91.451	213.881	574.465	1199.317	2879.091	B.G.
296	1315	897.213	B.G.	B.G.	B.G.	B.G.	B.G.	93.725	217.166	580.030	1205.005	2879.091	B.G.
300	1333	912.227	B.G.	B.G.	B.G.	B.G.	B.G.	94.635	224.009	591.624	1262.787	2879.091	B.G.
301	1340	946.351	B.G.	B.G.	B.G.	B.G.	B.G.	96.000	234.958	610.174	1366.066	2879.091	B.G.
303	1347	992.986	B.G.	B.G.	B.G.	B.G.	B.G.	96.000	247.823	631.970	1487.090	2879.091	B.G.
302	1343	987.526	B.G.	B.G.	B.G.	B.G.	B.G.	95.090	253.298	641.247	1527.810	2879.091	B.G.
299	1330	993.213	B.G.	B.G.	B.G.	B.G.	B.G.	94.863	255.487	644.955	1542.142	2879.091	B.G.
299	1328	1023.924	B.G.	B.G.	B.G.	B.G.	B.G.	93.953	261.236	654.694	1586.275	2879.091	B.G.
298	1324	1035.981	B.G.	B.G.	B.G.	B.G.	B.G.	93.953	262.878	657.476	1596.512	2879.091	B.G.
295	1313	1036.436	B.G.	B.G.	B.G.	B.G.	B.G.	93.953	264.521	660.260	1598.332	2879.091	B.G.
297	1323	1010.502	B.G.	B.G.	B.G.	B.G.	B.G.	93.953	268.353	666.751	1621.308	2879.091	B.G.
296	1317	1053.270	B.G.	B.G.	B.G.	B.G.	B.G.	95.090	273.828	676.028	1676.133	2879.091	B.G.
295	1311	1066.237	B.G.	B.G.	B.G.	B.G.	B.G.	96.000	281.218	688.548	1747.791	2879.091	B.G.
294	1310	1066.464	B.G.	B.G.	B.G.	B.G.	B.G.	95.773	281.491	689.011	1749.384	2879.091	B.G.
295	1312	1080.796	B.G.	B.G.	B.G.	B.G.	B.G.	96.000	282.040	689.940	1756.436	2879.091	B.G.

Table A.87 Measurement of Strain Gauges of 5SB15T-2.0-14-D (Continued)

Load Cell		N1	N2	N3	N4	N5	N6	N11	N12	N13	N14	N15	N16
kips	kN	m/m	m/m	m/m	m/m	m/m	m/m	m/m	m/m	m/m	m/m	m/m	m/m
295	1311	1102.635	B.G.	B.G.	B.G.	B.G.	B.G.	96.683	285.871	696.431	1801.251	2879.091	B.G.
293	1305	1124.246	B.G.	B.G.	B.G.	B.G.	B.G.	96.910	289.703	702.924	1841.971	2879.091	B.G.
293	1302	1107.185	B.G.	B.G.	B.G.	B.G.	B.G.	95.773	293.262	708.953	1875.412	2879.091	B.G.
292	1299	1148.588	B.G.	B.G.	B.G.	B.G.	B.G.	96.683	298.189	717.300	1930.237	2879.091	B.G.
286	1272	1159.735	B.G.	B.G.	B.G.	B.G.	B.G.	97.593	289.137	695.659	1981.422	2879.091	B.G.
286	1270	1161.782	B.G.	B.G.	B.G.	B.G.	B.G.	97.593	293.232	704.759	1990.976	2879.091	B.G.
284	1262	1162.465	B.G.	B.G.	B.G.	B.G.	B.G.	97.593	293.460	704.986	1993.479	2879.091	B.G.
284	1262	1177.024	B.G.	B.G.	B.G.	B.G.	B.G.	97.365	298.464	717.498	2005.535	2879.091	B.G.
283	1259	1177.251	B.G.	B.G.	B.G.	B.G.	B.G.	97.365	298.464	717.271	2006.218	2879.091	B.G.
283	1257	1187.488	B.G.	B.G.	B.G.	B.G.	B.G.	97.820	302.787	726.598	2019.867	2879.091	B.G.
282	1257	1241.176	B.G.	B.G.	B.G.	B.G.	B.G.	98.048	299.829	719.090	2076.057	2879.091	B.G.
275	1225	1242.540	B.G.	B.G.	B.G.	B.G.	B.G.	97.820	300.057	720.683	2075.829	2879.091	B.G.
275	1221	1242.768	B.G.	B.G.	B.G.	B.G.	B.G.	97.820	300.057	720.910	2074.919	2879.091	B.G.
274	1217	1242.995	B.G.	B.G.	B.G.	B.G.	B.G.	97.820	300.057	720.910	2074.464	2879.091	B.G.
273	1215	1244.360	B.G.	B.G.	B.G.	B.G.	B.G.	97.820	300.739	722.275	2074.919	2879.091	B.G.
274	1218	1245.043	B.G.	B.G.	B.G.	B.G.	B.G.	97.820	300.739	722.730	2075.602	2879.091	B.G.
270	1200	1248.228	B.G.	B.G.	B.G.	B.G.	B.G.	96.683	301.422	725.688	2074.692	2879.091	B.G.
270	1200	1247.773	B.G.	B.G.	B.G.	B.G.	B.G.	96.683	300.739	725.005	2073.554	2879.091	B.G.
269	1198	1247.090	B.G.	B.G.	B.G.	B.G.	B.G.	96.683	300.512	724.323	2072.644	2879.091	B.G.