Aspects of

Seam Strength Prediction

by

WAI-CHIU TSUI MSc, LTI

A thesis submitted to the Council for National Academic Awards in partial fufilment of the requirements for the award of the degree of Doctor of Philosophy

The Department of Textile Industries
The Polytechnic
Queensgate
Huddersfield HD1 3DH

in collaboration with
Wallis Fashion Group Ltd
Claremont Road
London NW2

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Declaration

I declare that while registered as a candidate for the degree of Doctor of Philosophy of the Council for National Academic Awards, I have not been a registered candidate for another award of the CNAA or of a University.

Wai-Chiu Tsui
January 1982

Statement

In accordance with the approved application for registration, the candidate has undertaken a programme of advanced studies in connection with his programme of research through attendance at selected conferences, symposia and colloquia organised by the Textile Institute, the Clothing Institute, the Shirley Institute and the Huddersfield Polytechnic.

In addition a programme of guided reading was successfully followed.

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ABSTRACT

In general, a seam may fail as a result of longitudinal or transverse loading. Previous workers have reported transverse seam strength to be a prime requirement in most cases of joining woven fabrics by the means of sewn seams. Transverse seam breaks can be divided into two types: Type I in which only the sewing thread breaks (with the fabric undamaged); and Type II in which only the fabric breaks (with the sewing thread undamaged). Most previous workers have tested seam strength in woven fabrics by using samples in which the warp or the weft yarns ran straight from jaw to seam to jaw; this configuration of seam loading, however, is uncommon in practical garments.

Accordingly, for seam strength investigations to have any real practical applicability, it is necessary to examine seams in which the fabric threads run at an angle of bias to the line of the seam; such being the configuration of fabric and seam in most garments.

The objectives of the present work were as follows:

(a) to investigate empirically the effects of angle of bias, gauge length and sample width on Type I and Type II lockstitch seams and unseamed fabrics over a range of woven fabrics of simple structures;

(b) to develop a generalized theoretical mathematical and physical model in an attempt to explain the relationships between seam strength and parameters such as angle of bias, gauge length, width of seam, fabric type and construction;

(c) to attempt to understand the complexities of a sewn seam in woven fabrics under load that an optimum configuration of the various parameters investigated (together with a consideration of garment design and pattern cutting) could be achieved for any given practical situation.

The experimental results showed a marked effect of the angle of bias together with the interaction of the ratio G/W*. 'W' shaped curves were evident under almost all of the situations except where the G/W ratio was below half.

A basic mathematical model, developed from previous work, has shown very good agreement with the experimental results for a square-sett plain-weave fabric. Further modifications have been made to extend the application of the model to non-square-sett and non-plain-weave fabrics. The theoretical and experimental results fit to a reasonable standard.

In order that the experimental and theoretical works could be related to practical situations, a survey of common garments, and the angles of seam/fabric bias contained in them, was undertaken. Several industrial applications have been suggested. Another theory for predicting the peak angle, the only unknown parameter in the model, has been suggested in the final chapter and can be seen to work well within the limitation of the fabrics used in this work.

* G is defined to be the gauge length (jaw to jaw for unseamed samples or jaw to seam for seamed samples). W is defined to be sample width.

CHAPTER 1 INTRODUCTION AND REVIEW OF LITERATURE

1.1 HISTORICAL

The origin of clothing is wrapped in obscurity, but the first garment was undoubtedly derived from animal skins or vegetation, both being readily obtainable. The original purpose of early garments was to give protection and warmth. Scraping and beating (to induce suppleness) and then shaping of the skins to conform more closely to the body shape, enable greater comfort to be achieved. The cut shapes were initially laced together with thongs and later by sewing them together with primitive needle and thread.

Around 14,000 to 8,000 B.C., the eyed needle was invented by the Magdalenian people, so the revolution of clothes making began.

In ancient China, costumes were cut and sewn from woven cloth, loose hanging lines gave a modified draped effect. The ancient Mediterranean clothing consisted of draped woven fabric as there was great and understandable reluctance to cut a rectangle of woven cloth because of the problem of fraying.

Nowadays clothing is made from fabric pieces cut from woven, knitted or non-woven fabrics. Shaping is achieved by sewing to conform to the contours of the body. In the nineteenth century,because of the mechanisation of the textile industry and the development of reasonably highly productive sewing machines, the clothing industry became mass-productive and the price of clothing began to fall. Then more types of fibres, yarns, fabrics, finishing and sewing threads were developed, and continually increasing sewing speeds led gradually to the realisation that basic research into the parameters affecting seam strength, seam efficiency and seam durability had to be undertaken to produce efficient seams in garments.

1.2 STITCHES, SEAMS AND STITCHINGS

1.2.1 BRITISH STANDARD CLASSIFICATION OF STITCH TYPES

The British Standards Institute[1] uses three terms to define stitches:-

i) Intralooping - the passing of a loop of thread through another loop formed by the same thread

ii) Interlooping - the passing of a loop of thread through another loop formed by a different thread

iii) Interlacing - the passing of a thread over or around another thread or loop of another thread.

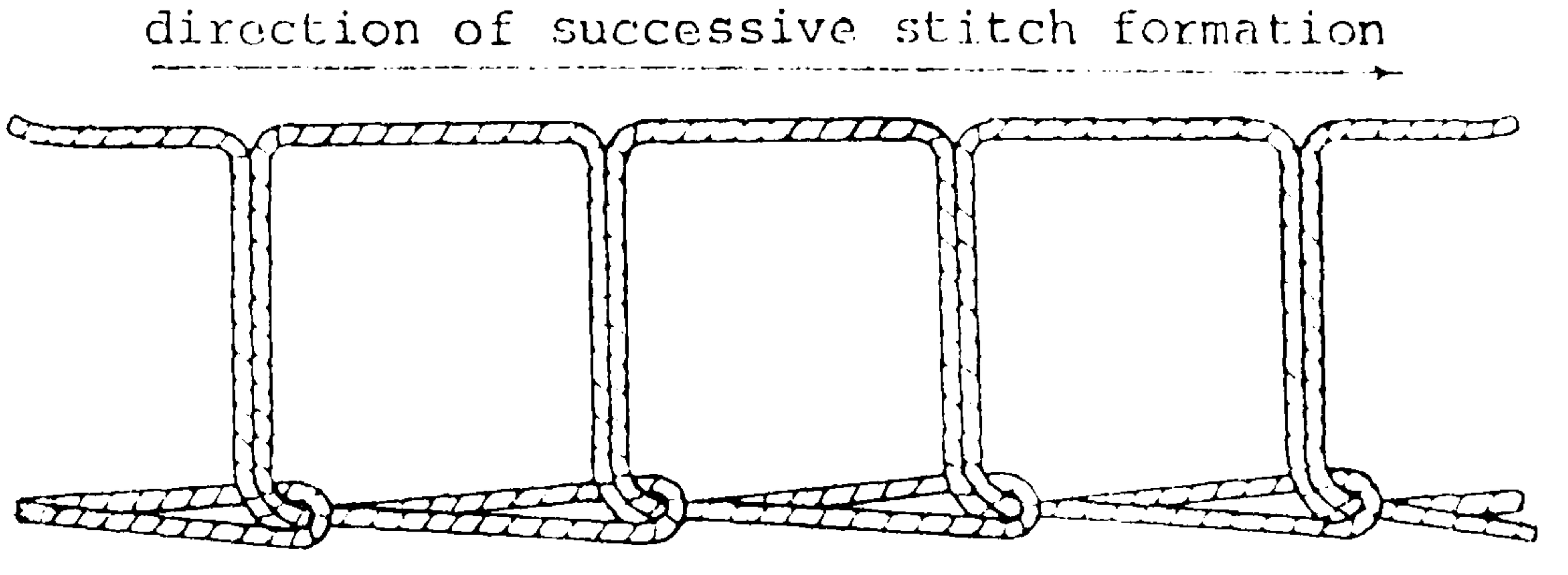
1.2.2 CLASSIFICATION OF STITCHES

BS 3870 divides stitches into eight main classes, each class being divided into subgroups. The classifications are as follows, and examples of some of the most common stitches are illustrated in Figure 1.1.

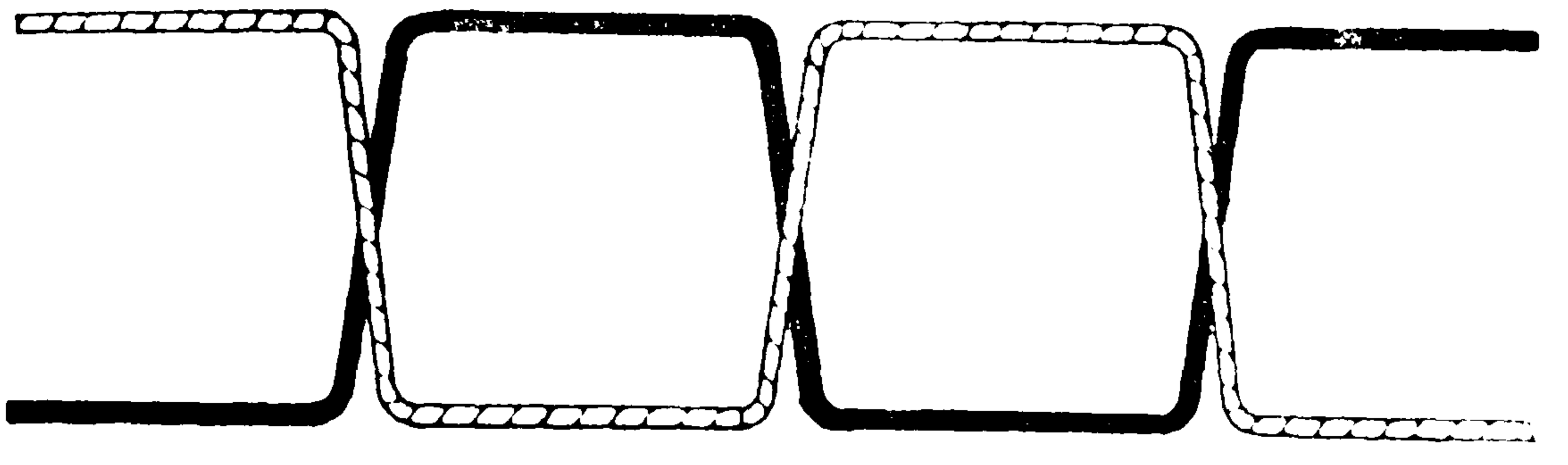
i) Class 100 - Chainstitch

The formation of this stitch (illustrated in Figure 1.1a Type 101) utilises one or more needle-threads together with the general characteristic of intralooping. A loop or loops of thread or threads is passed through the material and secured by intralooping with a succeeding loop or loops after they are passed through the material to form a stitch.

Figure 1.1 Common Machine-made Stitches



(a) Type 101 Chainstitch



(b) Type 201 Handstitch (Saddlestitch)

ii) Class 200 - Handstitch

This stitch illustrated in Figure 1.1b, Type 201 is formed by hand using one or more needle-threads. The stitch has a general characteristic that each needle-thread passes through the material as a single line of thread and the stitch is secured by this single line of thread passing in and out of the material or by intralooping of the threads with themselves. When more than one thread is used, the threads pass through the same perforation in the material.

iii) Class 300 - Lockstitch

This highly important stitch type illustrated in Figure 1.1c Type 301 is formed with two or more groups of threads and has a general characteristic of interlacing the two groups. Loops from the first group are passed through the material where they are secured by the thread or threads from the second group thus forming a stitch.

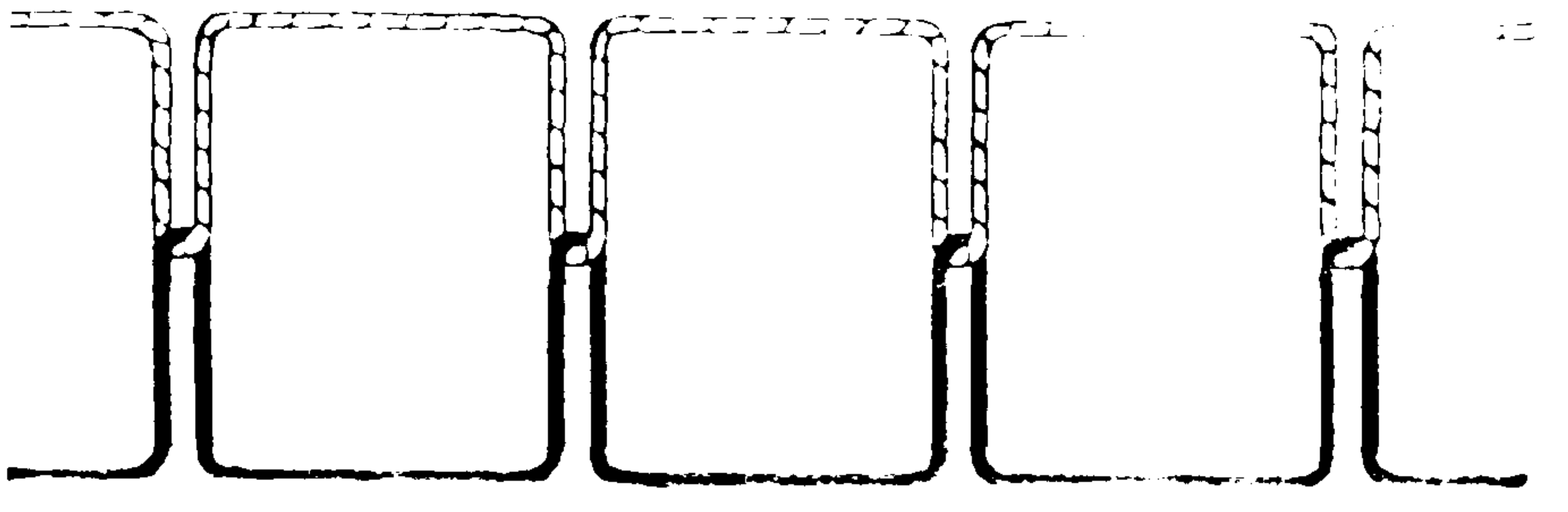
iv) Class 400 - Multi-thread chainstitch

For this class, the stitch illustrated in Figure 1.1d, Type 401 is formed from two or more groups of threads and it has a general characteristic of interlacing and interlooping the loops of the two groups. Loops of the first group and threads are passed through the material and are secured by interlacing and interlooping with loops of the second group to form a stitch.

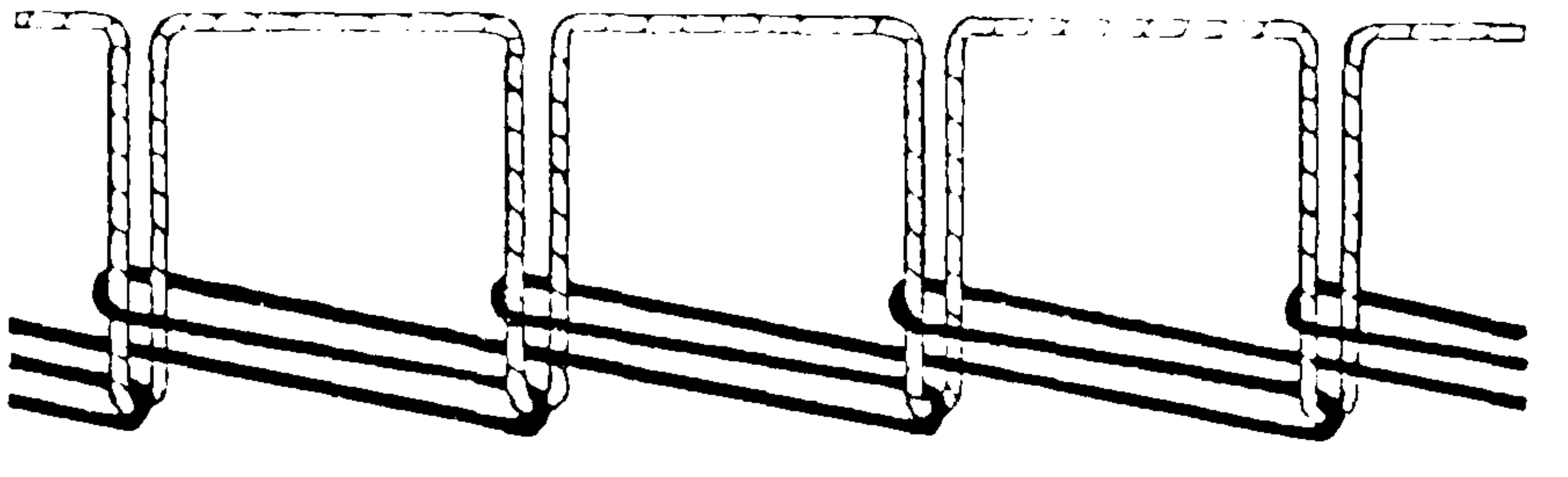
v) Class 500 - Overedge stitch (overlock)

This stitch illustrated in Figure 1.1e, Type 504 possesses one

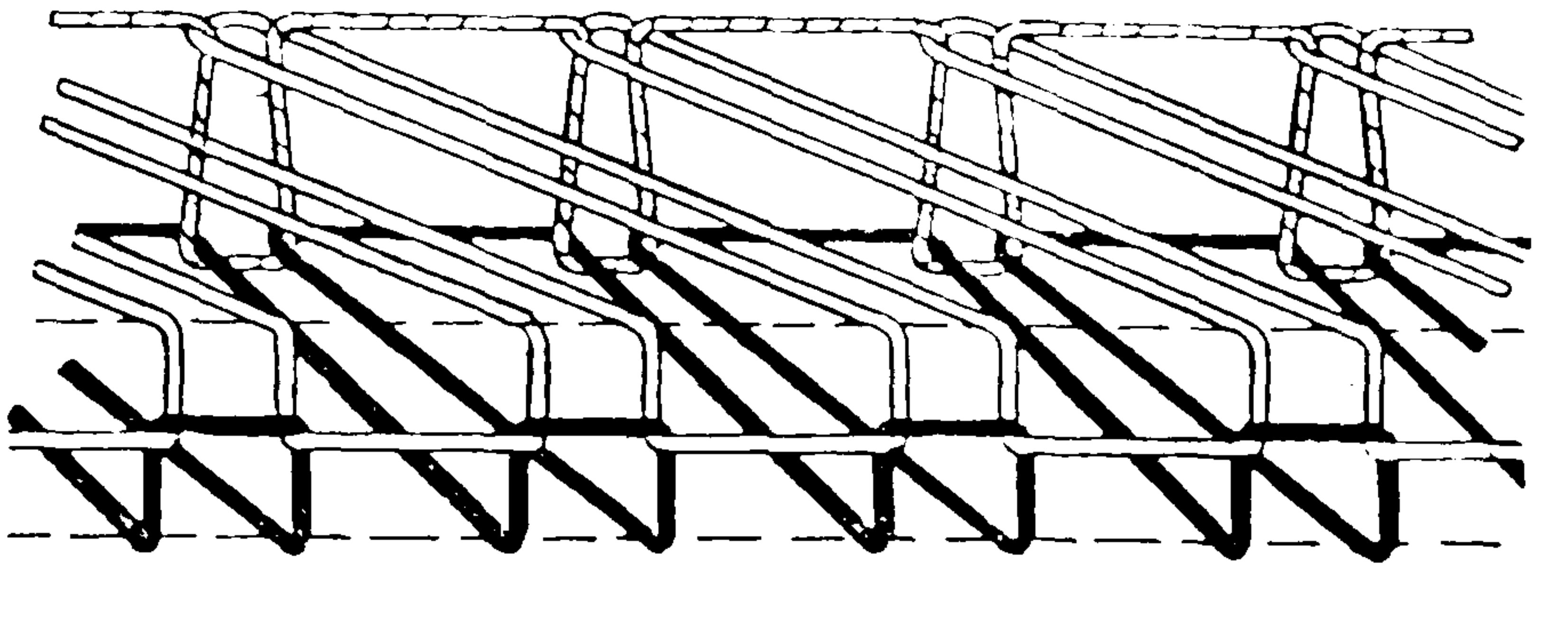
Figure 1.1 Common Machine-made Stitches (contd)



(c) Type 301 Chainstitch



(d) Type 401 Double Lockstitch



(e) Type 504 Overlock (3-thread)

or more groups of threads and has a general characteristic of loops from at least one group of threads passing around the edge of the material. Loops from one group of threads are passed through the material and are secured by intra-looping with themselves before succeeding loops are passed through the material, or secured by interlooping with loops of one or more interlooping groups of threads before succeeding threads of the first group are again passed through the material.

vi) Class 600 - Flat seam stitch

The stitch illustrated in Figure 1.1f,Type 601 is formed with three groups of threads, the general characteristic being that one group bridges the butted join on the face of the fabric, whilst the second group bridges the butted join on the back of the fabric, the two groups being interconnected through the fabric by the third group ie. the needle-threads.

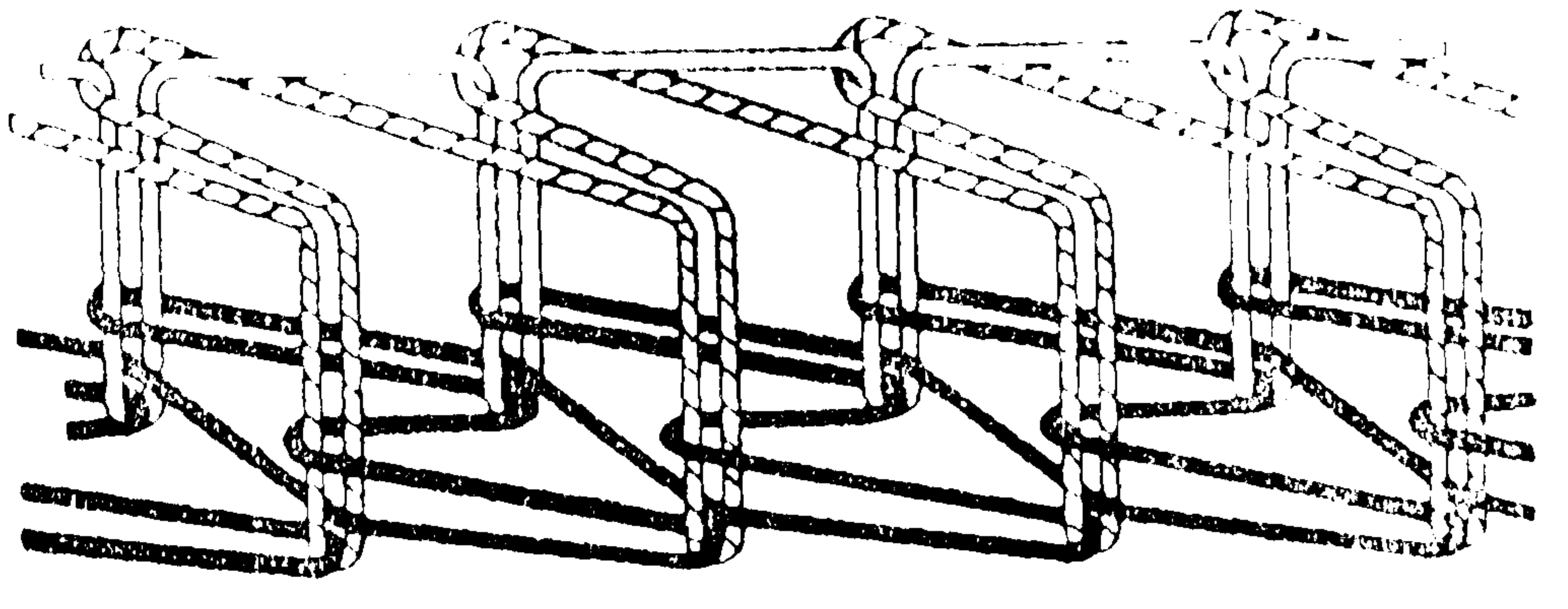
vii) Class 700 - Single thread lockstitch

The stitch illustrated in Figure 1.1g,Type 701 is formed with a single continuous needle-thread and has a general characteristic that at the penetration of the first stitch a portion of the needle-thread is wound onto a reel in the lower mechanism of the machine. The stitches are formed by interlacing the needle-thread with the thread wound on the reel.

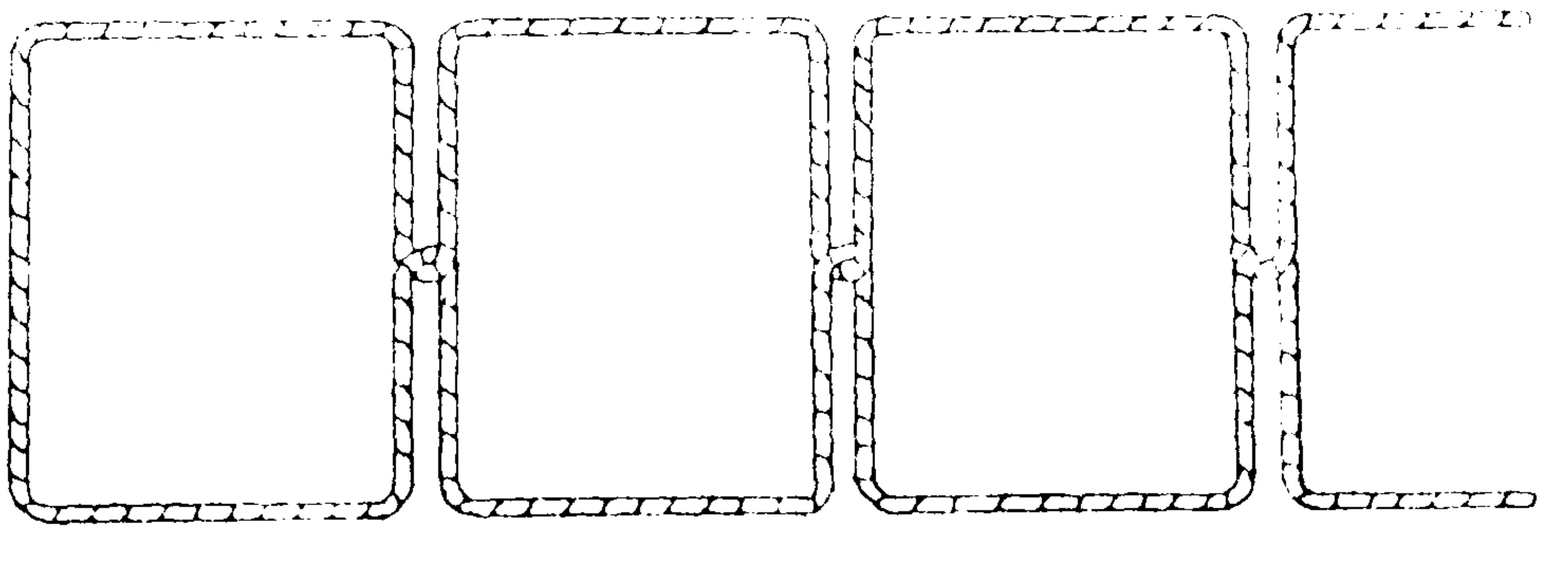
viii) Class 800 - Combination stitch

The stitches illustrated in Figures 1.1h and 1.1i, Types 802 and 803 possess rows of stitch types from two or more different stitch classes sewn simultaneously, at a specified distance

Figure 1.1 Common Machine-made Stitches (cont'd)

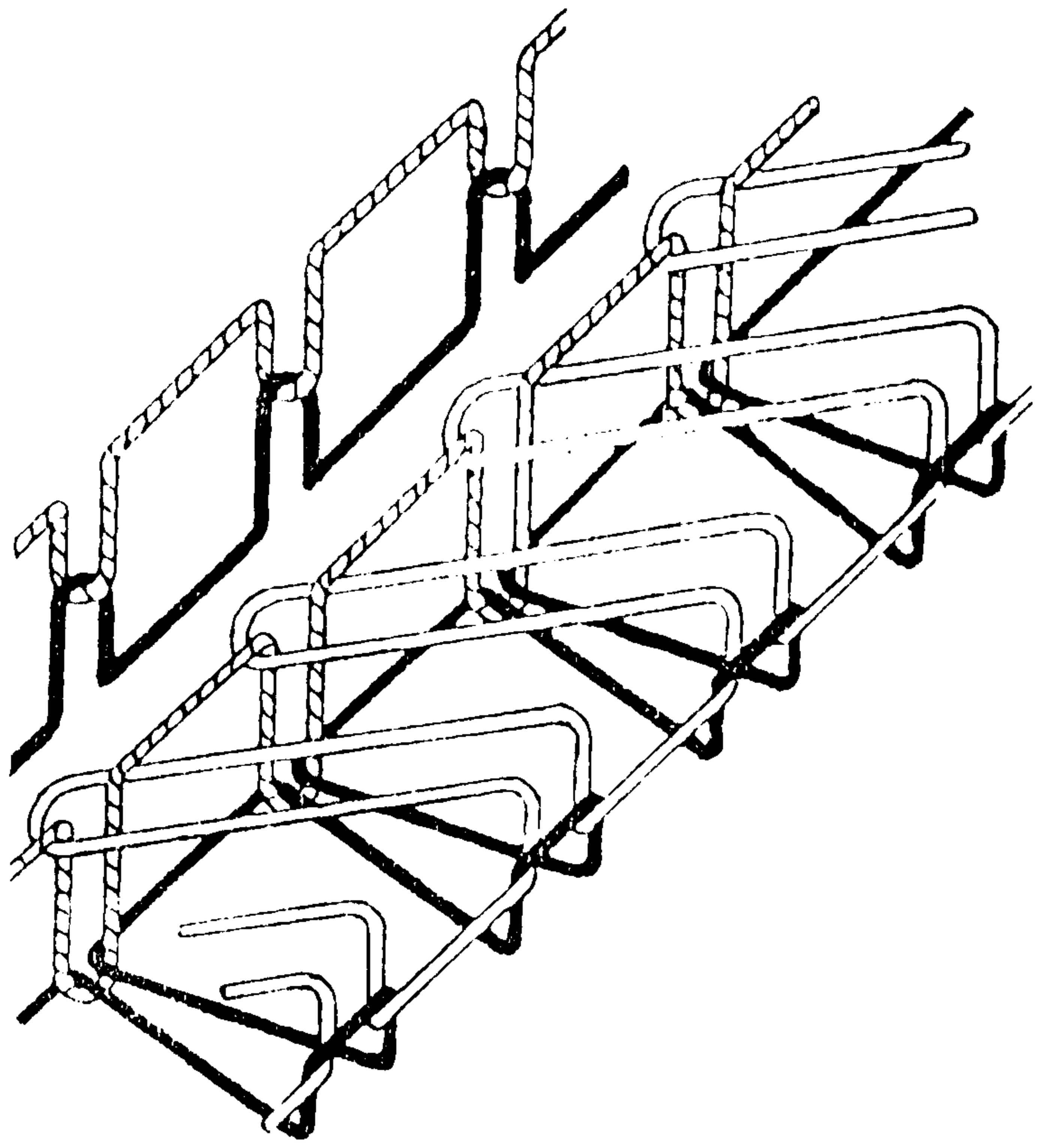


(f) Type 601 Flat Seam Stitch

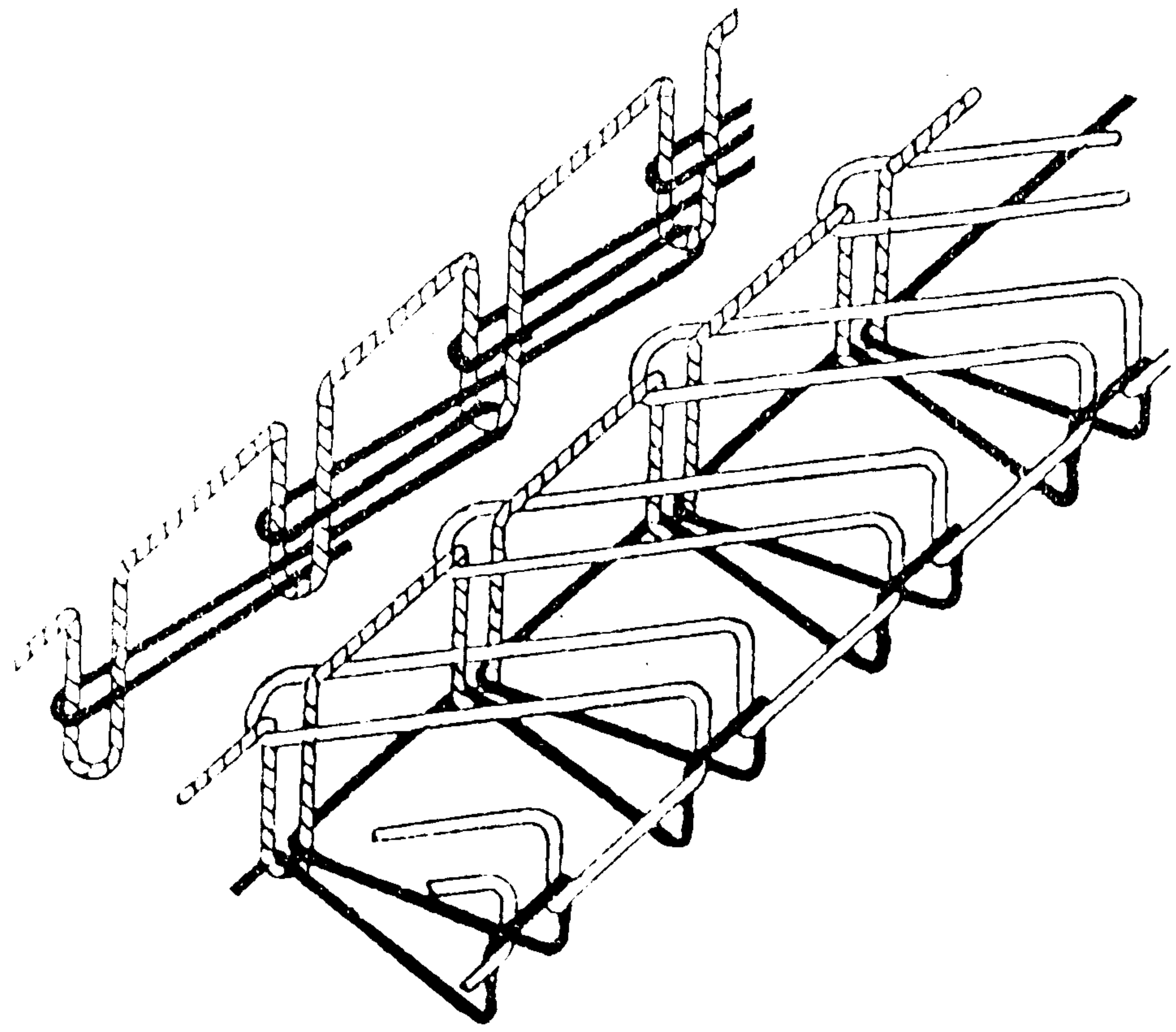


(g) Type 701 Single Thread Lockstitch

Figure 1.1 Common Machine-made Stitches (contd)



(h) Type 803 Combined Lockstitch and Overlock Stitch



(i) Type 802 Combined Chainstitch and Overlock Stitch from each other.

The British Standard Stitch Classes are designated by the first digit of a three digit number as can be seen from the above examples. Types of stitch within each class are designated and identified by the second and third digits.

Other seam specifications are stitch density, stitch length and run-in ratio.

a) "Stitch density" is defined as being the number of stitches in a unit length of seam and can be quoted in stitches per centimetre (stitches/cm).

b) "Stitch length" is defined to be the length of one stitch as it appears in the fabric (sometimes given in millimetres (mm)).

c) "Run-in ratio" is defined as the ratio of the "total length of thread used" to the "length of seam in the fabric".

In the present work stitch density is measured in stitches $(m \times 10^{-2})^{-1}$.

1.2.3 TYPES OF SEAM

The B.S.I[1] classifies seam types into four main groups represented by two capital letters. Again, each group contains several sub-group types of seam represented by lower case letters and numbers. The classes are as follows:

i) Type SS - superimposed

ii) Type LS - lapped

iii) Type BS - bound

iv) Type FS - flat.

Figure 1.2 illustrates one example of each of these four groups. In Figure 1.2(a) can be seen a plain seam (Type SSa-1), an example of a superimposed seam. A flat-felled seam (Type LSc-2) as an example of lapped seam is illustrated in Figure 1.2b. Figure 1.2c shows a bound seam (Type BSA-1), and Figure 1.2d shows a flat seam (Type FSc-1).

In the present work, all seams sewn were of the Type SSa-1.

1.2.4 TYPES OF STITCHINGS

The B.S.I.[1] definition of "Stitchings" contains two main classes:

i) OS - ornamental; and

ii) EF - edge finishing.

Examples of both types are shown in Figure 1.3. Each class contains a number of types. The complete designations also includes the stitch type, eg. stitching type 304-OSa-1 is an ornamental stitching of type 'a' using the row of stiches of type 304 zig-zag lockstitch.

1.2.5 OTHER TYPES OF STITCHES

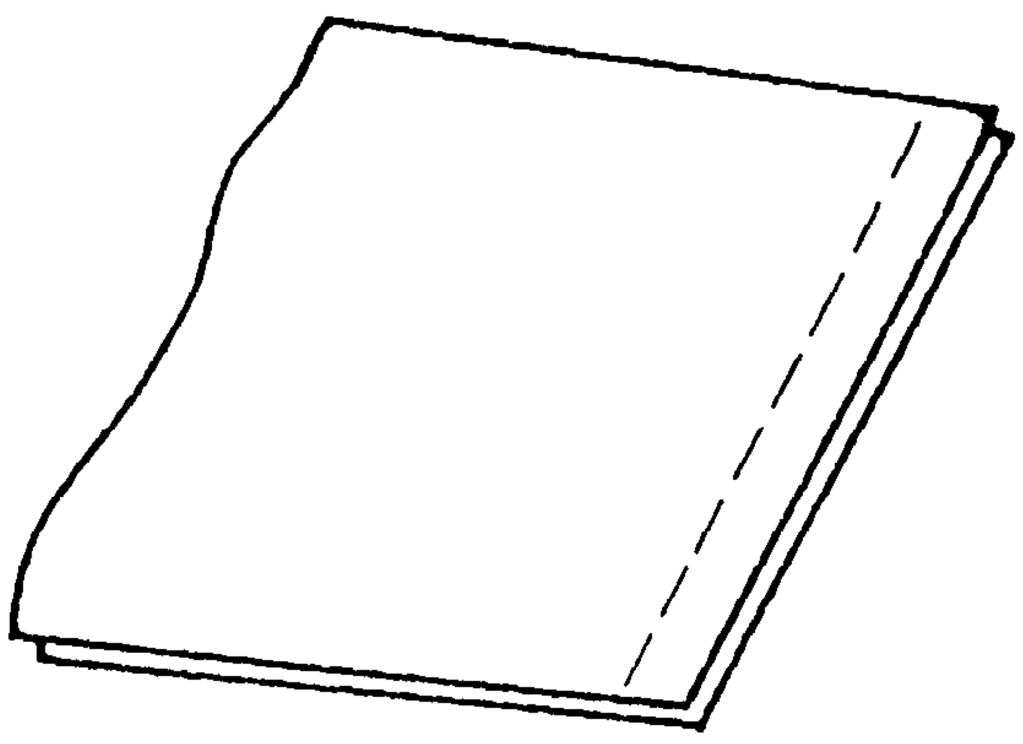
Atkinson [2], illustrates three more stitches in addition to those shown in B.S.3870. These stitches are:

i) the interlock stitch as shown in Figure 1.4a, a two or three needle structure used extensively in the knitwear industries for application of all types of trimmings, elastics etc.;

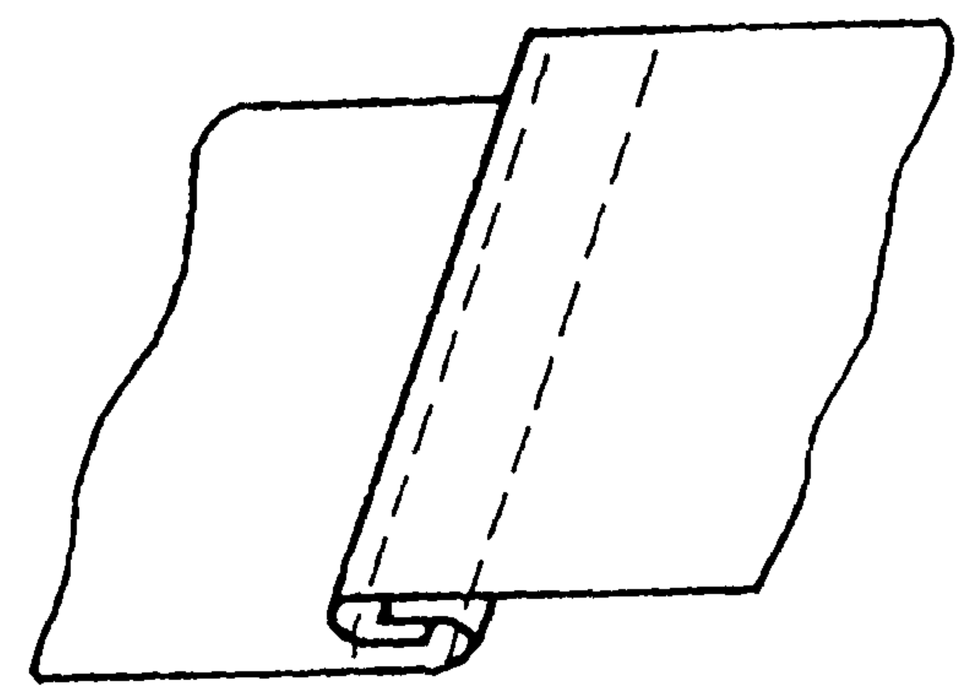
ii) a second interlock stitch as shown in Figure 1.4b, using four threads, the fourth being a cover thread; and

iii) an OV stitch, shown in Figure 1.4c, which is a modified form

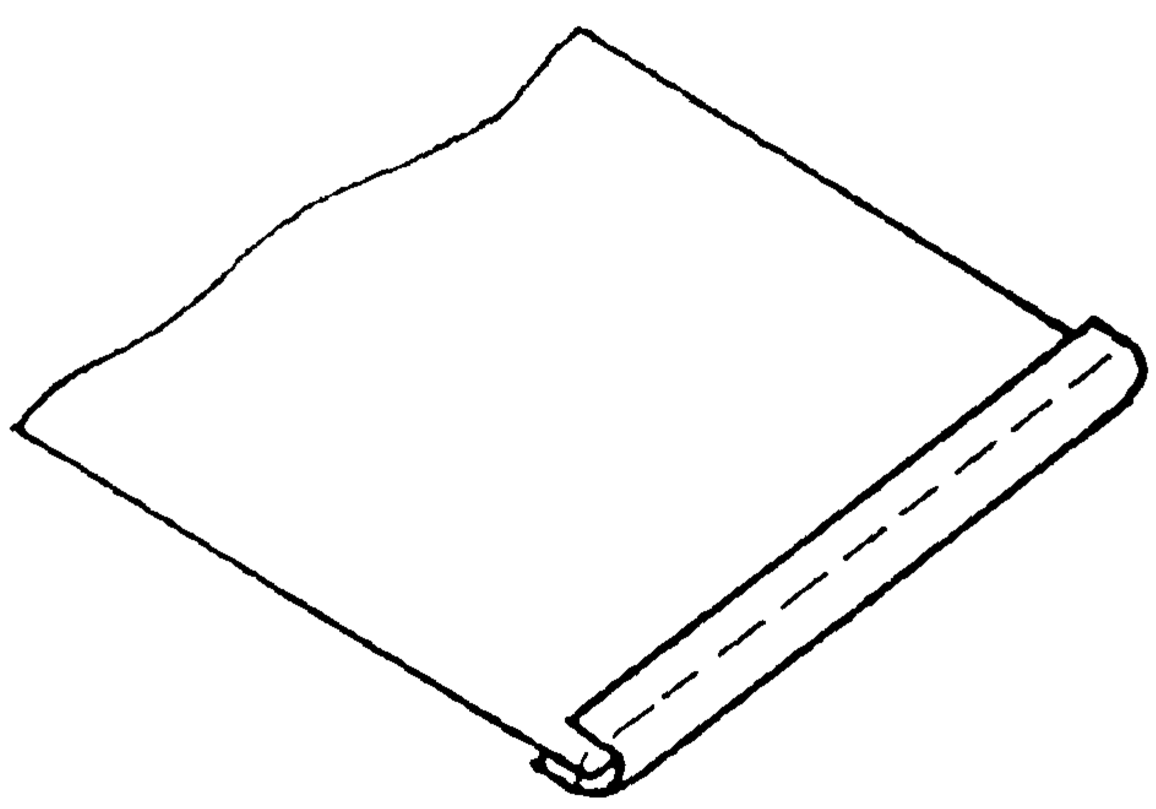
Figure 1.2 Four Common Types of Seam



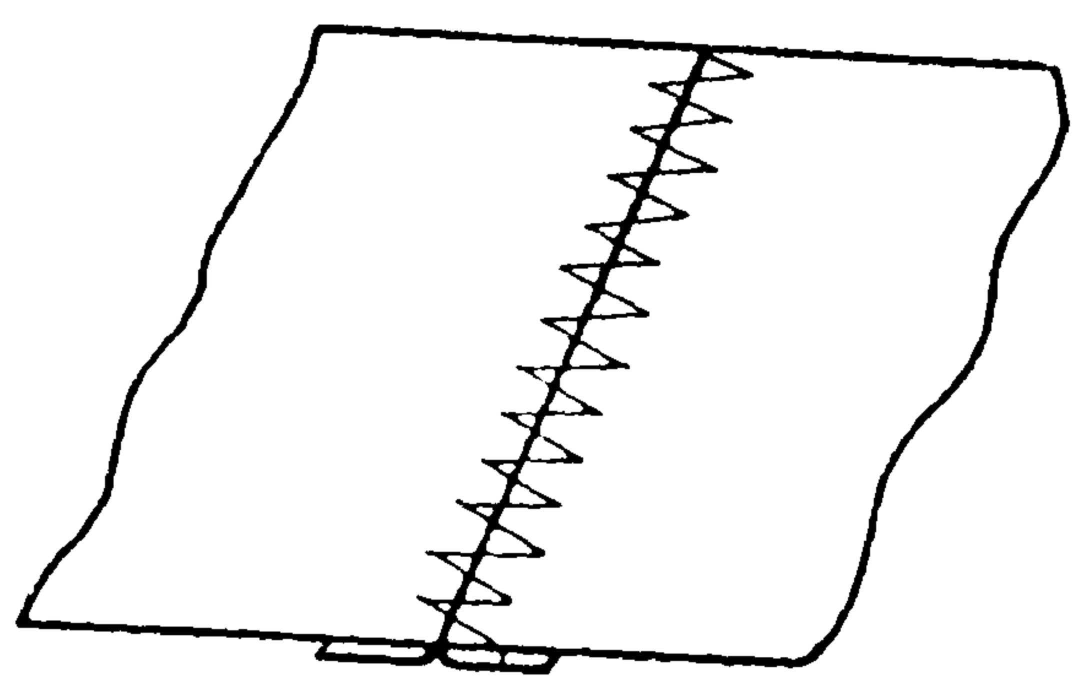
(a) Type SSa-1
Plain Seam
(Superimposed seam)



(b) Type LSc-2
Flat-felled Seam
(Lapped Seam)

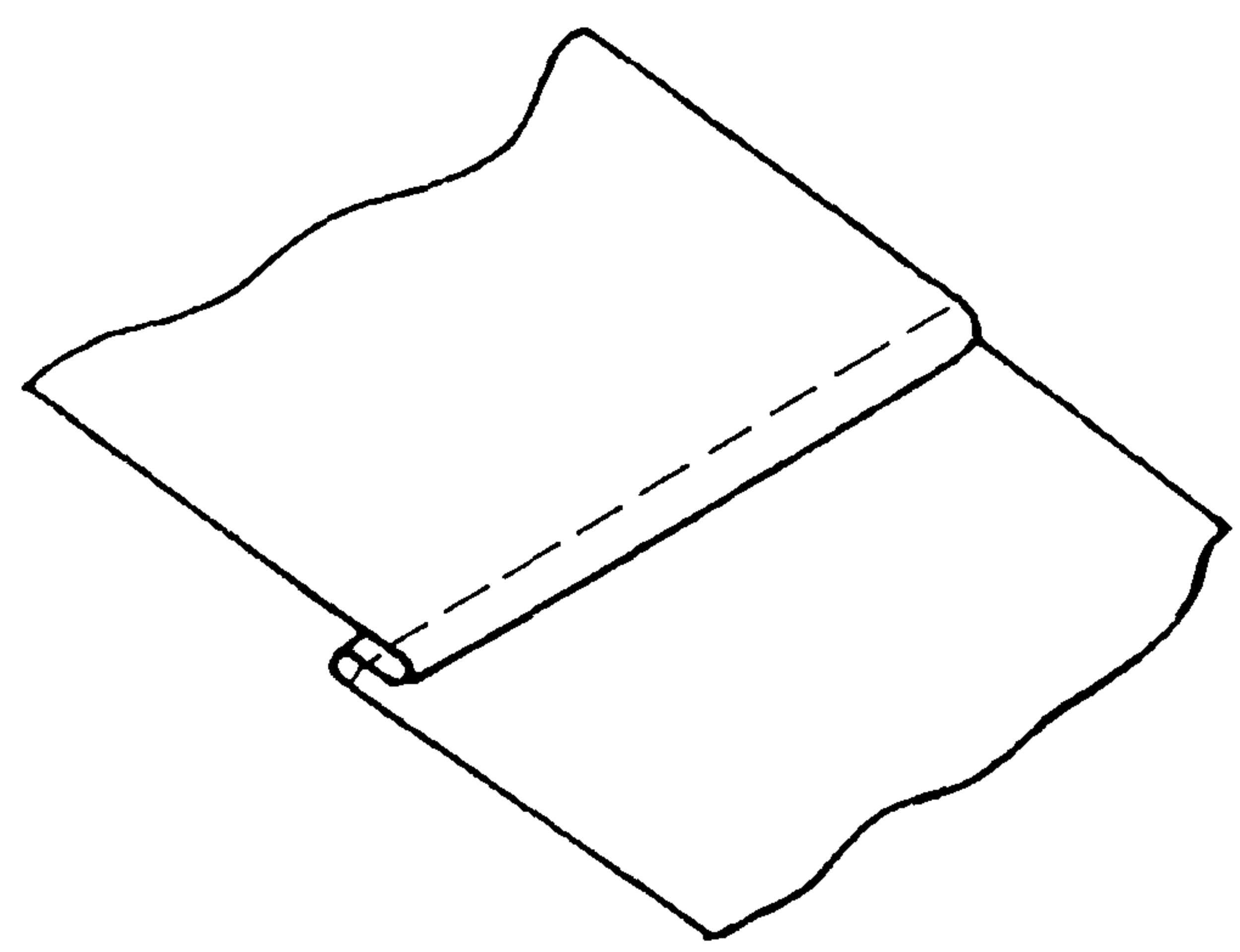


(c) Type BSa-1
Bound Seam

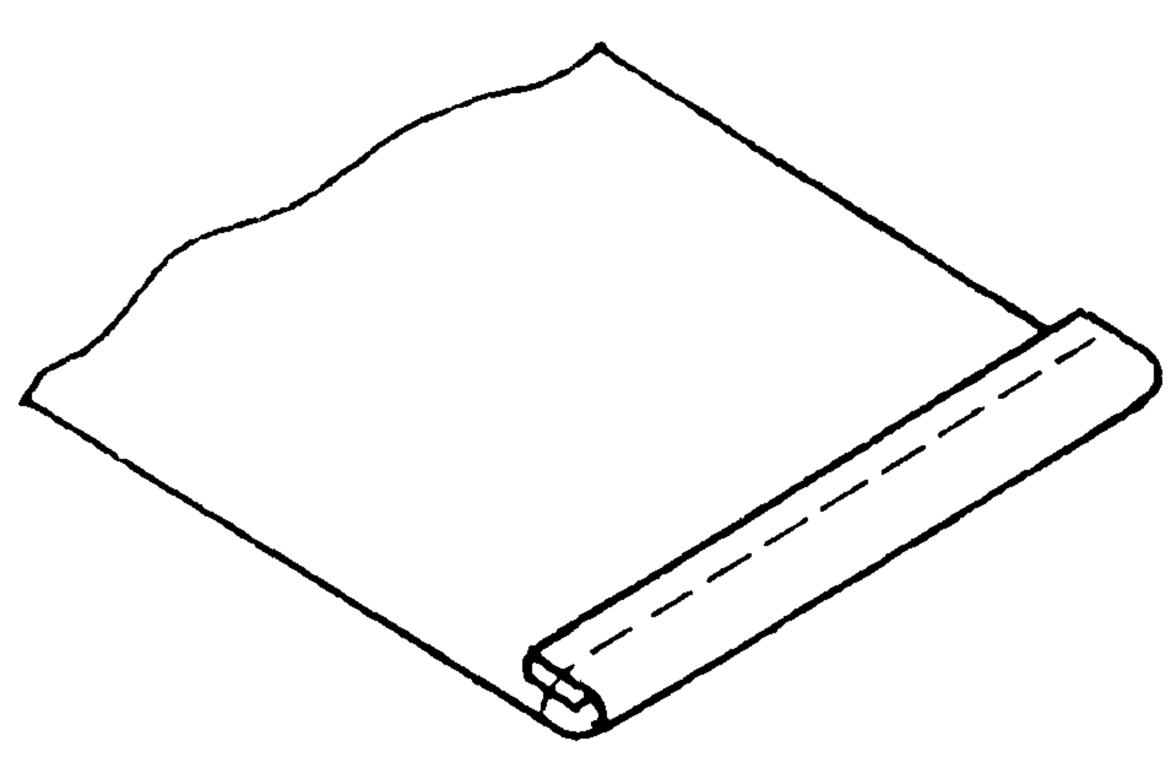


(d) Type FSc-1
Flat Seam

Figure 1.3 Two Common Types of Stitching

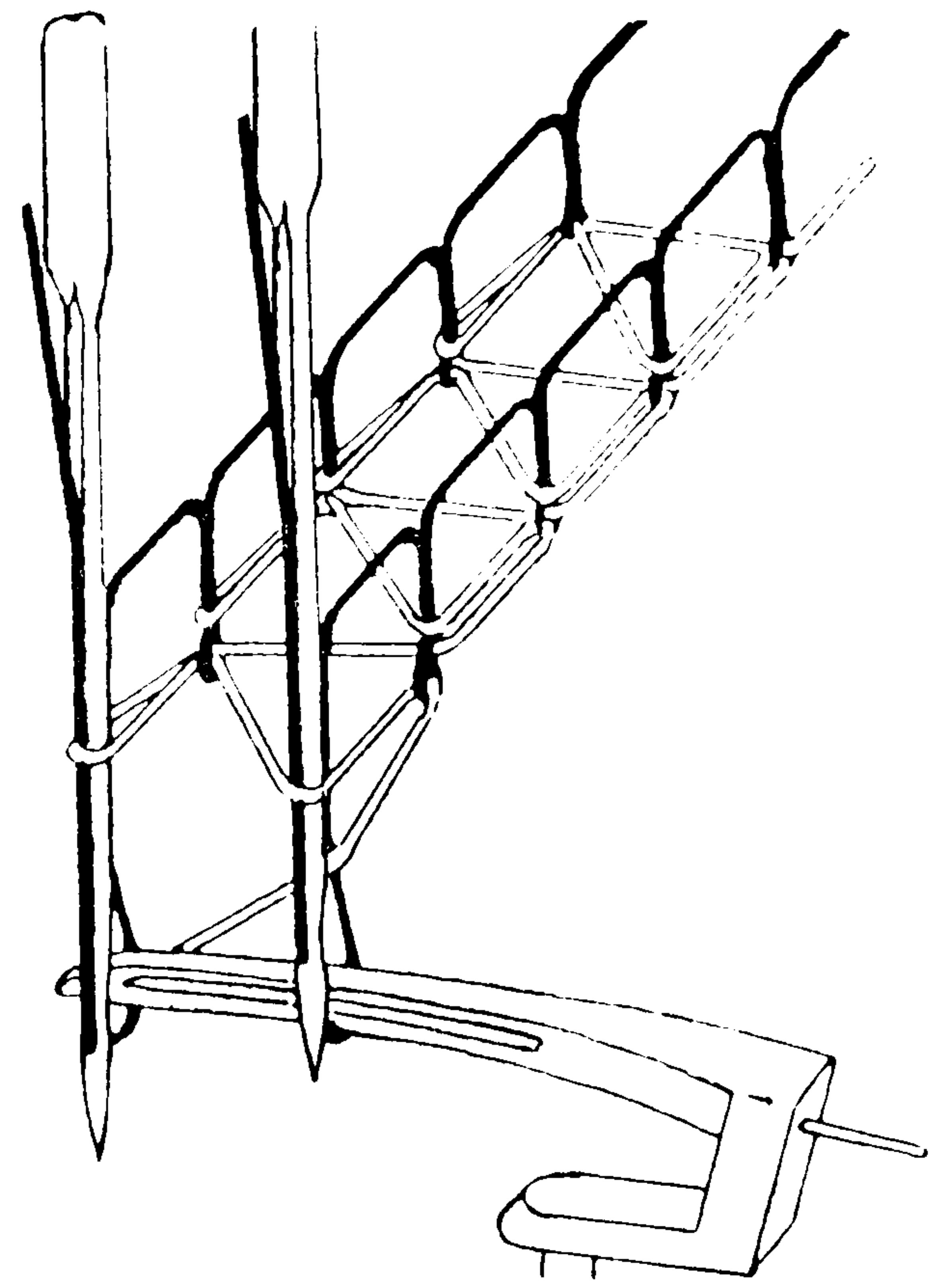


(a) Ornamental Type OSa-1

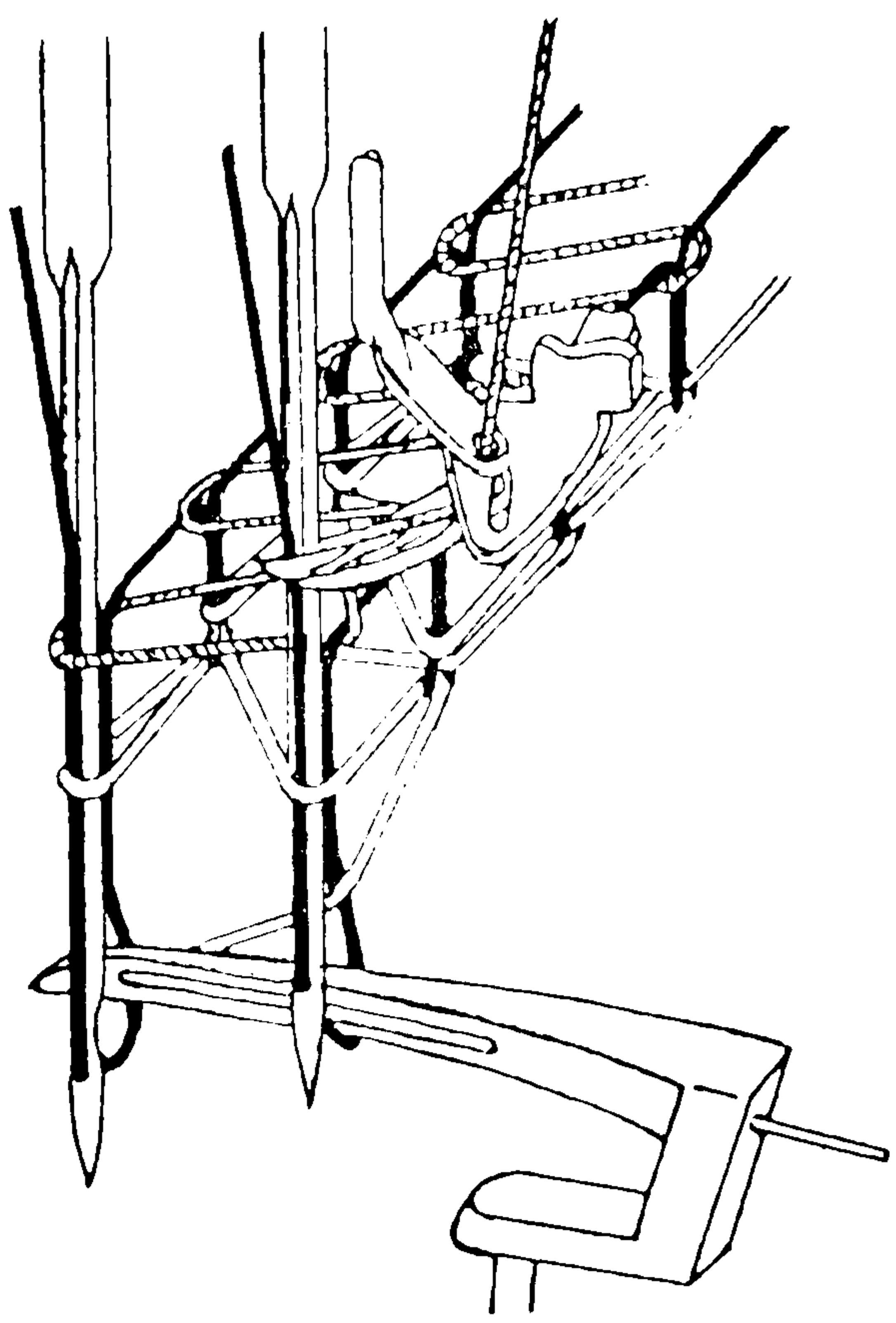


(b) Edge Finishing Type EFb-1

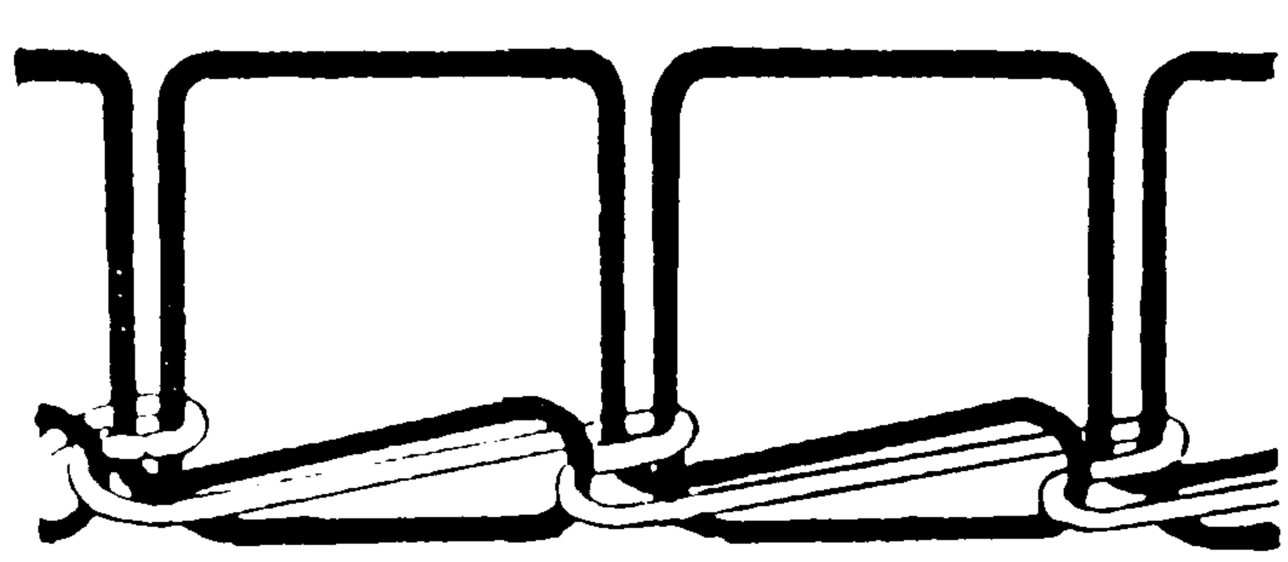
Figure 1.4 Three Modified Stitches for Knitwear



(a) Three-thread Overlock Stitch



(b) Interlock Stitch with a Fourth Cover Thread



(c) O V Stitch

of a double chainstitch produced on a cup seam machine. Its application is normally a special one for the production of fully fashioned knitwear and similar operations.

1.3 FORMATION OF THE TYPE 301 LOCKSTITCH SEAM

This type of seam was the one used extensively in this work and thus the author believes that it is important, at this stage, to describe the formation of seam Type 301 and the machine used to produce the seam.

The most common basic sewing machine for modern mass-production is a flat-bed lockstitch machine of the rotary hook type as shown in Figure 1.5. The basic components for the formation of stitch are the sewing needle, the feed dogs, the throatplate and the pressure foot, the rotary sewing hook, the bobbin and the bobbin case;

a) The sewing needle as typified in Figure 1.6 has the basic functions regardless of the class of stitch as follows:

   i) to penetrate the material, without damaging it, and to provide a hole through which the needle-thread may pass;

   ii) to carry the needle-thread down through the material and to form a loop in this thread through which the stitch forming element (eg. point of the rotary hook) can enter at the appopriate time;

   iii) on machines of the two-thread chainstitch or overlock types, to enter the looper-thread loop and assist in forming the stitch.

Figure 1.5 A Flat-bed Lockstitch Machine

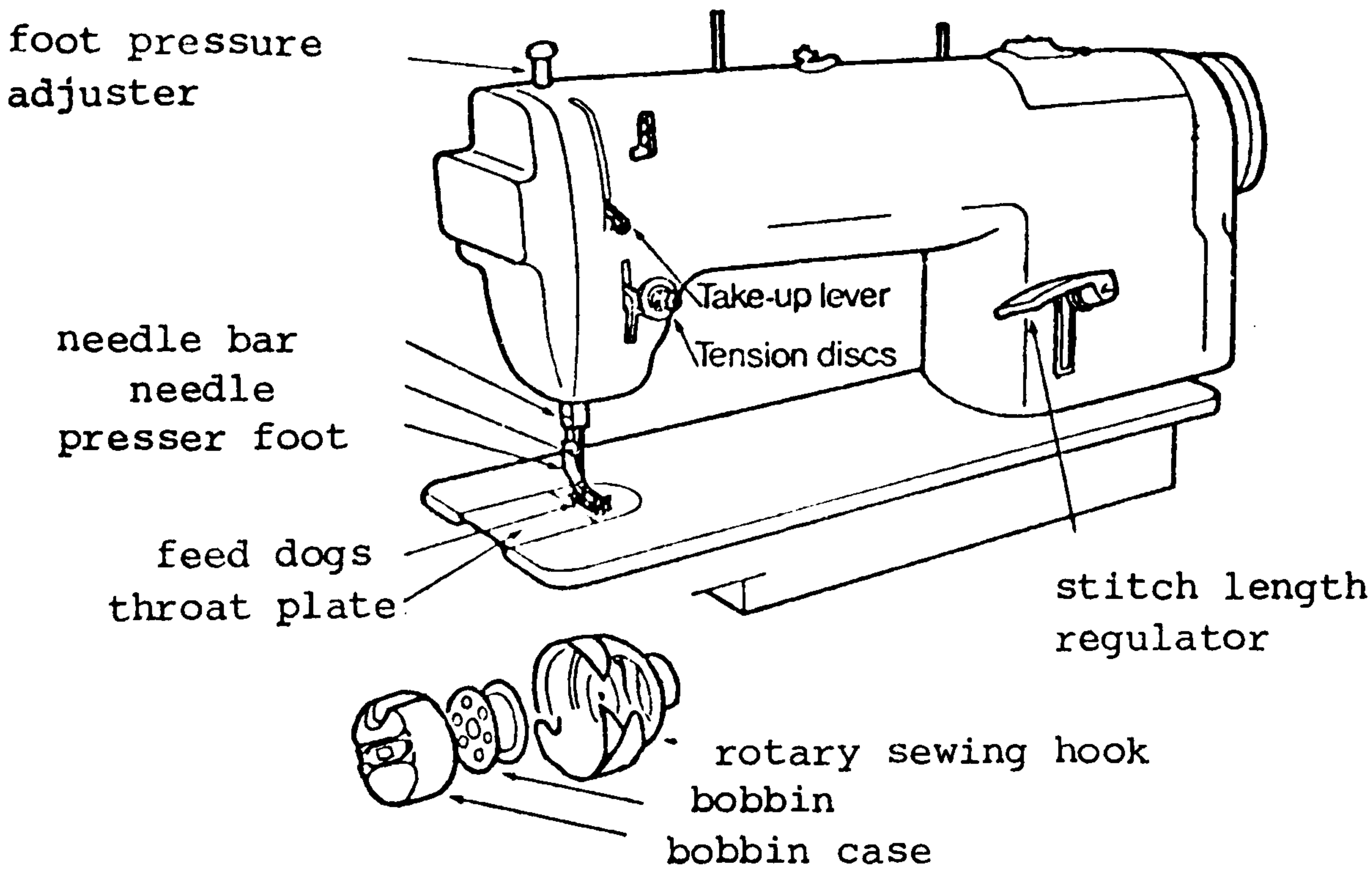
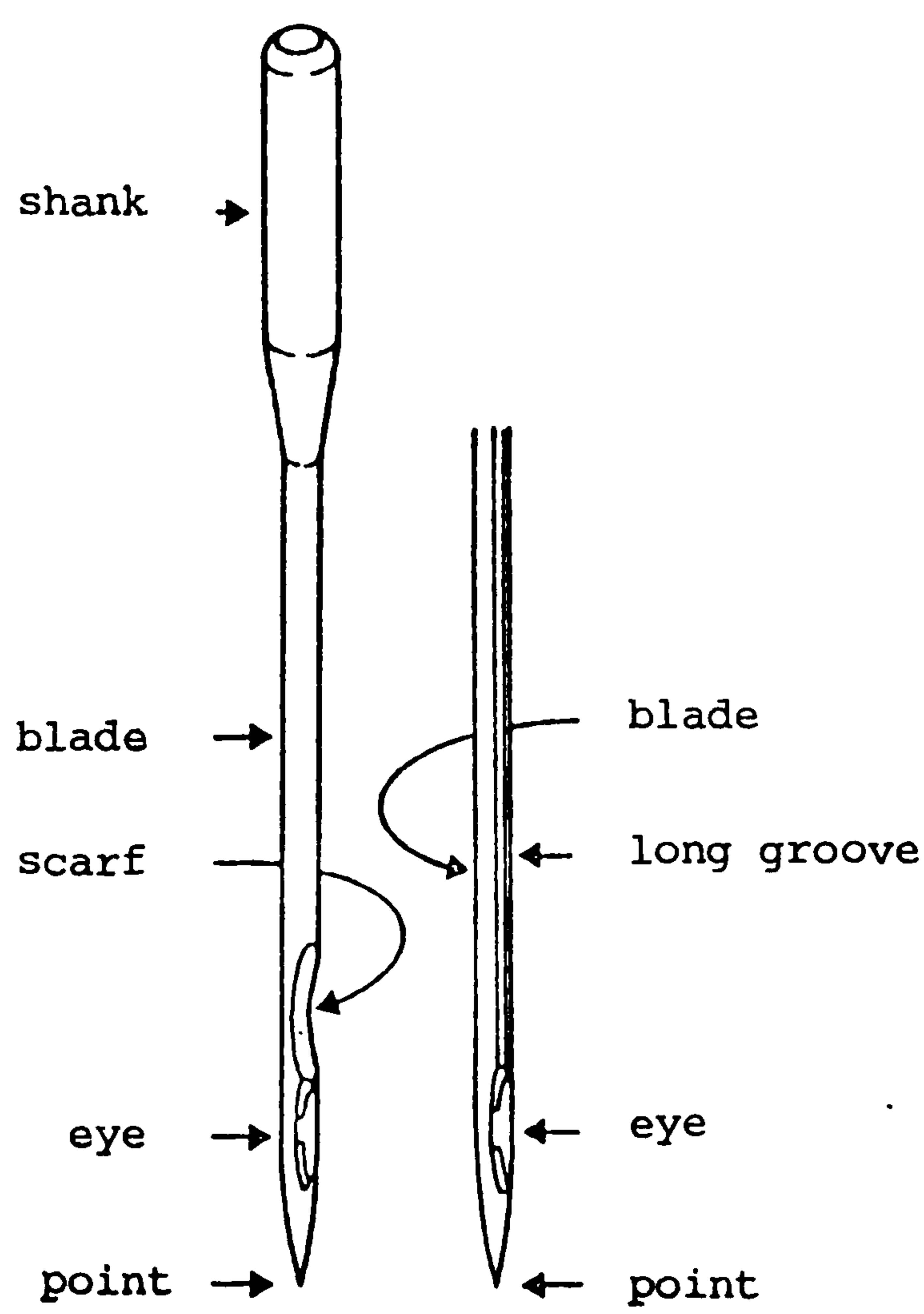


Figure 1.6 A Sewing Needle



b) The presser foot shown in Figure 1.7 has the function to hold the material firmly against the throatplate by means of a loaded spring and to prevent it from moving up and down or flagging as the needle ascends and descends.

c) The feed dogs, shown in Figure 1.8, have the purpose of moving the fabric forwards a predetermined distance between successive needle penetrations, thus helping it form a seam.

d) The throatplate shown in Figure 1.9, has the function to provide a smooth surface over which the material passes as successive stitches are made. The plate is provided with openings so that the feed dog can rise and engage the under surface of the material to commence forward action during the interval of each stitching.

e) The rotary sewing hook shown in Figure 1.10, has the function to carry the needle-thread loop around the bobbin-case and bobbin as it rotates, the inside of the loop slides over the face of the bobbin-case whilst the outside passes around the back to enclose the bobbin-thread.

f) The bobbin-case and bobbin shown in Figure 1.10, have the function of providing a space to contain a certain length of bobbin-thread, and the function of the bobbin-case is to keep the bobbin inside itself and tension the bobbin-thread whilst it passes through the case.

Figures 1.11 - 1.16 illustrate the lockstitch formation action of the machine. Unbalanced stitches are shown in the figures in order to simplify the presentation.

Figure 1.7 A Presser Foot

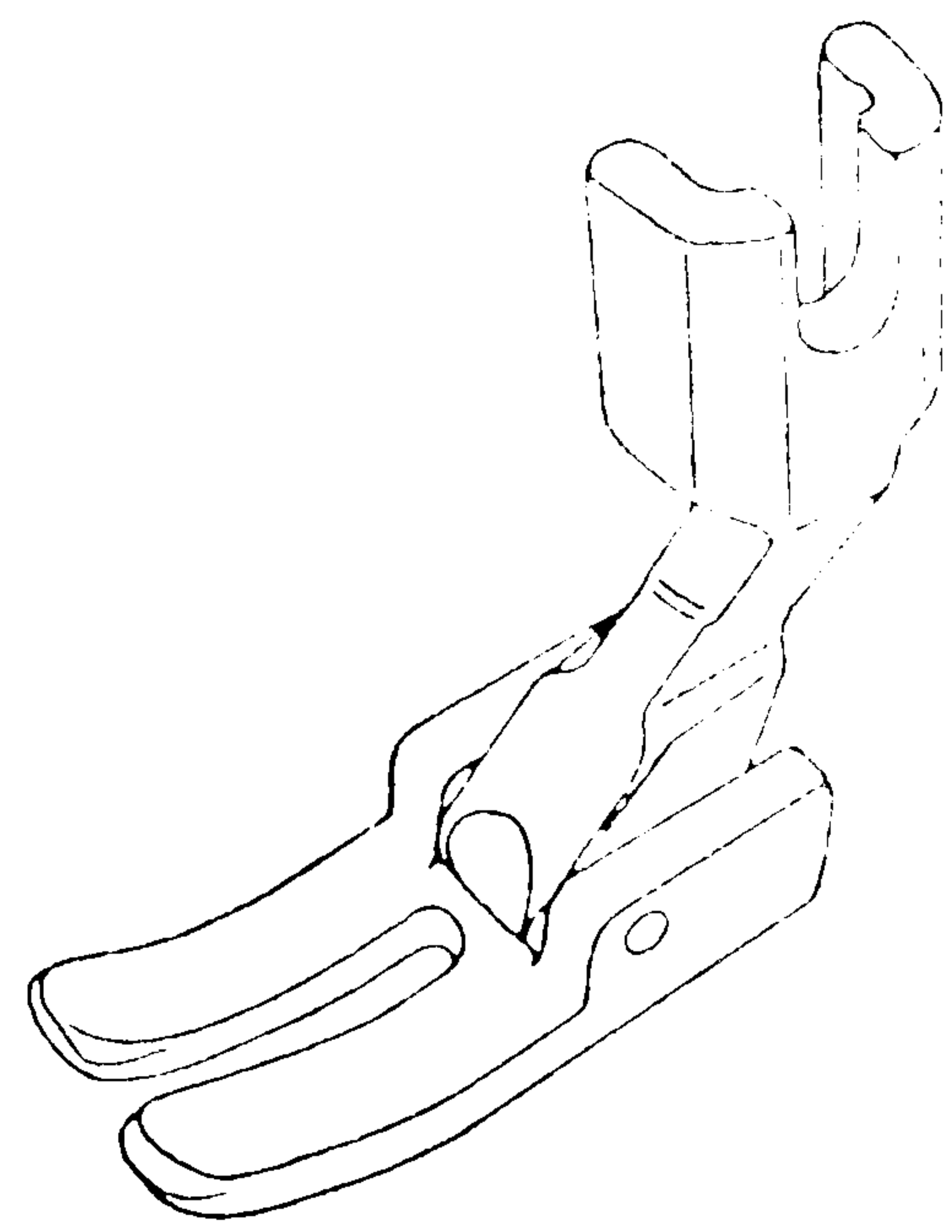


Figure 1.8 Feed Dogs with Drop-feed Motion

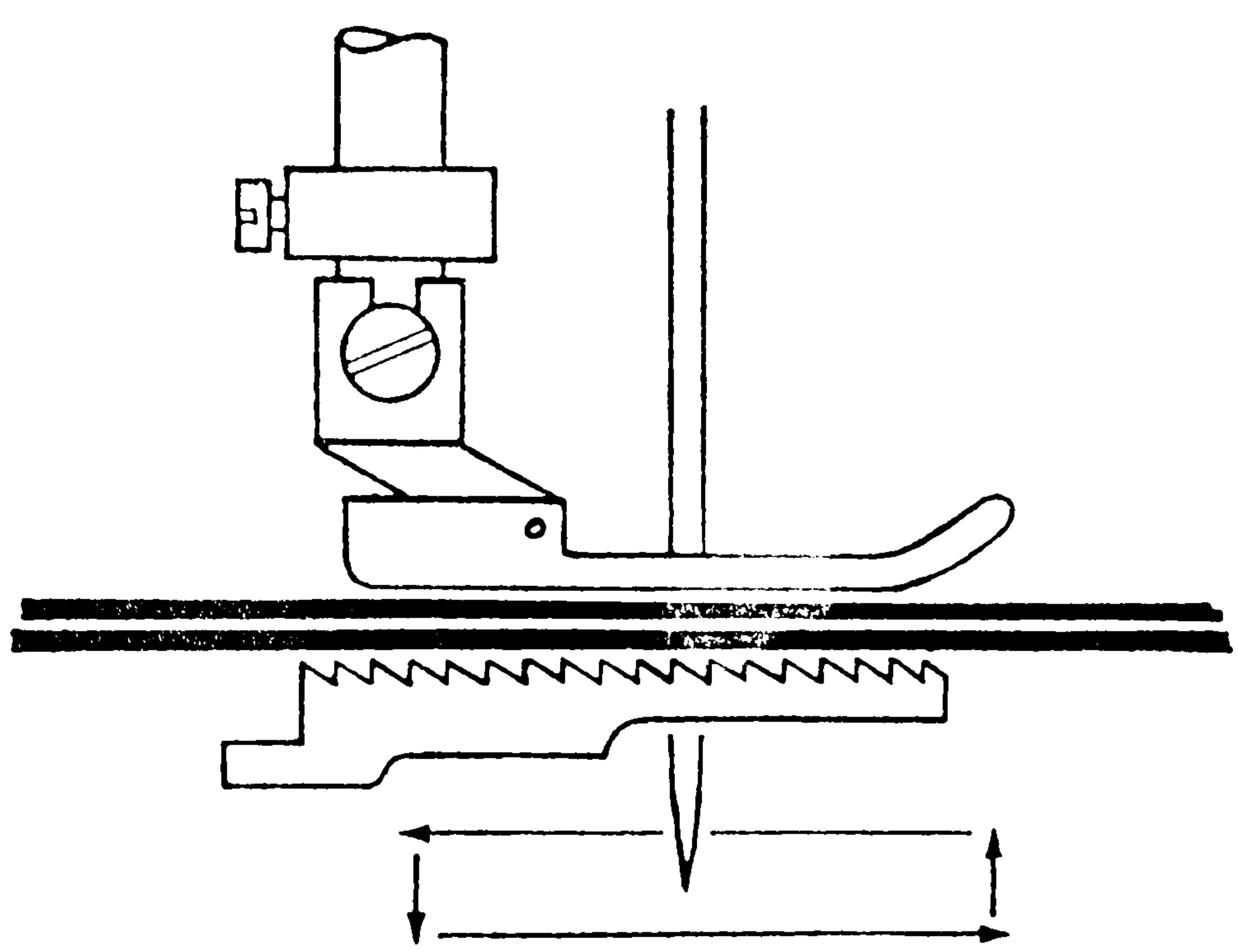


Figure 1.9 A Throat Plate

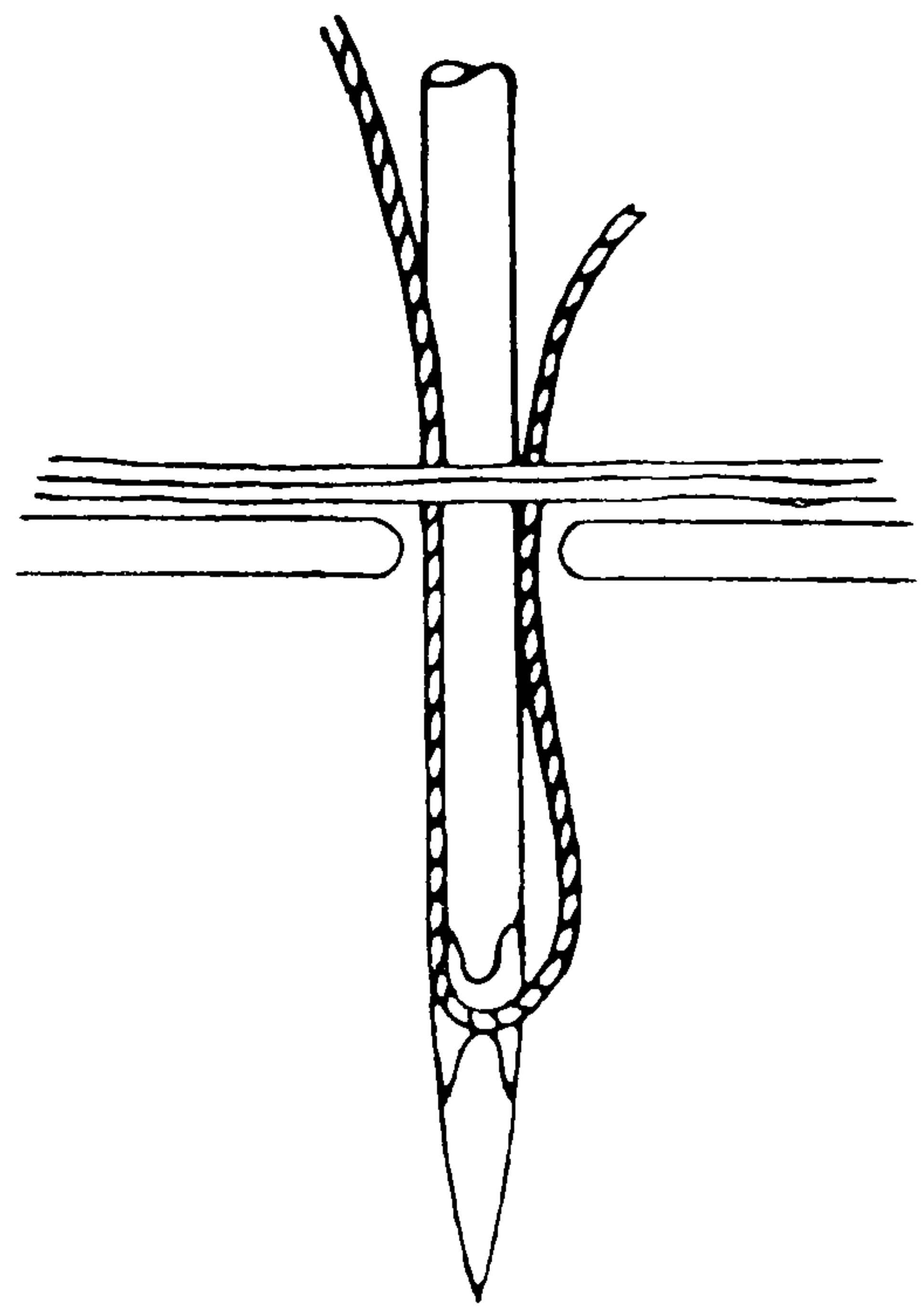
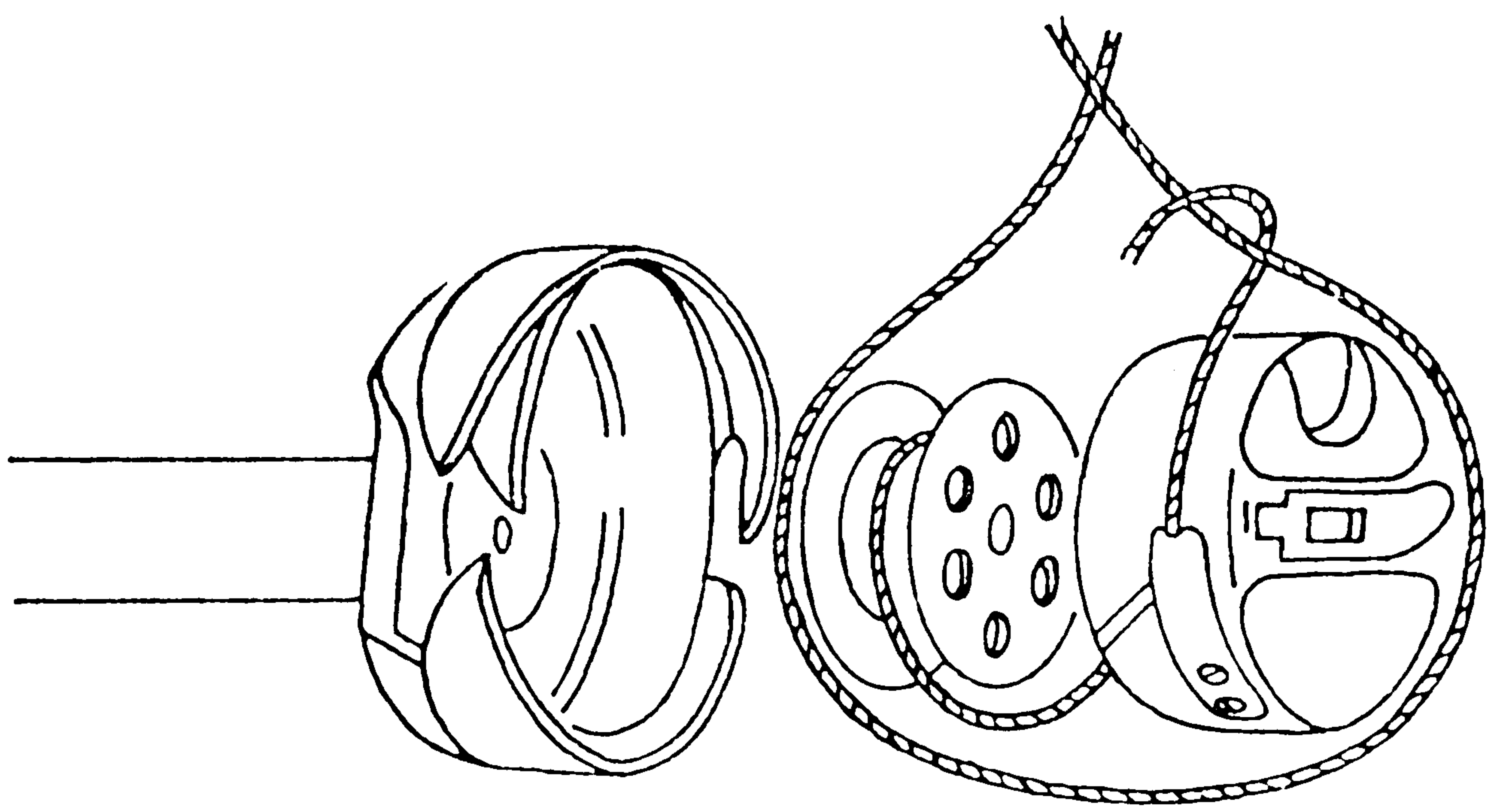


Figure 1.10 A Rotary Hook, a Bobbin Case and a Bobbin



Step 1 - the needle is at its highest point and is about to commence its descent.

Step 2 - the needle penetrates the fabric and the needle-thread underneath the fabric will be caught by the sewing hook.

Step 3 - the needle commences to rise and the thread take-up lever descends to permit the loop to be carried around the bobbin

Step 4 - the needle is cleared from the fabric, and the needle-thread loop commences to encase the bobbin and the bobbin-thread.

Step 5 - the needle rises to its highest point, the thread take-up lever commences its ascent to lift the loop off the sewing hook. The feed dogs start to engage the fabric.

Step 6 - the needle is still at its highest point, the thread take-up lever rises to its highest point in order to tension the needle and bobbins-threads to form a lockstitch, and the fabric is pushed back a stitch distance by the feed dogs.

1.4 THE NEEDS OF STITCHES AND SEAMS FOR GARMENTS

The principles of garment construction concern the assembly of fabric parts (mainly by sewing) to make a garment, the addition of working parts to enable the wearer to put on and take off the garment, the decoration of the garment by stitching on the surface of the fabric, and the insertion of pockets whether decorative or functional. Much of the technique of garment construction is designed to ensure the continuous finished appearance of the product.

Figure 1.11 Formation of Lockstitch Seam - Step 1.

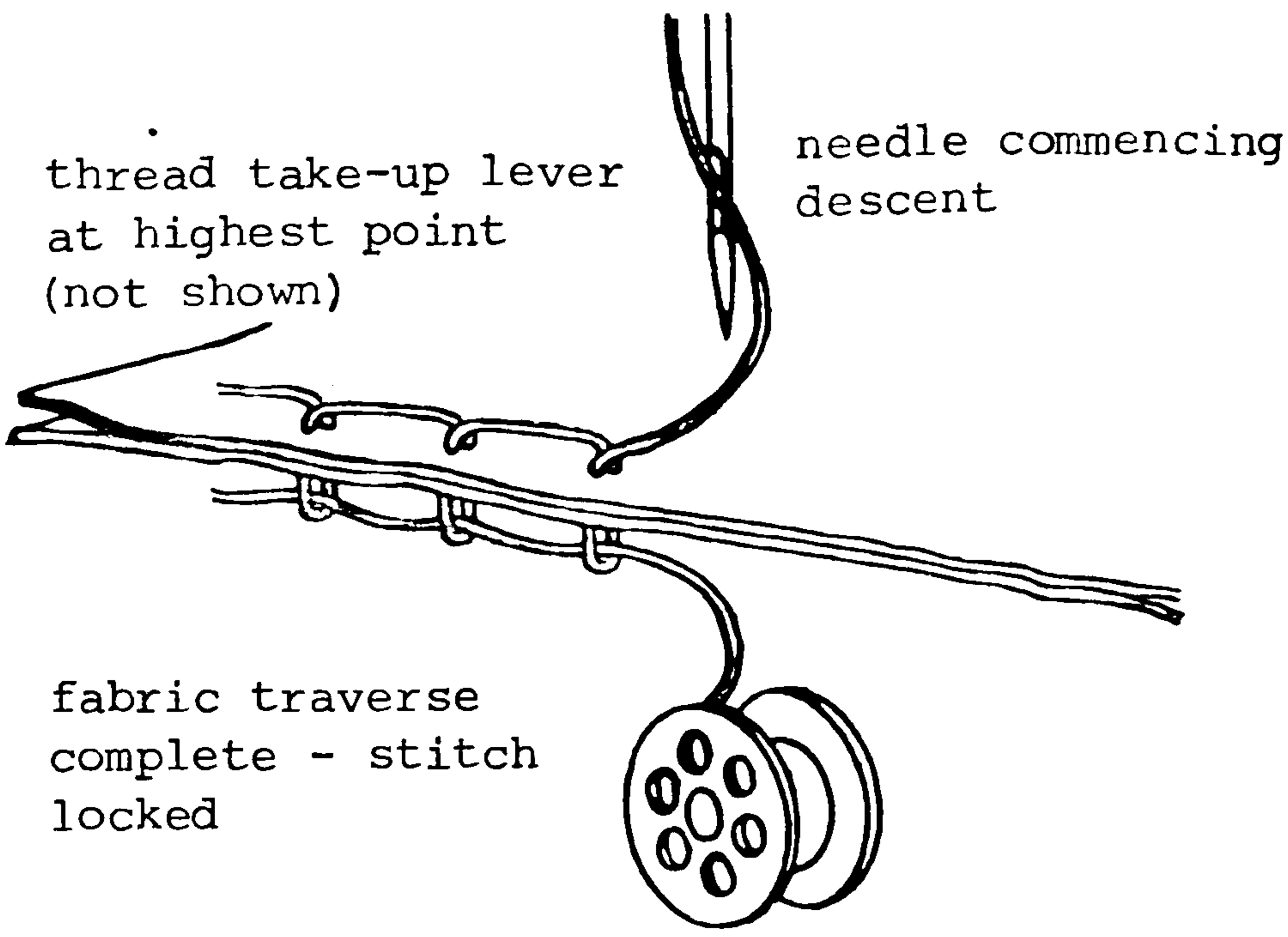


Figure 1.12 Formation of Lockstitch Seam - Step 2.

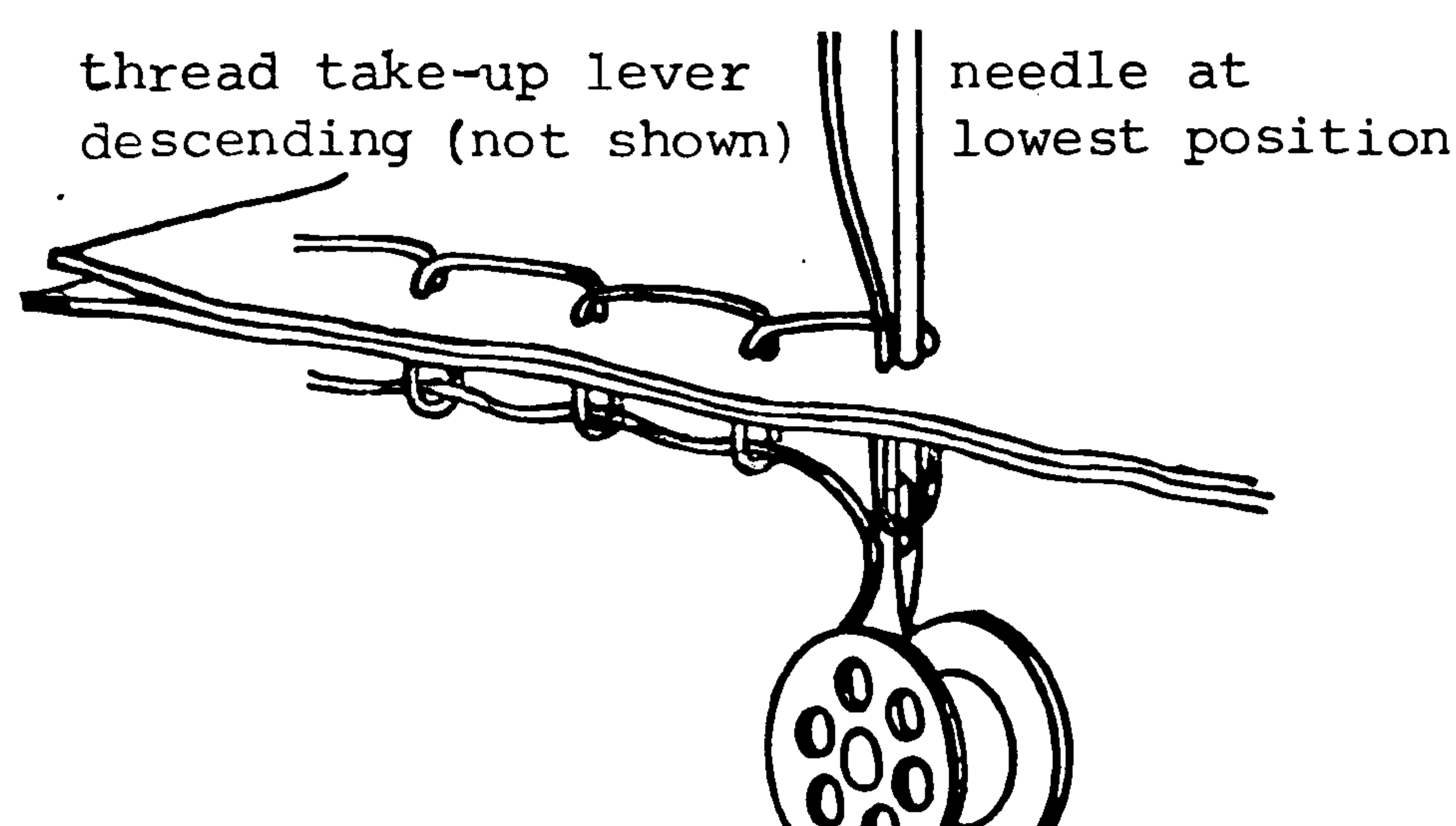


Figure 1.13 Formation of Lockstitch Seam - Step 3

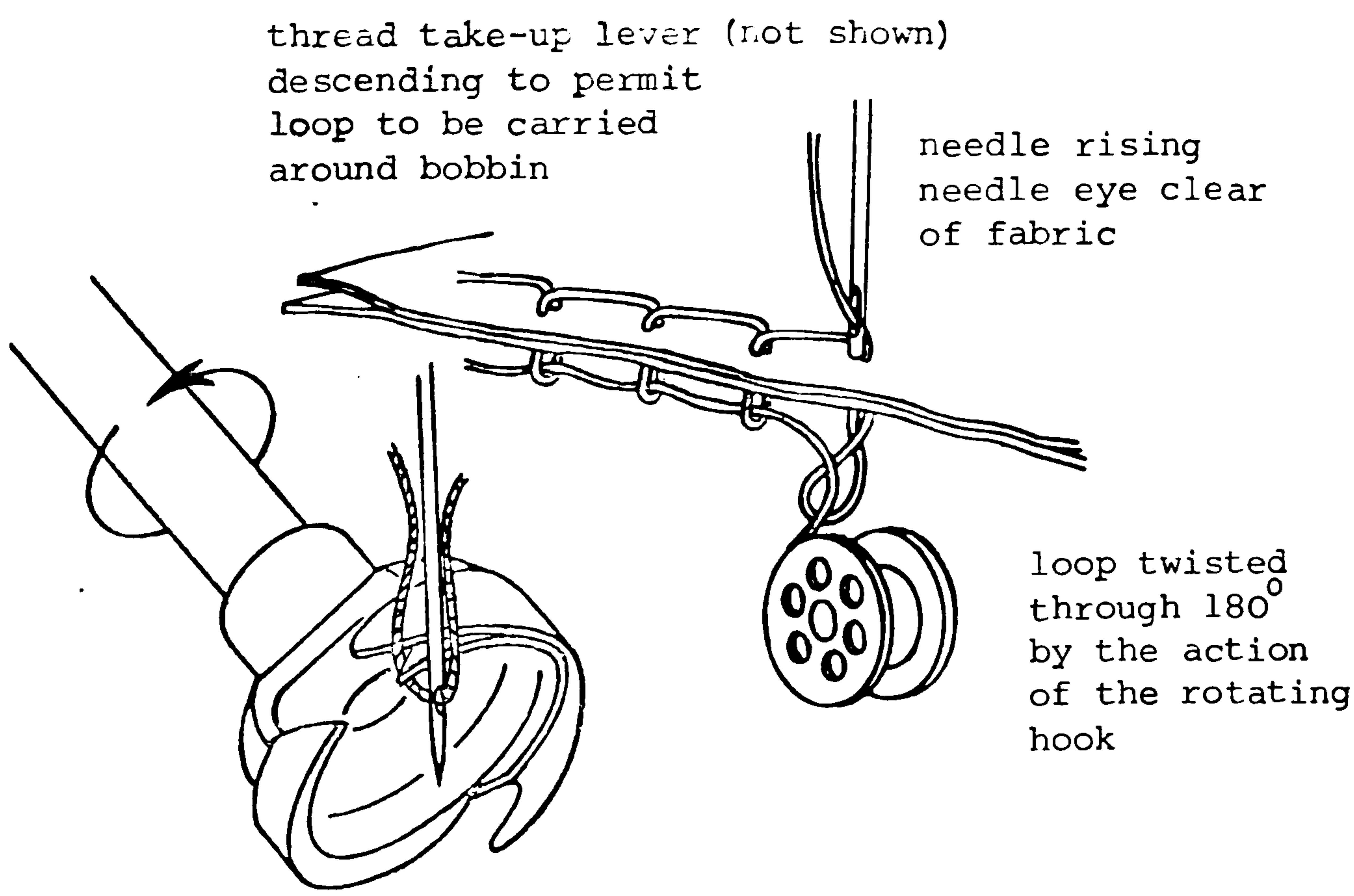


Figure 1.14 Formation of Lockstitch Seam - Step 4

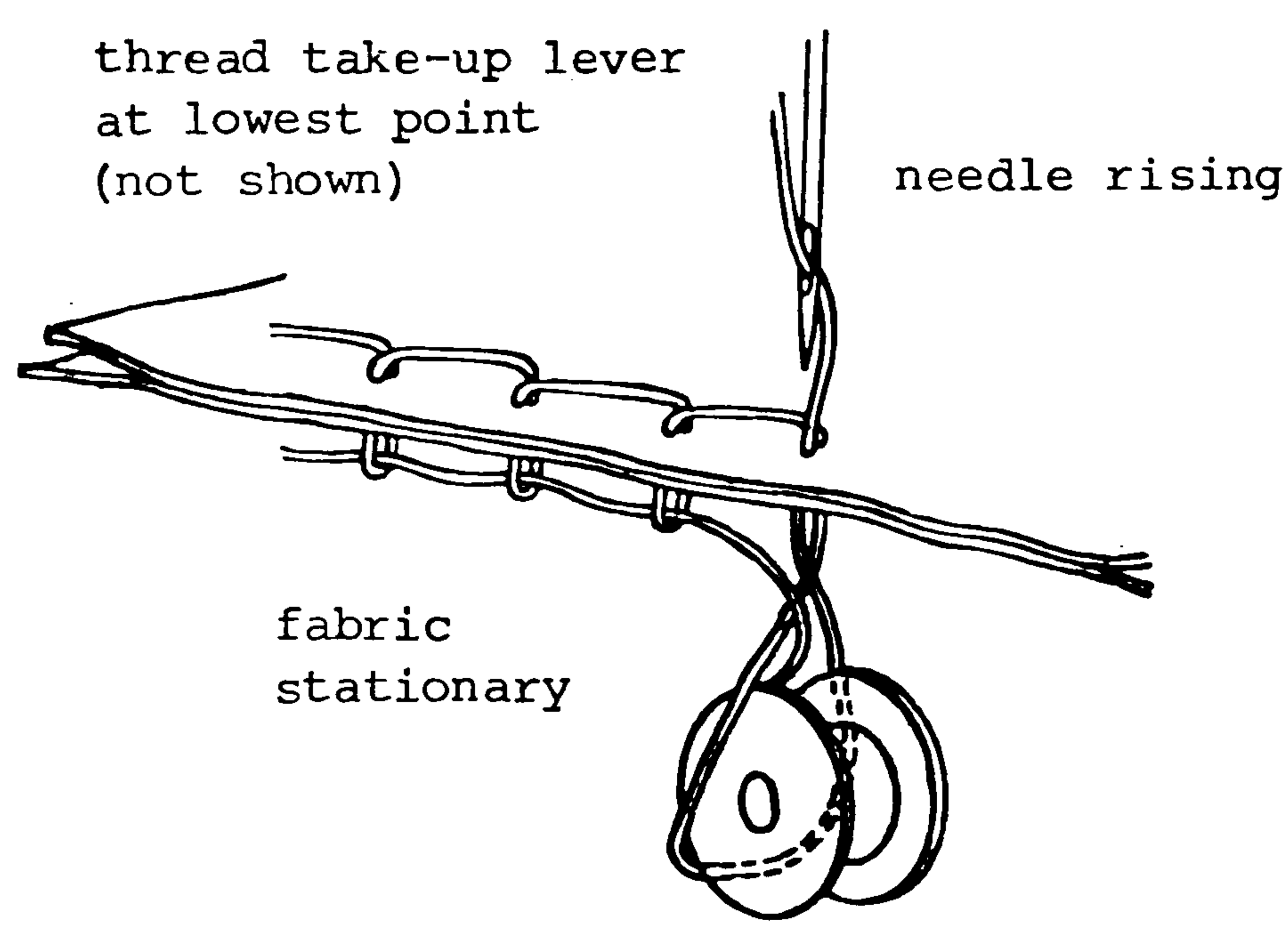


Figure 1.15 Formation of Lockstitch Seam - Step 5.

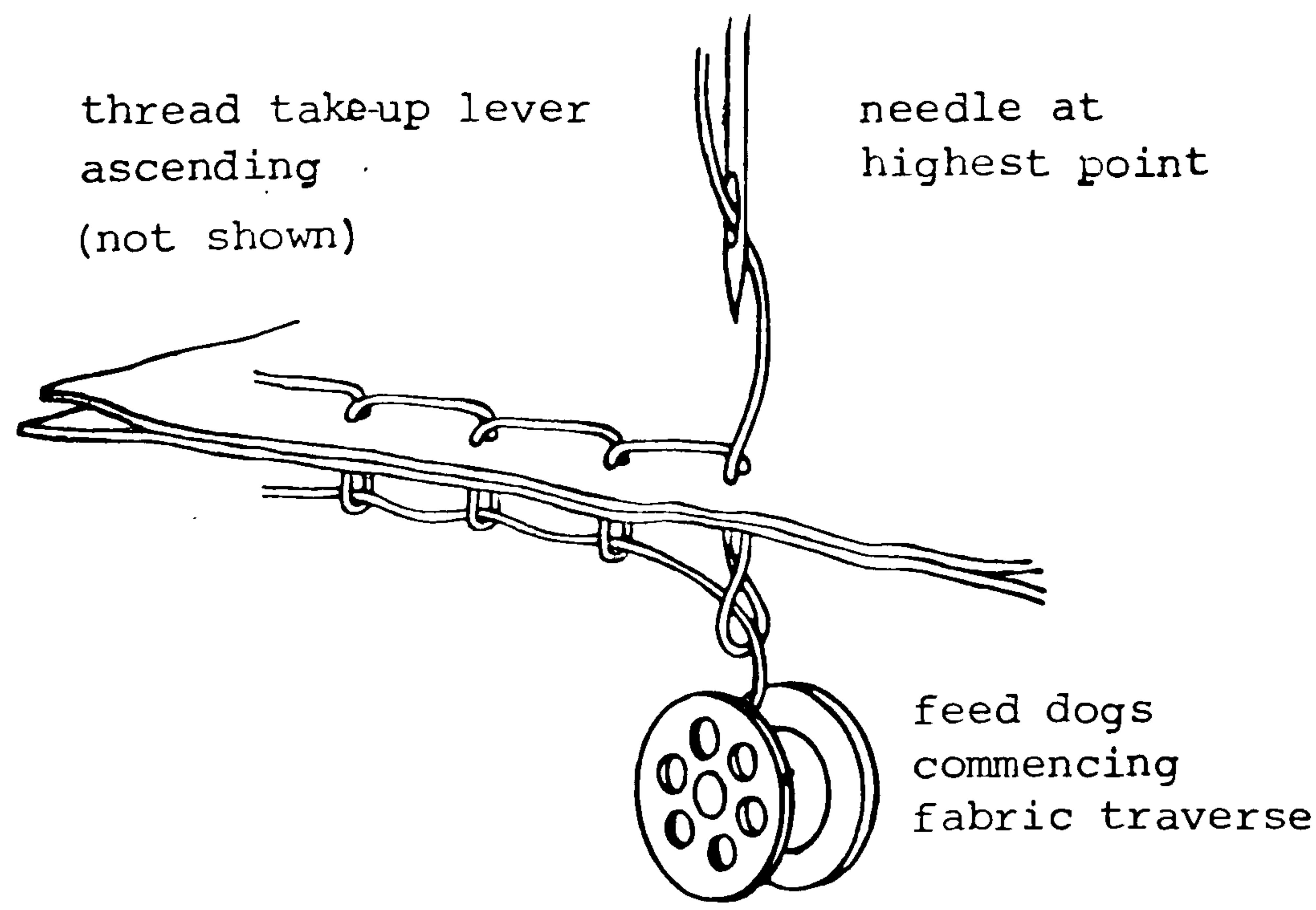
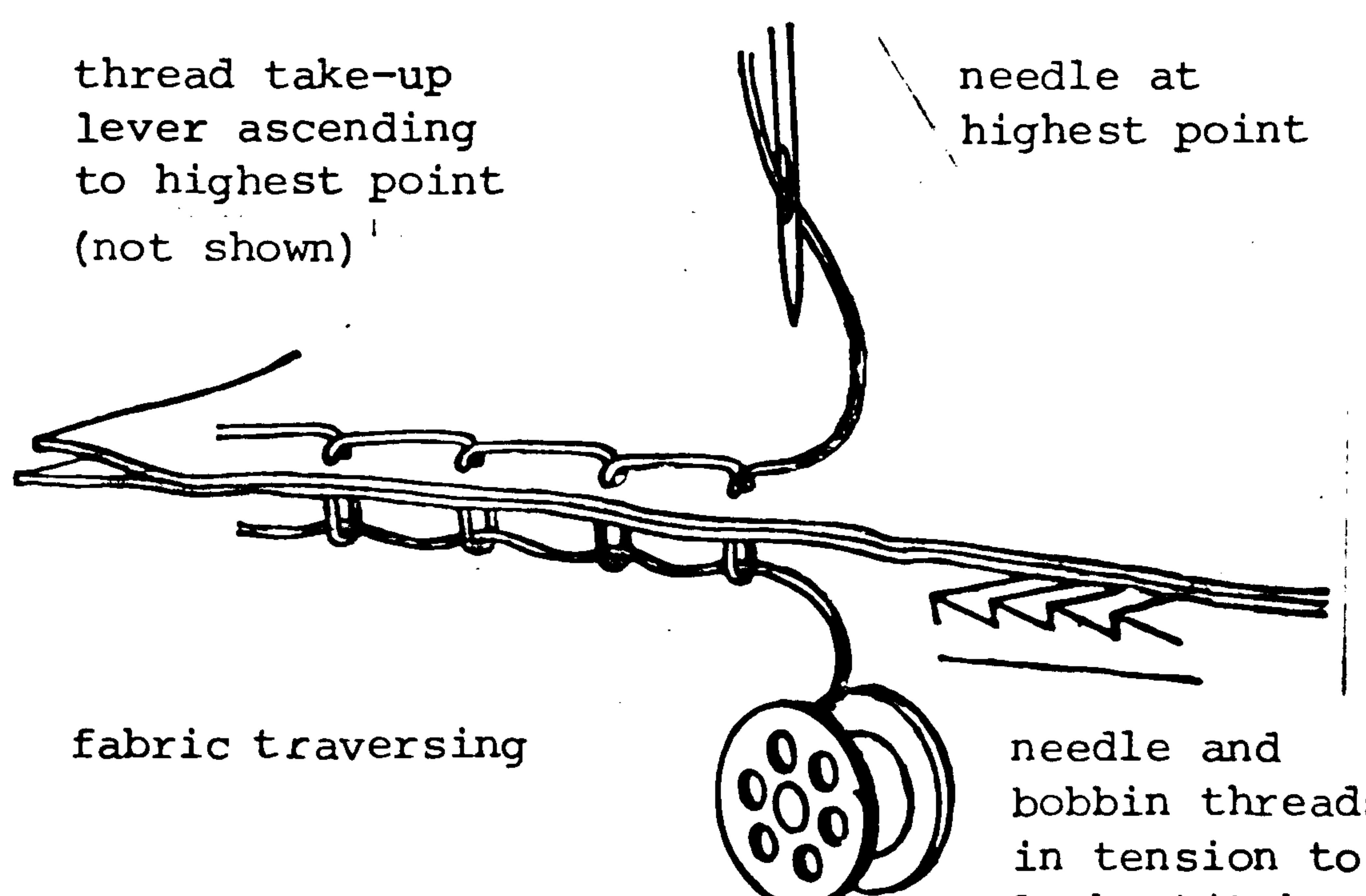


Figure 1.16 Formation of Lockstitch Seam - Step 6.



A seam is designed to achieve or assist in all of the above objectives. After the fabric is cut into parts for assembly, the fabric edges are rough and unfinished and fray easily.

Various types of seam can be used.

i) The simplest form of seam involves overlocking (eg. a three thread overlock stitch, shown in Figure 1.1) the two edges together after assembling the pieces of fabric by a simple seam (eg. plain seam, SSa-1 shown in Figure 1.1) or overlocking the two edges separately before assembling.

ii) A safety seam (Type 802) shown in Figure 1.1,involves simultaneous overlocking and chainstitch, therefore the fabrics can be joined together and have the edges covered in one sewing operation.

iii) One development is the raised seam (LSg-2)shown in Figure 1.17. The method used is the same as the plain seam, but one of the inside edges is wider than the other. After sewing, instead of being pressed open, both edges are pressed to one side with the narrow edge underneath the wider. From the outside of the garment and with the seam correctly opened, a line (or lines) of stitching is formed parallel to the original seam, by a plain lockstitch seam or a decorative stitch seam. The raised seam is usually for decorative effect on jackets, trousers, overcoats and skirts.

iv) An alternative to the raised seam is the double seam or lapped seam (LSc-2 shown in Figure 1.2) sewn on a double needle machine with folders, whose function is to turn both

Figure 1.17 Seam Type LSg-2 (Raised Seam)

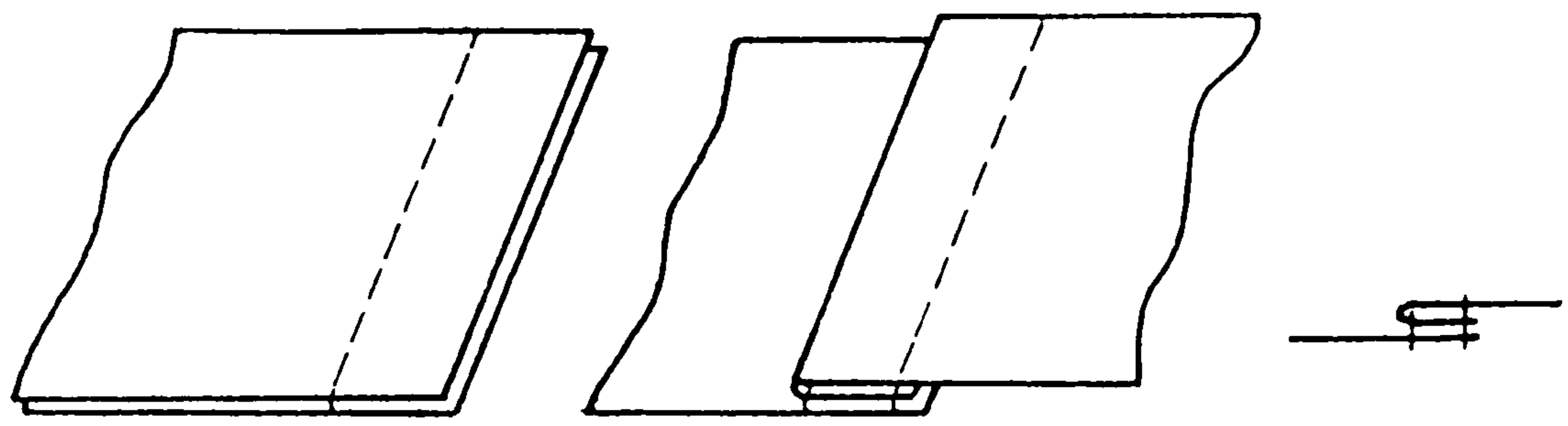


Figure 1.18 Seam Type LSa-2 (Flat Seam)

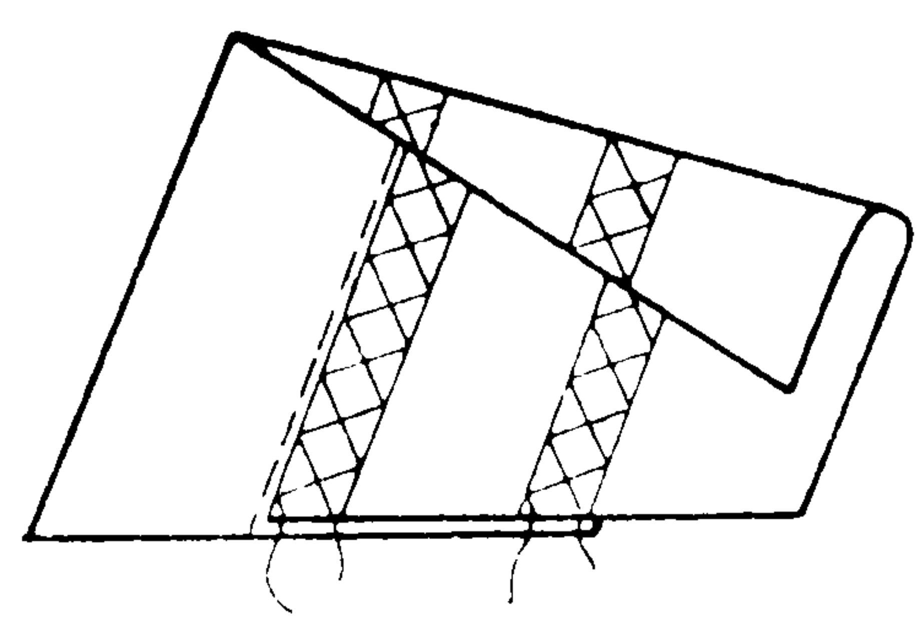
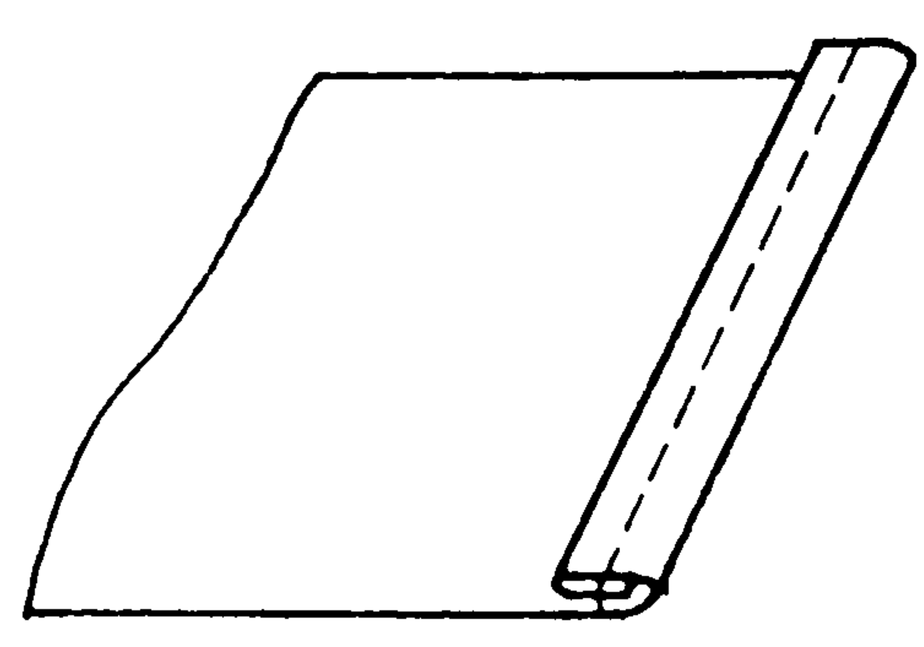


Figure 1.19 Seam Type EFb-1



raw edges of fabric into the space between the parallel lines of stitching. Both lines of stitching appear on the surface, and the seam looks the same from both sides. This seam is one of the strongest seams and is used in hardwearing and frequently washed garments, such as boiler-suits and jeans.

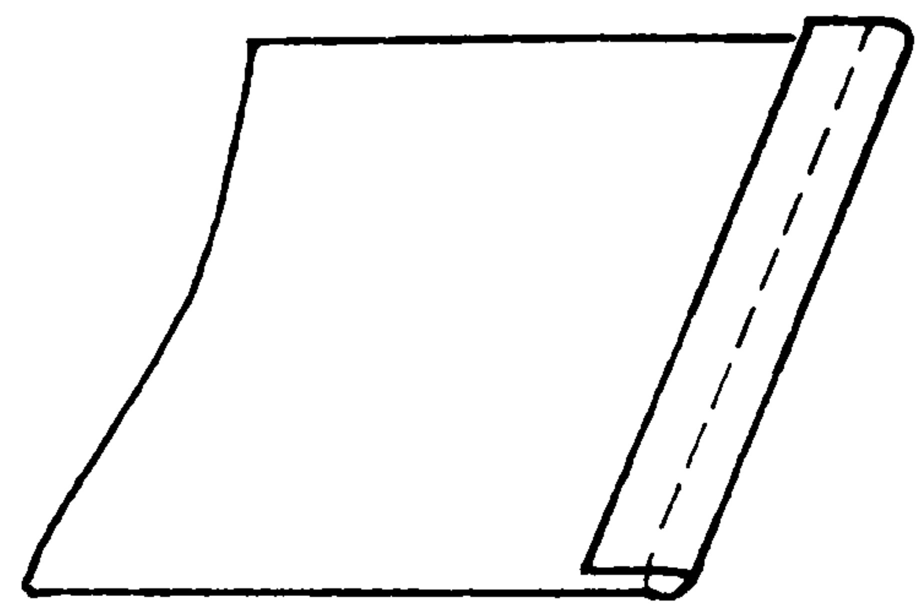
v) A flat seam (LSa-2) shown in Figure 1.18, is (basically) similar to the double seam. With the raw edges overlapping, the edges finish within the throw of the flatlock stitch, and are covered by it. A lot of seams of this type can be seen in knitted fabrics for men's underwear.

vi) To finish the bottom of a knitted garment or an overcoat made of naval melton, the stitching is EF b-1 shown in Figure 1.19, by turning over the edge twice, thus enclosing the raw edge, and secure the inner turned edge to the outer fabric by one (or two) line of plain lockstitch, as in some shirts, or by the blind stitch as in some parts of jackets.

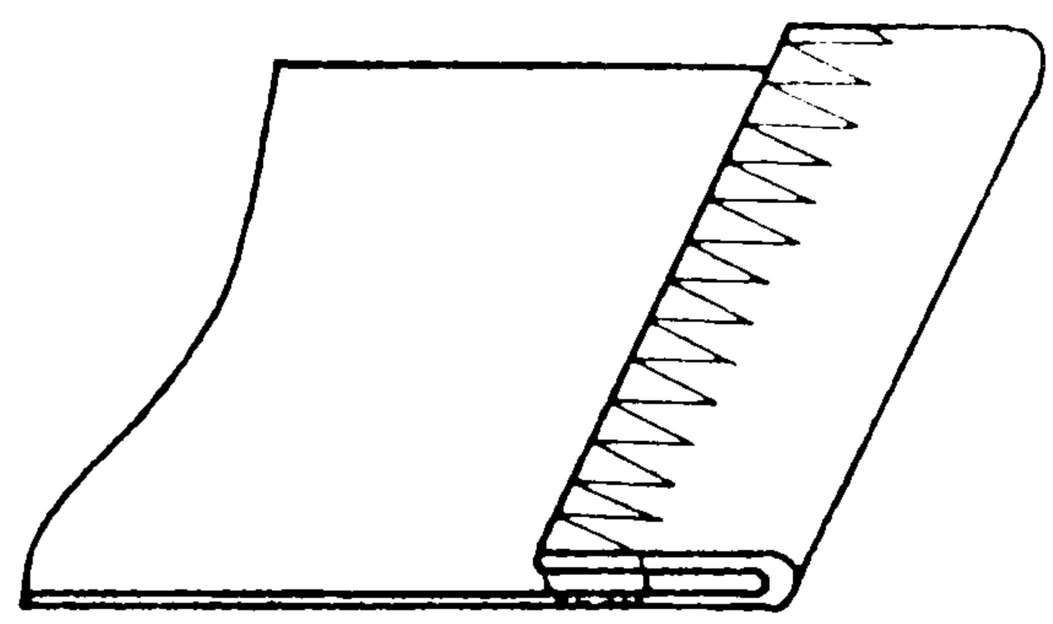
vii) Another alternative is stitching types EFa-1 and EFl-1, shown in Figure 1.20, the raw edge of the fabric may be finished by overlocking, or covered by tape, turned up and secured by a lockstitch seam as stitching type EFa-1 or by a blindstitch seam as stitching type EFl-1.

viii) Seam type BSa-1 shown in Figure 1.21, involves the edge enclosed by woven edge tape, perhaps continuous with front edges of a coat, thus becoming a decorative feature. It can be seen purely in men's underwear.

Figure 1.20 Stitching Types

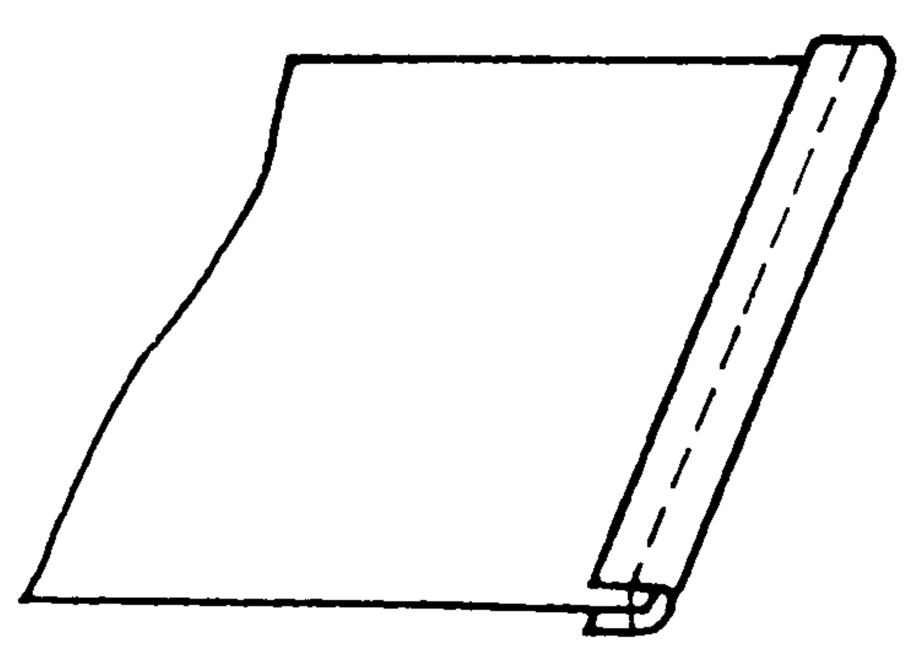


(a) Stitching Type EFa-1



(b) Stitching Type EF1-1

Figure 1.21 Seam Type BSa-1



1.5 THE CONCEPT OF SEAM STRENGTH AND DURABILITY

The characteristics of a seam or stitching[1] are strength, elasticity, durability, security and appearance. In order to form an optimum seam, the properties of the material must be balanced with these characteristics. In practice the end-use of the seam will largely govern the relative importance of these characteristics. The characteristics of strength and elasticity cover stitch type, thread strength, stitches per unit length, thread tension, seam or stitching type, seam efficiency of the material, and thread elasticity. In order to achieve the above properties, the first basic conditions are that (i) the thread tension balances within each stitch, and (ii) uniformity of stitch length is achieved. In practice, a balanced seam cannot be obtained, nor is it feasible to expect one, especially at the beginning and the end of a seam.

The durability of a seam depends largely upon the relationship between the strength and elasticity of the seam and the fabric material.

The causes of seam failure, as reported by the Singer Company [3], are (a) physical - stress, strain and abrasion, (b) chemical - ultra-violet rays, thermal degradation, acid and alkalis, salt water and bleaching, and (c) biological - mildew, mould and other forms of bacteriological rot. The author of this thesis believes that seam type, stitch type, angle of bias of seam in relation to the yarns in the fabric, thread tension, stitch rate, and type of sewing thread are all controllable factors affecting seam durability.

In general a seam may fail as a result of longitudinal or transverse loading. The failure of seams in woven fabric caused by transverse loading is defined by the Shirely Institute [4], as consisting of:

i) breakage of the sewing thread;

ii) breakage of the fabric; and

iii) slippage of the fabric yarns lying close to and parallel with the seam over the opposite yarns lying at right angles to the seam.

Some factors such as the strength of the sewing thread in relation to the fabric, the type of seam and stitch, and the stitch rate, can greatly affect the seam efficiency. Sewing needle damage in the form of severed fibres and yarns in the fabric can have a pronounced effect on seam efficiency particularly as a consequence of a closely woven structure, the use of large diameter needles, blunt pointed needles, or a high stitch rate [5,6].

Waite[7] has reported that an adequate longitudinal extensibility is important for seams in most knitted fabrics, whereas transverse seam strength is the prime requirement in many woven fabrics. It is also true that seam slippage can be a problem in certain woven fabrics in which yarns are smooth and this phenomenon is also an important element in the consideration of seam performance. Some writers[3,7] report that seam slippage can be prevented in certain cases by seaming at an angle to the fabric yarn, instead of parallel to the warp or weft.

1.6 SURVEY OF PREVIOUS WORK

1.6.1 GENERAL

A good deal of research work has been done in the field of seams and seam strength. Each worker in turn has expanded the knowledge of the effect of such parameters as the effect of stitch rate, needle size, needle damage, type of seam, type of stitch, seam balance, thread strength and finishes on the strength of seams in fabrics.

The Shirley Institute,[4] tested seam strength using a cotton khaki florentine drill fabric sewn by cotton sewing threads. The seams were B.S. Type SSa-1 plain lockstitch seam, and 301 lockstich, at 14 stitches/in, with 0.25 inch seam allowance. The results showed that only sewing thread breaks were present and that seam strength is approximately proportional to the loop strength of the sewing thread.

Another experiment was also performed by using the same fabric with varying stitch rate and a fine sewing thread. The results showed that the seam strength is approximately proportional to the stitch rate up to an experimental limit of 30 stitches/inch. It also showed that the seam strength, even at high stitch rates, is less than 50% of that of the unseamed fabric. The reason for this was cited as needle damage.

The effects of needle damage on seam strength for a range of cotton fabrics from US Quartermaster stores had been studied by Frederick[8] and the data shown in Table 1.1 has been abstracted from a larger table of results in the original report. Only Type II breaks (ie. fabric failure, sewing thread undamaged) were present in this test and the results showed that low seam efficiency is invariably related to needle damage (the number of cut yarns in the fabric). He concluded that seam-efficiency determinations are of greater value than direct counts of the numbers of cut threads as an indication of the probable sewability of fabrics.

Table 1.1 Average values of sewing characteristics of US Army cotton fabric

Fabric	Unseamed mean fabric strength (lb)	Seamed mean seam strength (lb)	Seam efficiency (%)	Cut yarns per inch (mean %)
Broadcloth (3.2oz)	29	18	60	14
Oxford (6.5oz)	62	51	83	19
Poplin (5.0oz)	81	64	78	8
Oxford (9.0oz)	92	85	92	2
Herringbone twill (8.5oz)	109	84	78	18
Uniform twill (8.2oz)	121	74	63	17
Sateen (9.0oz)	153	134	88	2

NB. the units quoted are those given in the original reference.

Zagiel[9] studied the changes in the individual stitch shape of 301 lockstitch seams when the seams are under transverse loading. By reference to simple geometry, an elliptical ring with its major axis in the direction of the seam is described at zero loading, this becomes circular in section as a transverse load is applied. Finally it becomes elliptical again,but with the major axis in the direction of the transverse load as the latter increases. The change in stitch shape causes gathering of the fabric yarnswithin each stitch. This causes greater strains in the outer yarns in the stitch (ie. those adjacent to the interlock points of the upper and lower sewing thread) compared with the strains suffered by the centre yarns in the stitch. He stated that this effect results in preferential breakage of the outer yarns within a stitch when a seam ultimately fails due to fabric breakage (Type II breaks). The change in stitch shape is said to be mainly responsible for seam slippage. This confirms the findings of Burtonwood.[11]

Howarth[6] studied the effects of needle size, thread count, and stitch size on seam strength over a wide range of woven fabrics. The results showed that in each of the fabrics tested the strength of plain seams (simple lockstitch seams) has the same trend, ie. as the stitch rate increases the seam strength increases up to a point and then decreases, the latter due to the effects of jamming (binding action of the sewing thread on the fabric yarns which increases the tendency to tear the fabric [12], and of needle damage. The mode of breakage correspondingly changes from predominantly sewing thread breaks (Type I breaks) to predominantly fabric breaks (Type II breaks). The results also showed that different thread sizes only have an effect in the case of the thickest fabric.

Burtonwood and Chamberlain[10,11] investigated seam strength in woven fabrics. They divided the seam failures into two types: Type I breaks due to sewing thread failure and Type II breaks due to fabric failure. They discussed the relationships between the simple thread strength, the loop strength and knot thread strength to predict seam strength. They pointed out that owing to the sharp bending of the thread in a loop strength test, the values are less than twice the normal single thread strength, while knot strength usually approximates to the half loop-strength values. The mechanics of seam failure in relation to thread strength were discussed in detail and the premise made that the minimum value, rather than the mean value of the loop or knot strength is the principal factor affecting sewing thread failure (Type I breaks) in lockstitch seams. They showed how the breaking load of lockstitch seam (Type I breaks) is a function of the sewing thread strength by the equation:

$$T_b = 2\ W\ t_b\ N$$

where T_b - total breaking load of sample

t_b - breaking load of sewing thread

W - width of sample

N - stitch rate

It was found that the experimental values agreed closely with the calculated values on the basis of the minimum 'sewn' knot strength. They suggested that because the needle thread in the 401 stitch (chainstitch) suffers less damage than the needle thread in the 301 stitch (lockstitch) in forming the stitch, the 401 chainstitch seams are somewhat stronger than 301 lockstitch seams at similar stitch rates.

For the Type II breaks a practical conclusion was that the optimum stitch rate with which the maximum breaking load can be obtained for very wide range of woven fabrics can be expressed by the equation:

$$\text{Optimum stitch rate} = \frac{\text{Sett (warp or weft)}}{6}$$

Burtonwood and Chamberlain further stated that it is possible to increase the seam efficency very appreciably, in certain instances to over 90%, by making two or more rows of parallel stitching with the fabrics being overlapped[10,11].

In their studies of the effect of seam allowance, stitch rate and weave structure on seam slippage, they found that greater seam allowance improved the seam strength and smaller seam allowances gave less strength, but greater fabric savings. Their other findings were as follows.

i) For a given width of seam allowance, the load required to cause irreversible slippage (seam opening load) increases markedly with the stitch rate; the effect is most noticeable with plain weave structures.

ii) The extent of seam opening (slippage) increases abruptly when the average float length of yarns in the weave exceeds 3; this points to the need to investigate seam production before any fabrics containing long floats are used for garment manufacture.

iii) The effect of seam allowance on seam slippage is similar, but varies in degree with the type of fabric and the inter-yarn frictional properties.

Burtonwood and Chamberlain[10,11] studied the effects of multiple row stitching, for lockstitch and chainstitch seams in woven fabrics on Type I seam strength by using an imperial cotton twill and a sewing thread under transverse loading. They concluded that the chainstitch is stronger than the lockstitch and that the seam strength (predicted from the loop strength of the thread) is proportional to the number of rows of stitching. They also made some tests to investigate the direction of sewings used for fixing car seat belts. They showed that, for a given length of stitching, the seam rows are more effective when placed at right angles to the direction of stress than when placed parallel to it.

Brain[13] made some estimates of seam strength from a prior knowledge of fabric and thread properties. He stated that the first stitch which breaks in a seam subjected to transverse loading is not necessarily the weakest in the seam since all stitches will not be subjected to the same mean loading. From this basic concept of minimum stitch strength:

$$S_n = A\, S_{min}$$

where S_n - the strength of first stitch to break in a group of n stitches

S_{min} - the strength of the weakest stitch in the same group.

A - constant

In order to obtain a form of prediction of seam strength from the measured thread strength f(t), Brain devised experiments to relate f(t) to S_n by the equation:

$$S_n = B\, f(t) + C$$

where $S_{min} = f(t)$

B and C are constants

Another concept is that of corrected minimum loop strength (C.M.L.) defined by the equation:

C.M.L. = minimum loop strength x Cos $\theta/2$ where θ is the angle of the open end of the thread stitch loop in a seam under transverse strain.

Brain claimed that the C.M.L. strength gave an improved prediction of seam strength results compared with tensile or average loop strength, but no overall formula was found to fit all threads or all the fabrics tested.

Kawanishi and Horino[14] have made a theoretical study of the tensile behaviour of lockstitch seams in the lower load region and at seam breakage. The work deals primarily with the possibilities of calculating the loading on seams from the separate tensile properties of the fabric and the sewing thread.

Gardner[19,20] has also done considerable work in the field of seam strength predictions, but his efforts were primarily concerned with "angle of bias" effects. His work is, therefore, more fully discussed in section 1.6.2.

1.6.2 EFFECT OF ANGLE OF BIAS

Singer[16] reported the angle of the seam with reference to the direction of warp is important in terms of seam strength, and seam strength increases as the seam approaches 45^0.

Burtonwood[11] reported that, with reference specifically to Type II breaks, a complex mechanical situation occurs when seams are tensioned leading to unequal sharing of the total load by the fabric threads. He also postulated an explanation of the Singer results in terms of increased seam length.

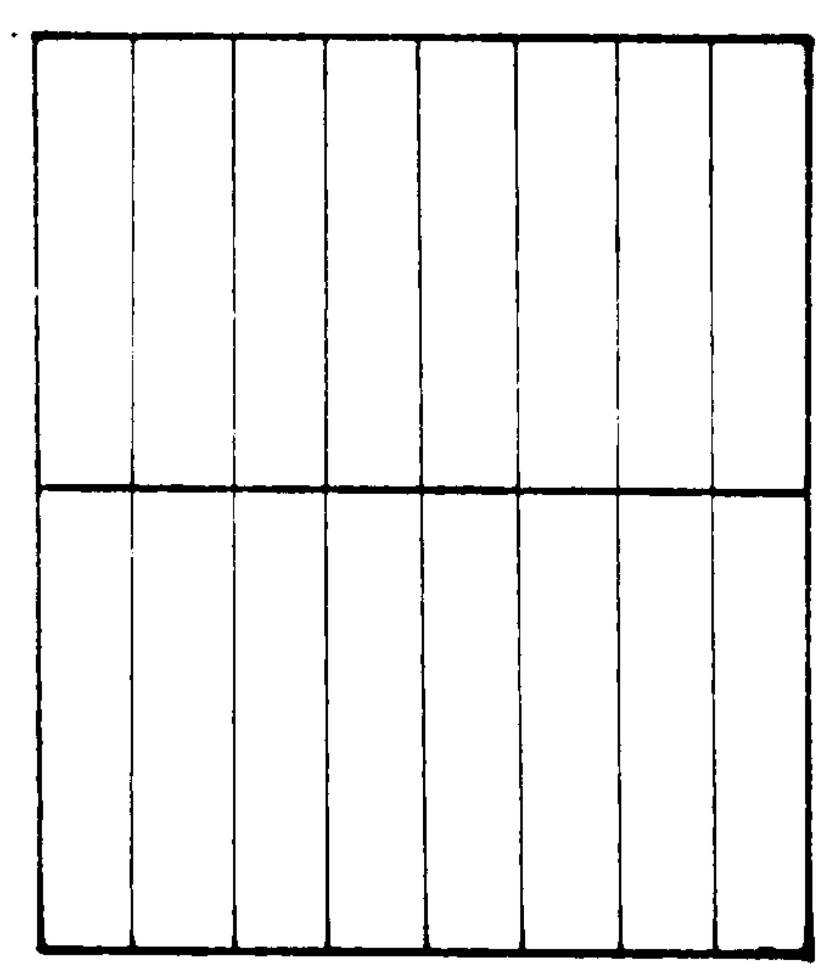
Blackwood[17] investigated the effect of seaming knitted fabric on the observed seam performance. He sewed the fabric samples in three ways shown in Figure 1.22. Samples A and B resulted in uneven loading and he decided, therefore to use method C. However this method leads to an increase in seam width and seam breaking load. When a correction factor is added the results are as follows:

$$\text{Corrected breaking load} = \frac{\text{linear stiches per 25mm} \times 2 \times \text{actual break load}}{\text{number of stitches on bias}}$$

Gardner[19,20] is believed by the present author to be the only one of the previous workers who has investigated seriously the angle of bias effect on seam strength. Lockstitch (Type 301) plain seams (SSa-1) were sewn into a plain square-sett fabric and "unseamed and unneedled", "unseamed and needled" and "sewn seams producing Type II breaks" (fabric breaks without damaging the sewing thread) were investigated. Gardner's results showed a marked angle of bias effect on the seam strength and a 'W' shaped curve was evident. The strength of the seam was found to have the highest values at 0^0 and 90^0, then decreased as the angle moves from these values to around 20^0 to 30^0 and around 60^0 to 70^0, it then increased again to the peak at 45^0. The results also showed that a mirror image (between the ranges 0^0 to 45^0 and 45^0 to 90^0) was evident for this square-sett fabric under all three types of breaking conditions.

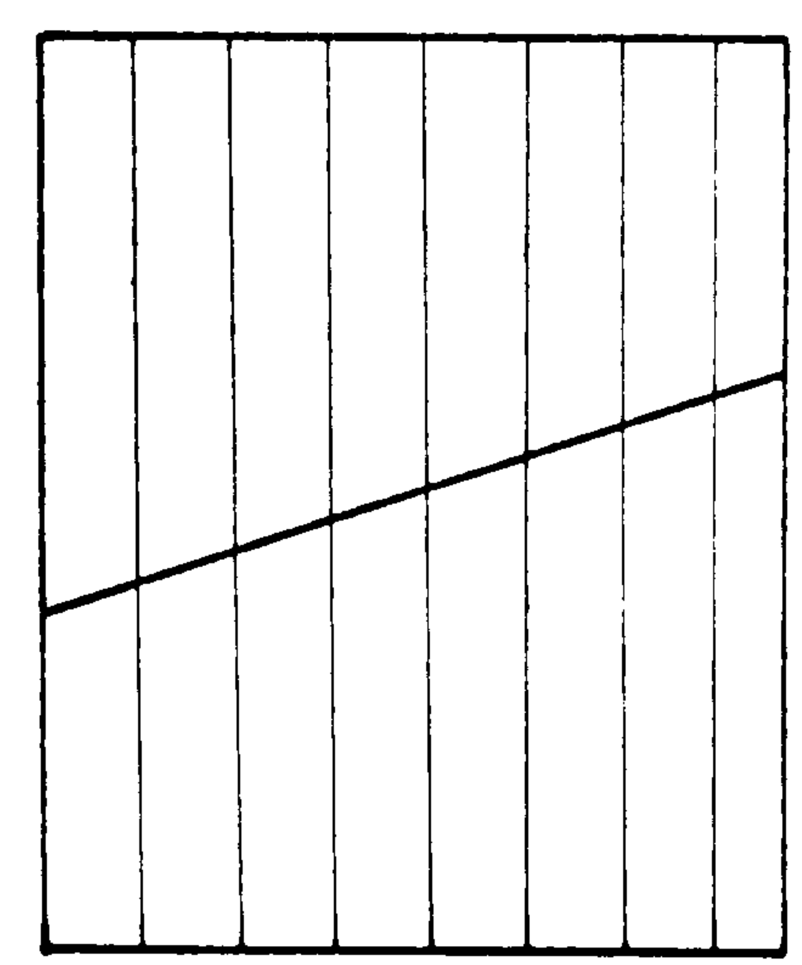
Gardner developed a tentative model for the prediction of sample strength for any of the three types of sample that he investigated. The model is, however, limited to what Gardner defined as primary

Figure 1.22 Ways of Sewing Fabrics Together



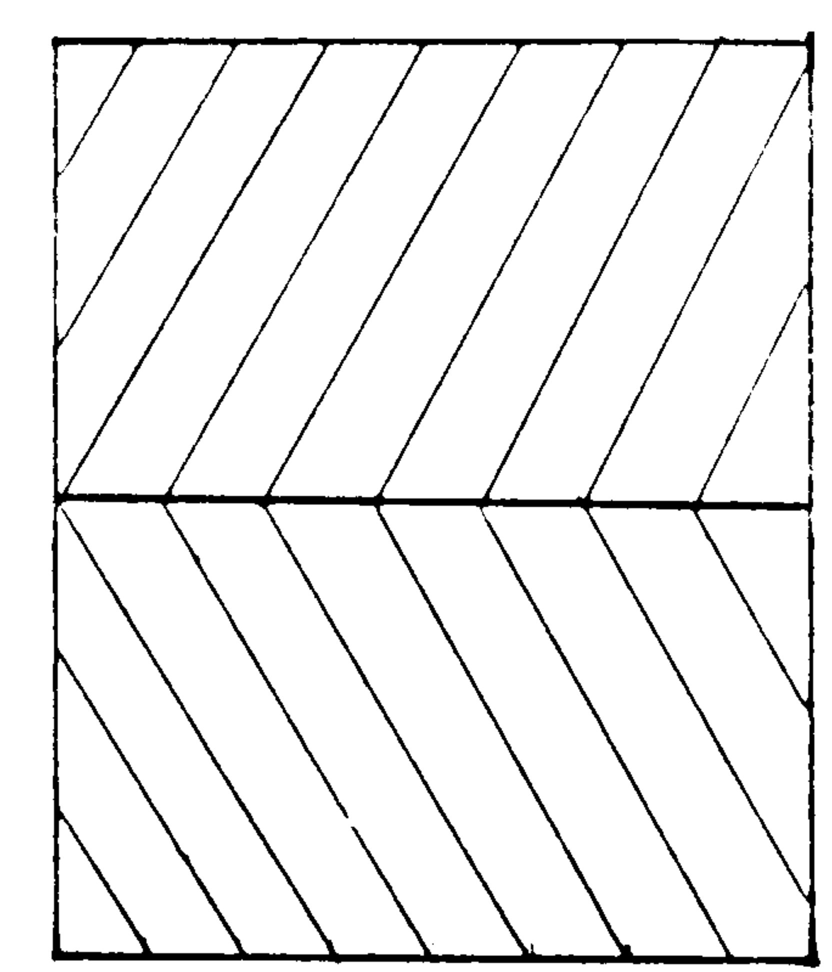
(A)

normal straight 'warp' seamed sample



(B)

straight 'warp' sample with biased seam



(C)

fabric biased seamed sample

and secondary load transfer zones. This limitation was satisfactory for all small angles of bias at all gauge lengths investigated and in all angles of bias at shorter gauge lengths.

1.6.3 EFFECT OF GAUGE LENGTH

Brain[13] studied the effect of gauge length on seam strength, and he showed that as gauge length decreases the seam strength increases although the extent varied with type of fabric. His explanation is given as non-uniform transfer of the total load to each stitch due to fabric irregularities having less effect as gauge length is reduced.

Burnip, Wilkinson and Dorkin[15] reported a different effect, namely that in certain circumstances higher seam strengths are obtained for longer gauge lengths.

Gardner's[19,20] work demonstrated some evidence of a gauge length effect on seam strength; shorter gauge lengths were shown to give higher strengths.

1.6.4 SEAM STRENGTH TESTING

Investigation of seam strength under laboratory test conditions is becoming important in order to understand the performance of a garment. There is, however, no British Standard testing method on sewn seam strength to enable researchers to compare and discuss their results positively with each other.

Howarth[6] investigated plain seams on woven fabric using 6in x 6in test specimens that were folded by half to measure 3in x 3in. The folded specimens were sewn on a domestic machine with 0.5in seam allowance from the fold, shown in Figure 1.23, which is cut before putting in grab jaws (set with 2in gauge). A constant rate of extension, 12 ± 0.5in per min, broke the seam and the breaking strength result was recorded if the seam opening was less than 0.25in.

Burtonwood and Chamberlain[10,11] used two 7in warpway by 2.5in weft way test specimens, as shown in Figure 1.24, frayed down to 2in width. The pair of specimens were sewn together with 0.5in seam allowance from each specimen. The specimens with two ends of thread tied off at each side were put on a pair of jaws of a strength tester with a constant rate of extension, 10in per min.

The American Standard Method[18] recommends seaming across the full width of two layers of fabric with 0.5in seam allowance from the edge. Samples with 4in length x 6in width are then cut from the seamed fabric as shown in Figure 1.25. A grab jaws (width 1") test with 3" gauge i used.

Brain[13] described his absolute method of seam strength testing in his work on the prediction of lockstitch seam strength in woven fabrics. He stated that the test method should be related to a seam as sewn into garment and not individually prepared as in the case of Howarth[6], Burtonwood and Chamberlain[10,11] and Gardner[19,20]. In his work, only lockstitch seams were used for reasons of simplicity, and he pointed out that good balance in seaming could not be achieved during the starting up and slowing down stages, and suggested seaming across the full width of fabric with 0.5in seam allowances and then discarding 2in at either edge as shown in Figure 1.26. Then the test specimens were cut out at a 2in width; within the 2in width, 0.5in width of strip on each edge is cut till

Figure 1.23 Preparation of Samples in Howarth's Work.

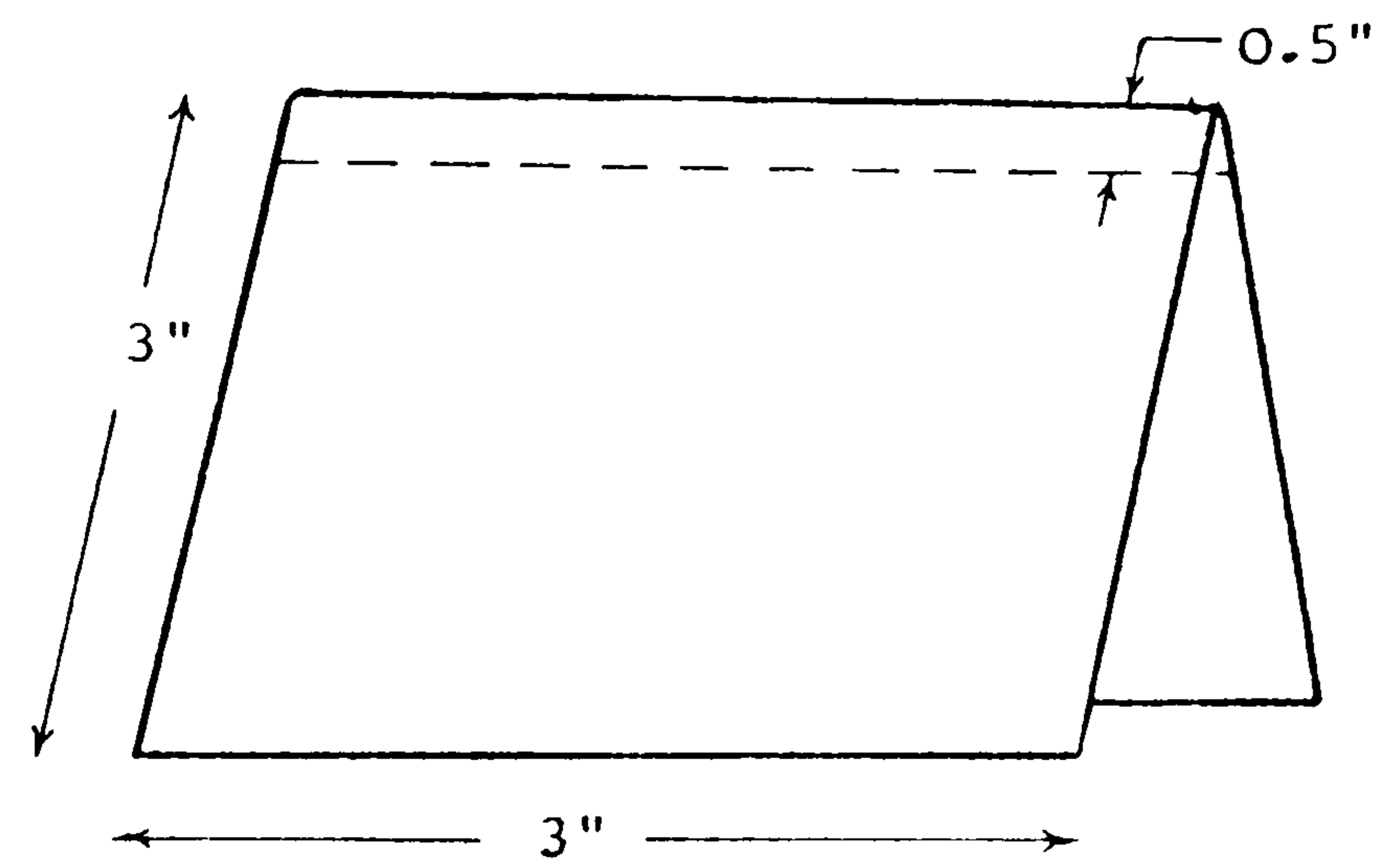


Figure 1.24 Preparation of Samples in Burtonwood and Chamberlain's Work.

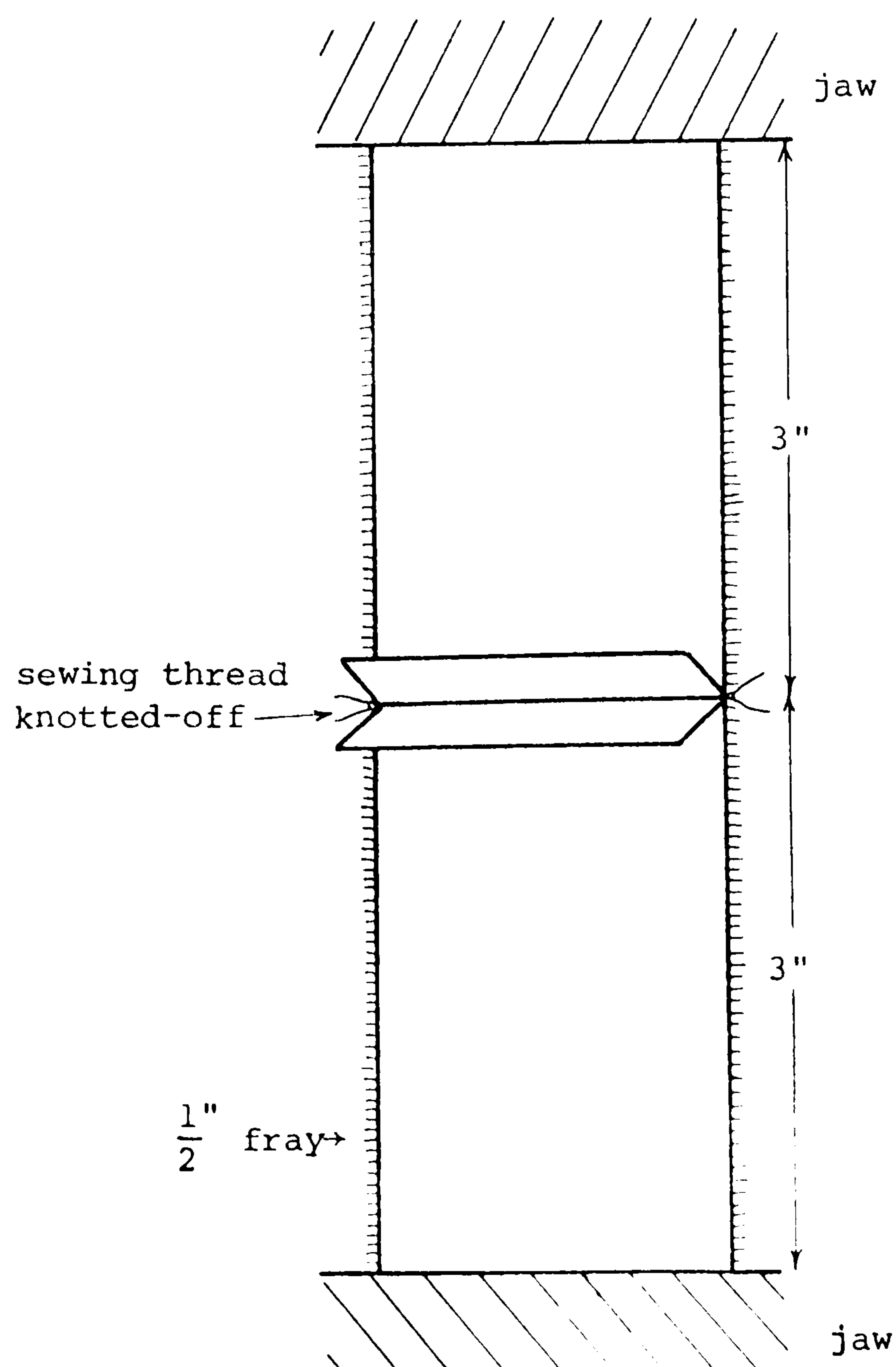


Figure 1.25 Preparation of Samples Using American Standard Method.

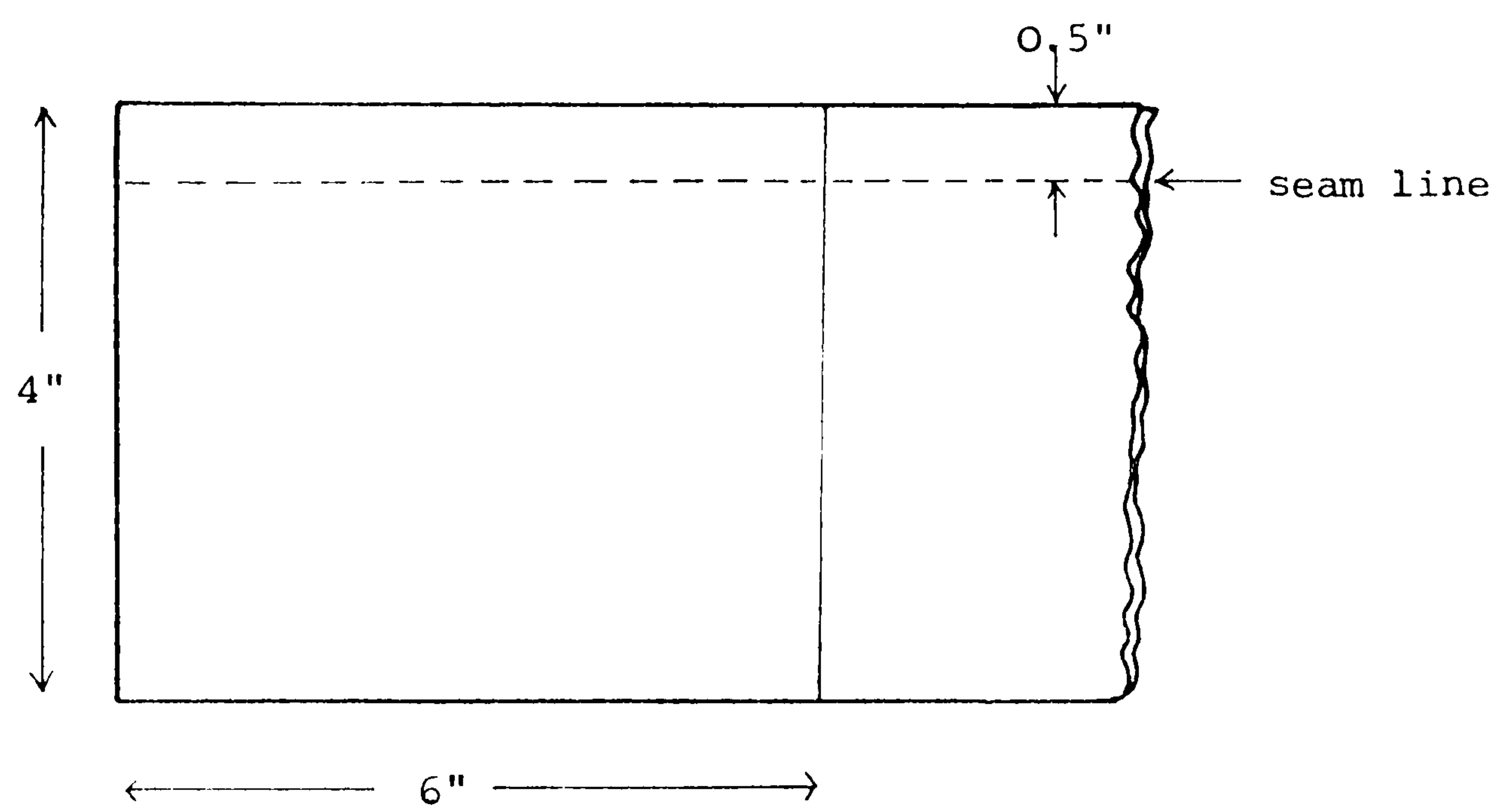
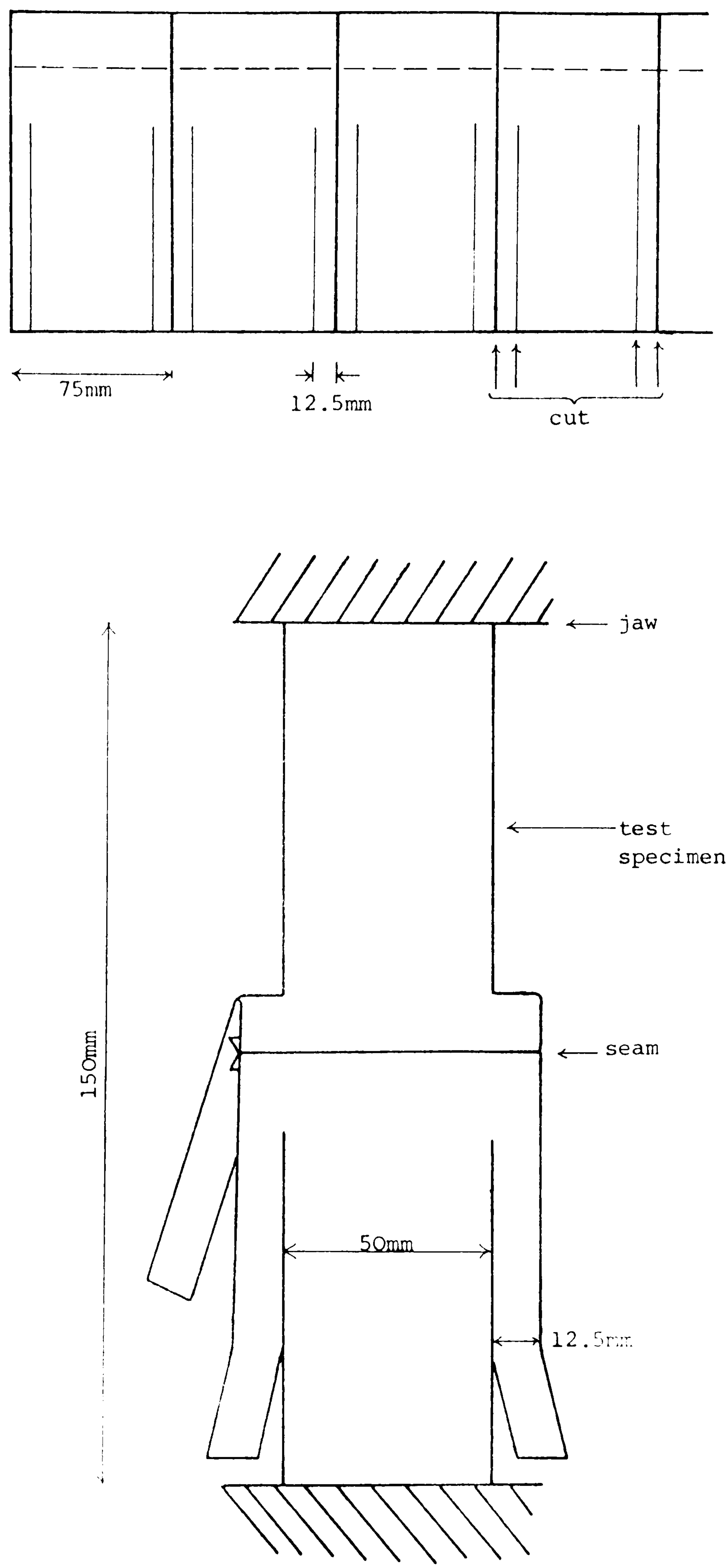


Figure 1.26 Brain's Absolute Method of Sample Preparation.



0.5in away from the seam line. Therefore the actual specimens width in the jaw was two inches width as shown in Figure 1.26.

1.7 REASONS FOR THE PRESENT WORK

A great deal of research work[2 to 20] has been done in isolating and studying the main factors that control the strength and efficiency of seams in woven and knitted fabrics. The need for investigation on the effect of load transference by the fabric threads has been observed to clarify what this effect has on seam strength.

Some workers[4,6,10,11,13,17,19,20] have developed mathematical models to predict seam strength, the results have showed satisfactory experiment/theory agreement. However, usually these workers have tested samples with warp or weft threads running straight from jaw to seam to jaw.

In practice, this situation is uncommon. In most garments fabrics are seamed with warp threads at an angle to each other on either side of the seam, ie. on a bias.

Blackwood[17] investigated the effect of angle of bias by seaming at an angle across a course-wise sample,but this leads to an increase in seam width. He actually started with fabric biased samples which occur in practice,but reverted to seaming at an angle across walewise samples because of the stress patterns on the fabric which became apparent on loading in a tensile testing machine.

As previously stated Gardener[19,20] has studied the effect of angle of bias of the seam under Type II conditions. He showed that the effect of angle of bias on unneedled, needled and seamed samples from reasonably square sett fabric has a marked effect on breaking strength under Type II conditions.

The effect of the angle of bias on seam strength has not been understood completely. Further study has been made in the present work as follows:

a) by investigating the angle of bias effect on Type II lockstitch seam breaks firstly for plain weave and then for different structures of woven fabric;

b) by investigating the angle of bias effect for different types of stitch on seam strength;

c) by developing a more generalized mathematical model in an attempt to explain the relationship between seam strength and parameters such as, angle of bias, gauge length, width of seam, and fabric type and construction;

d) by optimizing the relationship between the Type I and Type II breaks in order to obtain the most economical and practical condition of seam strength; and

e) by relating the findings to commercial applications in garment design and pattern cutting.

CHAPTER 2 EXPERIMENTAL METHODS

2.1 INTRODUCTION

In most woven garments, it is unusual for the warp or weft yarns to run perpendicularly to the seam during stressing (q.v. Figure 2.1). Therefore, the angle of bias would appear to be one of the most important parameters in the complex mechanism which produces the effect known as seam strength.

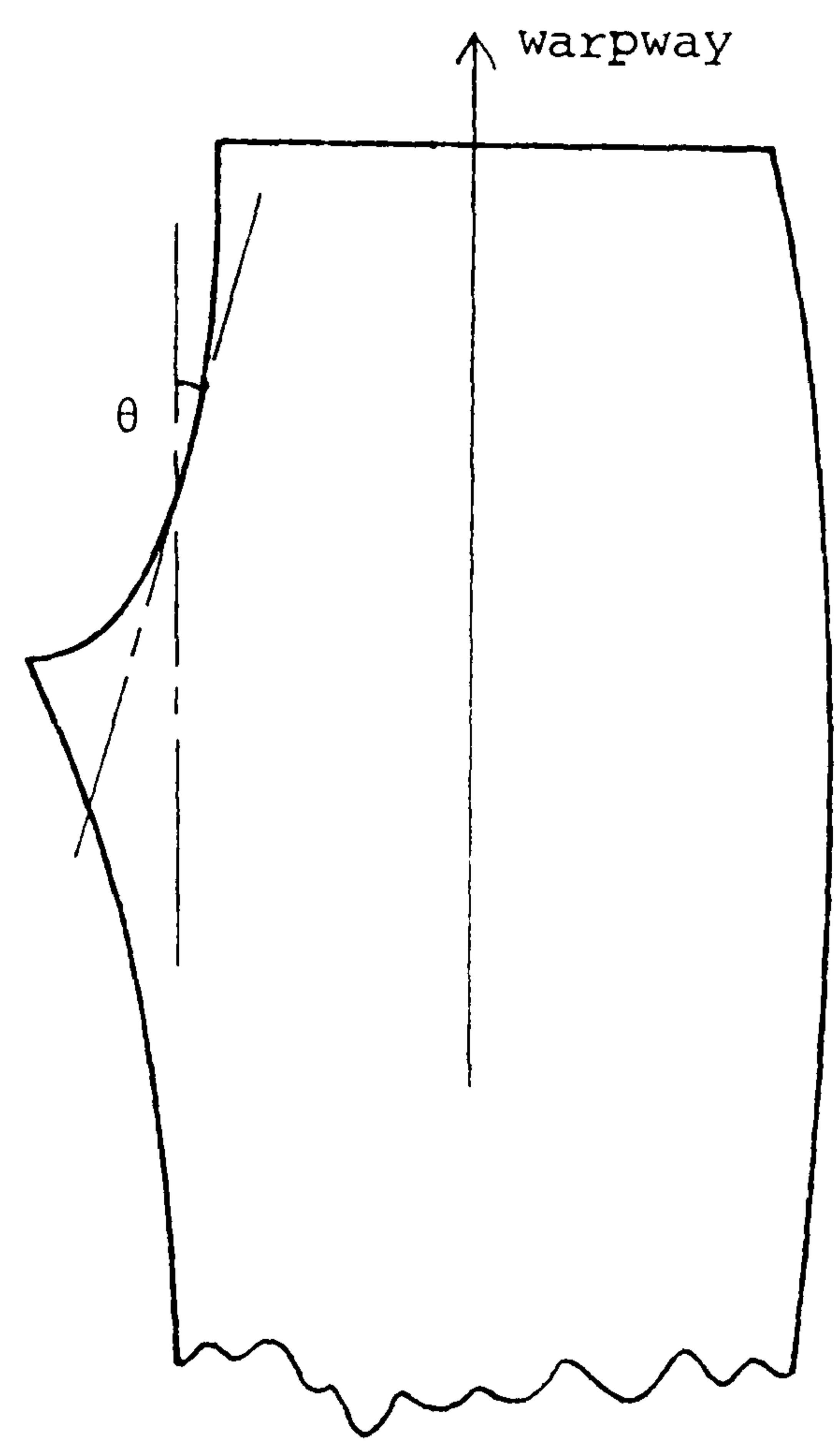
The objective of the experimental work was to assemble sufficient data for an understanding of the effect of the angle of bias to be achieved on seam strength in woven fabrics. Three types of breaking condition were examined: (i) unseamed fabric breaks; (ii) Type II breaks (fabric breaks only); and (iii) Type I breaks (sewing thread breaks only).

For each experiment, five samples were prepared; ie. for seamed sample tests, five identical pairs of pieces of fabric were cut and seamed, and for unseamed tests, five identical pieces of fabric were prepared. The samples were always broken on an Instron Strength Tester, the breaking load and the extension at break at which each sample failed was recorded. In addition the mean breaking strength and the mean extension at break of each set of five samples was calculated.

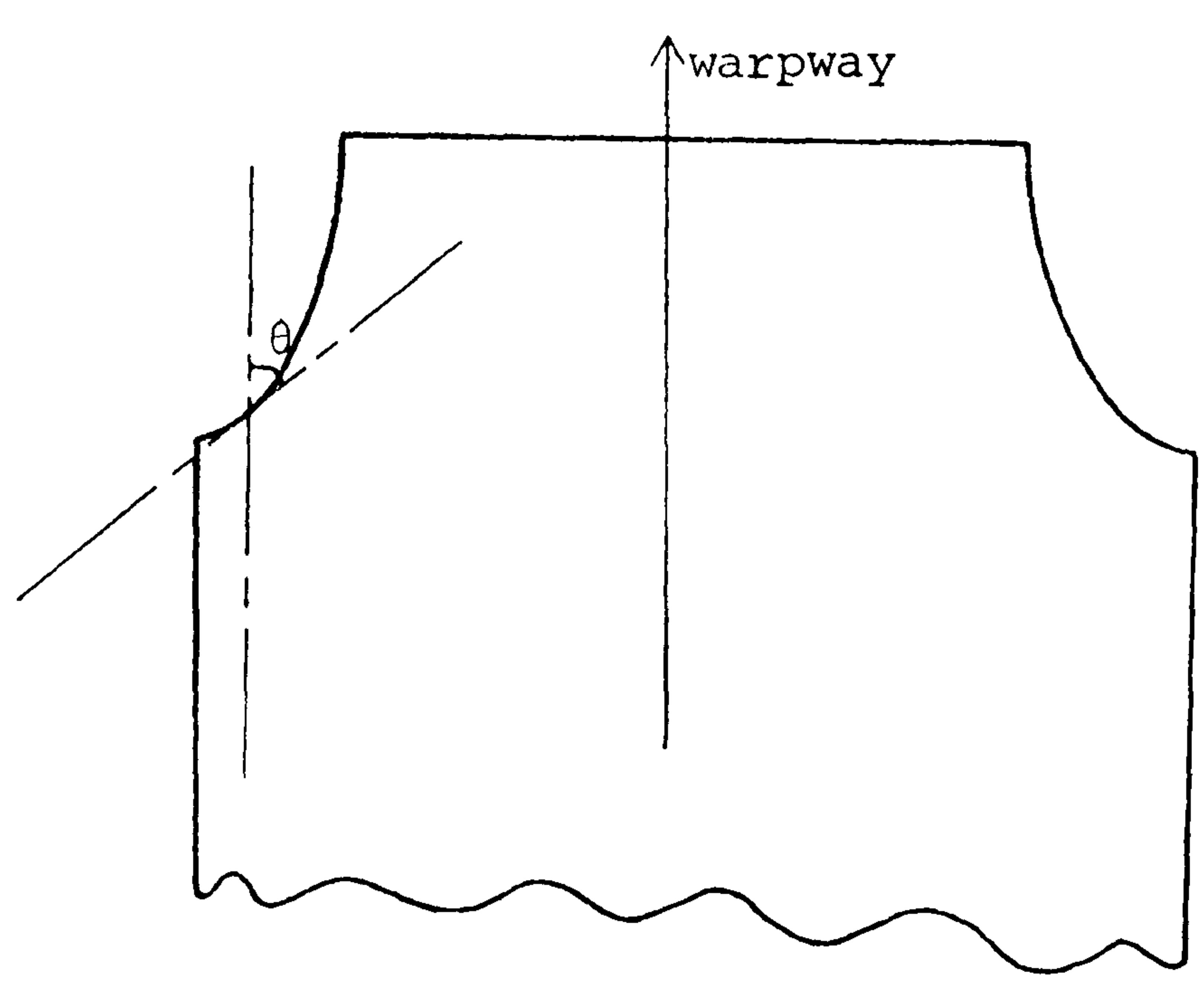
2.2 MEASUREMENT OF FABRIC PARAMETERS

Nine fabrics were used in the present experimental work, three of these were supplied by Whaleys (Bradford) Ltd., one was donated by Smith and Nephew Ltd., and the rest were supplied by the Department of Textile Industries of the Huddersfield Polytechnic. The fabrics used cover

Figure 2.1 Some Parts of the Patterns of a Pair of Trousers and a Shirt.



(a) back of a pair of trousers



(b) back of a shirt

a wide variety of structures and usages; viz bandaging, printing, shirting, trousering, overall and boiler suiting.

2.2.1 FABRIC THREADS PER UNIT LENGTH (WARP AND WEFT)[21]

A 2 $mx10^{-2}$ width counting glass was used. The mean of 10 measurements on each sample was recorded.

2.2.2 TWIST IN YARN REMOVED FROM FABRIC[22]

A "twist-untwist" twist tester was used. Fifty tests of 2.54 $mx10^{-2}$ test length for spun yarn (single and twenty tests of 20 $mx10^{-2}$ test length for folded and cable yarns were made. Standard mounting tensions were used; viz 0.75$kgx10^{-3}$ per unit of tex for under 7 tex; 0.2 $kgx10^{-3}$ per unit of tex plus 4 for above 7 tex.

2.2.3 LINEAR DENSITY OF YARN REMOVED FROM FABRIC[23]

The conditioned fabric was cut into two rectangular strips 50 $mx10^{-2}$ long containing warp ends, and five rectangular strips 5 $mx10^{-2}$ long containing weft ends; 50 threads were taken from each strip, and weighed. The ensuing results were converted into the Tex system.

2.3 DETERMINATION OF SEWING PARAMETERS

2.3.1 SEWING THREADS

Only two sewing threads, supplied by Coats Ltd, were investigated:

i) Coats Eagley 60's, 100% cotton sewing thread; and

ii) Coats Koban 75's, 70% polyester/30% cotton core-spun sewing thread.

2.3.2 SEWING THREAD STRENGTH

2.3.2.1 Single thread strength

Single thread tests were carried out in accordance with B.S. 1932:

Part I[24]; 30 tests using a 50 $mx10^{-2}$ test length were carried out on the Instron Electronic Tensile Testing Apparatus. The mean and the minimum strengths were recorded in each case.

2.3.2.2 Knot strength

The knot strength tests were carried out in accordance with B.S. 1932: Part II[25] on 30 conditioned threads with a test strength of 50 $mx10^{-2}$. A hand tied knot was tied in each thread. For S-twisted yarn, an S-knot should be used and vice-versa for Z-twisted yarn. The mean and the minimum strengths from the Instron Electronic Tensile Tester were recorded.

2.3.2.3 Loop strength

The loop strength tests were carried out in accordance with B.S. 1932, Part II.[25] Two of 60 conditioned threads with a test length of 50 $mx10^{-2}$ were used in each test. The two ends of yarns were clamped close together in one jaw of an Instron Tester, a second thread is looped through the loop of the first and its two ends were clamped to the other jaw. Mean and the minimum strengths were recorded.

2.3.3 SEAM TYPE

Stitch type 301 (lockstitch) together with Seam type SSa-1, as shown in the Figures 1.1 and 1.2 was the only construction used throughout the present experimental work for the sake of simplicity.

2.3.4 SEWING MACHINE AND NEEDLE

A Singer lockstitch 660 A2 sewing machine with a Singer No 18 needle was always used during sewing.

2.4 SAMPLE PREPARATION

The fabrics from which samples were to be cut were marked using a template and protractor, as shown in Figure 2.2. The samples were then cut using very sharp scissors. This is the method developed by Gardner.[19,20] It is impossible to prepare the samples according to the methods of some previous workers, eg, Burtonwood and Chamberlain's method[10,11] because the sample cannot be frayed down due to the angle of the sample being cut; Brain's absolute method[13] because the excess part near the seam would affect the seam strength when the sample is cut at an angle; the grab jaw test used by Howarth and the American Standard Method because the angle of bias effect cannot be evaluated by the grab jaw test since the transfer mechanism cannot be identified.

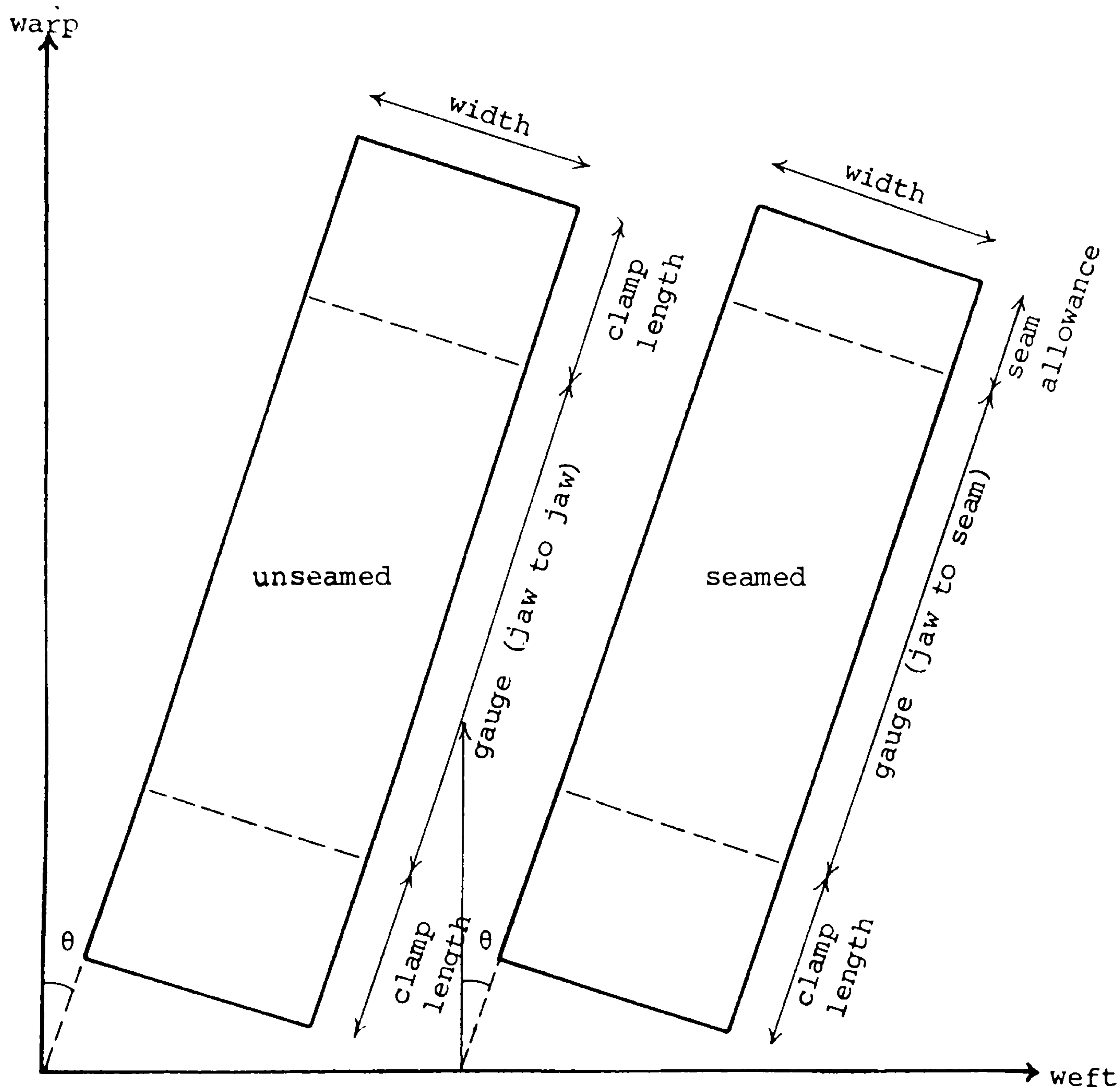
.4.1 UNSEAMED AND SEAMED SAMPLES

Samples for unseamed breaks were marked with lines at appropriate positions to give sufficient fabric at the both ends for the Instron clamps. (Gardner's work showed no significant fabric damage on samples needled with an 18's needle, therefore it was considered that needled samples were not necessary in the present work). Samples for seaming were marked off 2.5 $m \times 10^{-2}$ from the top to give a sewing line, which would result in a constant seam allowance of 2.5 $m \times 10^{-2}$. In addition a line was marked at a distance of half the required gauge length from the seam line to facilitate centralising of the seam between the jaws of the Instron.

4.2 SEWING OF SAMPLES

Samples were seamed by superimposing two marked specimens and sewing along the marked line with 2.5 $m \times 10^{-2}$ seam allowance. The direction

Figure 2.2 Preparation of Samples



of warp (or weft) samples under load should be as shown in Figure 2.3.

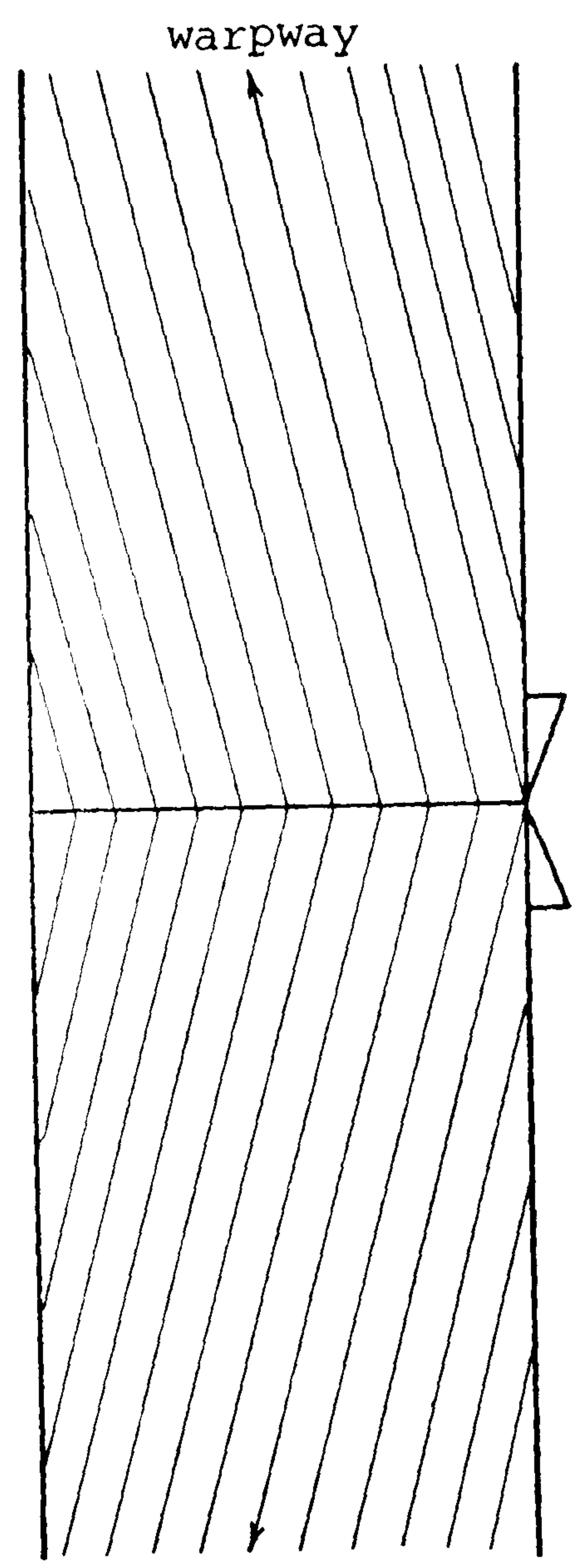
2.5 CONDITIONING OF SAMPLES

All samples were left in a standard atmosphere of 20±1^{0}C and 65±2% RH for 24 hours before testing. In addition, all breaking of samples was conducted under the same atmospheric conditions.

2.6 BREAKING STRENGTH ON THE INSTRON

A standard CT load cell was used and set up according to the manufacturer's instructions. The sensitivity of the amplifier was set to give a full scale deflection of 490.5N (50Kgf) or 981N (100Kgf) for the breaking of fabrics according to the strength of the samples, and 98.1N (10Kgf) for the breaking sewing threads and fabric yarns. The take-down speed of the crosshead was set at 0.1 metre per min and the chart speed was 0.2 metre per min. The Instron was operated at a constant rate of extension.

Figure 2.3 Sewing of Samples



CHAPTER 3 EXPERIMENTAL RESULTS

3.1 PROPERTIES OF FABRICS

The properties of the nine fabrics were measured according to the standard methods and are tabulated in Table 3.1.

3.2 PROPERTIES OF SEWING THREADS

Two types of sewing thread were used and their specifications are given in Table 3.2.

Sewing thread I was used for the weaker fabrics, (Fabrics A, B and C) and sewing thread II was used for the stronger fabrics, (Fabrics D, E, F, G, H and I). The stitch rate and the types of sewing thread used for the two types of breaks are given in Table 3.3.

3.3 BREAKING TEST RESULTS

3.3.1 INTRODUCTION

The samples were prepared using the parameters shown in Table 3.4 (a and b). Some fabrics were too strong to permit Type II breaks to be investigated even when very strong sewing threads were used.

Some samples were also prepared so that the strength of the "second zone only" (see Chapter 5) at different angles of bias could be found. The parameters of such samples are given in Tables 3.5 (a and b).

Each experimental breaking strength and extension at break shown in the figures in this chapter is the mean value of five results. In addition the mean of each group of five and the corresponding range (the minimum to the maximum), are shown in Appendices 1 to 9.

TABLE 3.1 Properties of Fabrics

Fabric	A	B	C	D	E	F	G	H	I
weave type	plain weave 100% cotton	plain weave 100% cotton	plain weave 100% cotton	plain weave 100% cotton	2/1 twill 100% cotton	weft sateen 100% cotton	heavy drill 100% cotton	2/3 twill nylon/ cotton	plain poplin 100% cotton
warp linear density (Tex)	17	29	23	44.67	19.2	68.7	50	47.5	16
weft linear density (Tex)	17	29.8	22	35	35	25.7	63	54	15.6
warp twist (turns per metrex10^{-2})	9.4	6.4	6.6	8.5	5.5	5	4.3	4.3	8
weft twist (turns per metrex10^{-2})	8.5	7	8.2	6.5	6	6	4	43	9
ends per metrex10^{-2}	25	22	17	27	40	28	32	10.6	26
picks per metrex10^{-2}	24	17	14	24	20	68	18	11.4	52
warp yarn strength (mean) (N) (min) (N)	2.65 2.16	0.94 0.90	0.68 0.64	5 48	7 6.8	9 8.6	6.4 6.2	11 10.4	3.4 3.0
weft yarn strength (mean) (N) (min) (N)	1.67 1.57	0.92 0.88	0.79 0.74	6.4 6.2	6.6 6.4	2.5 2.4	7 6	10.5 10	3.4 2.8

Note:- None of the fabrics was given any special finishing treatment.

Table 3.2 Properties of Sewing Threads

Sewing thread	I	II
Company	Coats Ltd	Coats Ltd
name	Eagley	Koban
material	100% cotton	polyester/cotton 70%/30%
art no.	K382	N569M
resultant linear density ('s)	60	75
Single thread in m strength (N) r	6.5 6.0 - 6.7	18.5 18.0 - 19.0
knot m strength (N) r	5.5 5.0 - 6.0	10.0 10.0
loop m strength (N) r	12.5 12.0 - 12.8	22.0 21.0 - 22.5

m - mean r - range

Table 3.3 The Stitch Rate and the Type of Sewing Thread Used in the Sewing of Samples.

Type of Fabric	Stitch rate (s/in) under Type I	Stitch rate (s/in) under Type II	Type of sewing thread
A	8	10	I
B	8	-	I
C	12	-	I
D	12	2x15	II
E	12	-	II
F	12	-	II
G	12	-	II
H	12	2x15	II
I	12	2x15	II

Note:- Two rows of seaming were used for the Type II breaks of three fabrics (D, H and I) in order to produce Type II breaks.

Table 3.4 Parameters of Samples Used in the Experiments

Table 3.4a

Fabric	A						B
breaking condition	Unseamed	Type II		Type I			Type I
width (mx10^{-2})	5.0	5.0	6.5	3.5	5.0	6.5	5.0
gauge (mx10^{-2}) (jaw to jaw)	2.5 - 20.0	5.0 - 15.0		5.0 - 20.0			5.0 - 20.0
angle of bias (degrees)	0^0 - 45^0	0^0 - 45^0		0^0 - 45^0			0^0 - 90^0

Table 3.4b

Fabric	A,B,C,D,E,F,G,H,I		A,D,H,I
breaking condition	Unseamed	Type I	Type II
width (mx10^{-2})	5.0	5.0	5.0
gauge (mx10^{-2}) (jaw to jaw)	10.0	10.0	10.0
angle of bias (degrees)	0^0 - 90^0	0^0 - 90^0	0^0 - 90^0

Table 3.5 Parameters of samples for finding the strength of "second zone only" at different angles of bias

Table 3.5a

Fabric	A,B,C,D,E,F,G,H,I		A,D,H,I
breaking condition	Unseamed	Type I	Type II
width ($m \times 10^{-2}$)	5.0	5.0	5.0

Table 3.5b

angles of bias (degrees)	10	20	30	35	40	45	50	55	60	70	80
gauge ($m \times 10^{-2}$) (jaw-seam)	28.35	13.74	8.66	7.14	5.96	5.00	5.96	7.14	8.66	13.74	28.35

3.3.2 UNSEAMED FABRIC BREAKS

3.3.2.1 Unseamed fabric breaks of Fabric A

Using Fabric A, tests (at various gauge lengths) for the "angle of bias effect" were carried out. The results (illustrated in Figure 3.1a) show a marked effect on strength caused by varying the angles of bias. This effect reduces the strength at the mid-range of bias angle (10^0-40^0). The general trend of the curves is a half 'W' shape, as in Gardner's results [20]. The minimum strength values at the gauge lengths of 5, 10 and 20 $mx10^{-2}$ occur at around 20^0-25^0 angle of bias. In the case of gauge length of 2.5 $mx10^{-2}$ this minimum occurs at around 30-35^0. The strengths at 0^0 angle of bias are larger than the strengths at 45^0 angle of bias.

Figure 3.1a also shows that the curves at each of the gauge lengths 5, 10 and 15 $mx10^{-2}$ are similar to each other. This infers that the gauge length effect is small. At a gauge length of 2.5 $mx10^{-2}$, the curve has the same maximum value at both 0^0 and 45^0, but it has a larger minimum value than the other cases; this value can be seen to have swung to the right hand side. For the gauge length of 20 $mx10^{-2}$, it can be seen that the same maximum values and minimum values occur as for the gauge lengths of 5, 10 and 15 $mx10^{-2}$, but a smooth curve instead of a "sharp" minimum results. This would infer that the angle of bias effect comes in more quickly in this case.

3.3.2.2 Unseamed fabric break of Fabric B

Fabric B was a 100% cotton plain weave fabric with a sett of 22/17 yarns per $mx10^{-2}$. The results for the angle of bias effect from 0^0

Figure 3.1a The Breaking Strength of Fabric A as a Function of Angle of Bias under the Unseamed Fabric Breaking Condition.

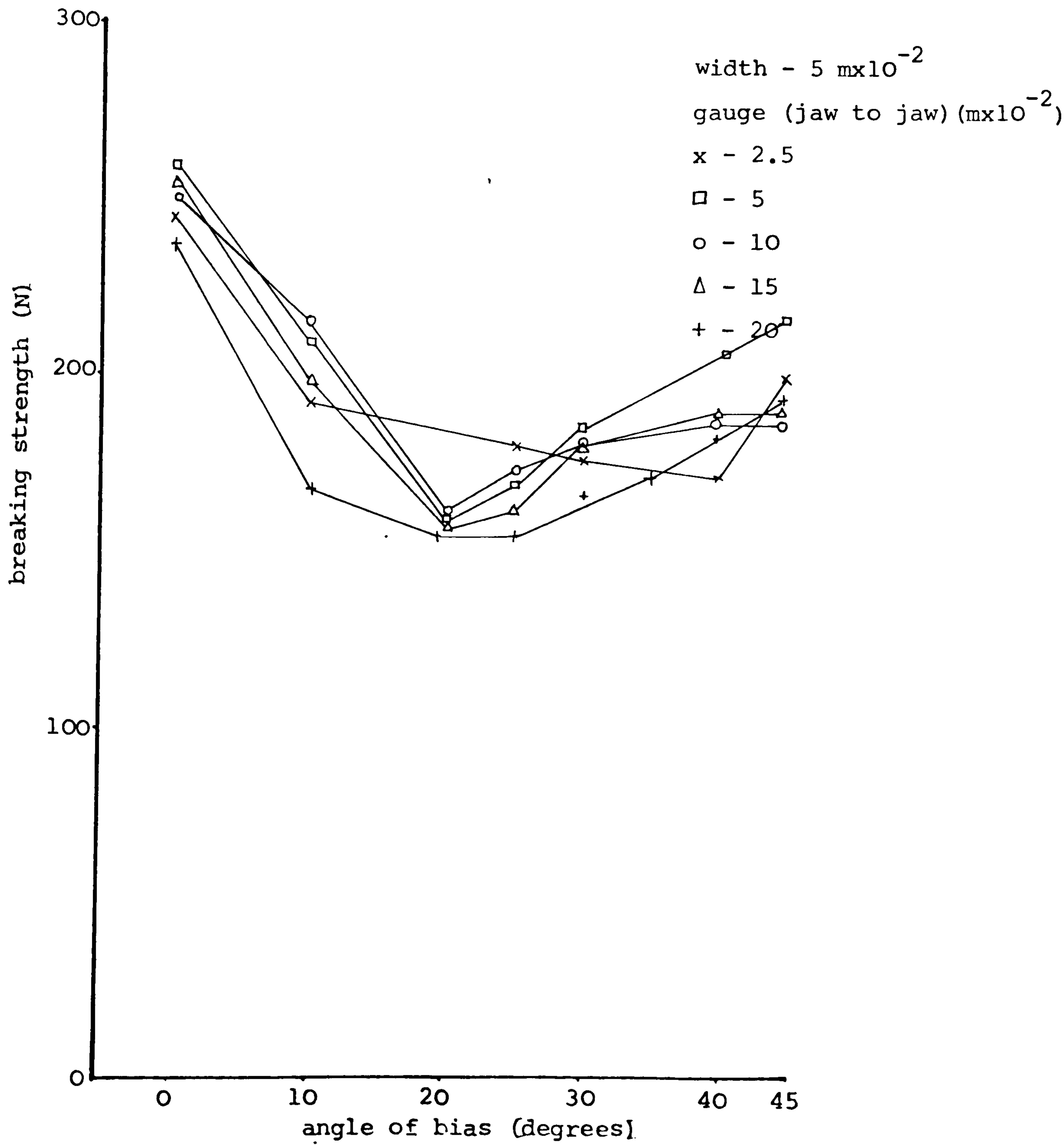
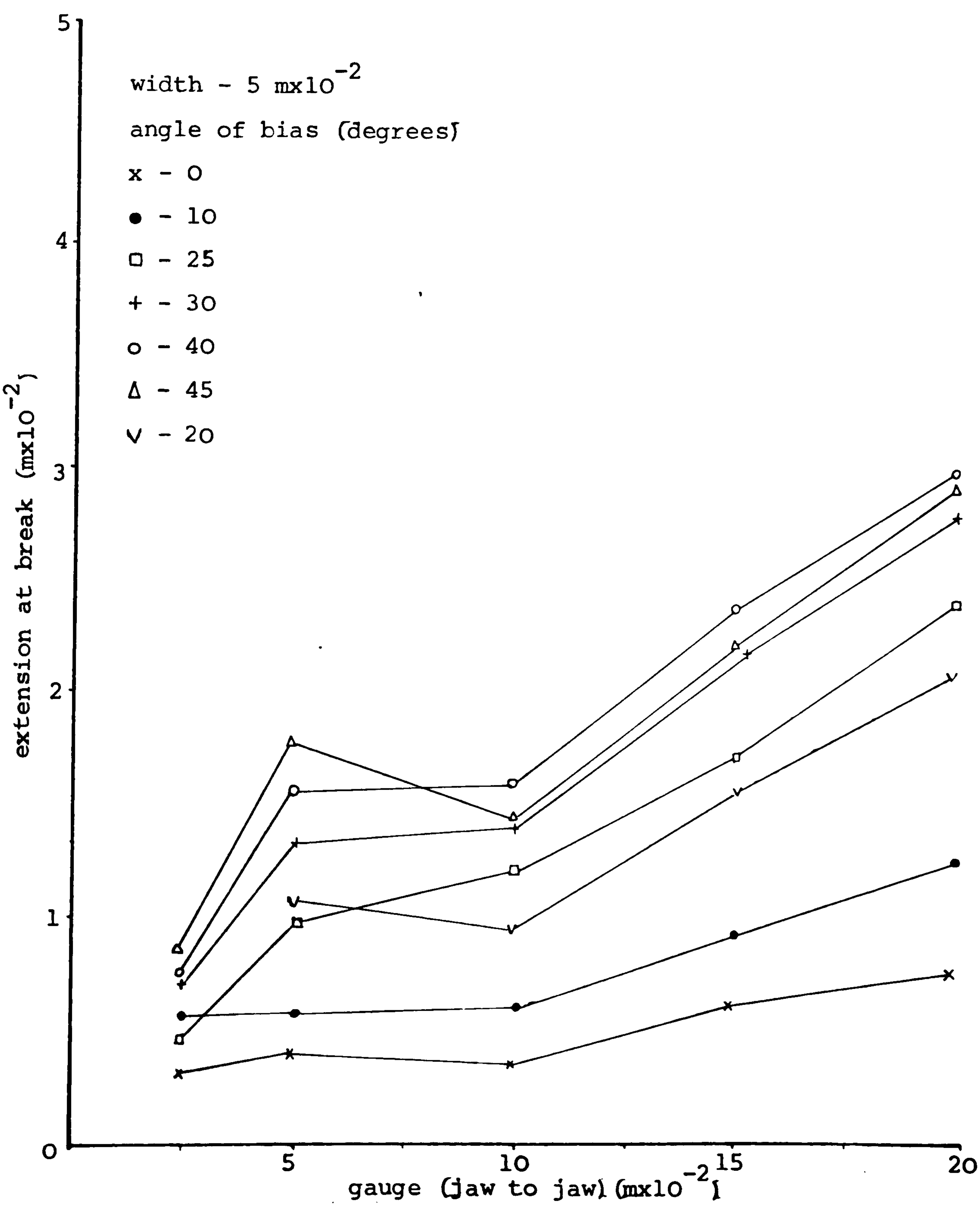


Figure 3.1b The Extension at Break of Fabric A as a Function of Gauge (Jaw to Jaw) under the Unseamed Fabric Breaking Condition.



to 90^0 are shown in Figure 3.2. The warp (at 0^0 angle of bias) is some 100N per 5 $mx10^{-2}$ width stronger than the weft (at 90^0 angle of bias). The two low troughs occur at 25^0 and 70^0 and the trough at 70^0 is approximately 35N stronger than the trough at 25^0. The middle peak occurs at 55^0 angle of bias.

3.3.2.3 Unseamed fabric break of Fabric C

Figure 3.3 shows the results of the angle of bias effect tests (from 0^0 - 90^0) on the strength of fabric C, a 100% cotton plain weave with sett of 17/14 yarns per $mx10^{-2}$. The warp is only some 20N per 5 $mx10^{-2}$ width stronger than the weft. The two low troughs occur at 30^0 and 60^0, and the trough at 60^0 is some 20N per 5 $mx10^{-2}$ width stronger than the trough at 30^0. The middle peak occurs at 50^0, but the strengths at 40^0 and 45^0 are approximately the same as at 50^0.

3.3.2.4 Unseamed fabric break of Fabric D

Fabric D was a 100% cotton plain weave fabric with a sett of 27/24 yarns per $mx10^{-2}$, the results of testing the angle of bias effect are shown in Figure 3.4. The warp is some 60N per 5 $mx10^{-2}$ width stronger than the weft. The two low troughs occur at 30^0 and 70^0, and the trough at 70^0 is 20N per 5 $mx10^{-2}$ width stronger than the trough at 30^0. The middle peak strength is at 50^0 and is about the same as the warp strength.

3.3.2.5 Unseamed fabric break of Fabric E

The rest of the fabrics (from fabric E to fabric I) used in the experiments were not plain weave fabrics. Fabric E was a 100% cotton 2/1 twill with a sett of 40/20 yarns per $mx10^{-2}$, the results for testing the angle of bias effect are shown in Figure 3.5. The

Figure 3.2 The Breaking Strength and the Extension at Break of Fabric B as a Function of Angle of Bias under the Unseamed Fabric Breaking Condition.

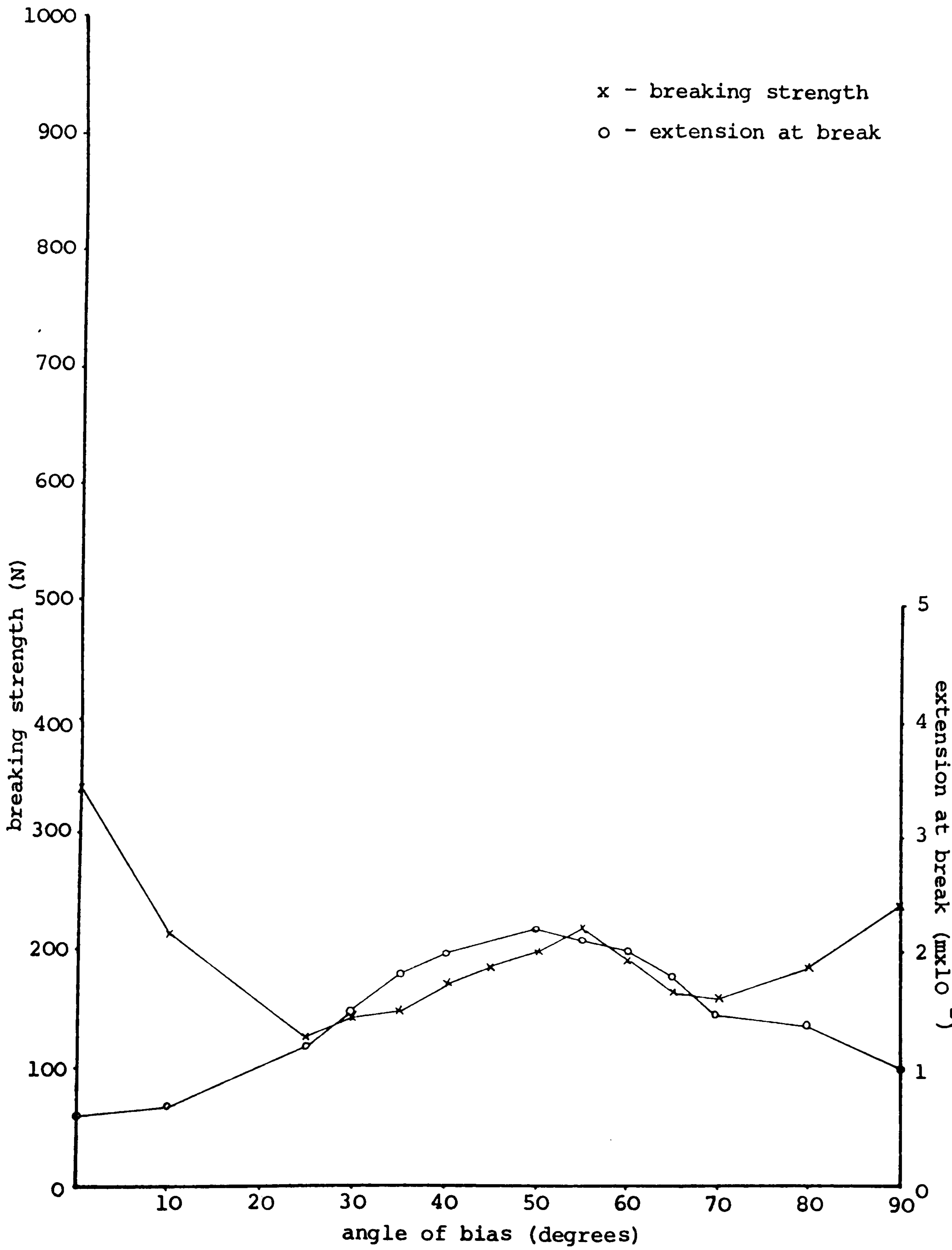


Figure 3.3 The Breaking Strength and the Extension at Break of Fabric C as a Function of Angle of Bias under the Unseamed Fabric Breaking Condition.

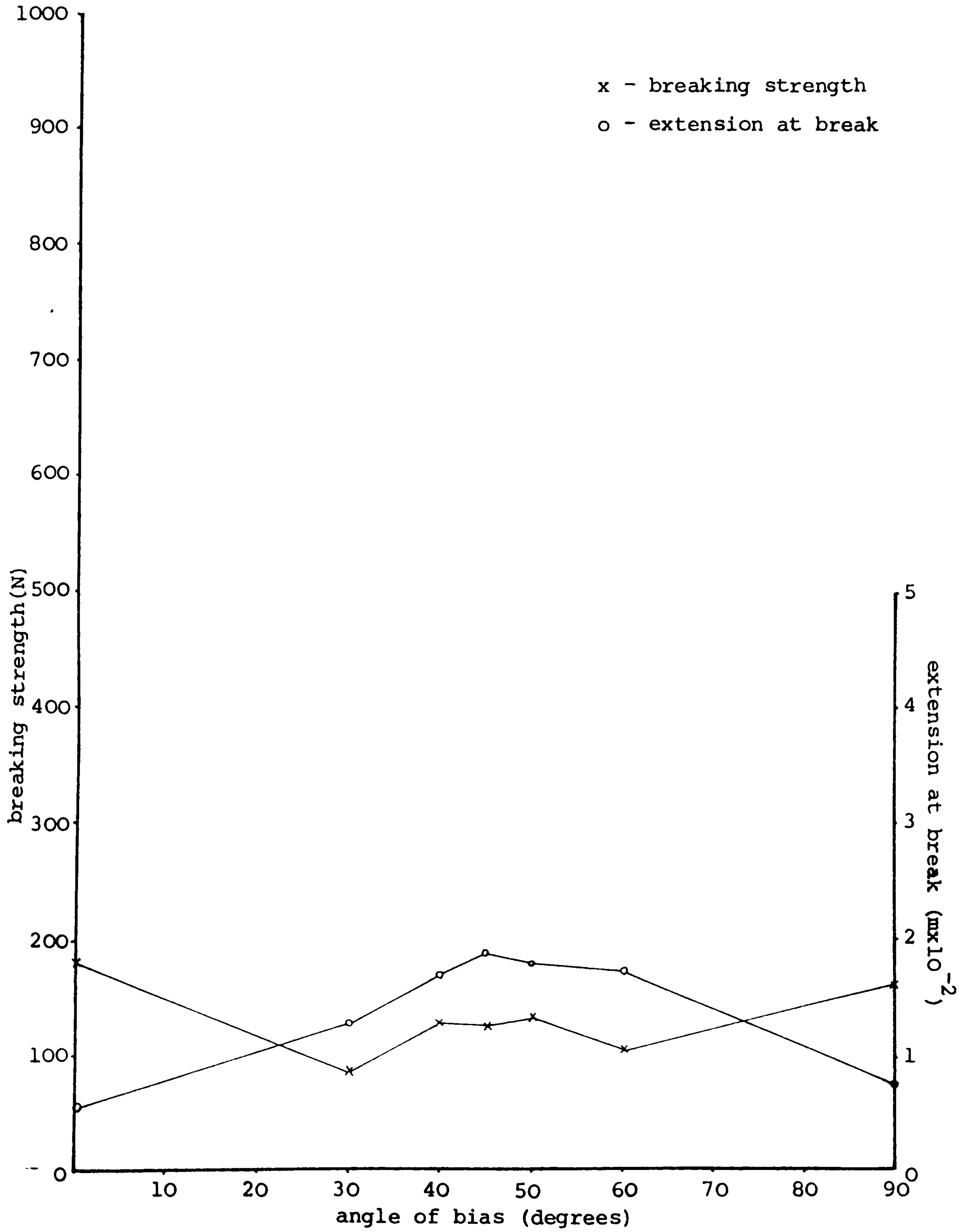


Figure 3.4 The Breaking Strength and the Extension at Break of Fabric D as a Function of Angle of Bias under the Unseamed Fabric Breaking Condition.

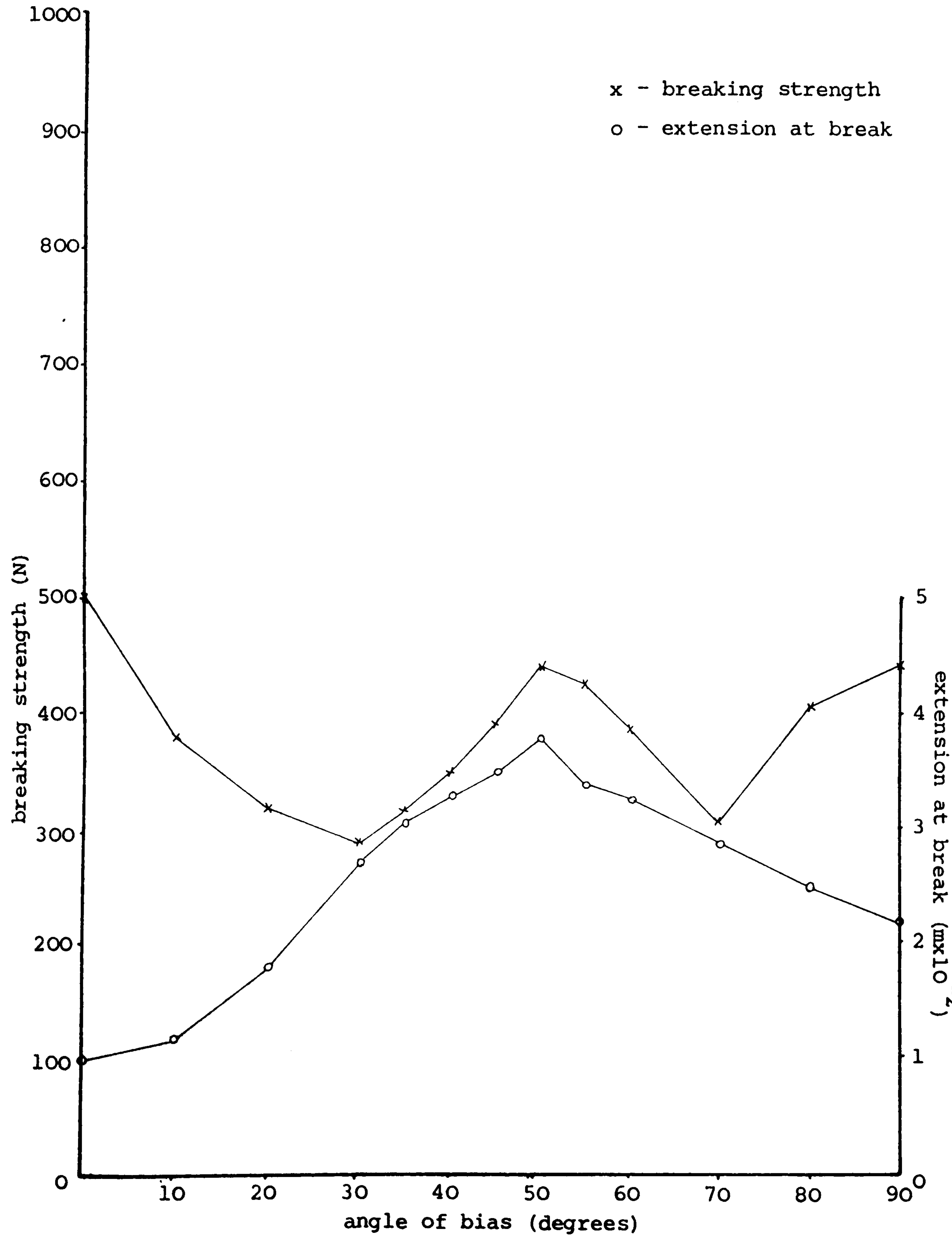
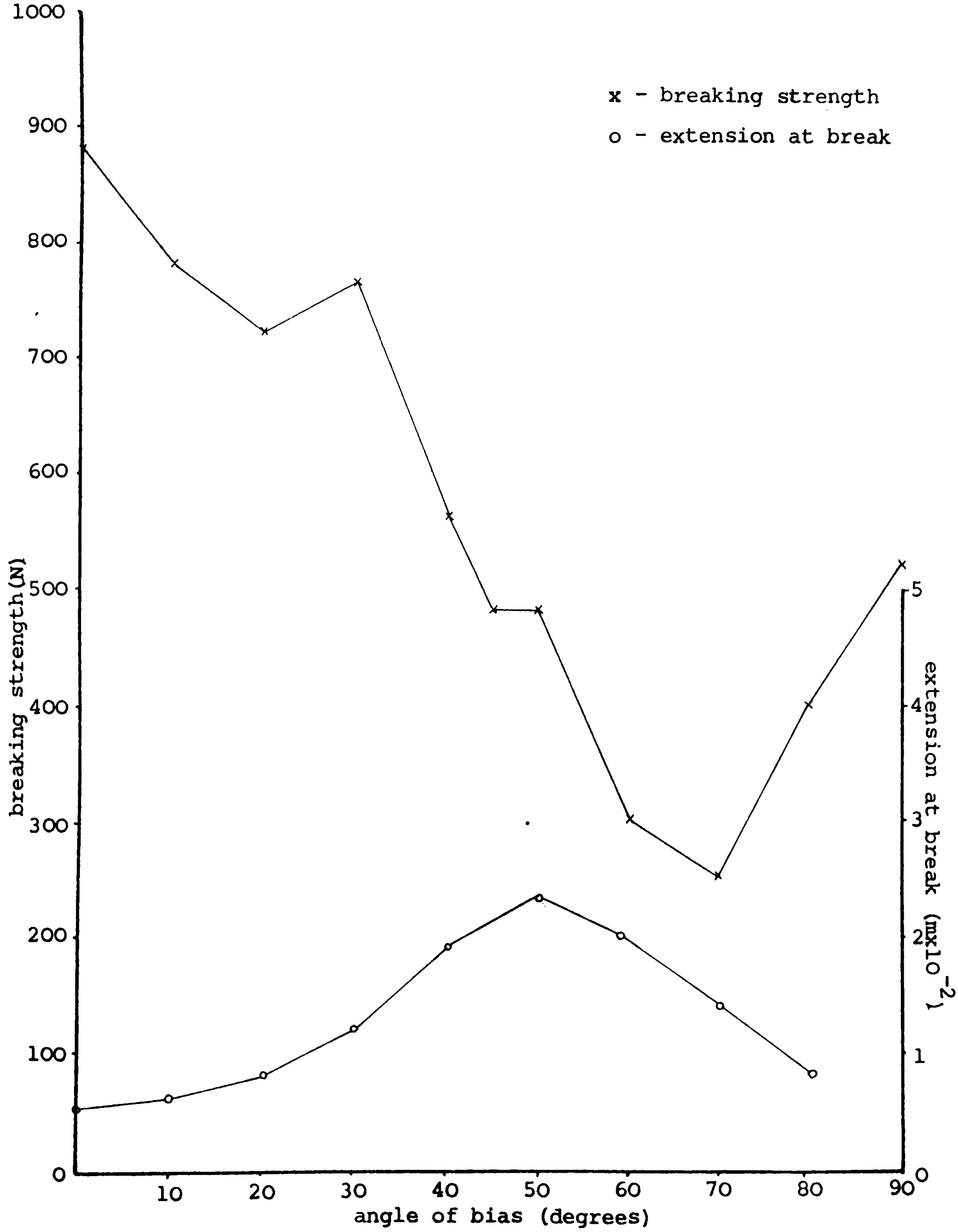


Figure 3.5 The Breaking Strength and the Extension at Break of Fabric E as a Function of Angle of Bias under the Unseamed Fabric Breaking Condition.



warp is some 360N per 5 $mx10^{-2}$ width stronger than the weft. The two low troughs occur at 20^0 and 70^0 angle of bias, the trough at 70^0 is about 470N per 5 $mx10^{-2}$ width stronger than the trough at 20^0. The middle peak (at 30^0) is quite strong being only 110N per 5 $mx10^{-2}$ width lower than the strength at 0^0.

3.3.2.6 Unseamed fabric breaks of Fabric F

Figure 3.6 shows the results of tests on the angle of bias effect for Fabric F. This was a 100% cotton weft sateen with sett of 28/68 yarns per $mx10^{-2}$. The difference between the warp and weft strength is only 60N per 5 $mx10^{-2}$ width. The two low troughs occur at 30^0 and 70^0, and the trough at 70^0 is about 70N per 5 $mx10^{-2}$ width stronger than the trough at 30^0. The middle peak appears to be between 40^0 and 45^0. It is suggested (for non-plain weave fabrics) that lowering the number of warp yarns per unit length push the middle peak below 45^0, as the warp and weft strengths are about the same, and vice versa.

3.3.2.7 Unseamed fabric breaks of Fabric G

Fabric G was a 100% heavy cotton drill with sett of 32/18 yarns per $mx10^{-2}$, and the results for angle of bias effect tests are shown in Figure 3.7. The warp is approximately 330N per 5 $mx10^{-2}$ width stronger than the weft. The two low troughs occur at 20^0 and 70^0, and the trough at 70^0 is about 180N stronger than the trough at 20^0. The middle peak occurs at the range 30^0 to 40^0 and has the same strength as the weft. The shape of the 'W' curve is distorted, perhaps, by the large strength difference between warp and weft.

.3.2.8 Unseamed fabric breaks of Fabric H

Figure 3.8 shows the results of angle of bias effect tests on

Figure 3.6 The Breaking Strength and the Extension at Break of Fabric F as a Function of Angle of Bias under the Unseamed Fabric Breaking Condition.

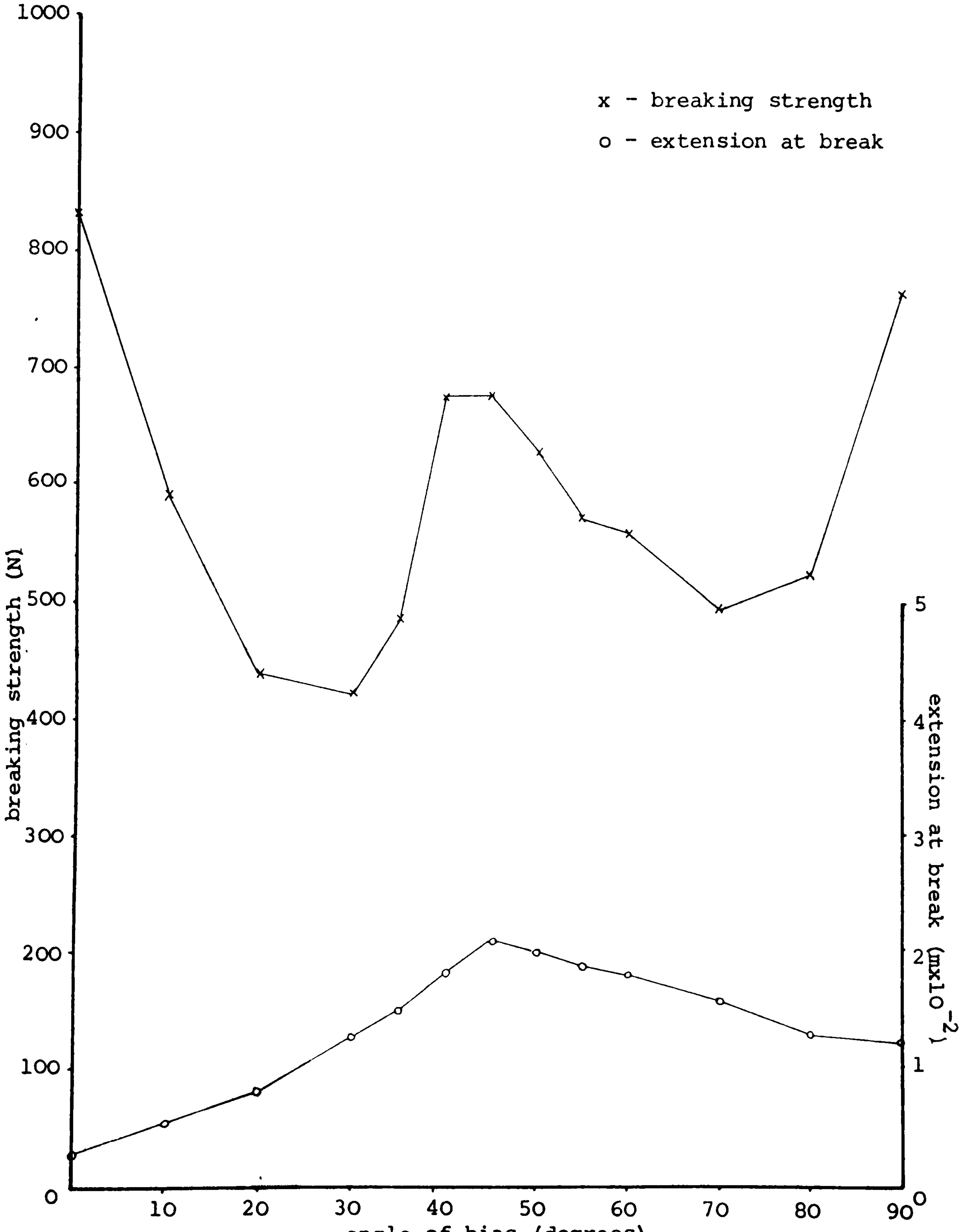


Figure 3.7 The Breaking Strength and the Extension at Break of Fabric G as a Function of Angle of Bias under the Unseamed Fabric Breaking Condition.

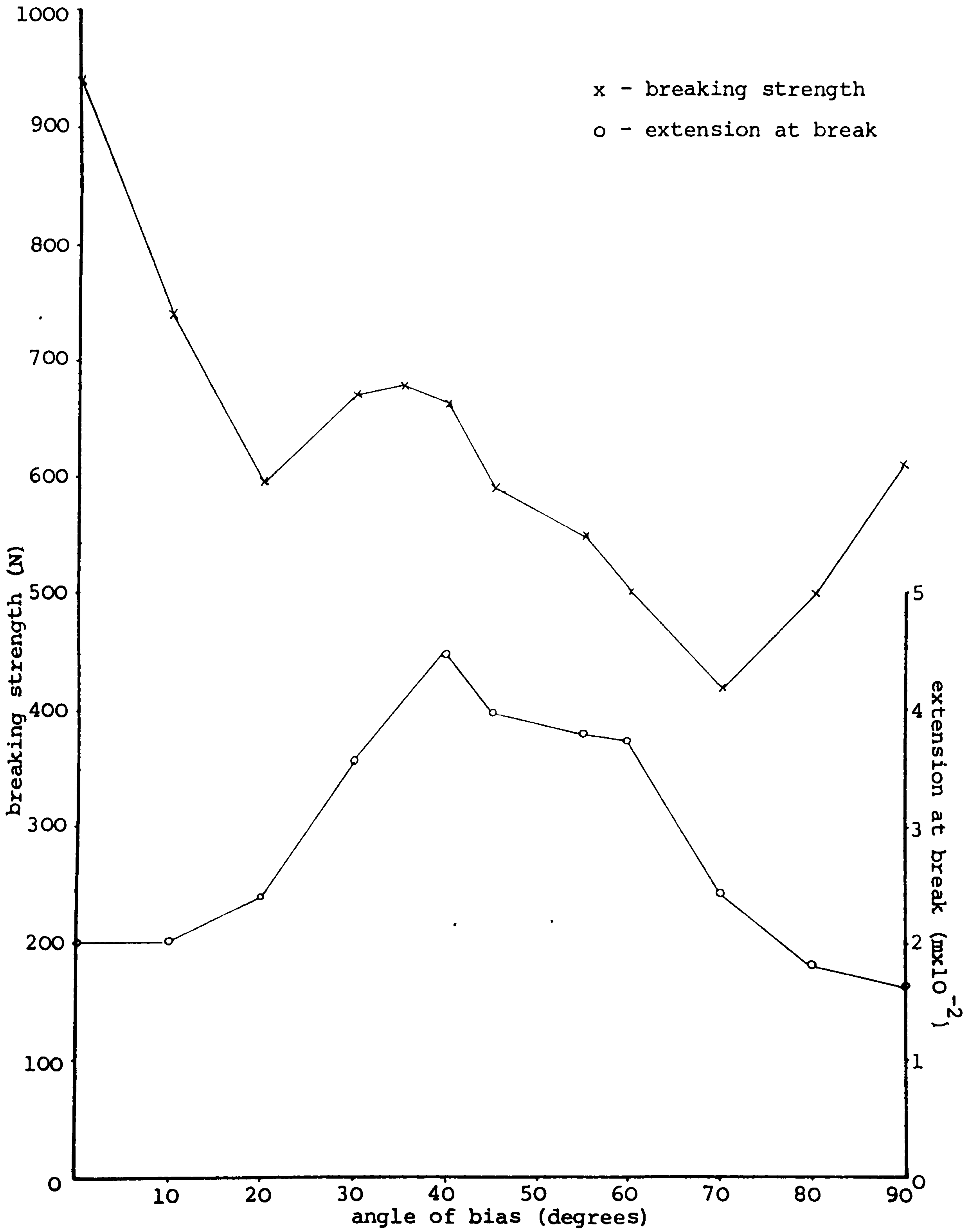
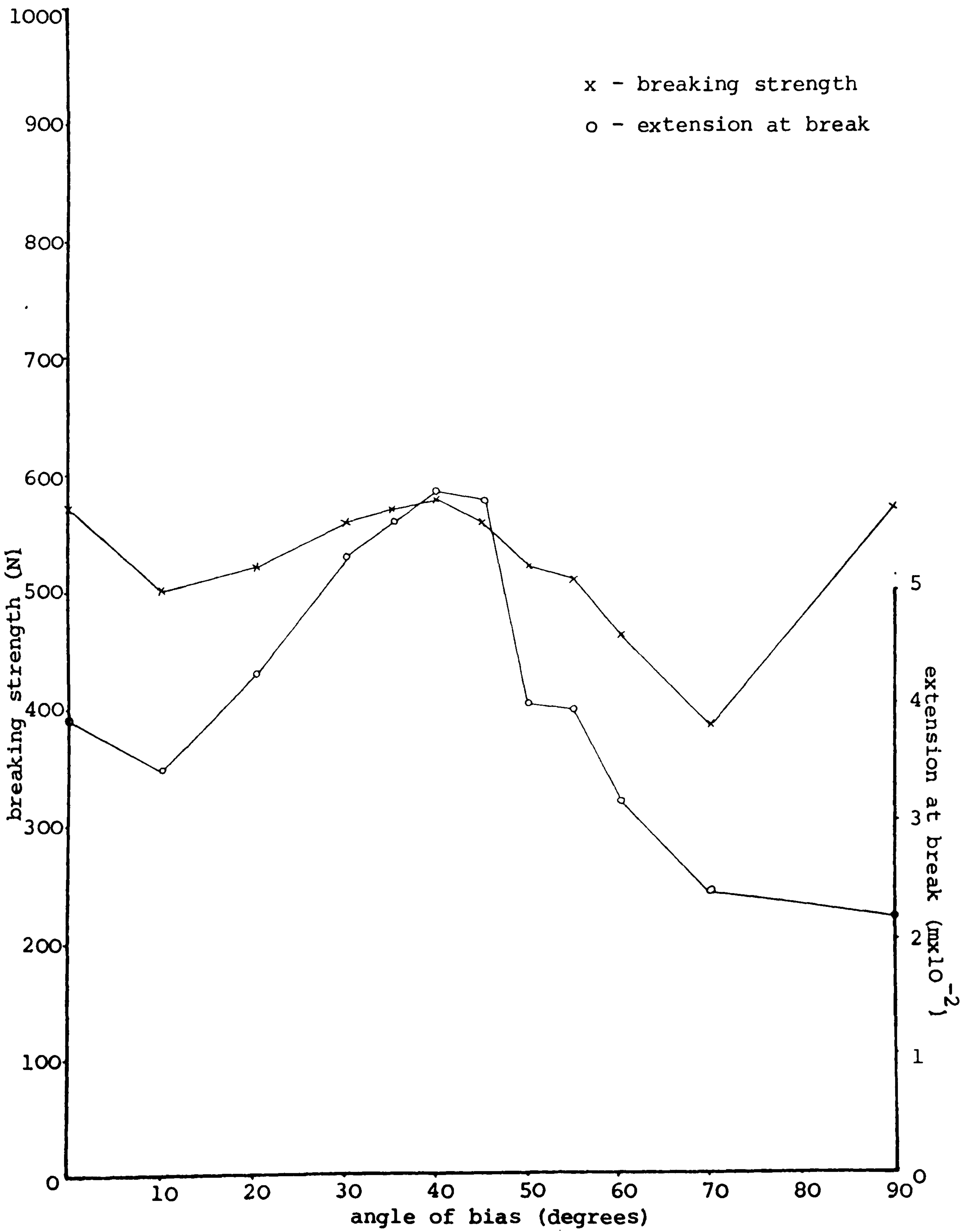


Figure 3.8 The Breaking Strength and the Extension at Break of Fabric H as a Function of Angle of Bias under the Unseamed Fabric Breaking Condition.



Fabric H which was a nylon/cotton blend with sett of 10.6/11.4 yarns per $mx10^{-2}$. The warp and weft have the same strength. The two low troughs occur at 10^0 and 70^0, and the trough at 10^0 is about 120N per 5 $mx10^{-2}$ width stronger than the trough at 70^0. The middle peak occurs at 40^0 and shows the same strength as for both warp and weft. It is suggested, again, that having less warp yarns per unit length pushes the middle peak below 45^0 as the warp and weft strength are about the same.

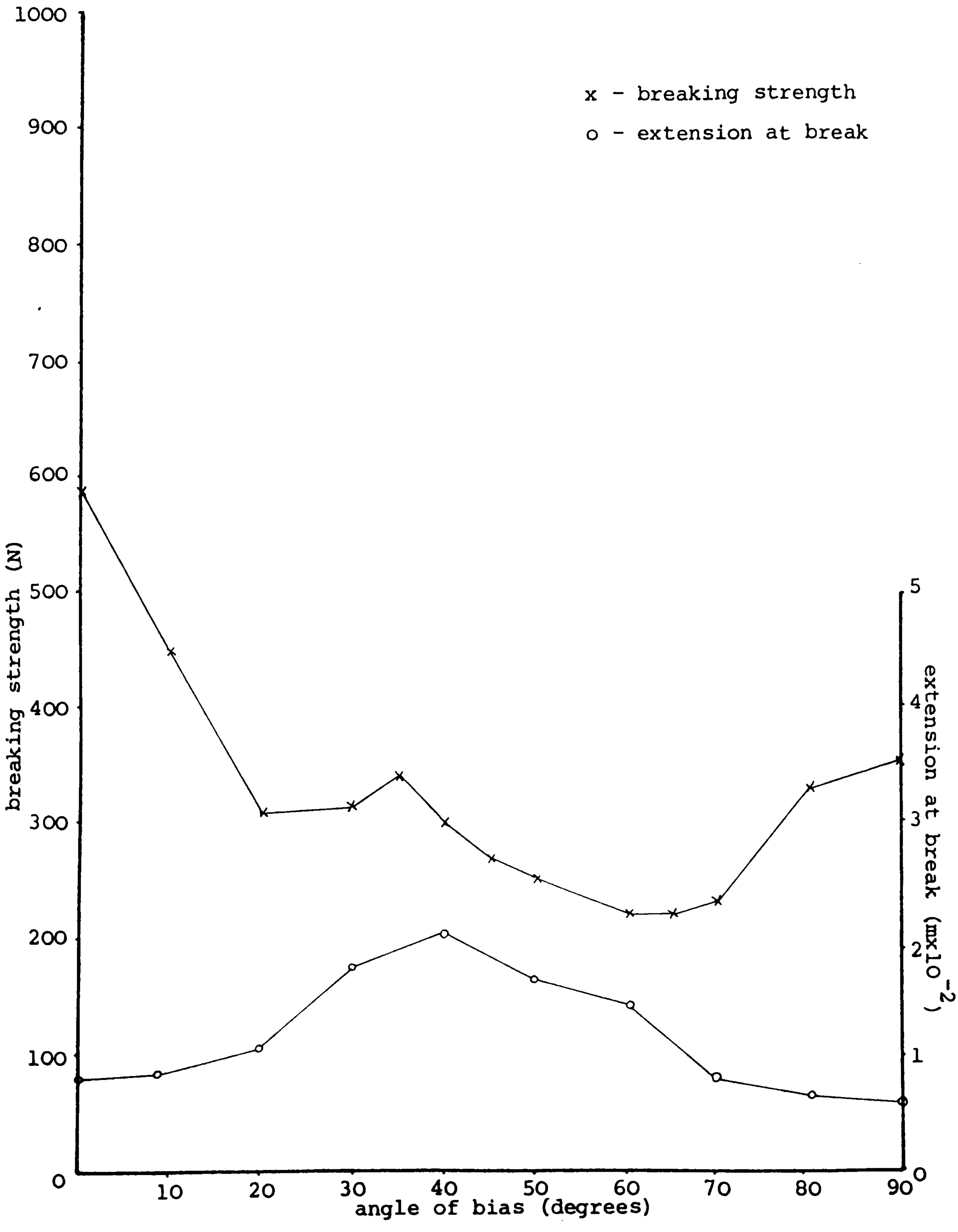
3.3.2.9 Unseamed fabric breaks of Fabric I

The last fabric used in the tests on the angle of bias effect for unseamed fabric breaks, shown in Figure 3.9, was Fabric I, a 100% Poplin cotton shirting with sett of 26/52 yarns per $mx10^{-2}$. The warp is about 230N per 5 $mx10^{-2}$ width stronger than the weft. The two low troughs occur in the range 20^0 to 30^0 and in the range 60^0 to 65^0. The trough in the range 60^0 to 65^0 is about 80N per 5 $mx10^{-2}$ width stronger than the trough in the range 20^0 to 30^0. The middle peak occurs at 35^0, this peak has the same strength as the weft. These suggest that high warp strength per unit length (compared with weft strength) brings the middle peak below 45^0 (and vice versa) even the warp contains more yarns per unit length than the weft.

3.3.2.10 Summary of unseamed fabric breaks

From the results of the first four plain weave fabrics (q.v. Figures 3.1a, 3.2,3.3, and 3.4) of one square-sett fabric and three non-square-sett fabric, it can be seen that half 'W' shaped curves (in Figure 3.1a) and 'W' shaped curves (in the other figures) are evident, the middle peak for the square-sett fabric happens at 45^0 angle of bias; the

Figure 3.9 The Breaking Strength and the Extension at Break of Fabric I as a Function of Angle of Bias under the Unseamed Fabric Breaking Condition.



middle peak in the cases of the other three non-square-sett fabrics happens in the range of 45^0 and 50^0. Coincidently, all three fabrics have more warp yarns per unit length than weft yarns. It can be suggested, therefore, that the middle peak has a relationship with fabric sett (as the warp and weft strengths are about the same). The figures also suggest that the strength of a trough increases if the middle peak moves to its side of 45^0.

The results for the last five fabrics (non-plain weave), illustrate that 'W' shaped curves are also evident, and a marked effect of angle of bias is shown especially for the stronger fabrics. The middle peaks have not settled at 45^0 angle of bias. The results of Fabric E, G and I (Figures 3.5, 3.7 and 3.9 respectively) illustrate a good deal of difference in strength between the warp and the weft (with the warp strength greater than weft strength). The middle peaks of these three fabrics occur below 40^0. Now fabric I has a lower number of warp yarns than weft, and Fabrics E and G have a higher warp number even though they still have the middle peak below 45^0. There is thus a contradiction to the suggestion mentioned in the last paragraph. It is therefore suggested that the ratio of warp to weft strength produces an effect on the position of the middle peak.

Careful examination of the movement of the middle peak as the ratios of the number of warp and weft and the warp and weft strength vary, produces the following conclusions:

i) a higher number of warp yarns per unit length than weft pushes the middle peak above 45^0 and vice versa, if the warp and weft strengths are about the same;

ii) higher warp than weft strength per unit length brings the middle peak below 45^0 angle of bias and vice versa even if the warp/weft yarn ratio is the other way round ;

iii) the strength at the trough increases as the middle peak moves to its side.

3.3.3 TYPE II BREAKS

The mean breaking strength found in experiments producing Type II breaks are shown in Figures 3.10a, 311a to 3.14, (the means and the ranges of these results are given in Appendices 3 and 4).

3.3.3.1 Type II breaks of Fabric A

A marked angle of bias effect is shown in the results illustrated in Figures 3.10a and 3.11a. This effect reduces the seam strength at the mid-range of the angle of bias (15^0-35^0). Only gauge lengths of 10 and 15 $mx10^{-2}$ produced a half 'W' shaped curve; only a very small angle of bias effect is apparently present at gauge length of 5 $mx10^{-2}$ for both the cases of 5 and 6.5 $mx10^{-2}$ sample widths.

The results support the view that the shorter the gauge length the less the effect of the angle of bias. The strengths at 0^0 and 45^0 can be seen to remain constant at different gauge lengths.

By superimposing Figure 3.10a on Figure 3.11a, a marked width effect is evident in the mid-range of the angles and only a slight width effect is evident at 0^0 and 45^0. The wider width gives the higher breaking strength. The other width effect is apparent in the changing of the angle of bias at the minimum value occurs; the minimum value tends to move to the right hand side of the curve as the width increases.

Figure 3.10a The Breaking Strength of Fabric A as a Function of Angle of Bias under the Type II Breaking Condition.

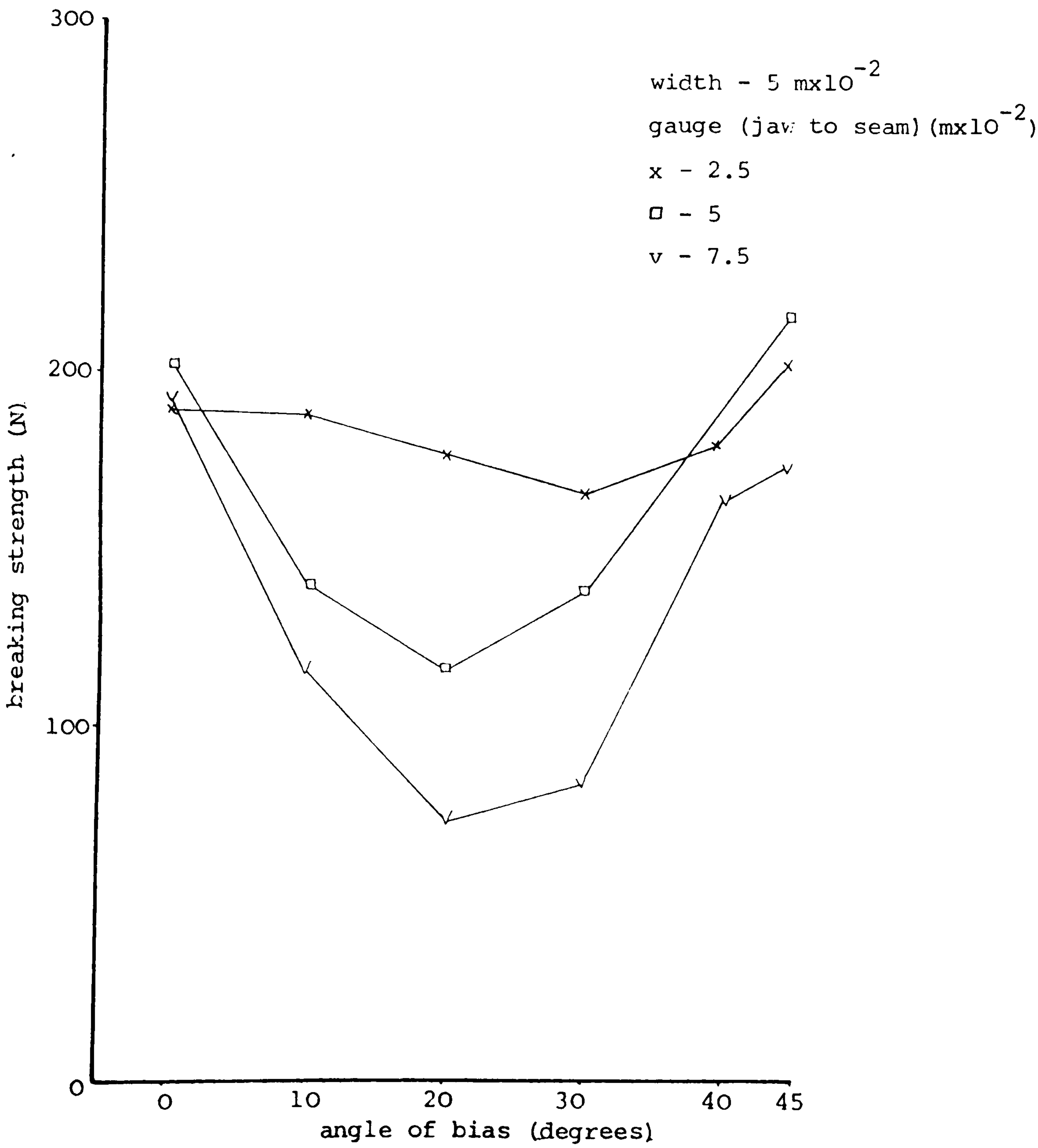


Figure 3.10b The Fxtension at Break of Fabric A as a Function of Gauge (Jaw to Jaw) under the Type II Breaking Condition.

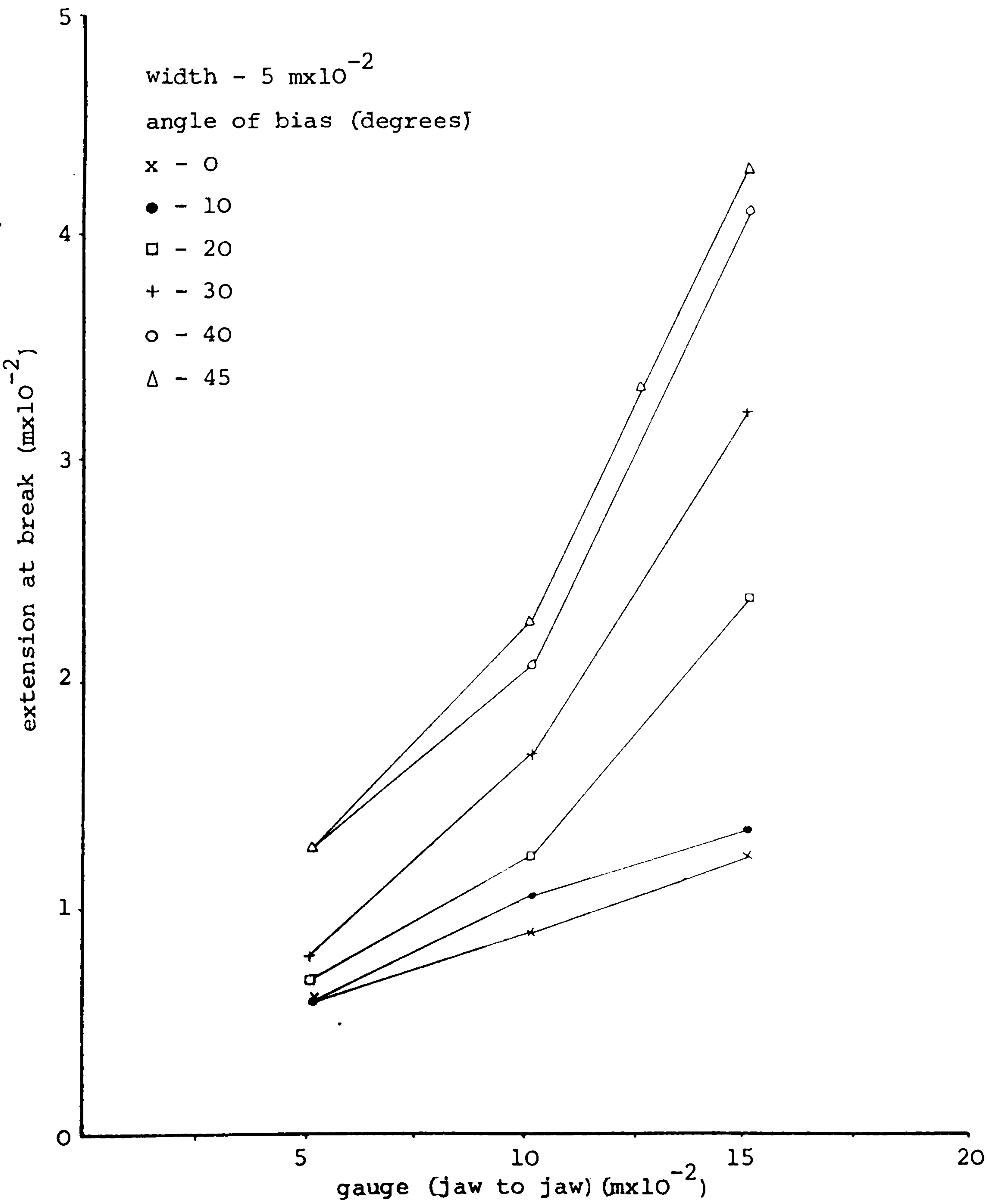


Figure 3.11a The Breaking Strength of Fabric A as a Function of Angle of Bias under the Type II Breaking Condition.

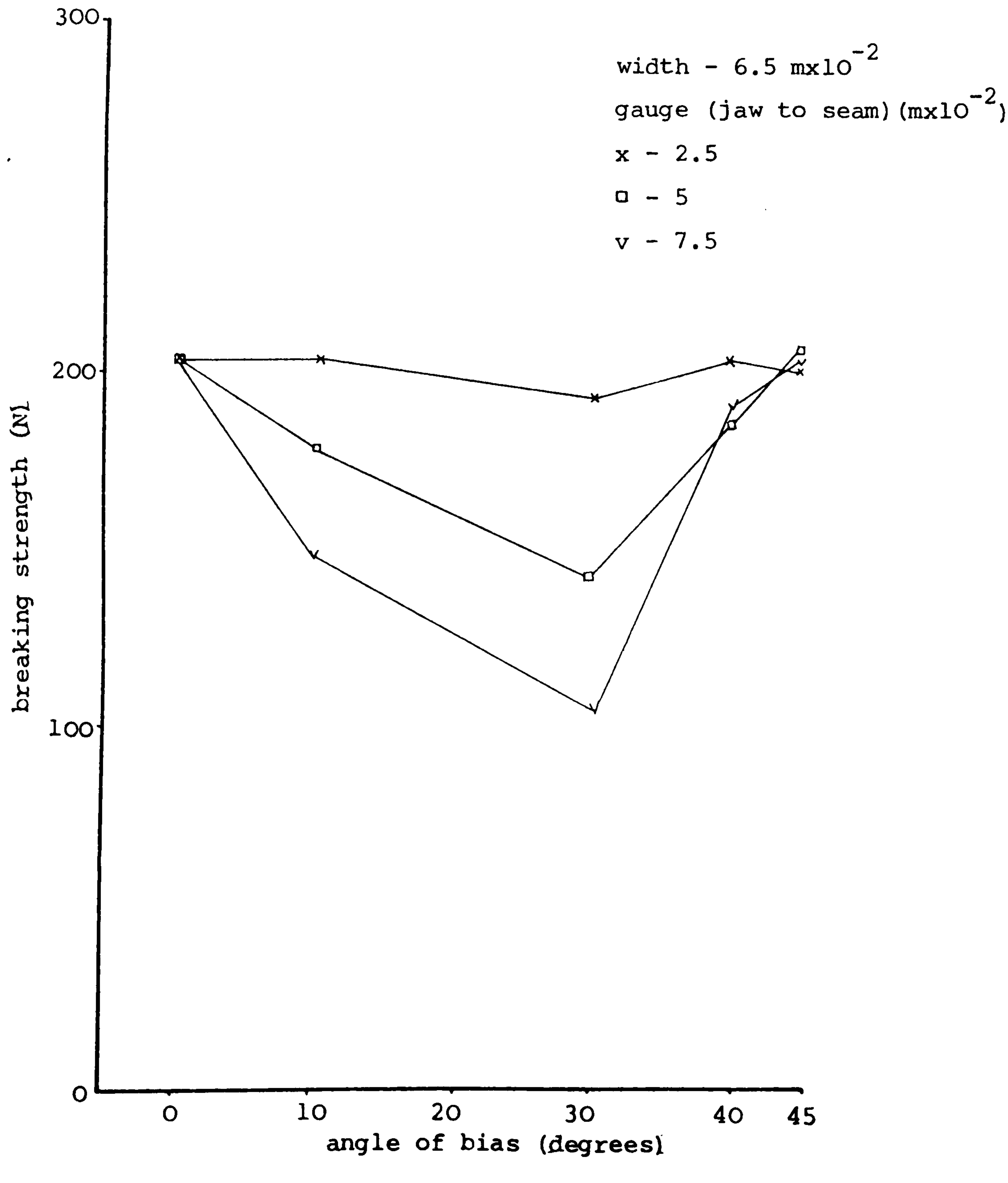
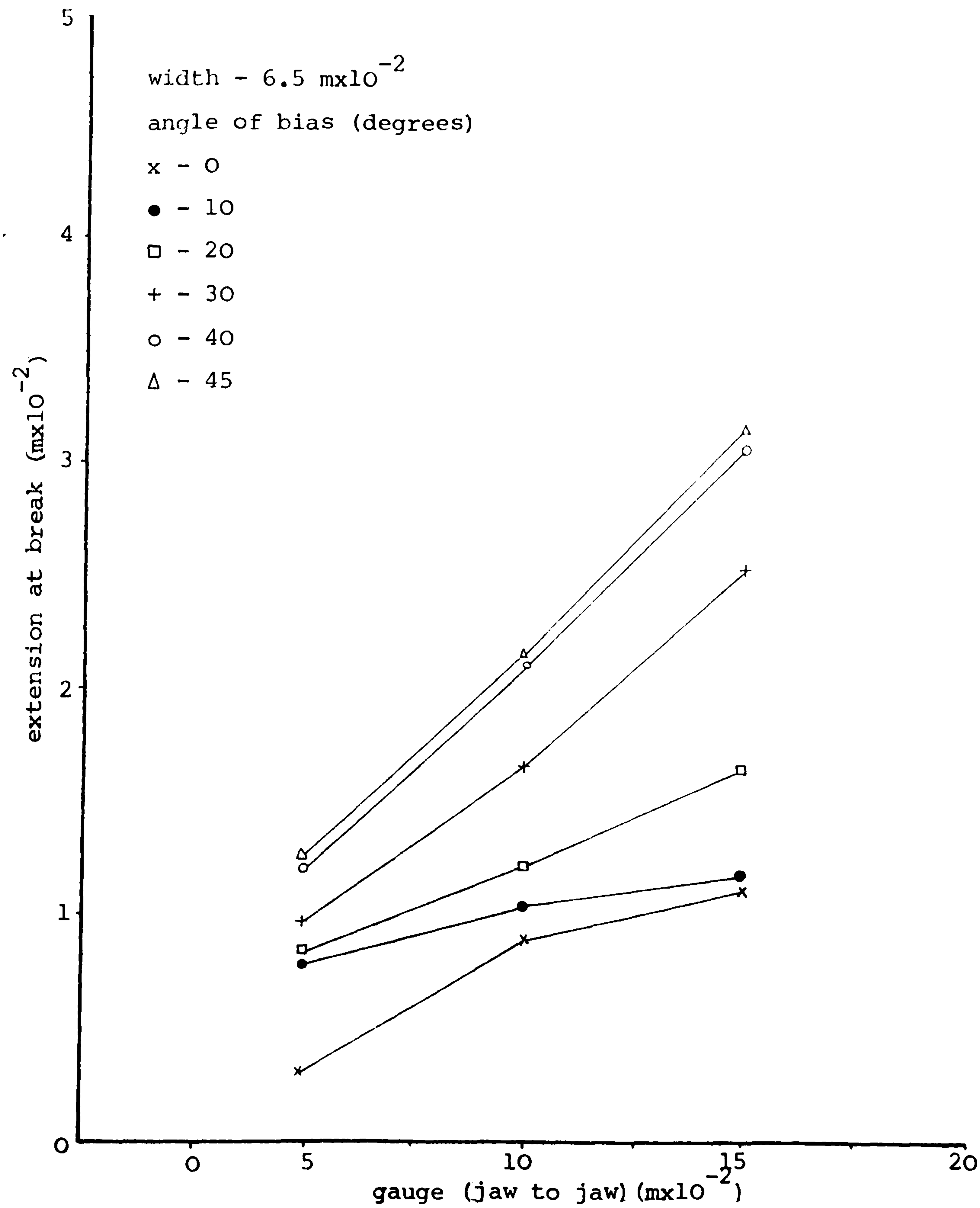


Figure 3.11b The Extension at Break of Fabric A as a Function of Gauge (Jaw to Jaw) under the Type II Breaking Condition.



Apart from Fabric A, only three more fabrics (D, H and I), were used under the Type II breaking conditions. This was because the rest of the fabrics were too strong to produce Type II seams even if the strongest sewing thread capable of sewing on industrial type equipment available was used.

3.3.3.2 Type II breaks of Fabric D

Figure 3.12 illustrates a very marked angle of bias effect on Fabric D where the maximum strength is in excess of twice the minimum strength. This was a 100% cotton plain weave fabric with sett of 27/24 yarns per $mx10^{-2}$. The warp strength is only 50N per 5 $mx10^{-2}$ width stronger than the weft. The two low troughs occur at 30^0 and at a range of 60^0 and 70^0 angle of bias. The trough at the range of 60^0 and 70^0 is about 100N per 5 $mx10^{-2}$ width stronger than the trough at 30^0. The middle peak moves to 50^0 angle of bias and produces a strength equivalent to the warp strength. The sett of the fabric has an effect on the position of the middle peak and pushes it from 45^0 to 50^0. It should be noted that the warp and weft strengths are approximately the same.

3.3.3.3 Type II breaks of Fabric H

A very marked angle of bias effect in Fabric H is illustrated in Figure 3.13. The warp and weft strength have only 20N per 5 $mx10^{-2}$ width in difference. The two low troughs occur at 20^0 and 70^0, and the trough at 20^0 is about 60N per 5 $mx10^{-2}$ width stronger than the trough at 70^0. The middle peak moves to 40^0 angle of bias and produces about the same strength as the weft. The results suggest again that the sett of the fabric has an effect on the position of the middle peak even when the warp and weft strengths are about the same.

Figure 3.12 The Breaking Strength and the Extension at Break of Fabric D as a Function of Angle of Bias under the Type II Breaking Condition.

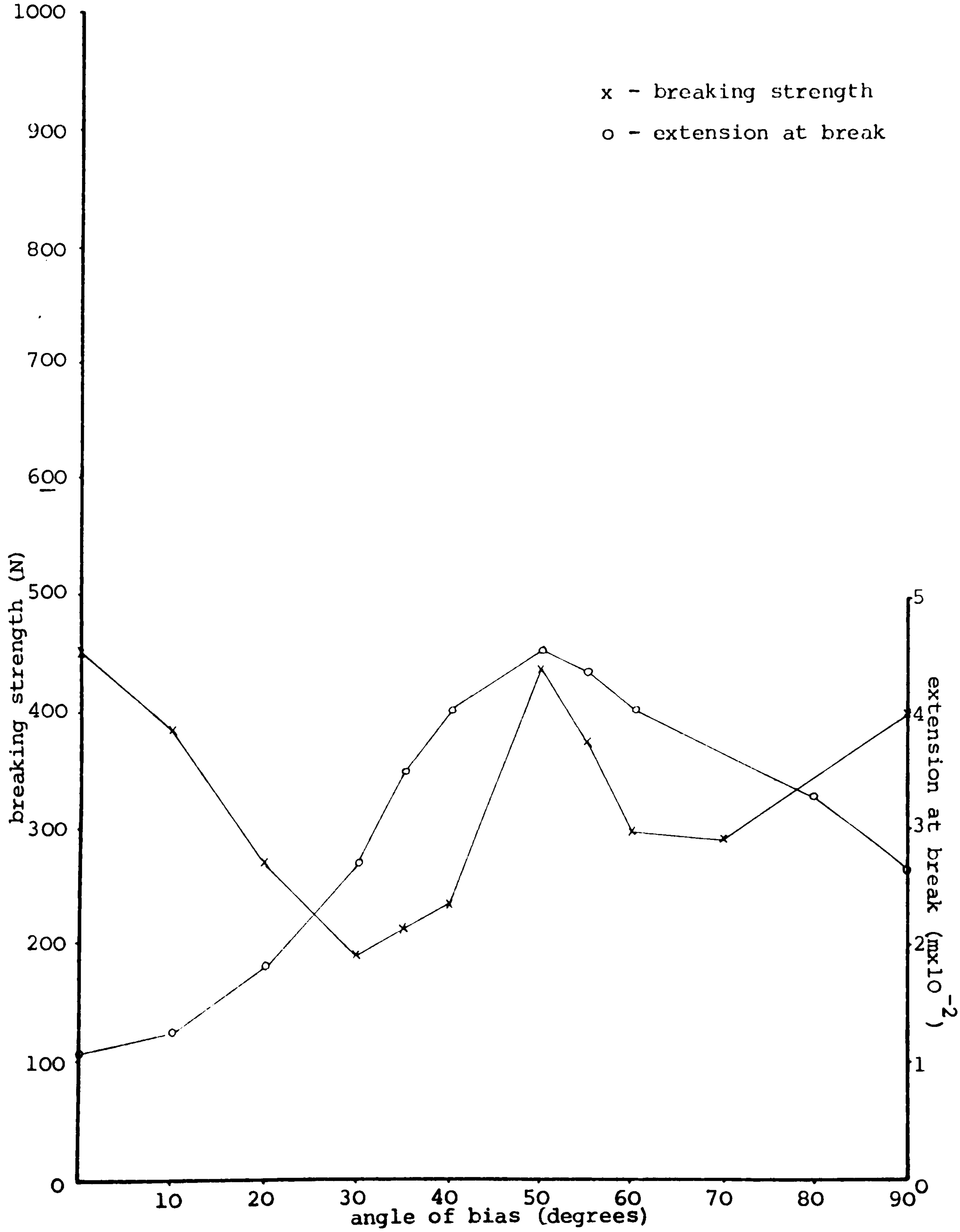
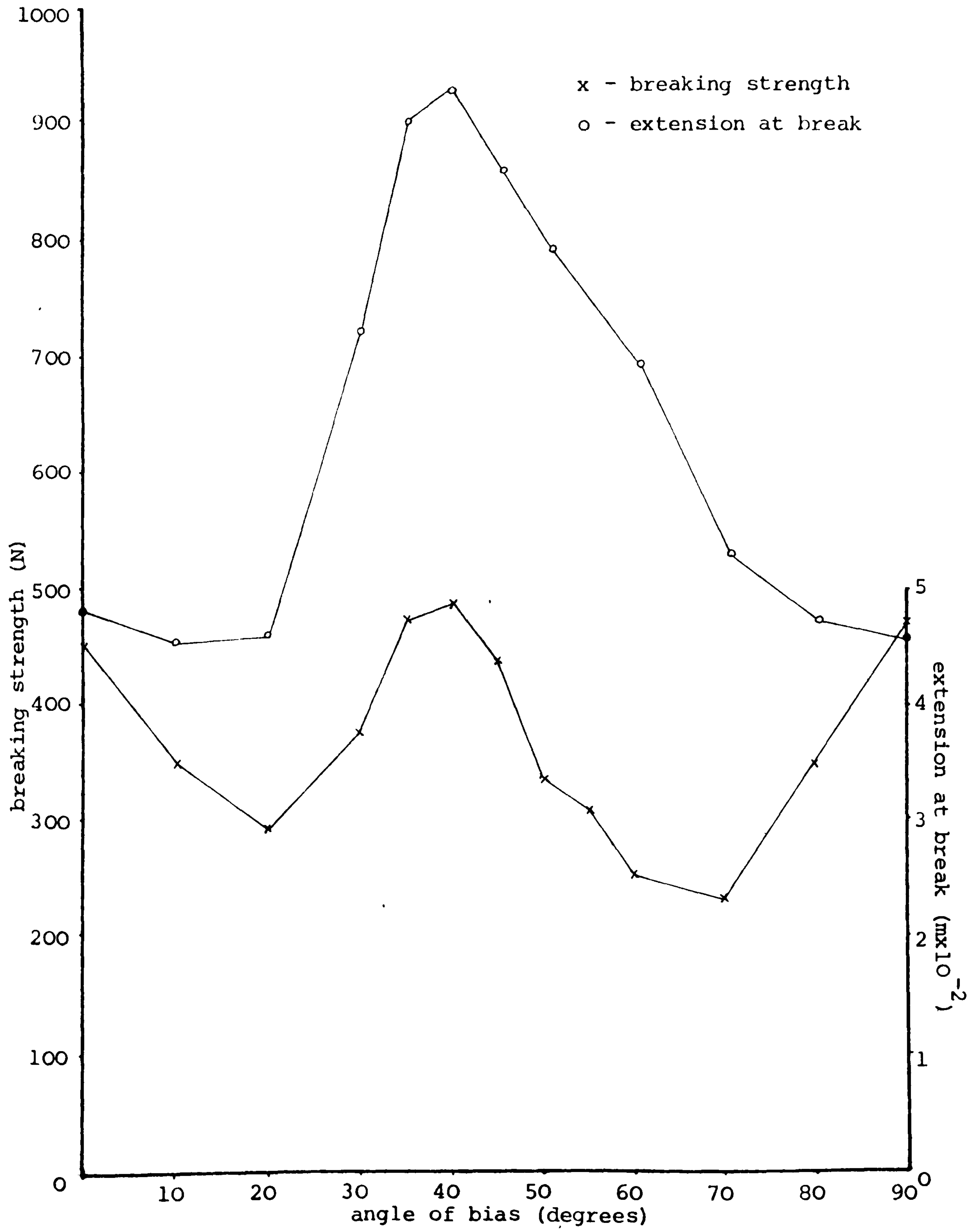


Figure 3.13 The Breaking Strength and the Extension at Break of Fabric H as a Function of Angle of Bias under the Type II Breaking Condition.



3.3.3.4 Type II breaks of Fabric I

In Figure 3.14, a distorted 'W' shaped curve is illustrated for Fabric I (a 100% poplin cotton shirting). The warp is about 250N per 5 $mx10^{-2}$ width stronger than the weft. The two low troughs occur at 20^0 and 70 and the trough at 20^0 is about 50N per 5 $mx10^{-2}$ width stronger than the trough at 70^0. The middle peak occurs at 40^0. In this case, the proportions of warp and weft strength and the sett of fabric are both in favour of a move of middle peak to below 45^0.

3.3.3.5 Summary of results on Type II breaks

The results for the four fabrics (A,D,H and I) used, illustrate a very marked angle of bias effect. Apart from Fabric A, the others show irregular 'W' shaped curves. The same suggestions as for the unseamed fabric break results are made viz:

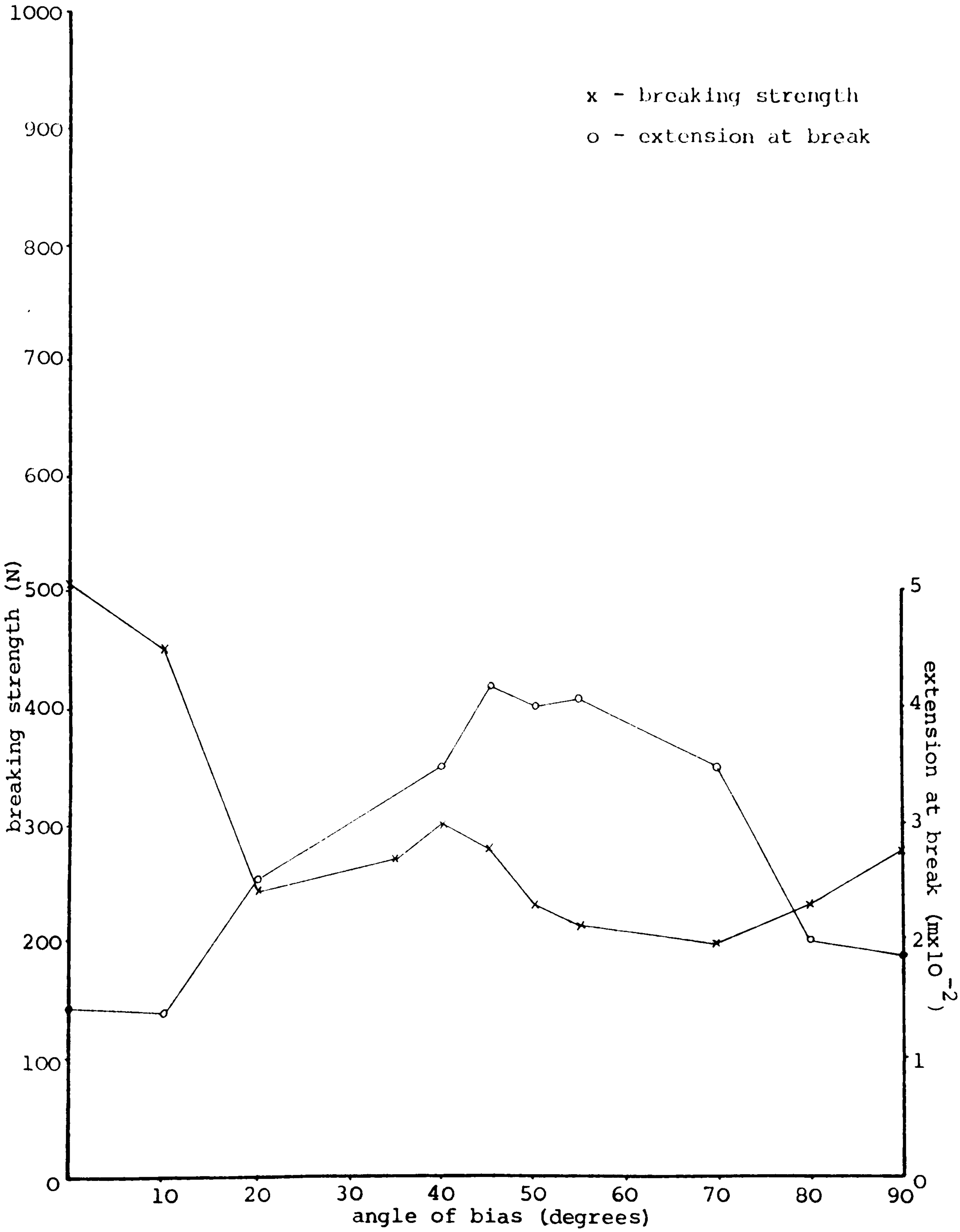
i) a higher number of warp yarns per unit length pushes the middle peak above 45^0 and vice versa even when the warp and weft strength per unit length are about the same;

ii) a higher warp strength per unit length brings the middle peak below 45^0 angle of bias and vice-versa, even when the sett ratio is the other way round;

iii) the strength at a trough increases if the middle peak moves to its' side.

In addition, gauge length and sample width effects were also noted.

Figure 3.14 The Breaking Strength and the Extension at Break of Fabric I as a Function of Angle of Bias under the Type II Breaking Condition.



3.3.4 TYPE I BREAKS

The mean strengths of the experimental results are shown in Figures 3.15a, 16a, 17a to 25, the mean strength and the range are given in Appendices 5 and 6.

3.3.4.1 Type I breaks of Fabric A

A marked effect of the angle of bias is shown in Figure 3.15a. This effect reduces the strength at the mid-range of the angle (15^0-35^0) except in the case of the 5 $mx10^{-2}$ gauge length and width of 6.5 $mx10^{-2}$. All other cases show the familiar half 'W' shaped curve.

A gauge length effect is also shown in Figure 3.16a in addition to the angle of bias effect at the mid-range of the angles. The strength, however, remains constant at angles of 0^0 and 45^0.

By superimposing Figures 3.15a, 3.16a and 3.17a, a marked effect of width is evident. This means an overall increase in strength along the angle of bias with the minimum values swinging slightly to the right as the width increases. The decreasing rate of the minimum value tends to slow down as the gauge length increases and the width decreases.

3.3.4.2 Type I breaks of Fabric B

Figure 3.18 shows that the usual 'W' shaped curves resulted, and extra angles of bias, especially around 45^0 (at the gauge length of 10 $mx10^{-2}$) were investigated. It became clear that the middle peak does move to 50^0 instead of 45^0 (as for Fabric A).

It is suggested therefore again that a higher number of warp yarns per unit length pushes the middle peak above 45^0 even when the

Figure 3.15a The Breaking Strength of Fabric A as a Function of Angle of Bias under the Type I Breaking Condition.

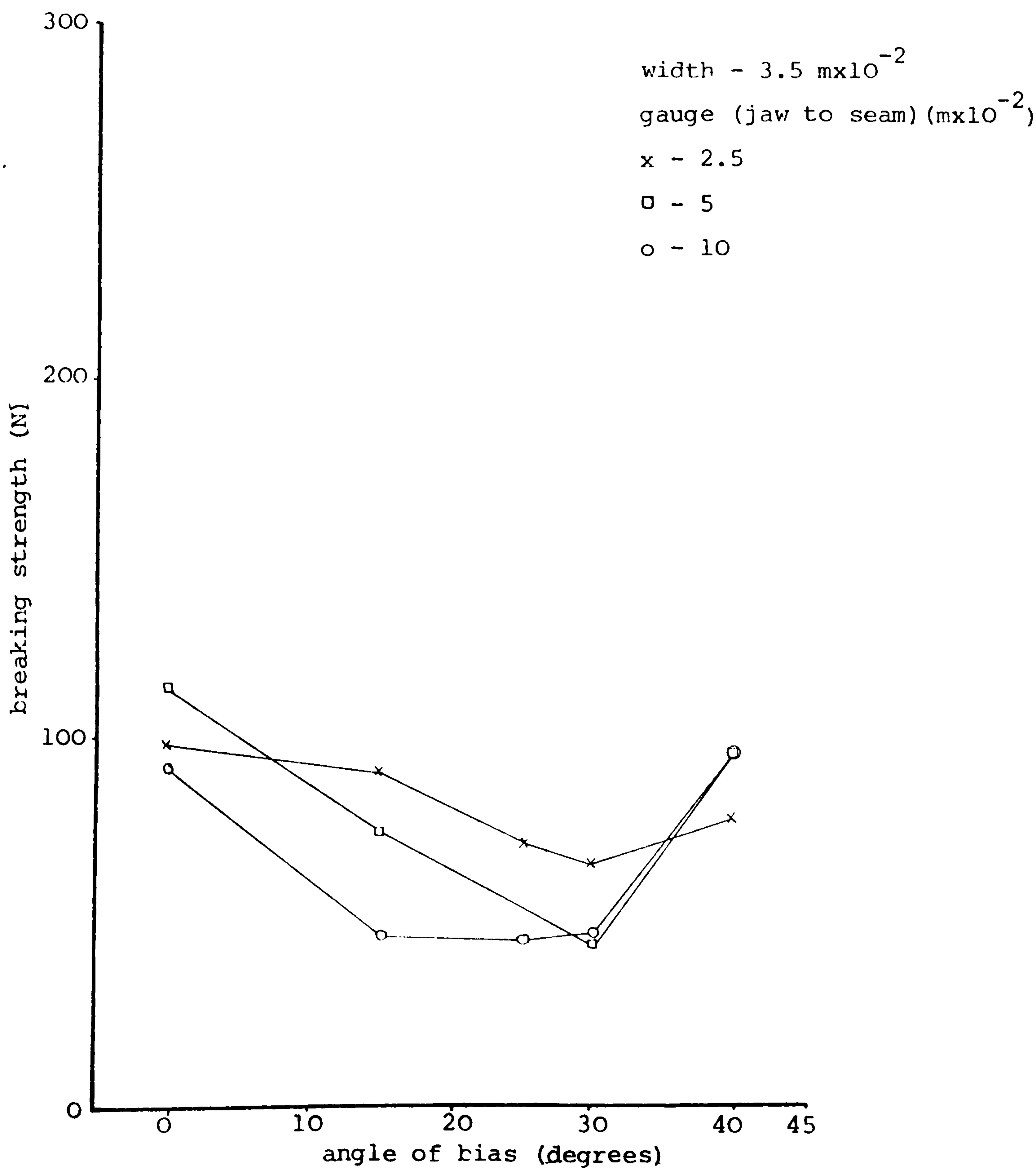


Figure 3.15b The Extension at Break of Fabric A as a Function of Gauge (Jaw to Jaw) under the Type I Breaking Condition.

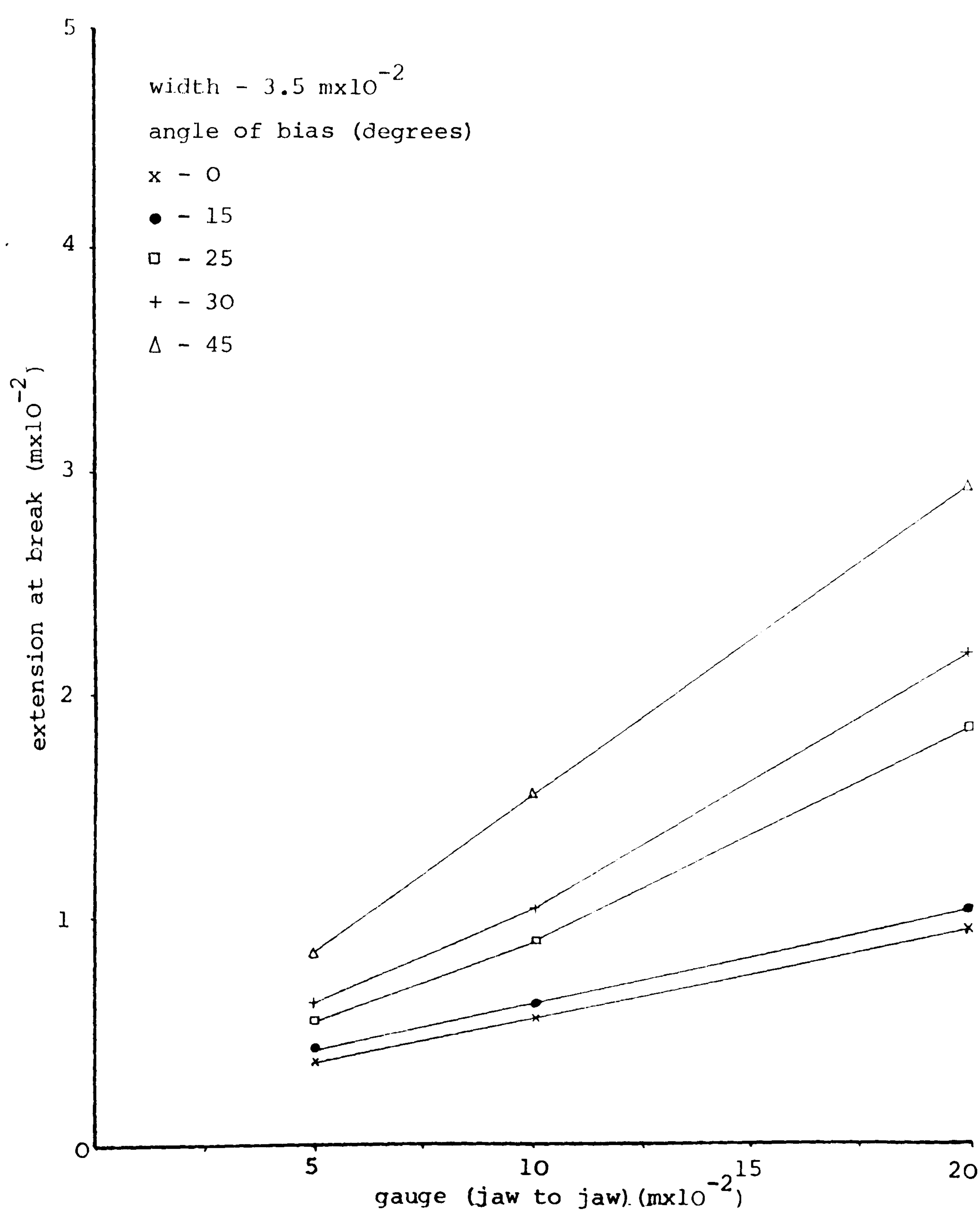


Figure 3.16a The Breaking Strength of Fabric A as a Function of Angle of Bias under the Type I Breaking Condition.

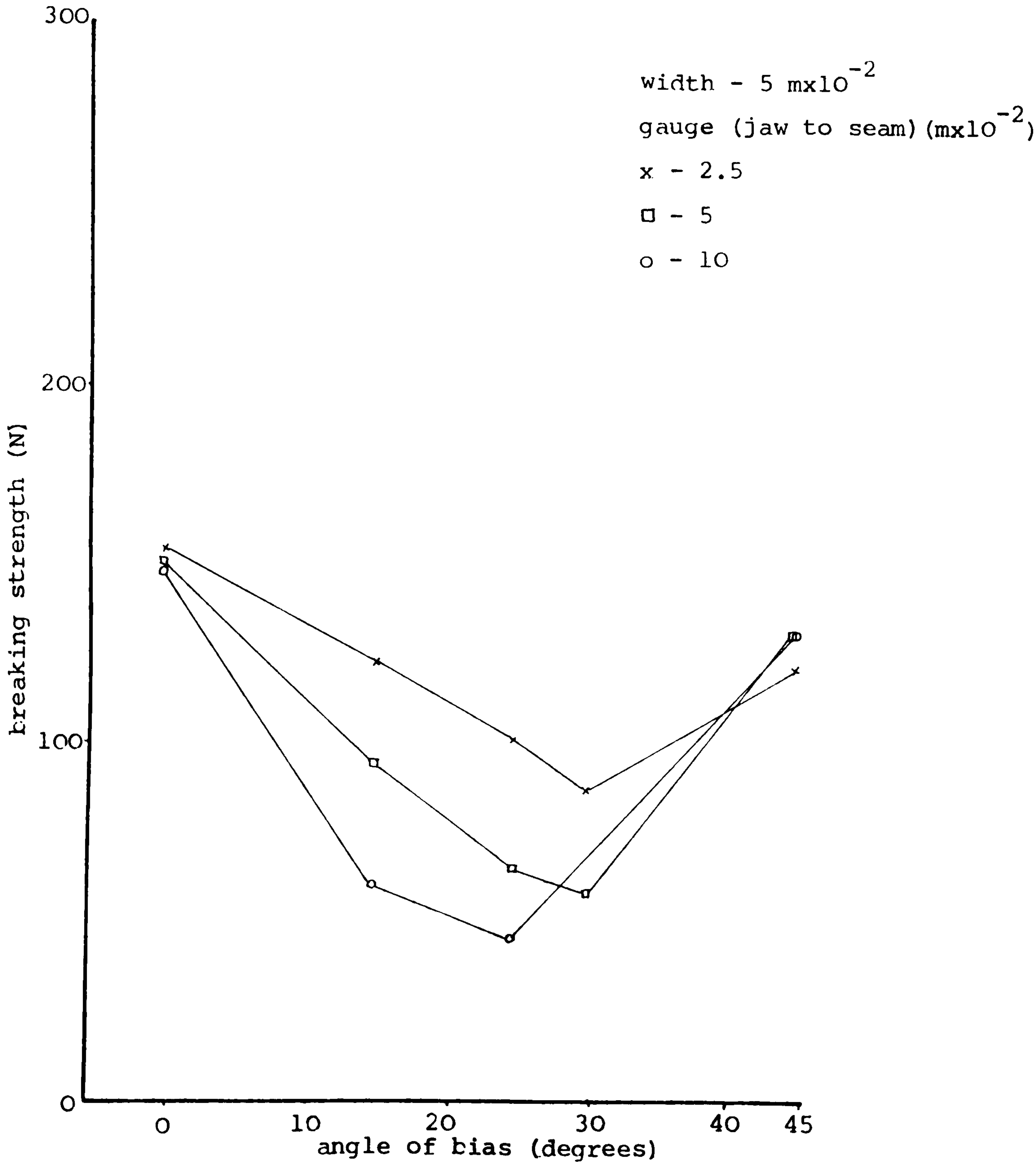


Figure 3.16b The Extension at Break of Fabric A as a Function of Gauge (Jaw to Jaw) under the Type I Breaking Condition.

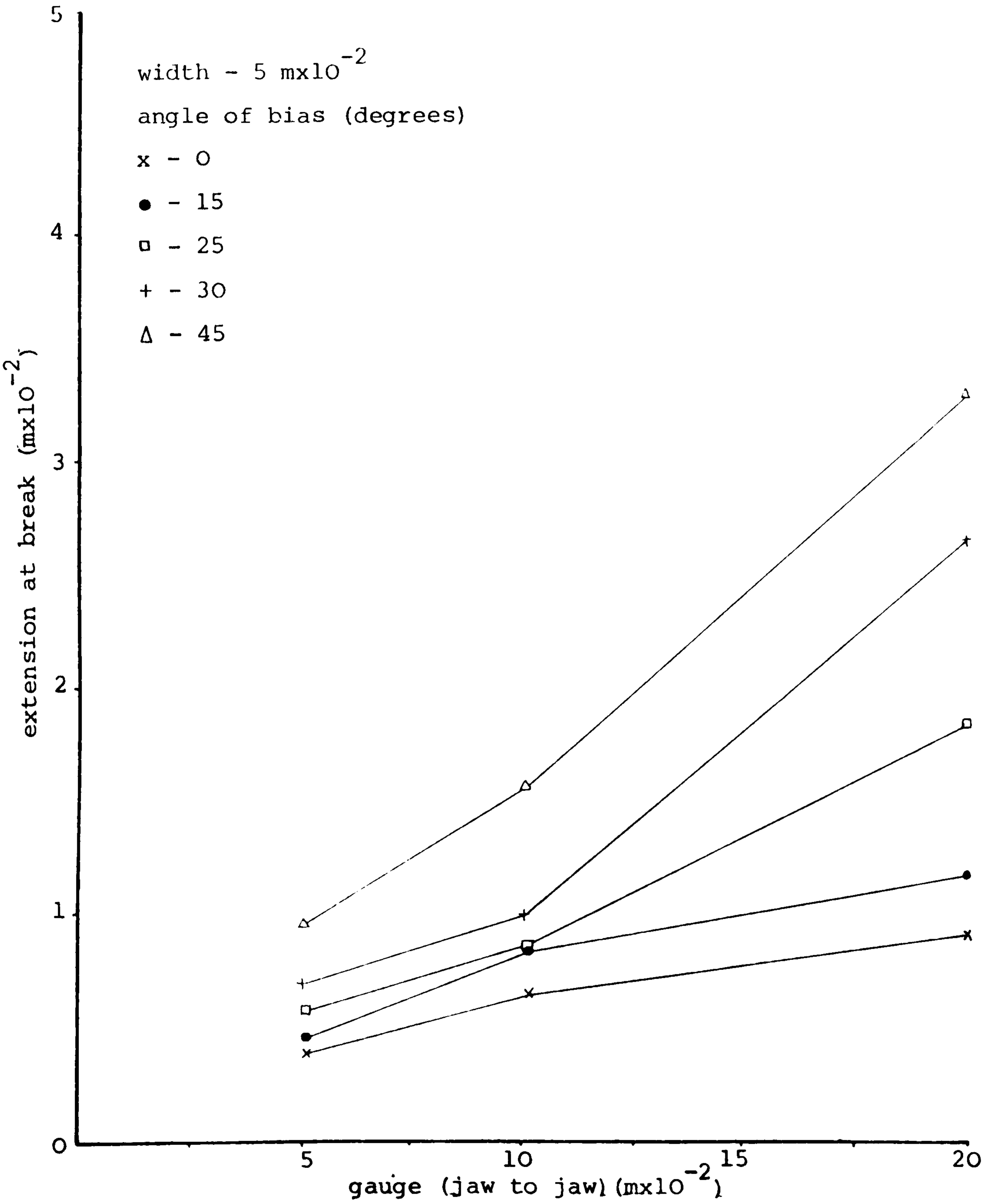


Figure 3.17a The Breaking Strength of Fabric A as a Function of Angle of Bias under the Type I Breaking Condition.

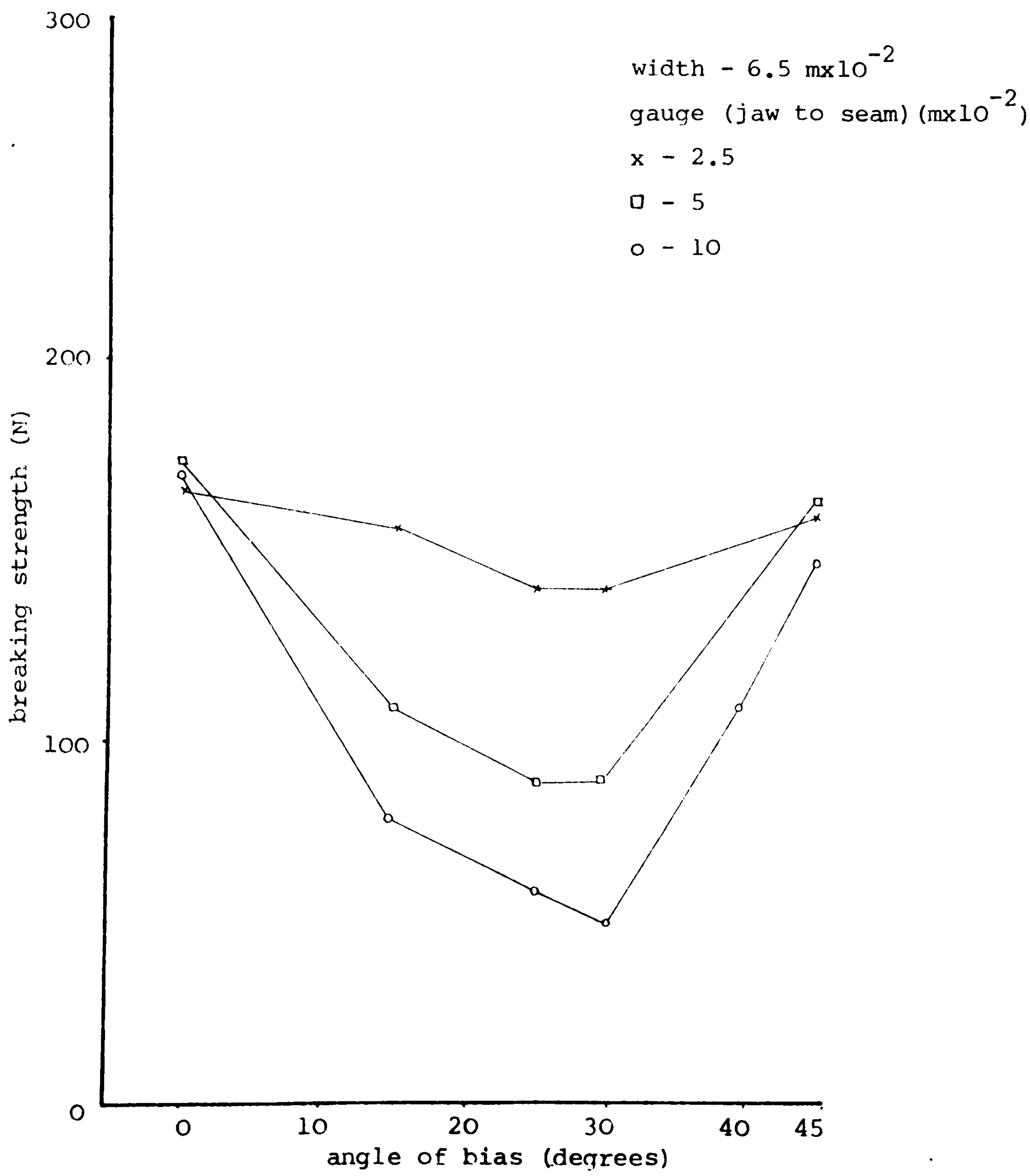


Figure 3.17b The Extension at Break of Fabric A as a Function of Gauge (Jaw to Jaw) under the Type I Breaking Condition.

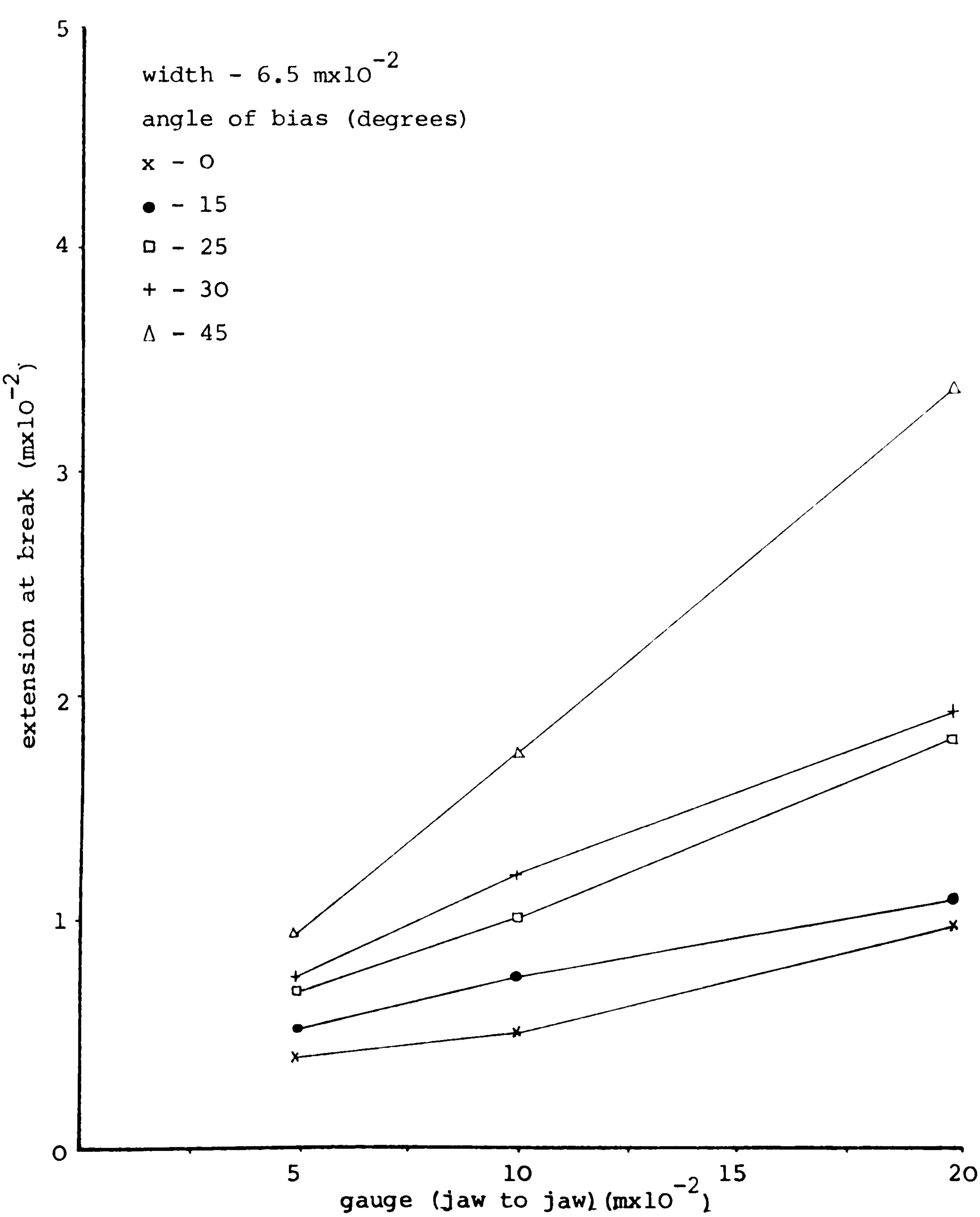
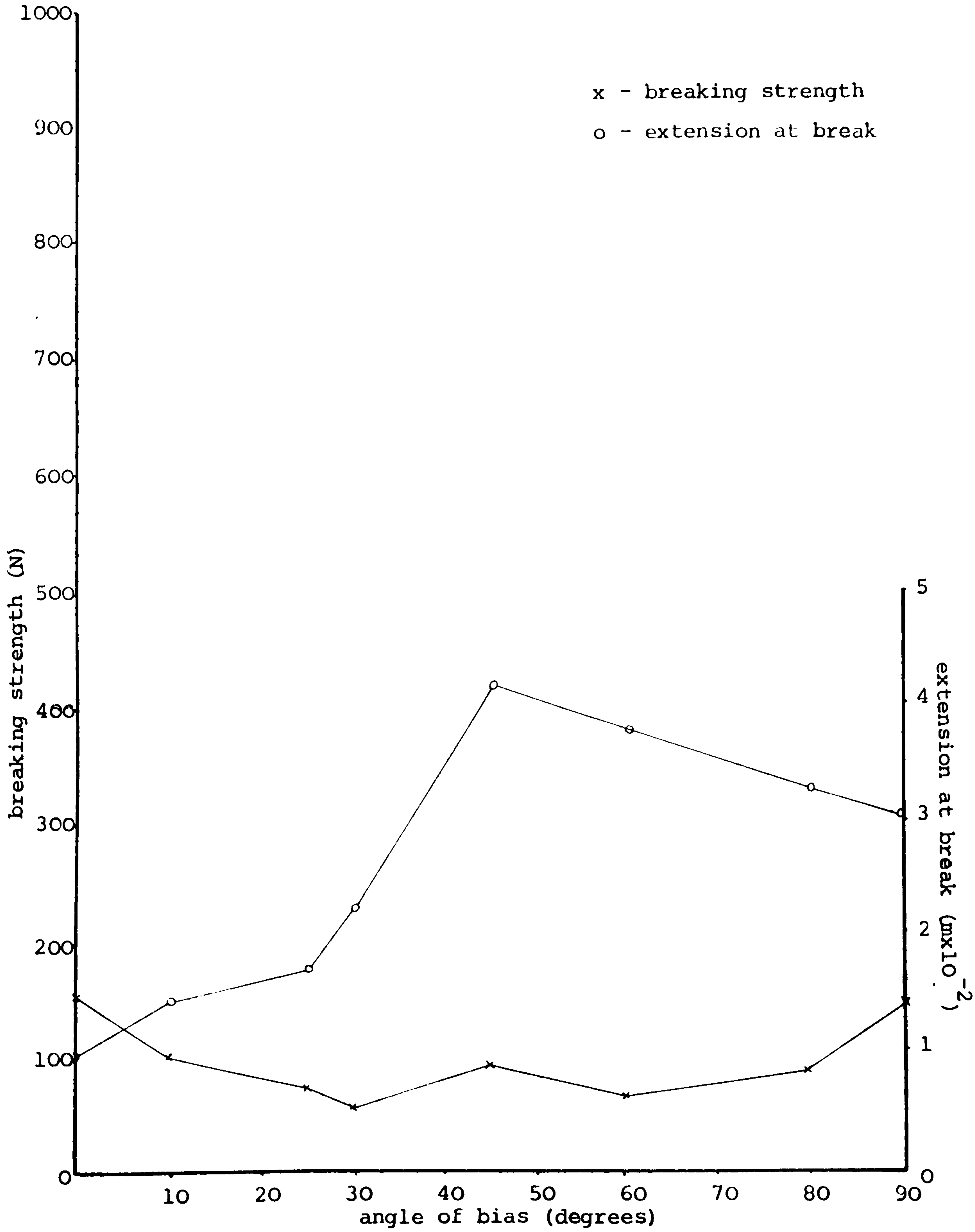


Figure 3.18 The Breaking Strength and the Extension at Break of Fabric B as a Function of Angle of Bias under the Type I Breaking Condition.



warp and weft strength per unit length are about the same. In addition the strength at the trough increases as the middle peak moves to its side.

3.3.4.3 Type I breaks of Fabric C

For the angle of bias effect shown in Figure 3.19, the warp and weft strengths can be seen to be about the same. The two low troughs occur at 30^0 and 60^0, and the trough at 60^0 is slightly higher than the trough at 30^0. The middle peak moves to 48^0 instead of 45^0 (as for Fabric A). Therefore the results suggest again that:

i) a higher number of warp yarns per unit length pushes the middle peak above 45^0 angle of bias and vice versa, even when the warp and weft strength per unit length are about the same; and

ii) the strength at the trough increases as the middle peak moves to its side.

3.3.3.4 Type I breaks of Fabric D

Figure 3.20 shows that the angle of bias has a marked effect on Fabric D (a 100% cotton plain weave with a sett of 27/24 yarns per $mx10^{-2}$). The warp and weft strengths have only 30N per 5 $mx10^{-2}$ width in difference. The two troughs are at 30^0 and 70^0, and the trough at 30 is about 40N per 5 $mx10^{-2}$ width stronger than the trough at 70^0. The middle peak moves to 50^0 instead of 45^0. Again, the sett of the fabric (higher warp number) moves the middle peak from 45^0 to 50^0 as the warp and weft strengths are about the same.

3.3.3.5 Type I breaks of Fabric E

Figure 3.21 shows a marked bias angle effect on Fabric E (100% cotton

Figure 3.19 The Breaking Strength and the Extension at Break of Fabric C as a Function of Angle of Bias under the Type I Breaking Condition.

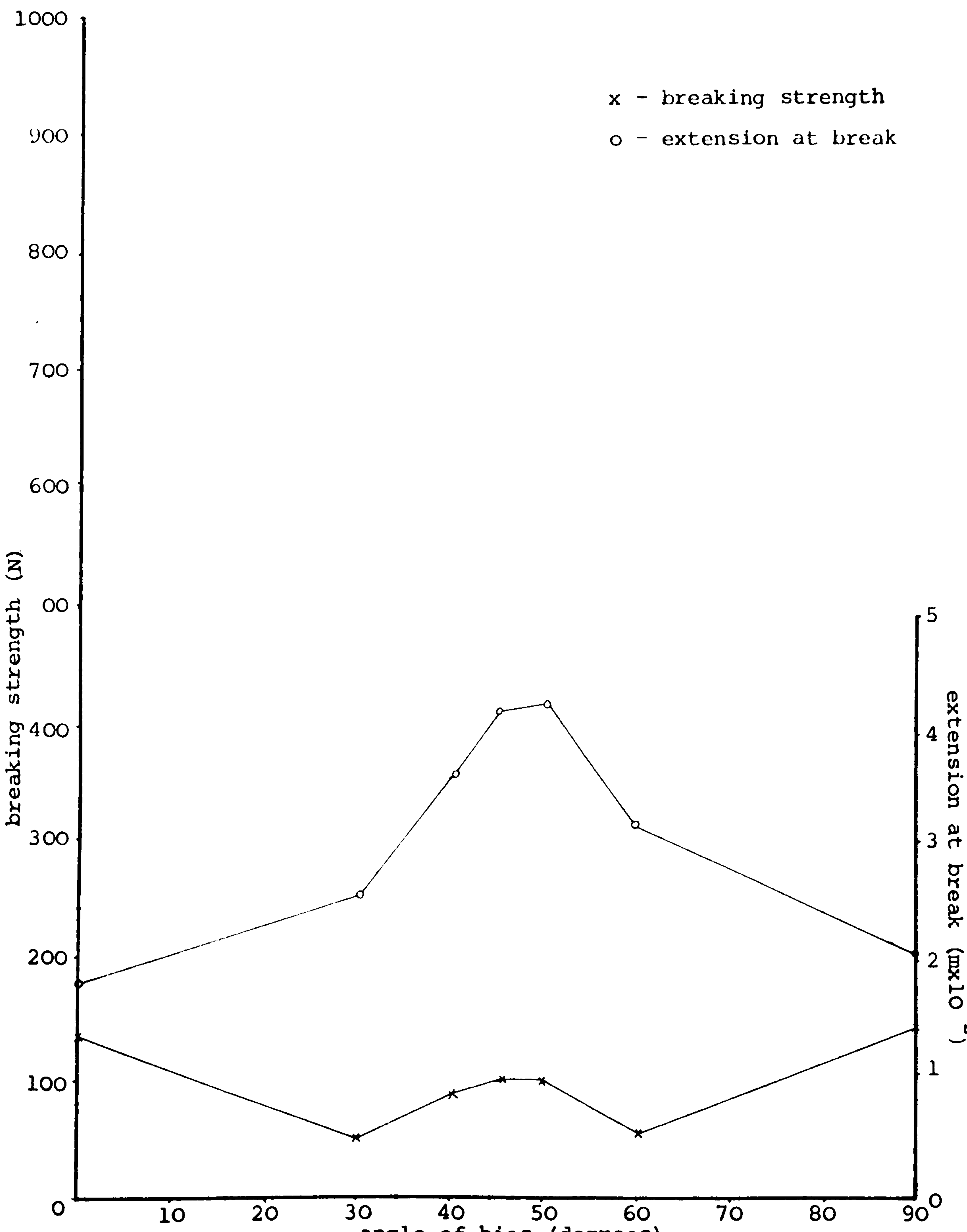


Figure 3.20 The Breaking Strength and the Extension at Break of Fabric D as a Function of Angle of Bias under the Type I Breaking Condition.

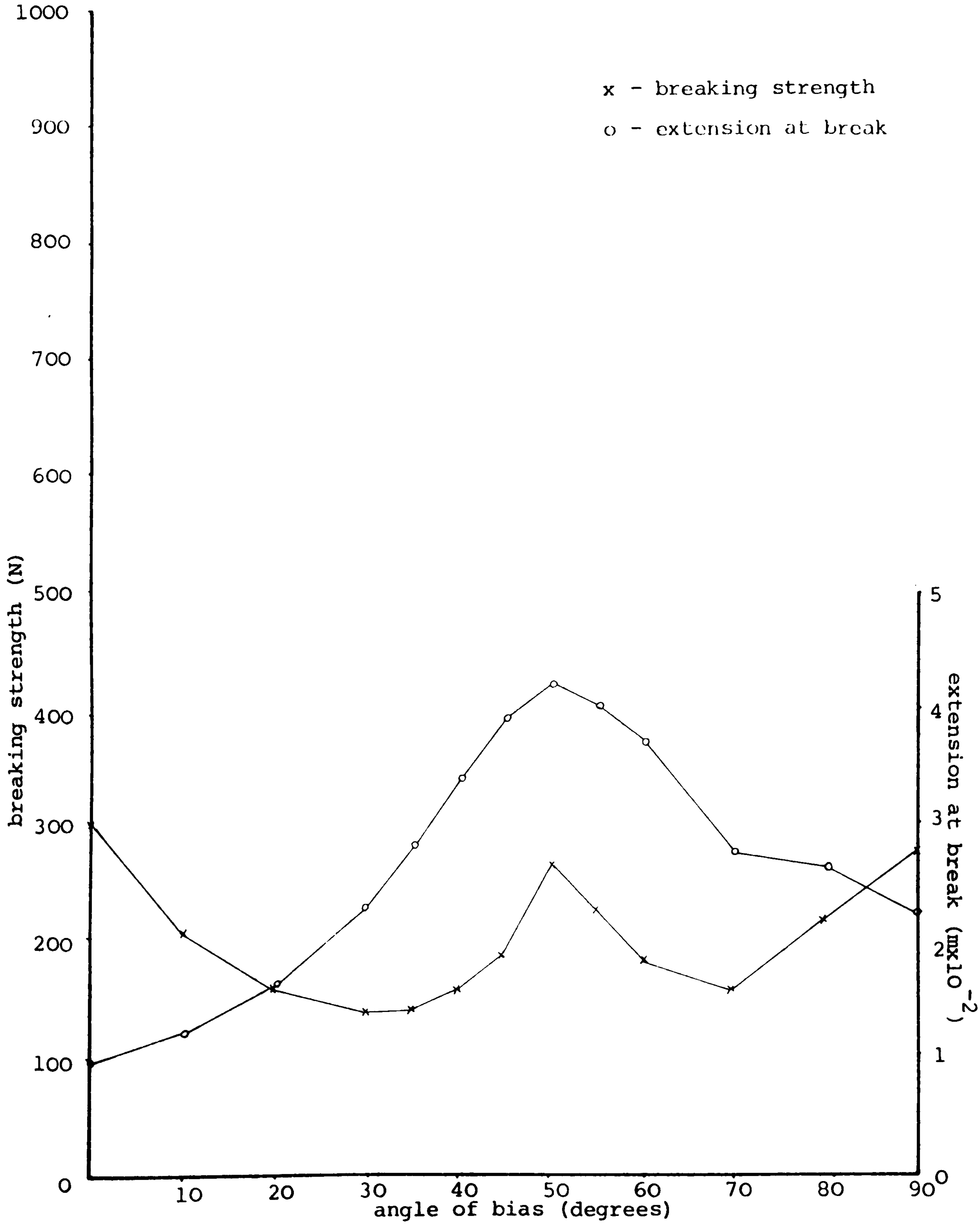
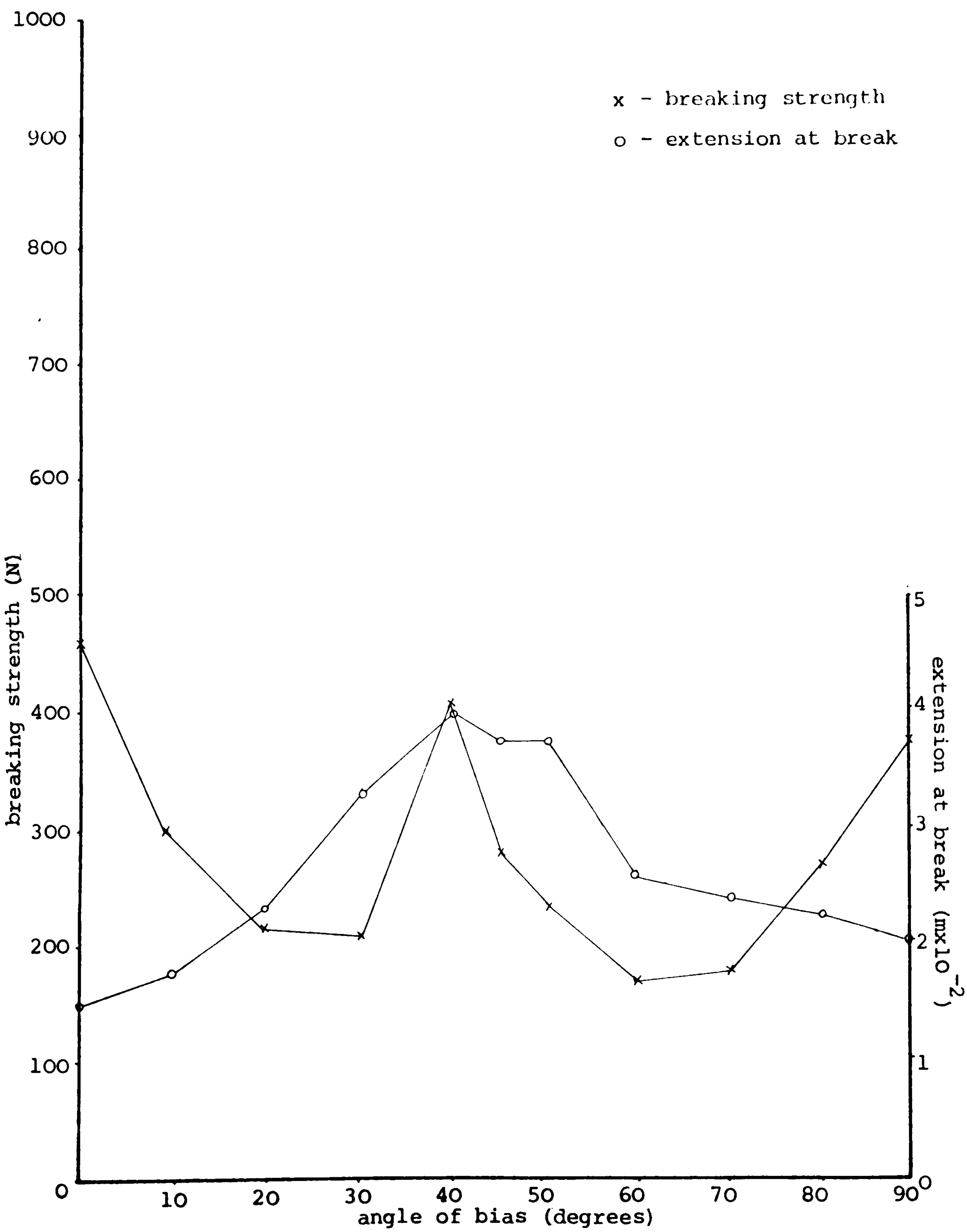


Figure 3.21 The Breaking Strength and the Extension at Break of Fabric E as a Function of Angle of Bias under the Type I Breaking Condition.



2/1 twill with sett 40/20 yarns per mx10^{-2}). The warp is about 70N per 5 mx10^{-2} width stronger than the weft. The trough at 30^0 is about 40N stronger than the trough at 60^0. The middle peak at 40^0 has the average strength between the warp and the weft. It can be seen very clearly that the trough at 30^0 is stronger than the other trough when the middle peak (40^0) is at its side of 45^0.

3.3.4.6 Type I breaks of Fabric F

Figure 3.22 shows a very marked angle of bias effect on Fabric F, which is a 100% cotton weft sateen fabric with a sett of 28/68 yarns per mx10^{-2}. The warp and weft strengths are the same. The two low troughs occur at 30^0 and 70^0 angle of bias, and the trough at 70^0 is about 50N per 5 mx10^{-2} width stronger than the trough at 30^0 while the middle peak moves to 50^0 angle of bias. These results contradict the previous results because the middle peak moves above 48^0 instead of below 45^0 even though the number of yarns per unit length is less than the number of weft yarns and the warp and weft strengths are the same. The reason may be that Fabric F is a very tight and complex structure thus altering the load transfer mechanism.

3.3.4.8 Type I breaks of Fabric G

A very marked effect of angle of bias is shown in Figure 3.23. The warp and weft strength have only 20N per 5 mx10^{-2} width difference. The two troughs occur at 30^0 and 60^0 angle of bias, and the trough at 30^0 is only 30N per 5 mx10^{-2} width stronger than the trough at 60^0, but the middle peak stays at 45^0 angle of bias. The middle peak has about the same strength value as have the warp and weft. Another contradiction is shown that the strength at the trough decreases as the middle peak moves to its side, but again, Fabric G

Figure 3.22 The Breaking Strength and the Extension at Break of Fabric F as a Function of Angle of Bias under the Type I Breaking Condition.

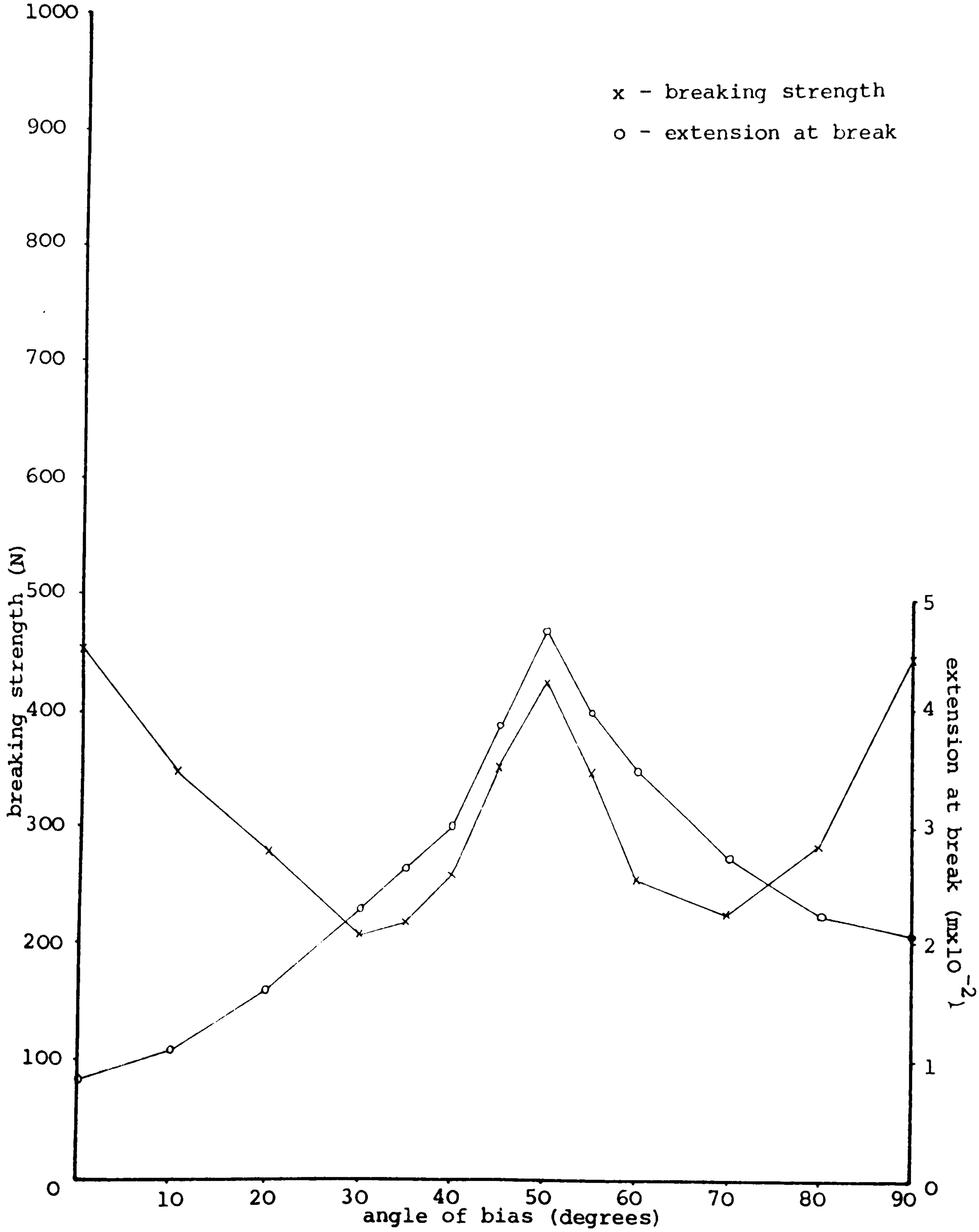
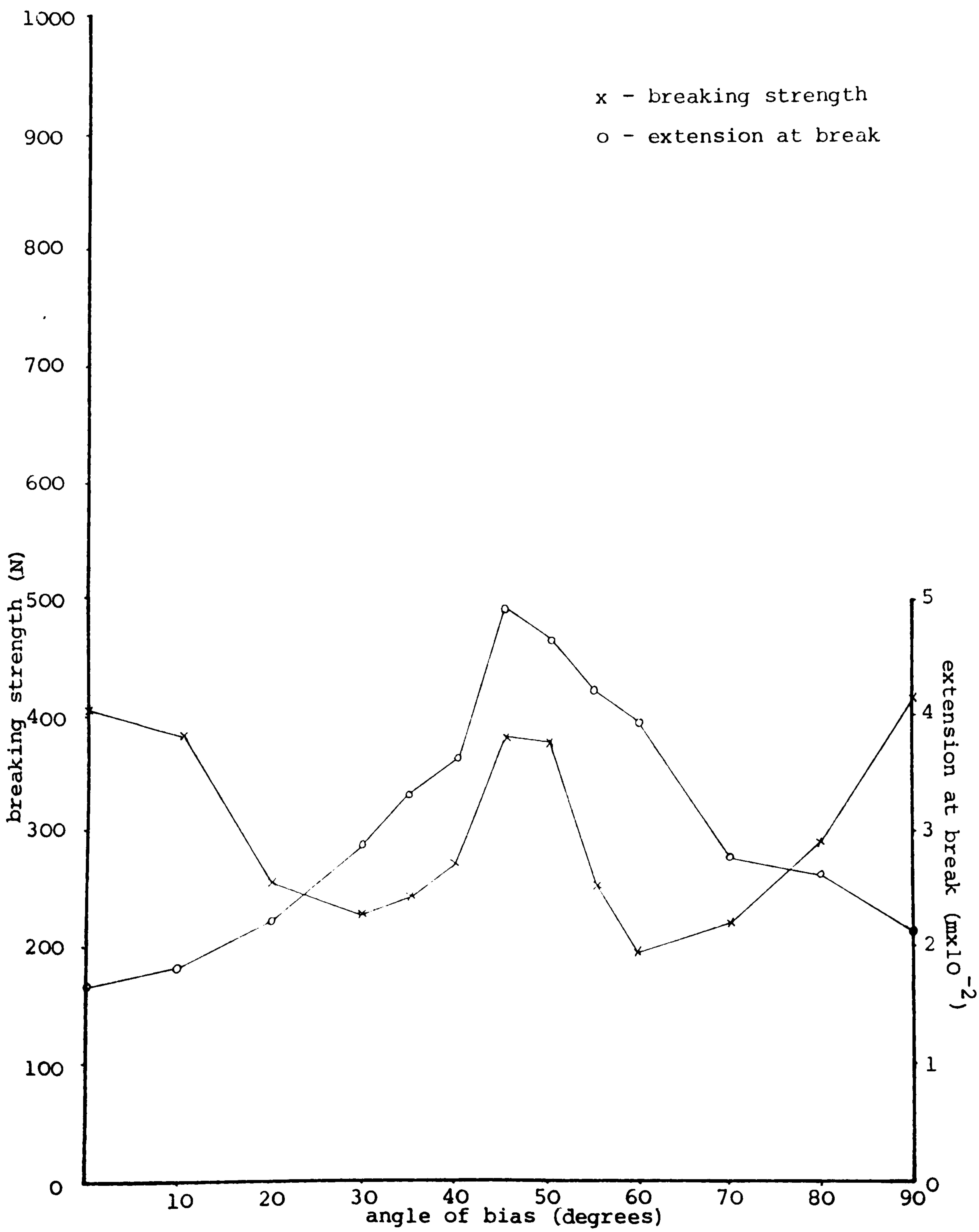


Figure 3.23 The Breaking Strength and the Extension at Break of Fabric G as a Function of Angle of Bias under the Type II Breaking Condition.



is a tight and complex structure fabric which might alter the load transfer mechanism.

3.3.4.9 Type I breaks of Fabric H

Figure 3.24 shows a marked effect of angle of bias on Fabric H (a nylon/cotton blend with sett of 10.6/11.4 yarns per $mx10^{-2}$). The warp and weft strength have only 20N per 5 $mx10^{-2}$ width difference. The two low troughs occur at about 30^0 and 55^0 angle of bias, and the trough at 55^0 is 60N per 5 $mx10^{-2}$ width stronger than the trough at 30^0 while the middle peak moves to 40^0. The results suggest, again, that a lower number of warp yarns per unit length brings the middle peak below 45^0 as the warp and weft strengths are about the same.

3.3.4.10 Type I breaks of Fabric I

Figure 3.25 shows a marked effect of angle of bias on Fabric I, which is a 100% poplin cotton shirting with sett of 26/52 yarns per $mx10^{-2}$, but the warp and weft strength has only 20N per 5 $mx10^{-2}$ width in difference. The two low troughs happen at 35^0 and 70^0 angle of bias, and the two troughs have about 10N in difference and the middle peak stays at 45^0 angle of bias. The results suggest that Fabric I behaves like a square-sett plain weave fabric because it has the same strength in the warp and weft direction, and at the two troughs, and the middle peak stays at 45^0.

.3.4.11 Summary of Type I breaks

'W' shaped curves resulted in all cases, in other words, marked angles of bias effect are evident in Type I breaks. In general the results show, that for fabrics where there are similar strengths

Figure 3.24 The Breaking Strength and the Extension at Break of Fabric H as a Function of Angle of Bias under the Type I Breaking Condition.

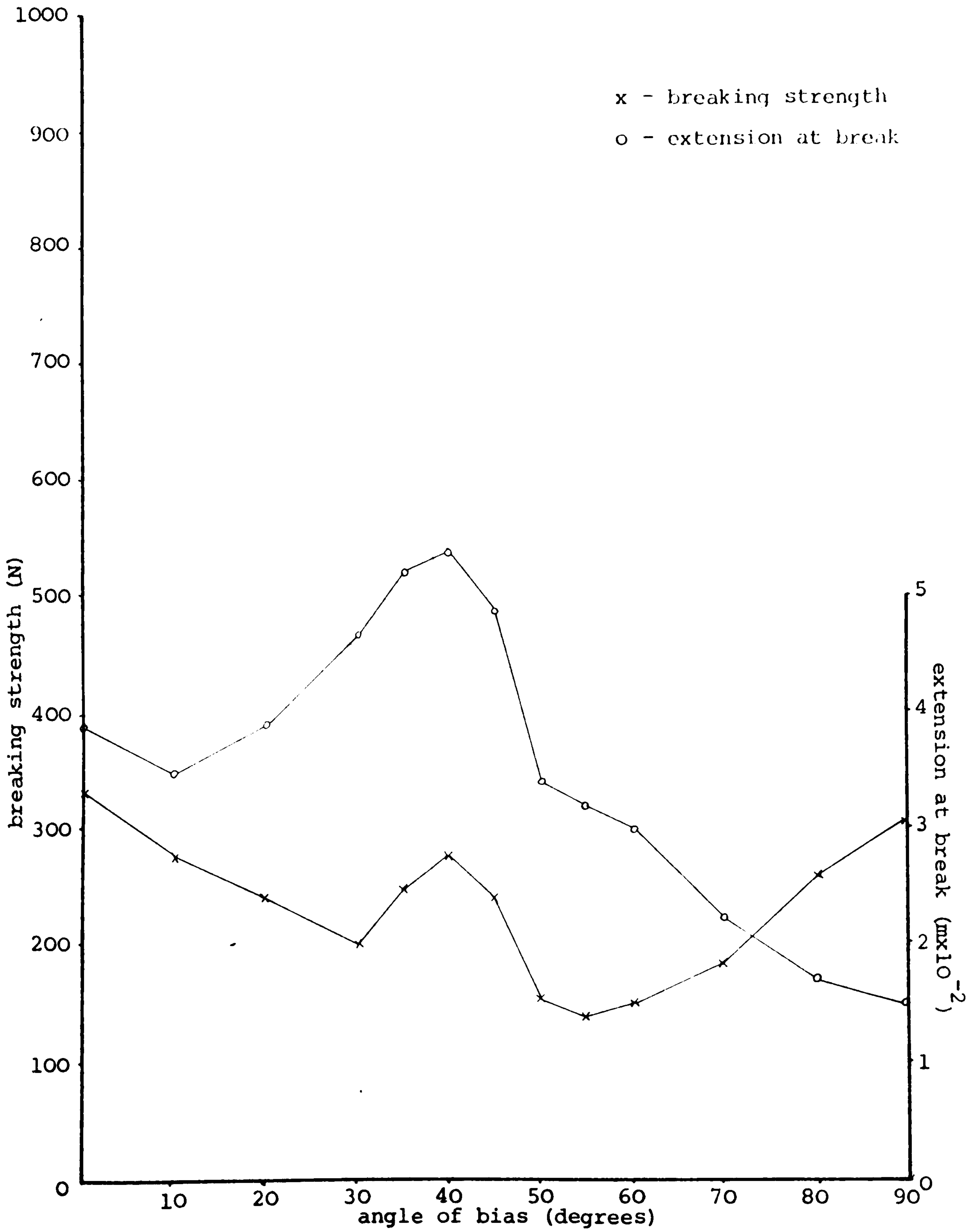
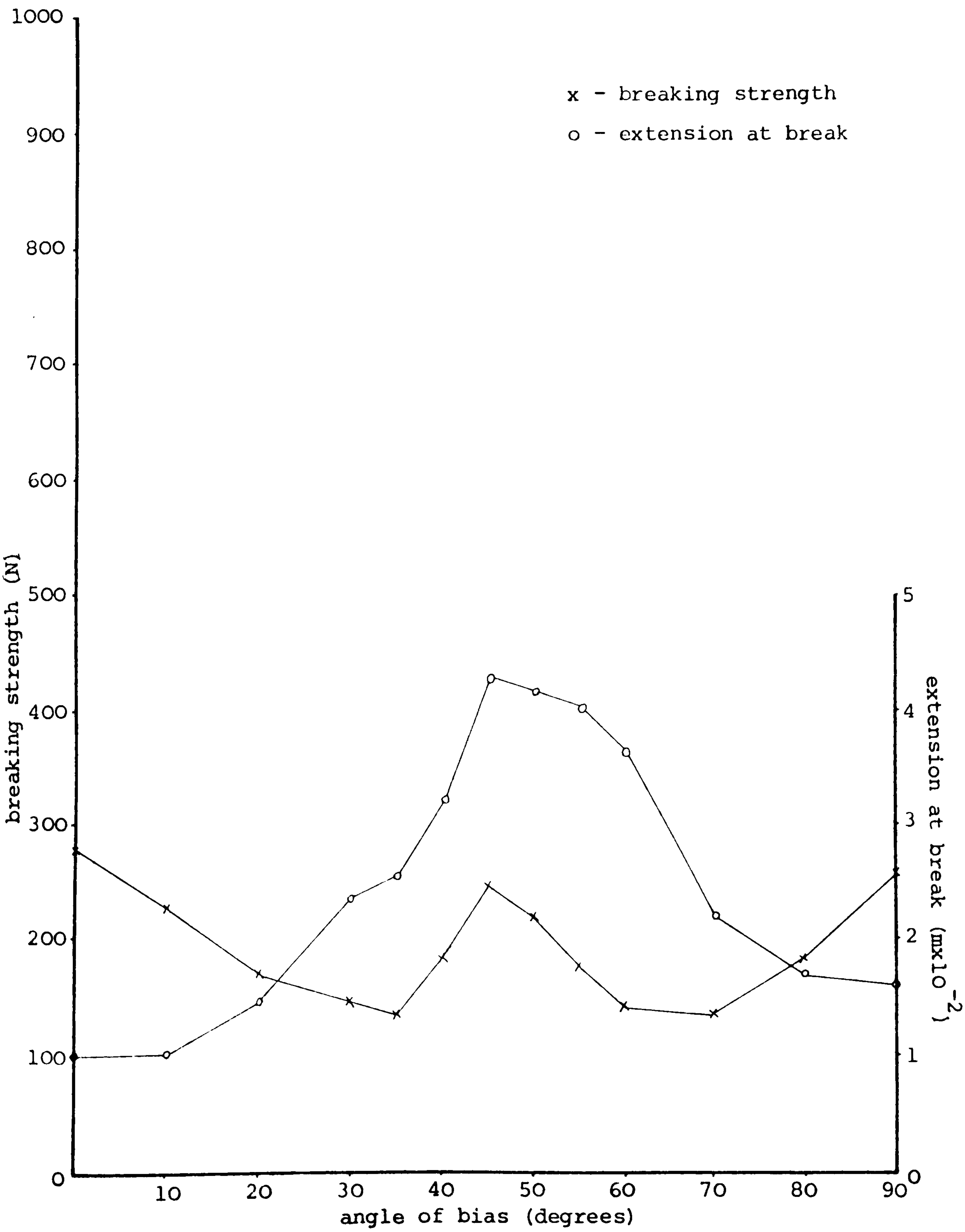


Figure 3.25 The Breaking Strength and the Extension at Break of Fabric I as a Function of Angle of Bias under the Type I Breaking Condition.



in the warp and weft directions (0^0 and 90^0) that (i) the middle peak moves above 45^0 if the number of warp yarns per unit length is higher and vice versa; and (ii) the strength at the trough increases if the middle peak moves to its side. Thus, the sett of the fabric can be seen, in general to have an effect on the position of the middle peak. There are however two contradictions to this suggestion, but those happened on two tight and reasonably complex structured fabrics, which could change the load transfer mechanism. It is suggested therefore that the structure of fabric might have some interrelationship with the angle of bias.

The range of the middle peak of the angle of bias varies from 40^0 to 60^0 even when the structures and setts are vastly different from each other. The strengths at the middle peak are almost as strong (80-90%) as the strength in the warp and weft direction.

3.3.5 THE EXTENSION AT BREAK OF THE BREAKING RESULTS

Extensions at break were measured and the relevant mean results are shown plotted in Figures 3.1 to 3.25. The means and ranges are given in Appendices 1 to 6.

3.3.5.1 The extension at break of unseamed fabric breaks

Figures 3.1b to 3.9 show the effect of varying the angle of bias on the extension at break of different types of fabric. The extension at break increases as the gauge length increases and as the angle of bias increases until the peak strength angle and then gradually decreases until 90^0. The extension at break has its lowest values at 0^0 and 90^0, and has its highest value around the middle peak, and quite high strength apart from the strength at

0^0 and 90^0. The figures also show that "extension peaks" approximately coincide with "breaking strength peaks". Therefore the ideal angle of bias for garments (for unseamed breaks) would appear to be in the vicinity of the middle peak ($\pm5^0$).

3.3.5.2 Extension at break of Type II breaks

Figures 3.10b and 3.11b show that an increase in gauge length for Fabric A at different widths gives an increase in the extension at break; also an increase in the angle of bias gives an increase in the extension at break. Comparison of the two figures (Figures 3.10b and 3.11b) also illustrates that the lower the width the higher the extension at break. The increasing rate of extension at break is not linear when considered against the angle of bias; this is especially true at longer gauge lengths.

The results for Fabrics D, H and I in Figures 3.12, 3.13 and 3.14 respectively show that the extensions at break of these three fabrics have their lowest value at both ends of the curve (0^0 and 90^0).

Higher strength gives lower extension at break; this only applies to the regions from 0^0 to the first trough and the second trough to 90^0 of the breaking strength results. Thus the extension at break increases as the strength increases until the middle peak is encountered. Therefore the ideal angle of bias for the direction of a moving part of a garment (for Type II breaks) can be suggested, also, to be around the regions of the middle strength peak $\pm5^0$ of the middle peak).

.3.5.3 Extension at break of Type I breaks

Figures 3.15b - 3.17b show the results of plotting the extension at break of Fabric A against the gauge length at different angles of bias and width . Because of the mirror image effect (as per Gardner's experimental evidence for this square-sett fabric) the results were only examined up to 45^0. The extension at break increases as the gauge length increases, and as the angle of bias increases up to 45^0 angle of bias, the other half of the curve (45^0 to 90^0) is presumed to be a mirror image. The increasing rate of extension at break at different angles of bias is quite linear when considered against the gauge length . However the increasing rate of extension at break is not linear when considered against the angle of bias especially at long gauge lengths (10 to 20 $mx10^{-2}$). Comparison of the three figures does not demonstrate much effect of width on the extension at break.

Figures 3.18b to 3.25 show the results of the extension at break of other fabrics against the angle of bias. Fabric B (Figure 18b) also shows that an increase in the gauge length produces a rise in the extension at break. The extensions at 0^0 and 90^0 have usually the lowest value, this value gradually increases to the middle peak which also has the third strongest strength. The results also show the extension at break at 0^0 angle of bias (warp direction) is always higher than the extension at break at 90^0 angle of bias (weft direction) and it is because in weaving, yarn of a lower twist factor is used in the weft in order to reduce breakage of weft during weaving.

3.3.6 THE STRENGTH OF THE SECOND ZONE AT DIFFERENT ANGLES OF BIAS

The strength of the second zone at different angles of bias of each type of fabrics under each type of breaking conditions has been found by testing the sample strength at the gauge length which causes the first zone just to disappear. The results are shown in Figures 3.26 to 3.34 and the means and the ranges are shown in Appendices 7 to 9.

3.3.6.1 The strength of the second zone of Fabric A

Figure 3.26 shows an increase in the strength of the second zone as the angle of bias increases up to 45^o. The unseamed fabric has the strongest overall breaking strength, and the Type I is the lowest, but the strength of the Type II breaks rises sharply from about 40^o to about the same strength as the unseamed fabric strength at 45^o.

3.3.6.2 The strength of the second zone of Fabric B

Figure 3.27 shows that the lowest values are at 10^o and 80^o angles of bias and then the strength increases gradually until the middle peak, as 50^o in this case, the same peak as for the breaking strength results. The strength of the unseamed second zone is at a higher level than the Type I second zone.

3.3.6.3 The strength of the second zone of Fabric C

Figure 3.28 shows that the Type I breaks only have the same trend as the above results with the maximum strength at 48^o, the same as for the breaking strength results shown in Figure 3.19.

Figure 3.26 The Breaking Strength of the Second Zone as a Function of Angle of Bias under three Types of Breaking Condition.

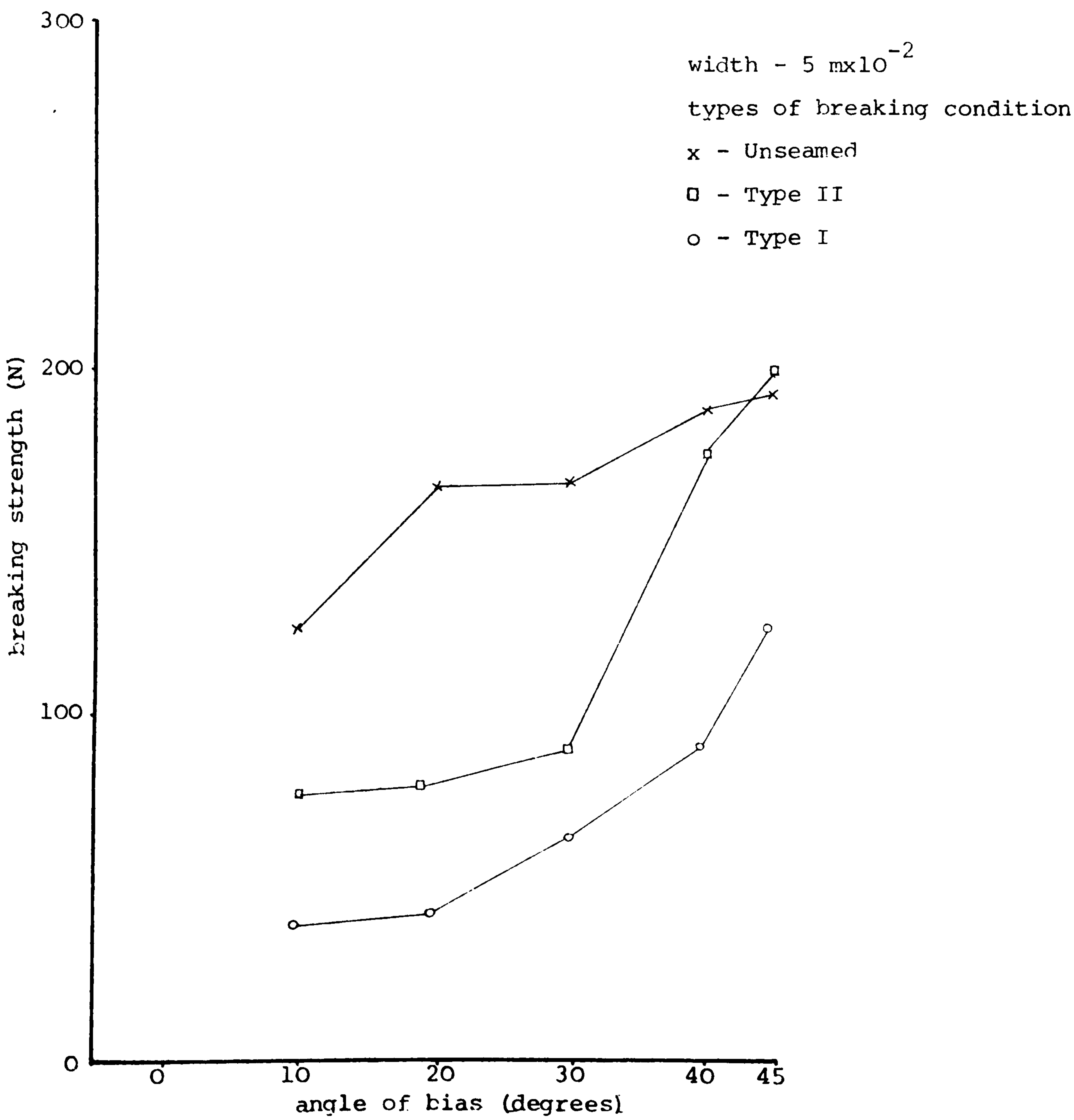


Figure 3.27 The Breaking Strength of the Second Zone of Fabric B as a Function of Angle of Bias under Two Types of Breaking Condition.

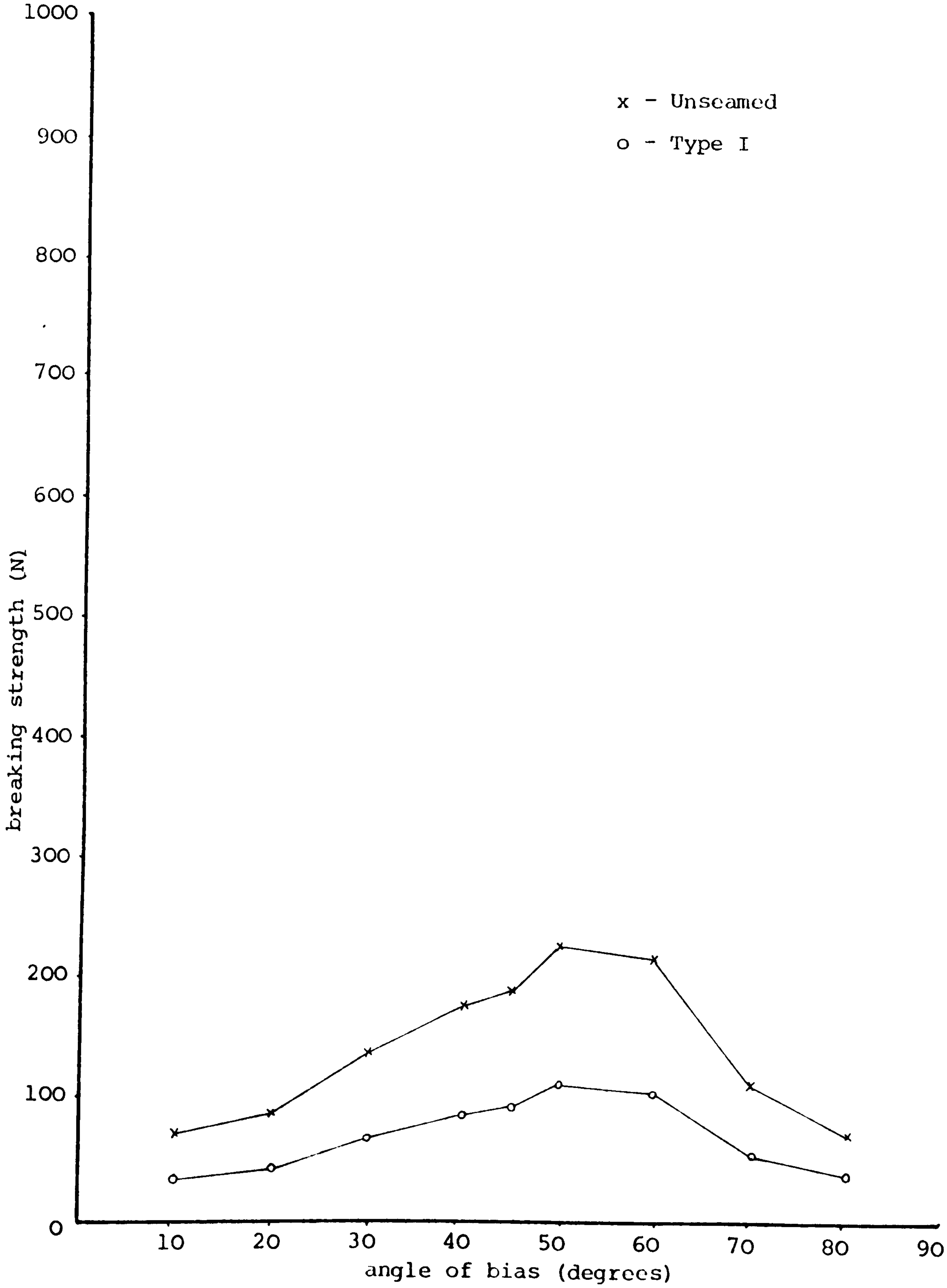
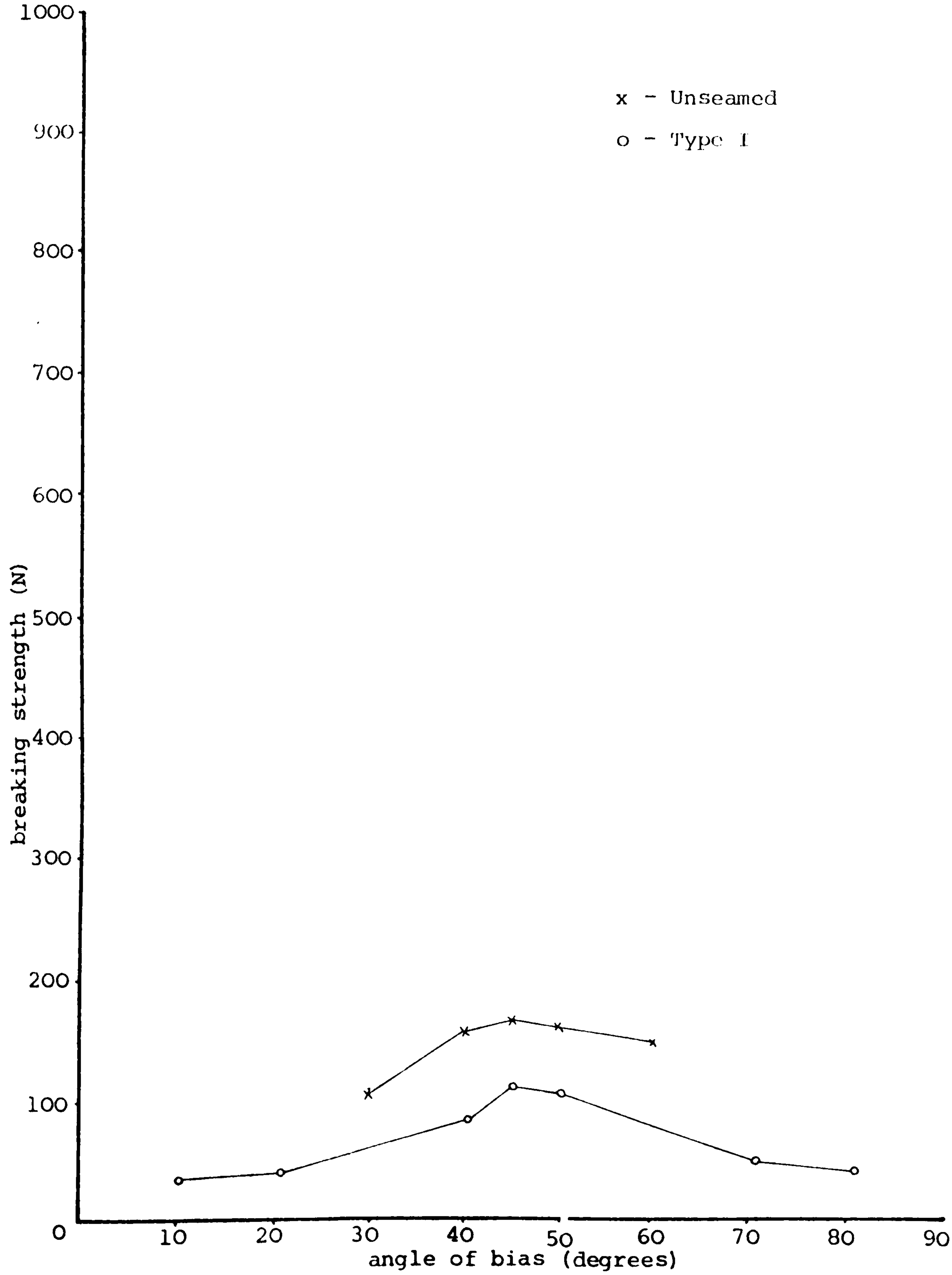


Figure 3.28 The Breaking Strength of the Second Zone of Fabric C as a Function of Angle of Bias under Two Types of Breaking Condition.



3.3.6.4 The strength of the second zone of Fabric D

Figure 3.29 illustrates similar trends of angle of bias effect on the second zone strength under the three types of breaking condition. The levels of the strength are about the same under the Unseamed and Type II breaking conditions. The strength at 80^{0} is higher than at 10^{0} as in the results of normal tests of the angle of bias effect (Figures 3.4,3.12 and 3.15). All the middle peaks happen at 50^{0} angle of bias.

3.3.6.5 The strength of the second zone of Fabric E

The results of Fabric E, in Figure 3.30,show the trends and under the two types of breaking conditions are different from each other; it is suggested that the fabric acts as a load carrier under the Type I breaking condition, therefore the structure and the proportion of warp and weft strength do not have as much effect as under the Unseamed breaking condition.

3.3.6.6 The strength of the second zone of Fabric F

Figure 3.31 shows that the middle peak occurs at 50^{0}, the strength at 80^{0} angle of bias is higher than at 10^{0}. The shape of the two curves looks similar.

3.3.6.7 The strength of the second zone of Fabric G

Figure 3.32 shows that the middle peak occurs at 40^{0} angle of bias for Unseamed and 45^{0} angle of bias for Type I breaks. The strength of the second zone at 10^{0} is much higher than at 80^{0} (about 250N per 5 mx10^{-2} width difference). The two sides of the curve look

Figure 3.29 The Breaking Strength of the Second Zone of Fabric D as a Function of Angle of Bias under Three Types of Breaking Condition.

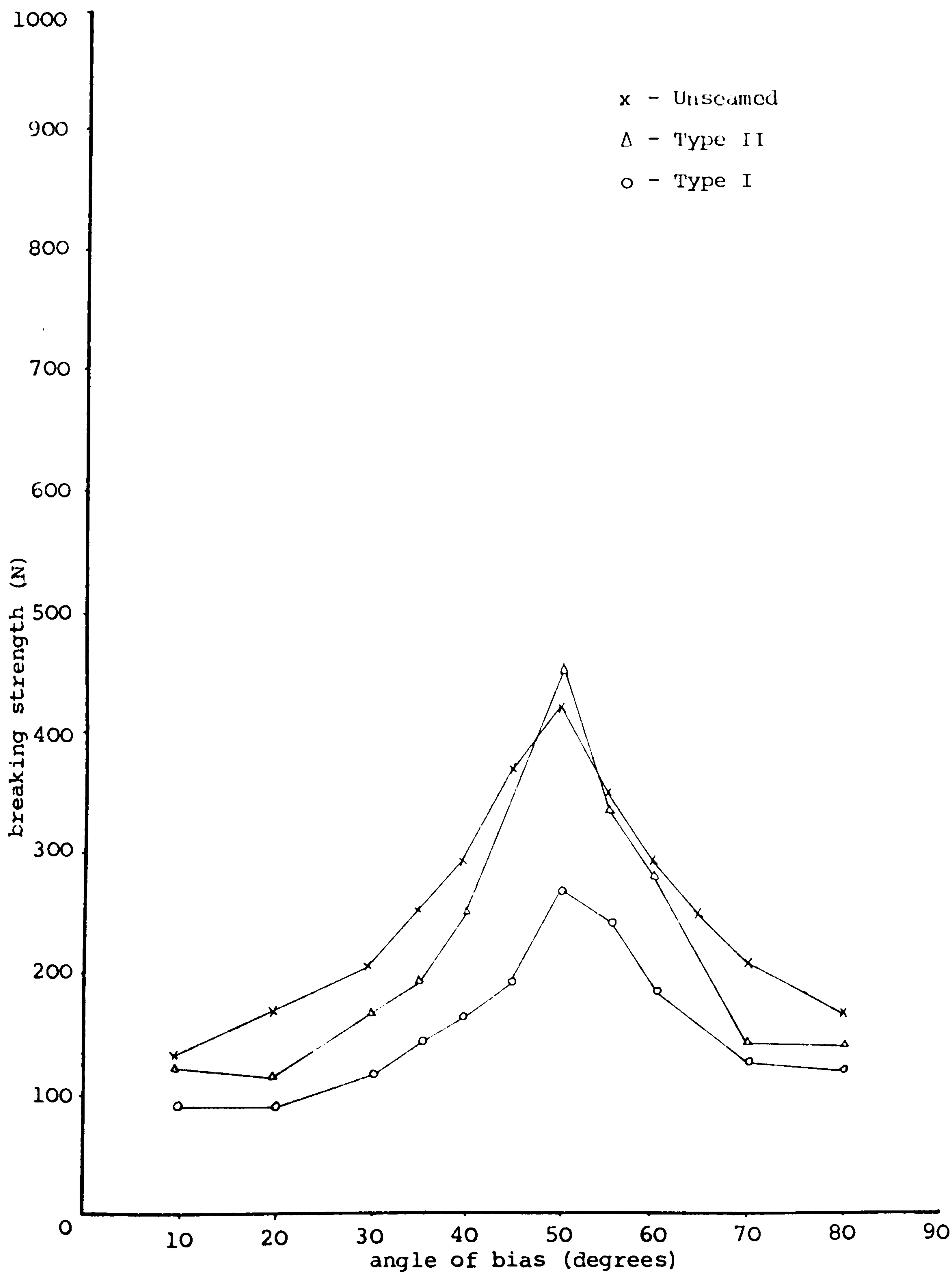


Figure 3.30 The Breaking Strength of the Second Zone of Fabric E as a Function of Angle of Bias under Two Types of Breaking Condition.

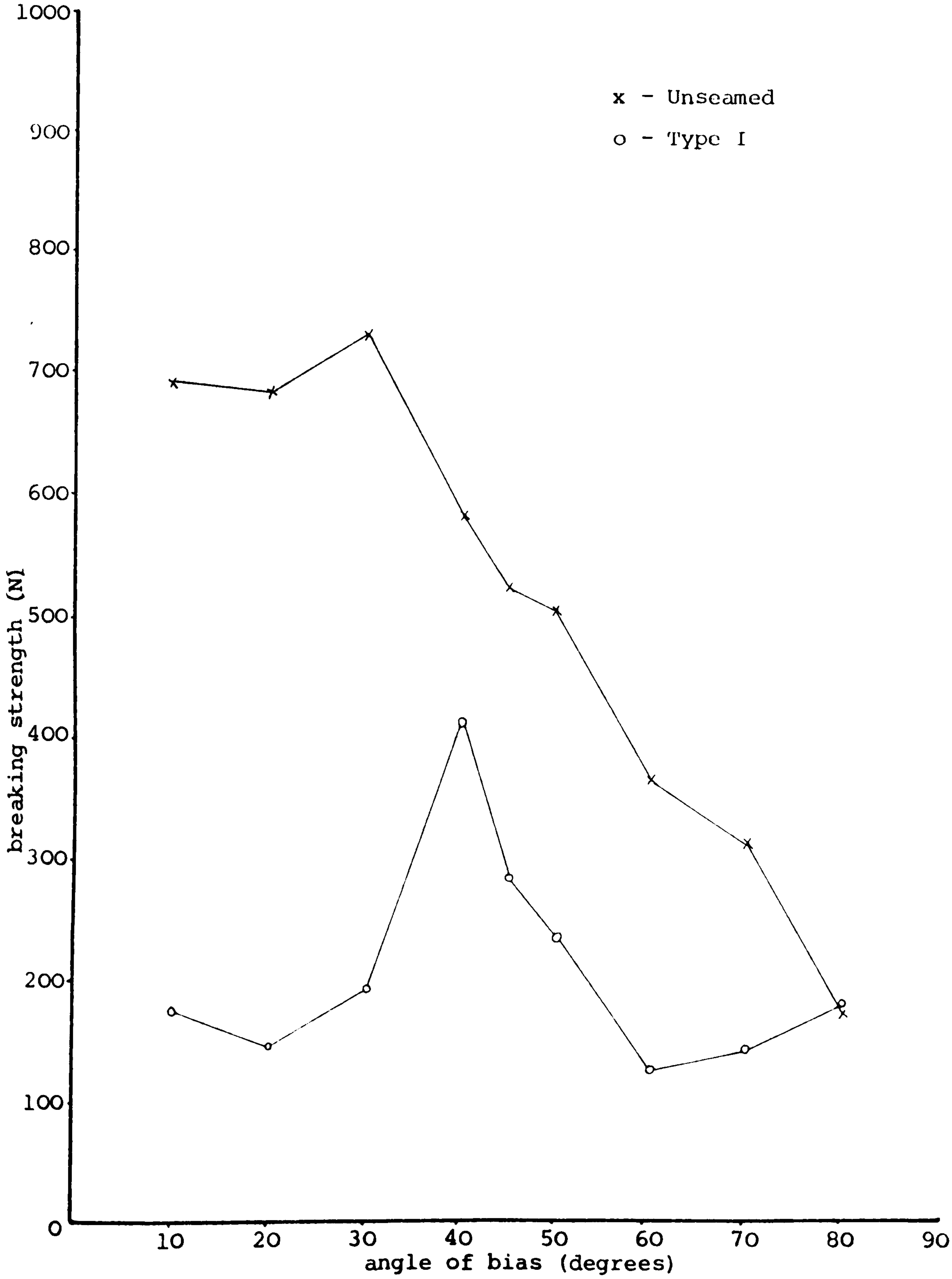


Figure 3.31 The Breaking Strength of the Second Zone of Fabric F as a Function of Angle of Bias under Two Types of Breaking Condition.

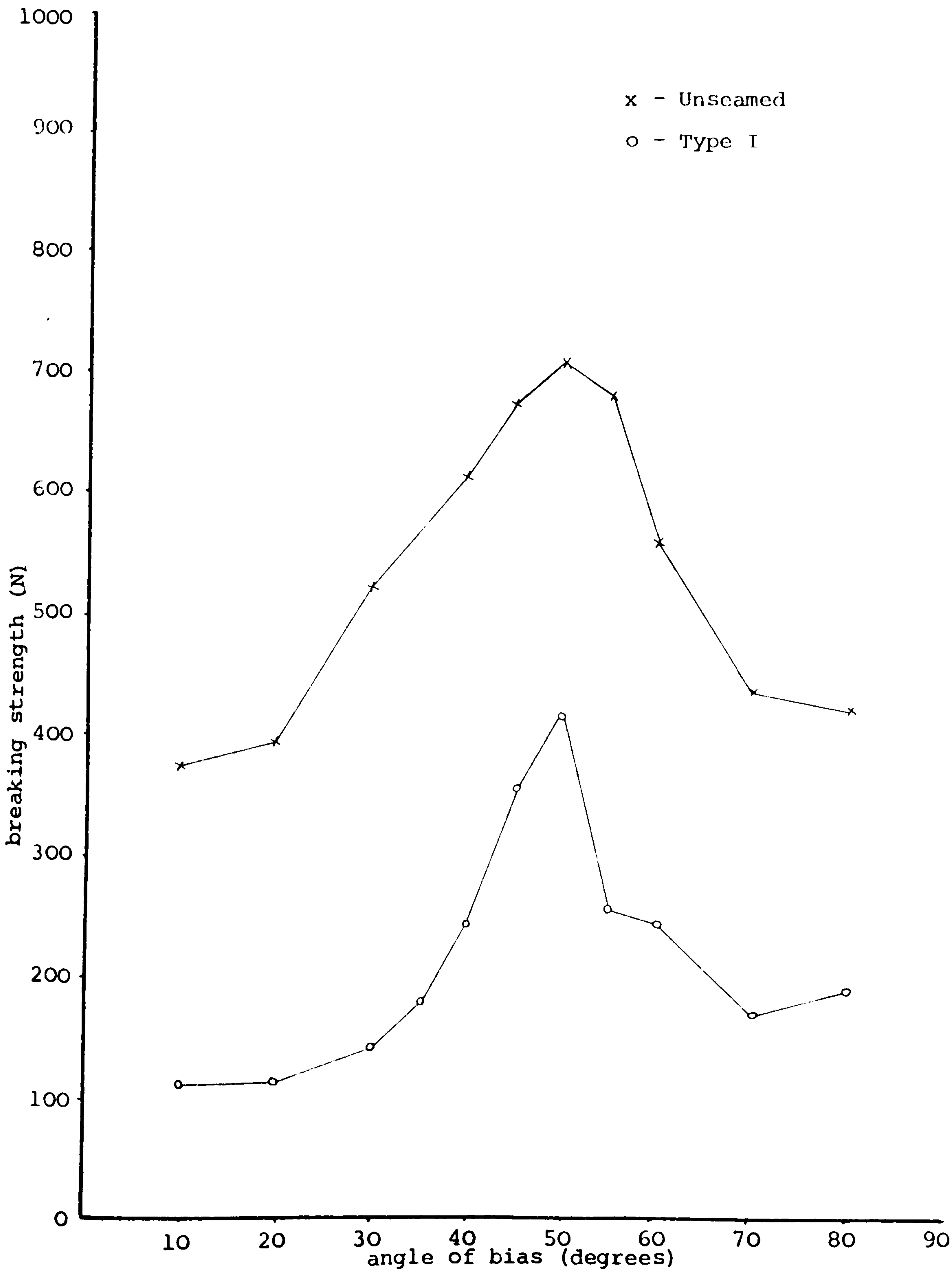
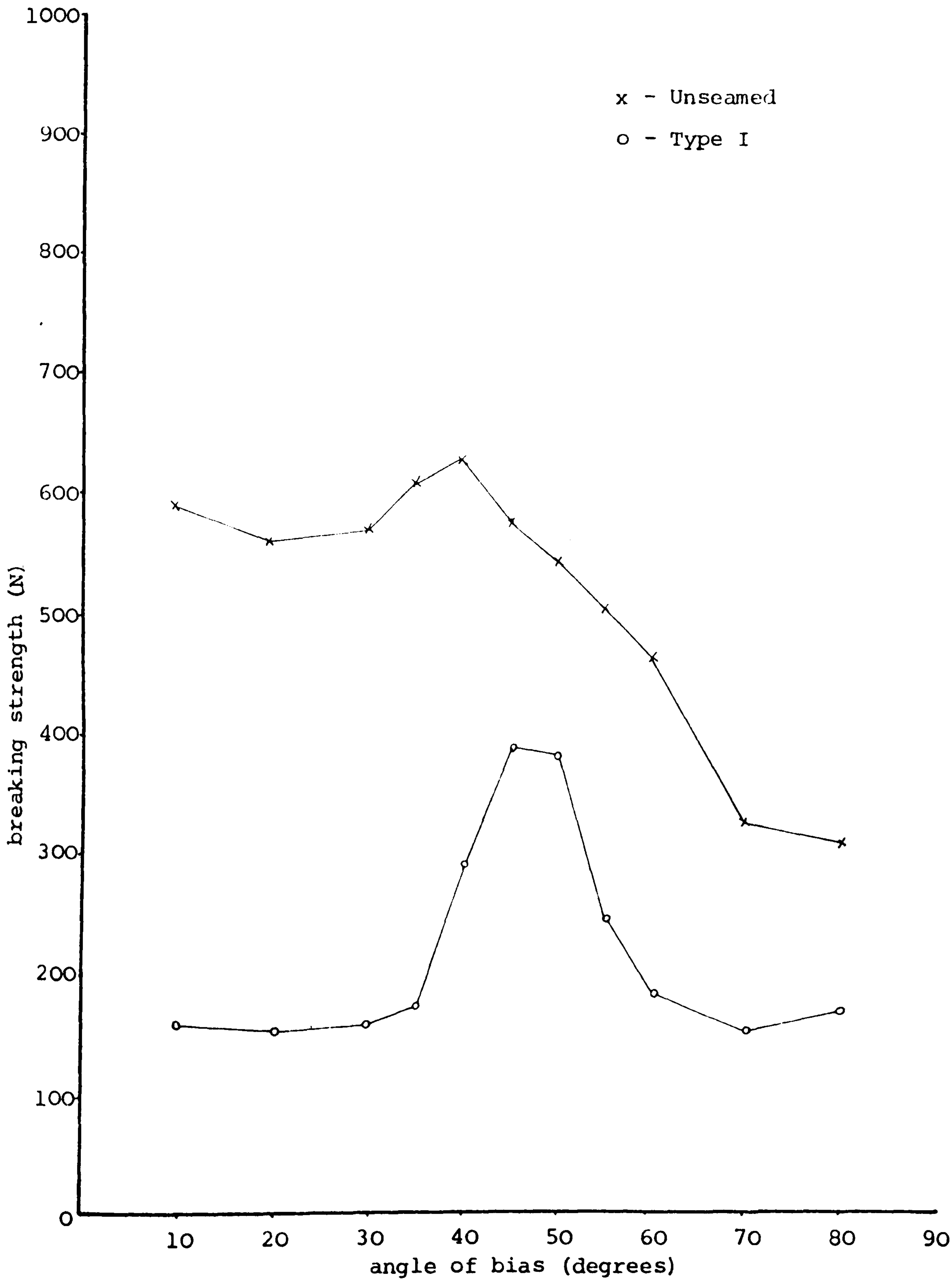


Figure 3.32 The Breaking Strength of the Second Zone of Fabric G as a Function of Angle of Bias under Two Types of Breaking Condition.



similar under the Type I breaking condition, but not under the Unseamed breaking condition. Therefore it is suggested again that the structure and the proportion of warp and weft strength under the Type I breaking condition do not affect the angle of bias effect and the fabric acts only as a load carrier.

3.3.6.8 The strength of the second zone of Fabric H

Figure 3.33 shows the middle peak occuring at 40^0 angle of bias both under the Type I and Type II breaking conditions, and at the regions of 35^0 and 40^0 angle of bias under the Unseamed breaking condition. The results show that the shape of the curve under the Unseamed breaking conditon is much flatter than the one under the Type II breaking condition, the cause may be that seam damage has more effect on the fabric in such cases.

3.3.6.9 The strength of the second zone of Fabric I

Figure 3.34 shows that the trend of the two curves is alike, the middle peaks both occur at 45^0 and the strength at 10^0 and 80^0 in both cases is about the same. Even the level of strength are very similar.

Figure 3.33 The Breaking Strength of the Second Zone of Fabric H as a Function of Angle of Bias under Three Types of Breaking Condition.

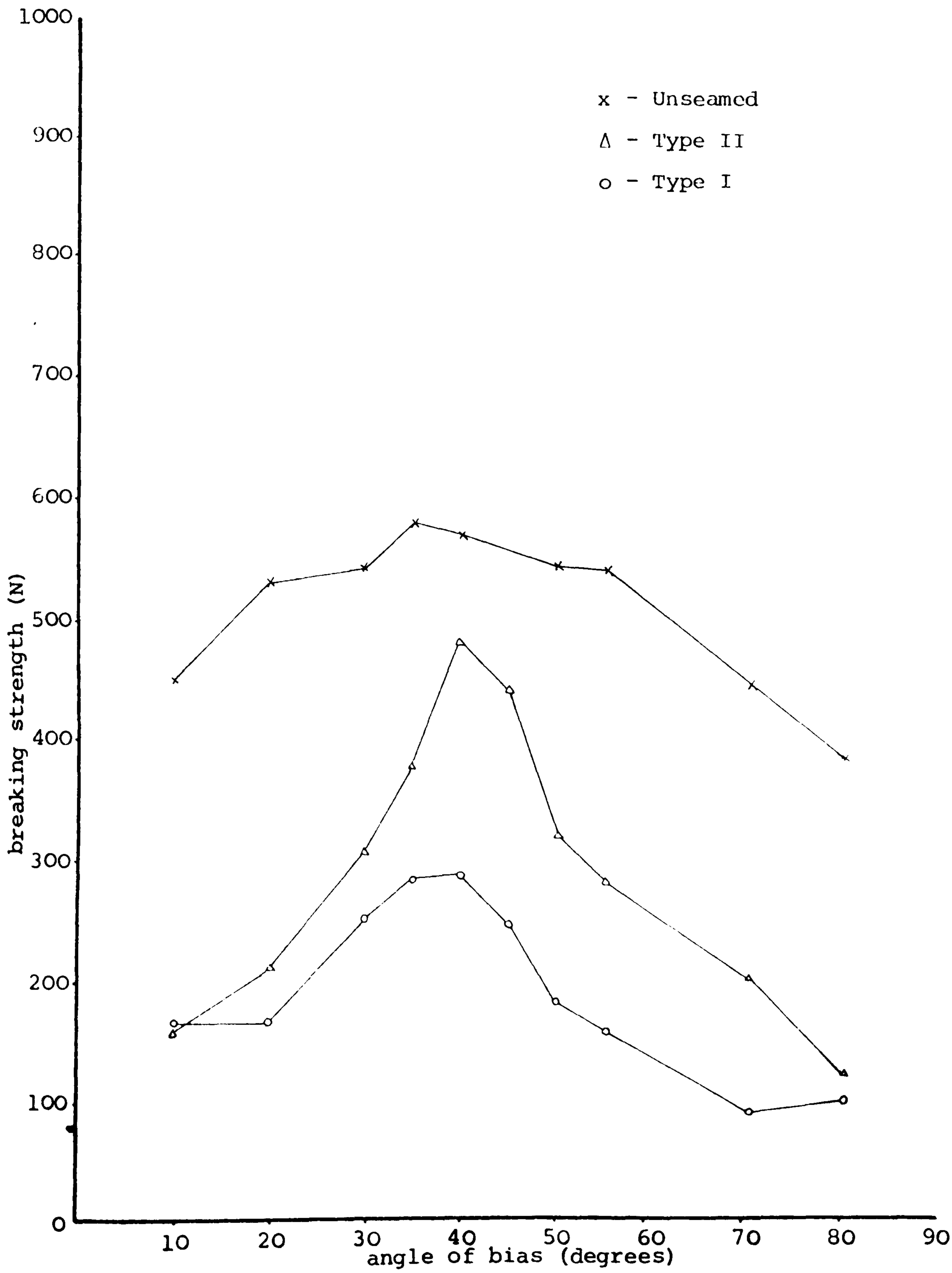
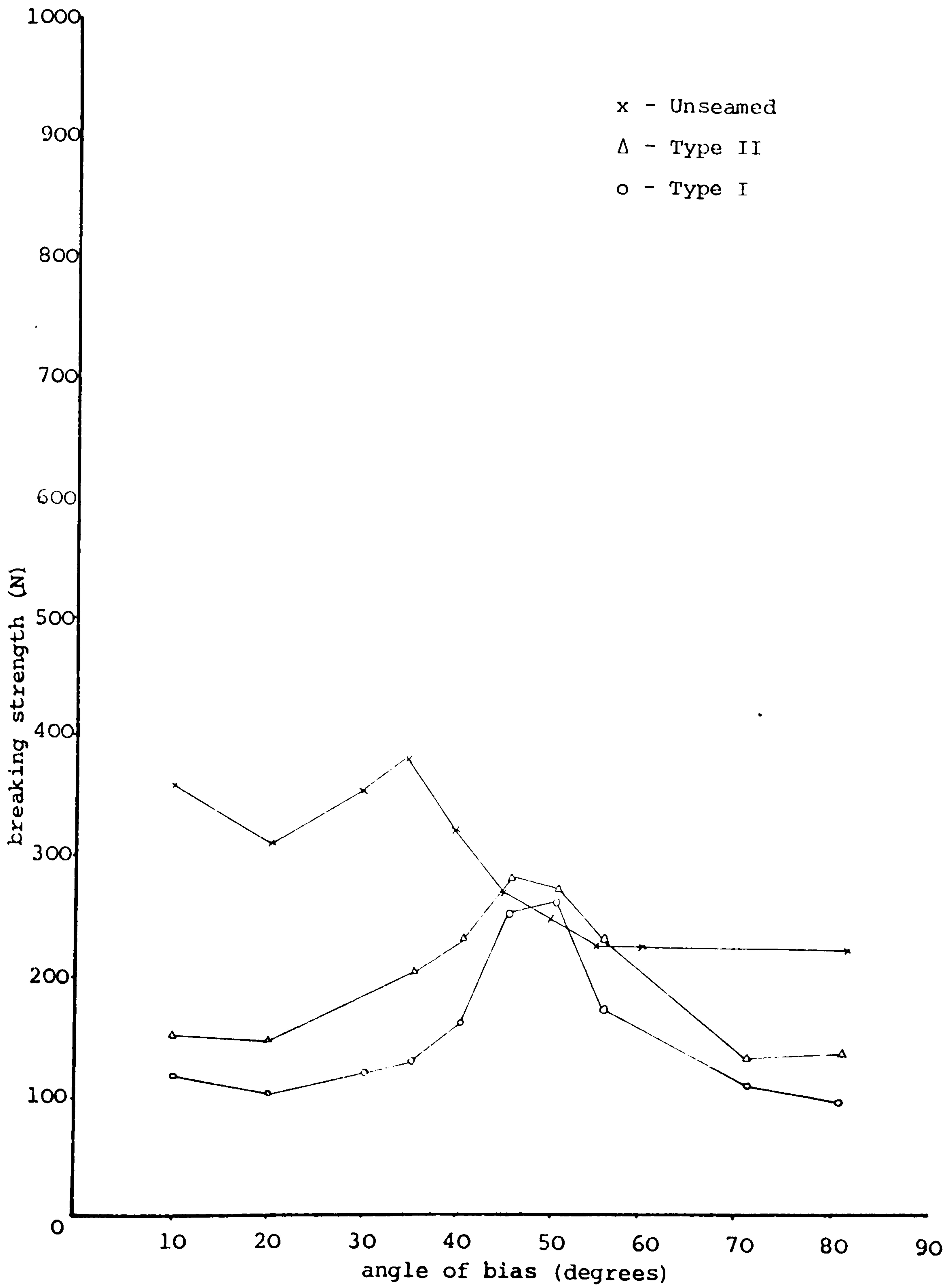


Figure 3.34 The Breaking Strength of the Second Zone of Fabric I as a Function of Angle of Bias under Three Types of Breaking Condition.



CHAPTER 4 PHYSICAL MODEL

4.1 GARDNER'S MODEL FOR PREDICTING SEAM STRENGTH AND FABRIC STRENGTH

Gardner's[19] suggested model shown in Figure 4.1 contains three load transfer zones. Gardner called these the primary, secondary and tertiary zones. The primary zone is defined as being one containing direct transfer from jaw to jaw or jaw to seam to jaw through the fabric yarns. This transfer is considered to be directly proportional to the number of yarns (represented by the length of DB' and CL) gripped by both of the two jaws (AB and CD) for unseamed samples or by one jaw (AB) and the seam (CD) for seamed samples. The secondary zone is defined as an indirect load transfer mechanism (where the load is transferred from yarn to yarn at points of yarn intersection); the mechanism is considered to be proportional to the areas (Δ DC'X and BA'Y) within which the yarns (warp and weft) are gripped by jaw or seam only at one end. The tertiary zone is considered to be the rest of the area (AC'XD' and CA'YB'') within which the yarns are not gripped by jaws or seam at either end.

In his prediction of sample strength, Gardner used only the primary and secondary zones, because he suggested that the tertiary zone was negligibly small within the range of his experimentation. The results showed that the model was appropriate for small angles of bias,for longer gauge lengths and for all angles of bias for shorter gauge lengths. Gardner, however,demonstrated in the case of a unseamed sample at 10 $mx10^{-2}$ width, when the angle of bias was increased to 45^0 (as illustrated in Figure 4.2) neither the primary nor the secondary zone exists; the fabric still has strength, thus suggesting that a testing type of different load transfer mechanism should exist.

Figure 4.1 Gardner's Model

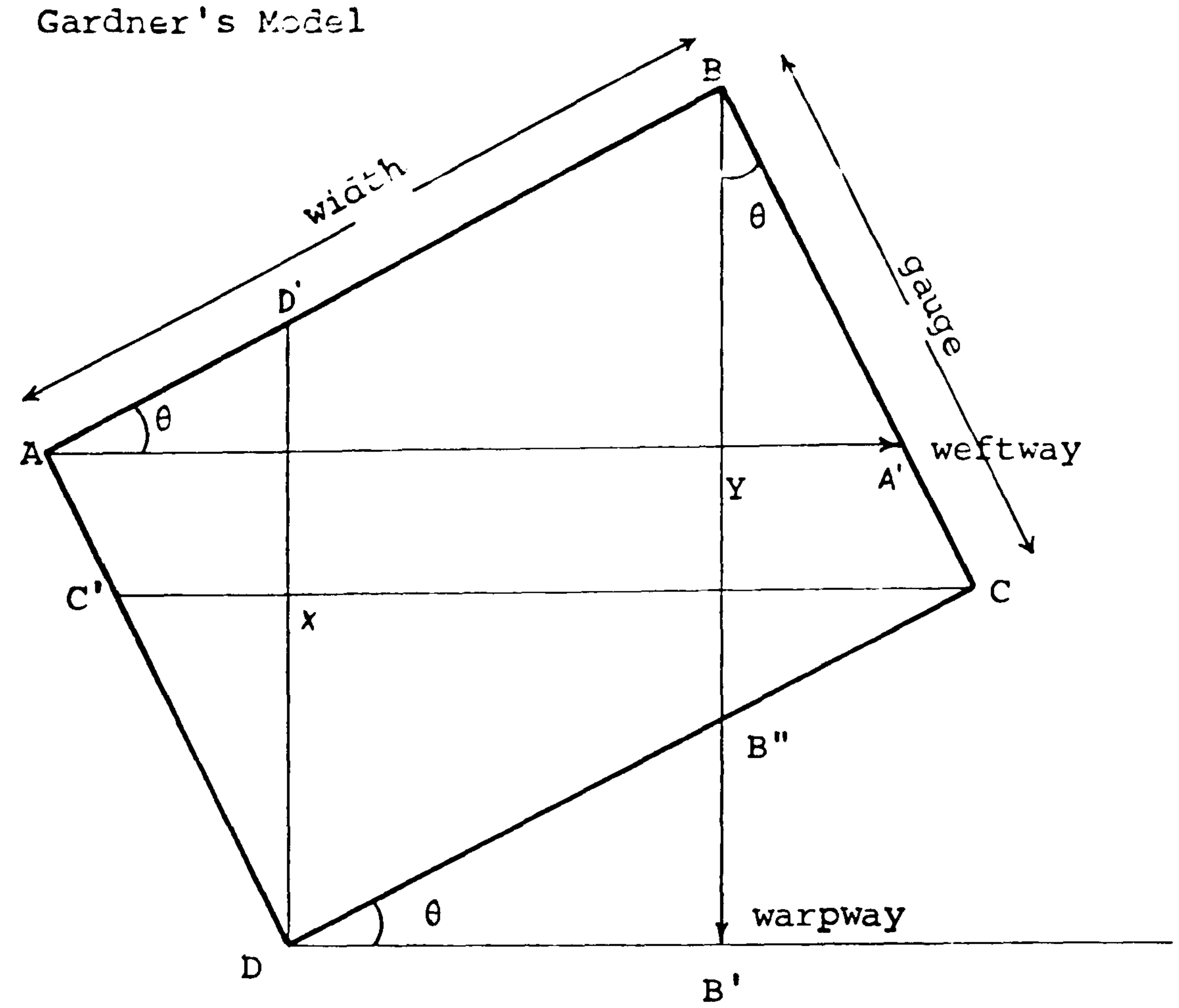


Figure 4.1a One First Zone Present

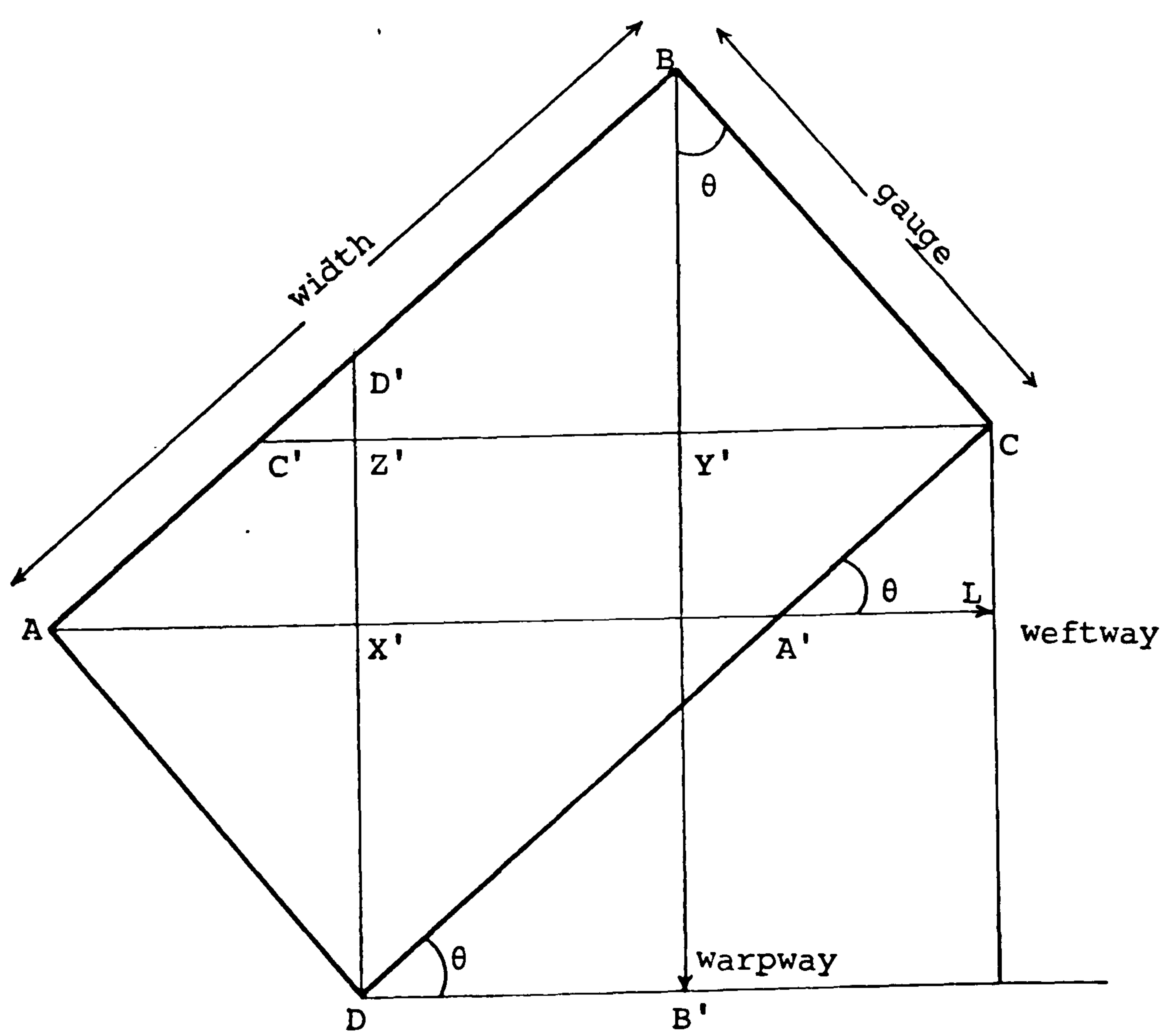
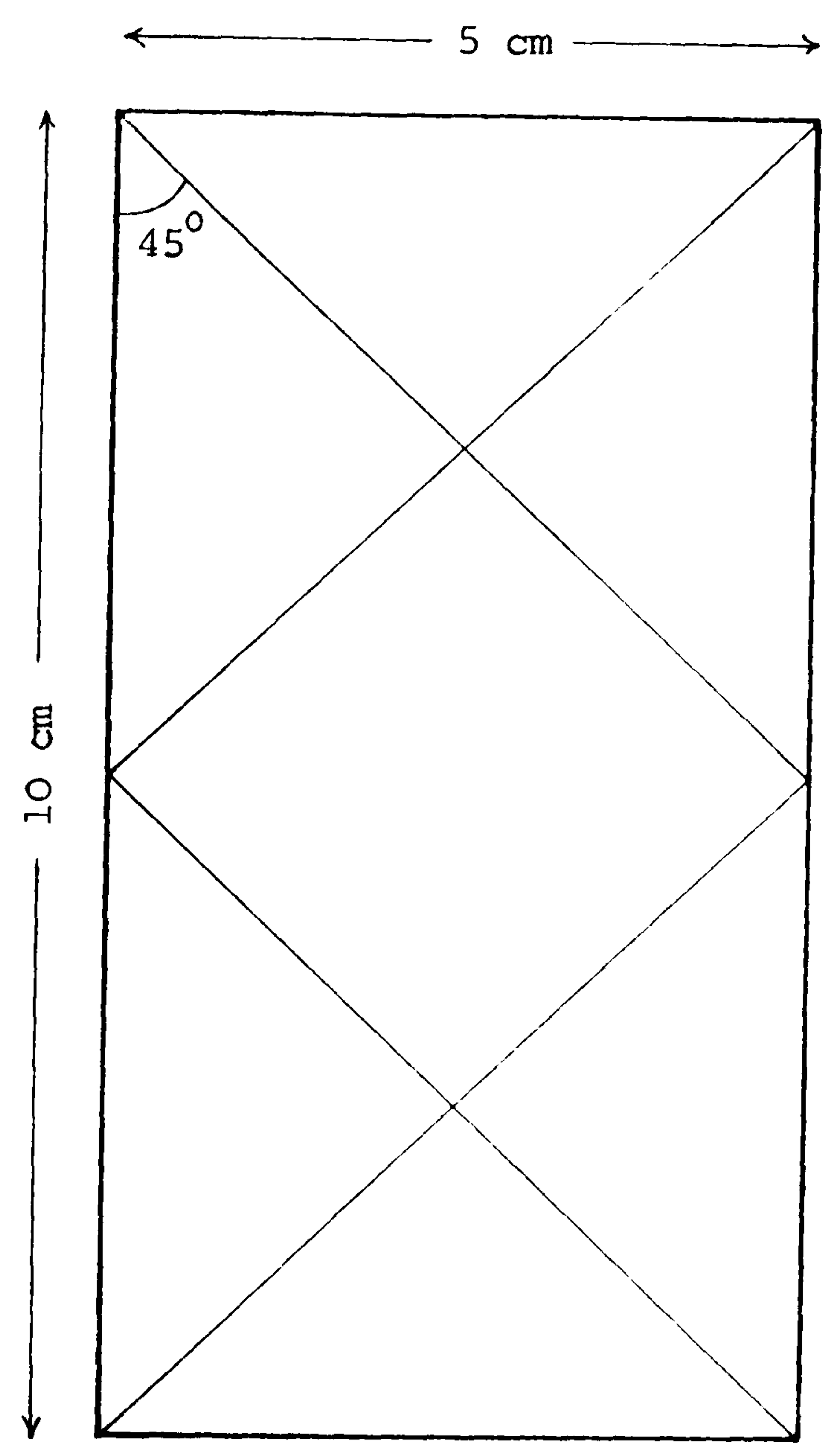


Figure 4.1b Two First Zones Present

Figure 4.2 The Case When Neither the Primary Nor the Secondary Zone Exists.



One of Gardner's experimental and calculated results[20] (shown in Figure 4.3) illustrates what happens as a consequence of his not taking the third zone into consideration especially for long gauge lengths; the strength approaches zero at 25^0, and thus the third zone mechanism becomes so large that it cannot be ignored.

After careful examination of Gardner's model, it was felt that a direct development of his model would not be appropriate. This is because the basic approach of this model in defining the secondary and tertiary zones is to consider load transfer at points of yarn intersection as the strength contribution. This would mean that a continuous increase in gauge length (thus increasing continuously the number of points of yarn intersection in the secondary or the tertiary zones) would give a continuous increase in the fabric strength.

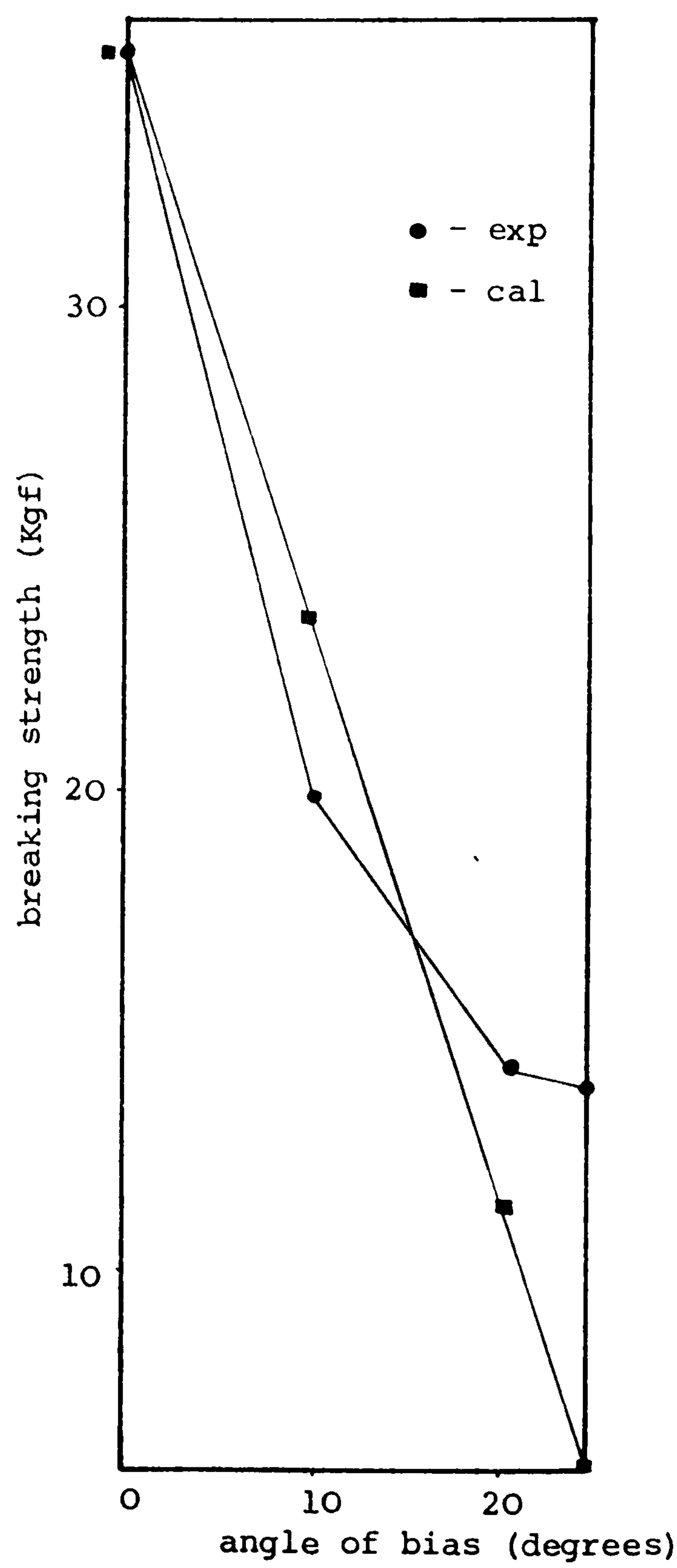
The present work, as illustrated in Figure 3.1 as an example, shows very clearly that an increase in the gauge length to and above $10\ mx10^{-2}$ (at a width of at $5\ mx10^{-2}$) gives similar levels of strength's curves and similar values of strength at 0^0 at all gauge lengths. Therefore this author suggests that the model should be developed or modified in an attempt to explain why:

i) the angle of bias effect is as it is;

ii) the strengths at 0^0 and 90^0 should be constant for different gauge lengths; and

iii) the strength should be kept constant at different gauge lengths at the same angle after the disappearance of the first zone as the width is assumed to be constant.

Figure 4.3 The Breaking Strength of Unseamed Fabric as a Function of Angle of Bias at the gauge of 10 cm and width of 5 cm.



4.2 DEVELOPMENT OF GARDNER'S MODEL

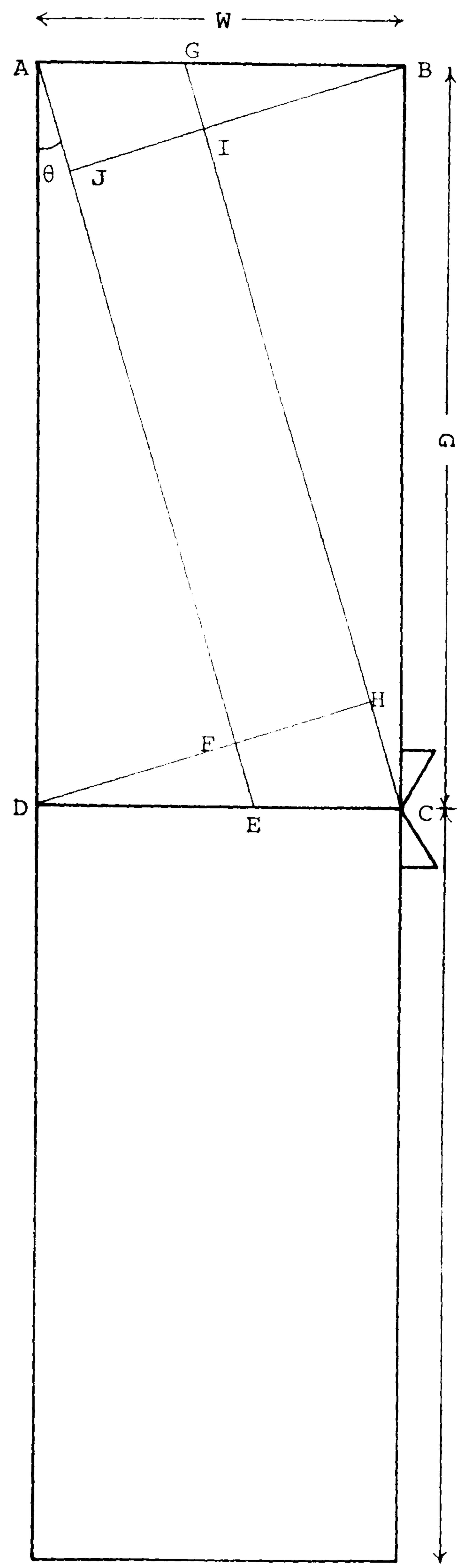
Consider a piece of rectangular square-sett fabric when it is stressed with the warp yarns of the fabric at an angle of bias to the loading. The essential parts of the sample are shown in Figure 4.4.

In the diagram, for unseamed fabric, AB is the top jaw, and CD is the lower jaw. For seamed fabrics,AB is the top jaw and CD is the seam line. Another identical sample is being joined by a seam and gripped at its other end by the lower jaw (ie. two identical samples in series).

Therefore, load can be transferred from jaw to fabric yarns,to jaw or to seam,to fabric yarns to jaw,when it is stressed. The fabric yarns, of course, bear the load, but not necessarily uniformly in all parts of the fabric. On careful examination of the fabric, it is clear that some fabric yarns are gripped at both AB and CD. Other fabric yarns are either gripped at one end (by the jaw or the seam line) and not gripped at the other, or not gripped at either end. Naturally the yarns gripped at both ends tend to bear more load than the rest of yarns, because of direct load transfer. Yarns gripped at only one end,or not gripped at either end,transfer load from jaw to jaw (or jaw to seam to jaw) at points of intersections between warp and weft yarns.

It is proposed that the strength of the sample is dependent on the number of yarns gripped at the jaw which transfer load either through direct load transfer (yarns gripped at both end) or through indirect load transfer (yarns gripped at one end) to the seam line or to the

Figure 4.4 The First and Second Zones of the Physical Model in a Seamed Fabric.



W - width of sample

G - gauge length (jaw to seam)

θ - angle of bias

other jaw.

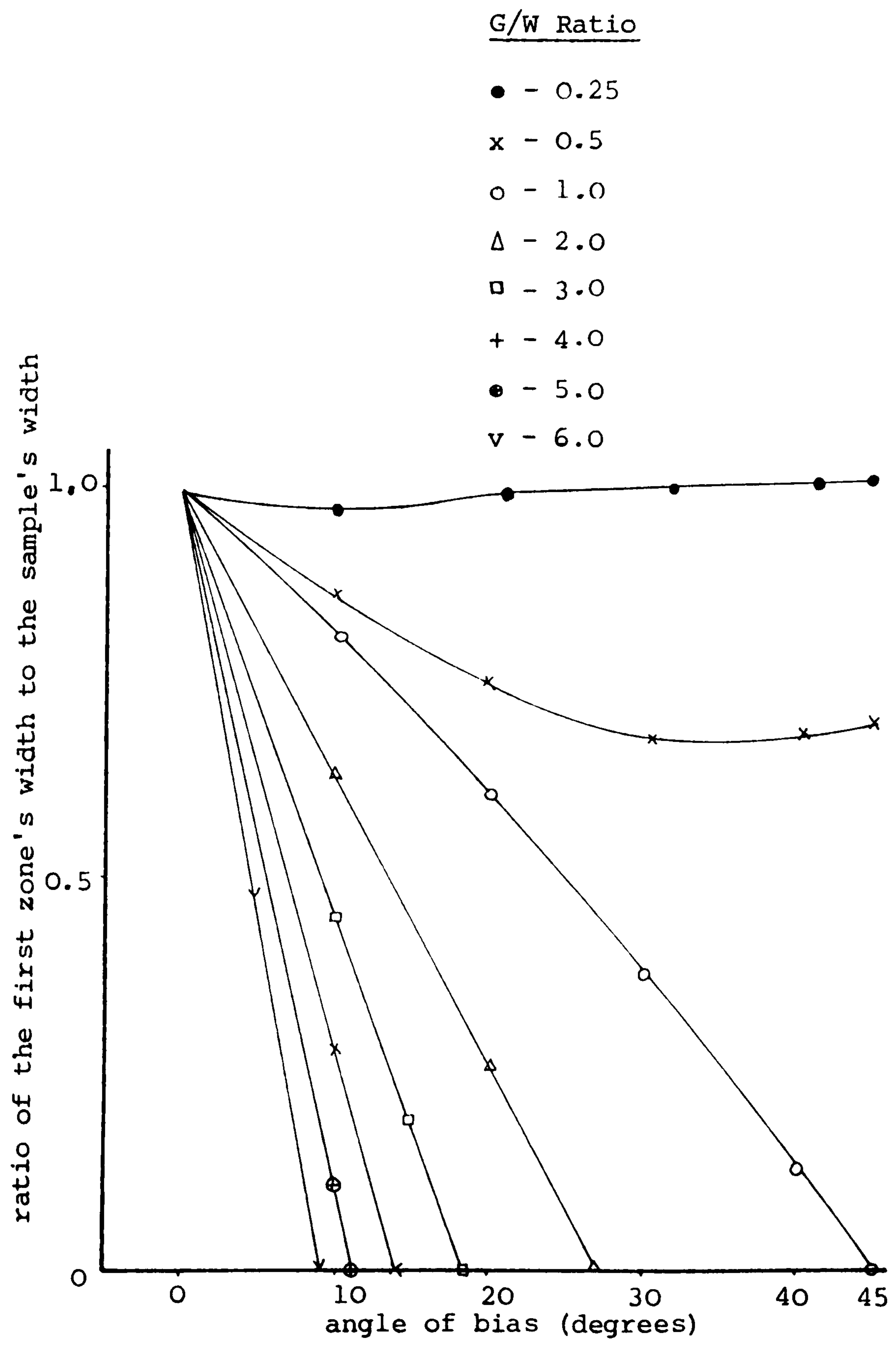
The number of yarns gripped at the jaw is the length of DH multiplied by the number of warp yarns per unit length and the length of HC multiplied by the number of weft yarns per unit length (the number of yarns gripped at the other jaw or the seam line will be the same at the same angle of bias) as shown in Figure 4.4. In this basic model, the number of warp yarns per unit length is assumed to be the same as the number of weft yarns per unit length as only the case of a square-sett plain-weave fabric is under consideration.

It is proposed to divide the strength contribution of the number of yarns gripped at the jaw into two zones. The first zone is one of direct load transfer; the length of FH multiplied by the number of warp yarns per unit length. The second zone is considered from the length DF multiplied by the number of warp yarns per unit length and the length of HC multiplied by the number of weft yarns per unit length.

4.3 STRENGTH IN THE FIRST ZONE

In the first zone, the amount of load bearing is determined by the number of yarns gripped at both ends. In another word, this is proportional to the length of FH (q.v. Figure 4.4). Figure 4.5 shows how the length of FH in the first zone would be changed as the angle of bias changes at different G/W ratios, where G represents the gauge length (jaw to jaw for unseamed samples or jaw to seam for seamed samples) and W represents sample width. Figure 4.5 shows that when the ratio of G/W tends to one, the first zone would disappear above certain angles of bias. In this case, all of the strength would be contributed by the secondary zone only. The same figure (Figure 4.5) also

Figure 4.5 The Ratio of the Width of the First Zone to the Width of the Sample as a Function of Angle of Bias at Different G/W Ratios.



shows that when the G/W ratio is less than unity, two first zones would appear above certain angles; one from the warp and the other from the weft (shown in Figure 4.6). In this case, the two first zones will be called first zone of warp and first zone of weft. The total number of yarns will be proportional to the length of FH plus the length of HE. Figure 4.5 also shows that when the G/W ratio is less than one half, the total length of FH and HE would be greater than unity above certain angles (as shown in Figure 4.5).

4.4 STRENGTH IN THE SECOND ZONE

In the second zone, the load is only transferred indirectly from the jaw through the intersections of warp and weft yarns. The strength of the second zone will be proportional to the number of warp and weft yarns gripped at one jaw only which is proportional to the length defined by DH+HC minus the length of the first zone (q.v. Figure 4.4).

Figure 4.7 and Table 4.1 show the changes of the ratio of the length (DH+HC) at different angles of bias to the length of DC. The length of DH+HC is equal to $\frac{DC \cos\theta + DC \sin\theta}{DC}$, therefore it can be written in the form $\cos\theta+\sin\theta$. Table 4.1 shows that the ratio at 45^0 has the highest value (highest no. of yarns) which means that it should have the highest strength among the other angles of bias, for a square-sett plain weave fabric.

4.5 PHYSICAL MODEL IN RELATION TO THE ANGLE OF BIAS

The total breaking strength (S) of a seamed or unseamed fabric is the sum of the contributions of the strength in the first zone (S_1)

Figure 4.6 The Physical Model with Two First Zones.

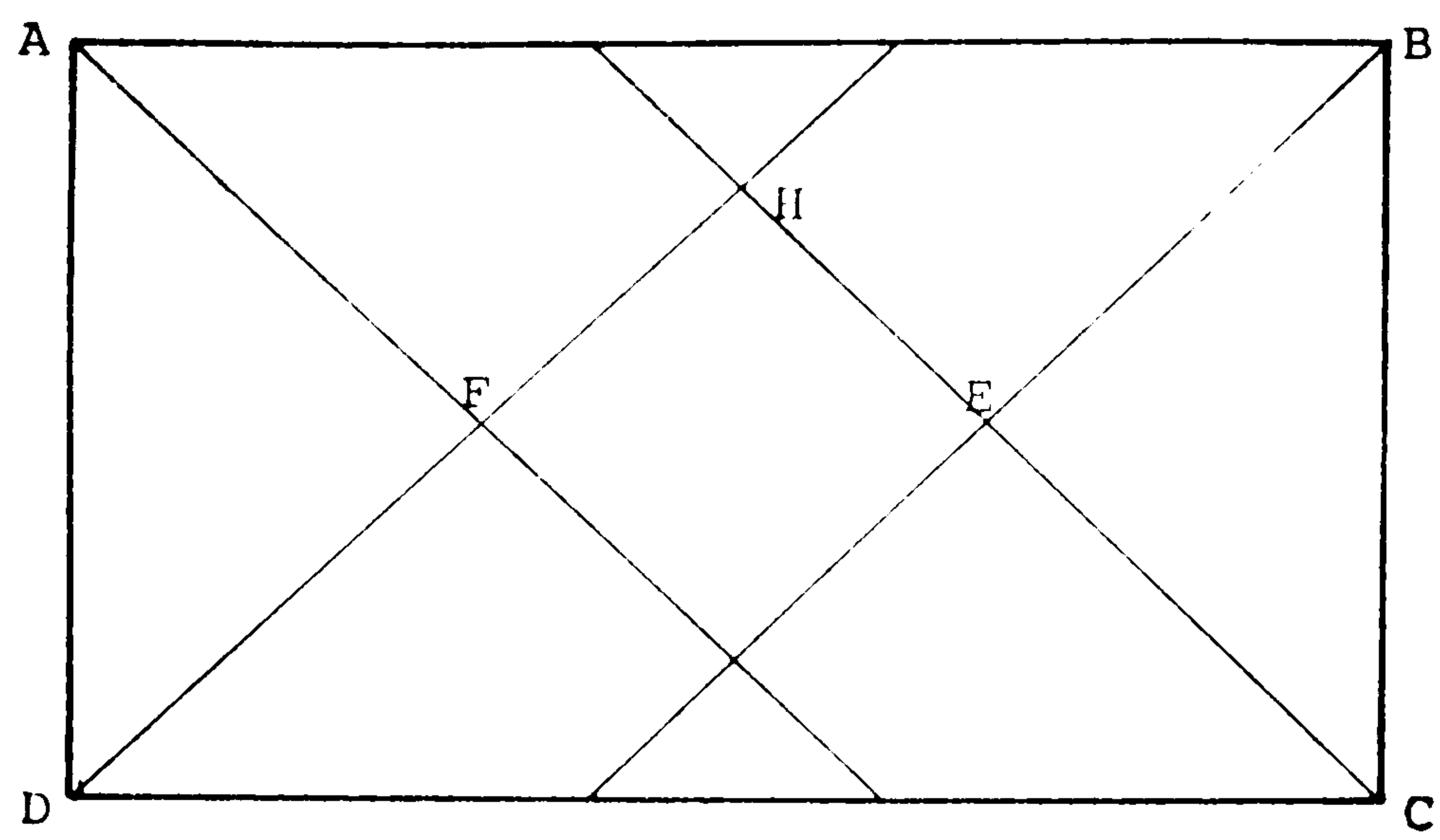


Figure 4.7 Change of the Ratio Between the Warp and Weft Length (DH + HC) to the Width (CD) at Different Angles of Bias.

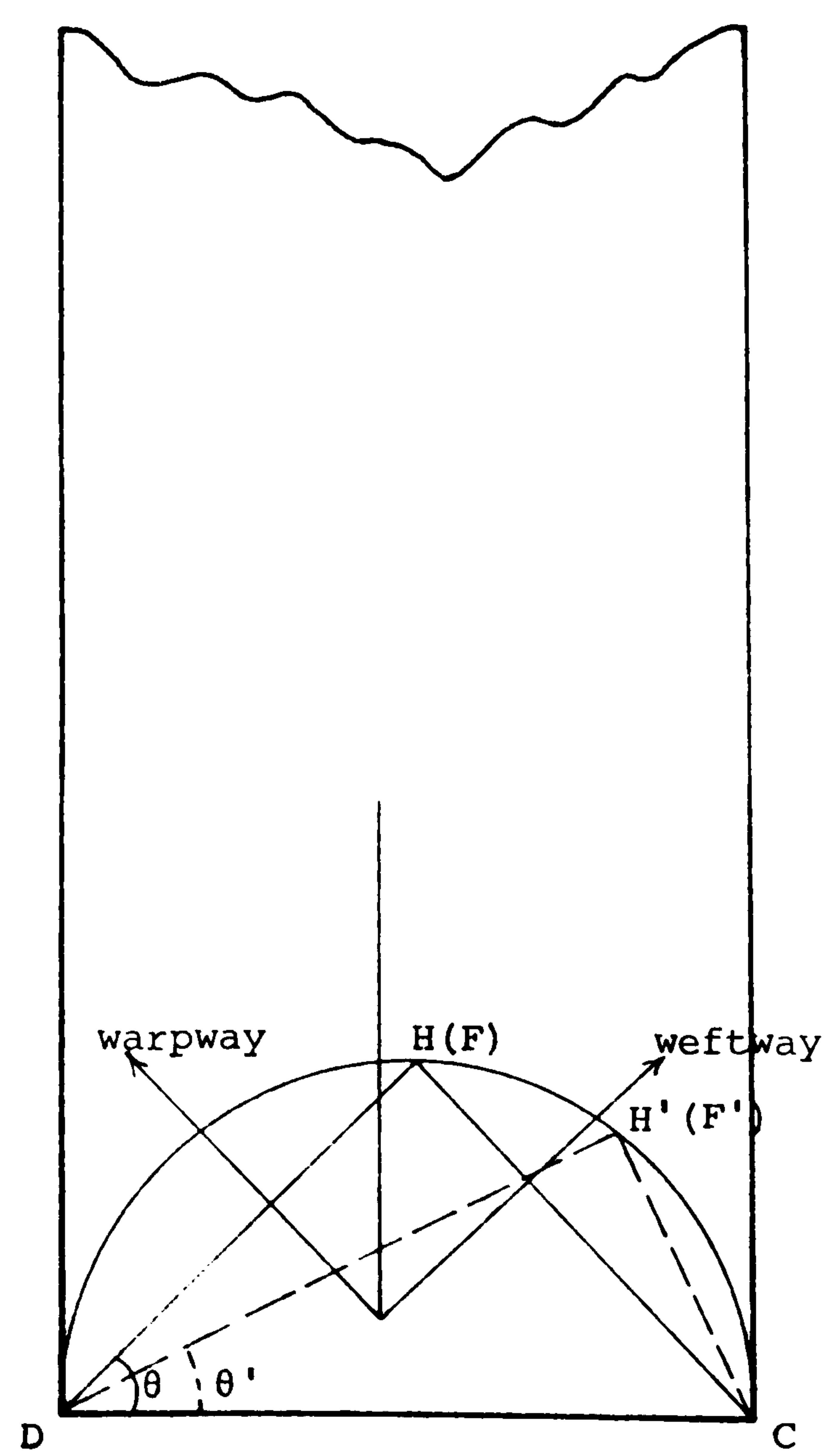


Table 4.1 Ratio of the length of DH+HC at different angles of bias to the length of DC

Angle of bias	10^0	20^0	30^0	40^0	45^0
Ratio of (DH+HC)/DC	1.158	1.282	1.366	1.41	1.414

and the strength in the second zone (S_2); $S = S_1+S_2$. When the fabric is at the angle of 0^0 or 90^0, only the first zone exists, therefore all the warp yarns contribute all of the strength at the angle of 0^0, and all the weft yarns contribute all of the strength at the angle of 90^0. As the angle of bias increases from 0^0 or decreases from 90^0, the first zone decreases as shown in Figure 4.5, and the influence of the second zone increases, except for when the G/W ratio is less than or equal to one half. As mentioned before, the first zone disappears above certain angles of bias in some cases. The decrease in the contribution of the first zone leads to a reduction in the fabric strength even though the contribution of the second zone is increasing at the same time. This is because the first zone is considered to be the main contributor to the total strength. Figure 3.26 illustrates that for different angles of bias, the second zone has different breaking strengths. The strength at 10^0 has the lowest value, then the strength gradually increases as the angle increases till 45^0.

From the behaviours of the first zone and the second zone, therefore, it is expected that (for a sample with G/W ratio approximately equal to one) the strength would decrease as the angle increases from 0^0 because of the domination of the first zone until the second zone becomes the predominant strength contributor and thus the strength rises as the angle approaches 45^0. A mirror image of the strength curve (from 45^0 to 90^0) will be expected for a square-sett plain-weave fabric.

6 THE EFFECT OF THE RATIO OF G/W ON THE ANGLE OF BIAS

Figure 4.5 illustrates very clearly that if the G/W ratio increases, the rate of decrease of the first zone increases and the sooner will the zone disappear (as the angle of bias increases) thus causing a decrease in the contribution of first zone strength until the point at which the first zone just disappears.

Once the first zone disappears, the numbers of yarns in the secondary zone (gripped at one end only) is expected to be remained constant at the same angle, so the sample strength should remain the same as the G/W ratio increases and W remains constant. This effect is called the gauge length effect (G varies and W remains constant). The strength at the angles of 0^0 and 90^0, are of course, expected to be remained constant (no gauge length effect) because the number of yarns in the first zone remains constant (as the gauge varies), W remains constant and the secondary zone does not exist.

Fabric width is expected to have a greater effect on sample strength. An increase in the fabric width will give:

i) an increase in the first zone and a decrease of the secondary zone (when both of the zones exist);

ii) an increase in the secondary zone when the secondary zone is the only zone in existence (until the first zone appears).

4.7 SUMMARY

Gardner used points of yarn intersection in his definition of secondary and tertiary zones. In his seam strength prediction (without taking the tertiary zone into the calculation) the results show that the model's applicability is limited. The load transfer mechanism of the tertiary zone is very complicated, therefore a different approach in this present work has to be used. The present model suggests that the number of yarns gripped by both jaws contributed the strength of the first zone; (direct load transfer), and the number of yarns gripped by only one jaw contributed the strength of the second zone (indirect load transfer). This model thus an attempt to explain the observations made in Chapter 3; viz:

i) the angle of bias effect;

ii) the constant strengths at 0^0 and 90 for different gauge lengths as the width remains constant; and

iii) the strength should remain constant at different gauge lengths at the same angle after the disappearance of the first zone (the width remaining constant).

CHAPTER 5 THE BASIC MATHEMATICAL MODEL - A MODIFICATION OF THE GARDNER MODEL FOR SQUARE-SETT PLAIN-WEAVE FABRICS

5.1 INTRODUCTION - THE MODEL FOR SQUARE-SETT PLAIN-WEAVE FABRICS WHERE WARP STRENGTH IS EQUAL TO WEFT STRENGTH

The physical model suggested in Chapter 4, postulated that the breaking strength of a sample is composed of the sum of the contributions made by two distinct zones in the fabric, namely the first and second zones as illustrated in Figure 4.4.

In Figure 4.4, ABCD is a piece of fabric, AB is the jaw line, and CD is either the other jaw line (for unseamed samples) or the seamed line (for seamed samples). The angle of bias is the angle between the line perpendicular to the seam and the warp direction ($\angle$DAE), where G is the gauge length (jaw to jaw for unseamed samples or jaw to seam for seamed samples). The first zone is the length of FH (yarns gripped at both ends by jaw-jaw for unseamed samples or jaw-seam for seamed samples); the second zone comprises the remainder of the length of DH+HC (only one yarn end being gripped by the jaws or seam).

5.2 BREAKING STRENGTH IN THE FIRST ZONE

5.2.1 WHEN THE RATIO OF G/W TENDS TO UNITY

The breaking strength of the first zone (S_1) is dependent on the number of load carrying fabric yarns contained in it. Both ends of such yarns are gripped by the jaw AB and the jaw (or seam) CD. Thus S_1 is dependent on the length of FH, where

$$FH = EC \cos \theta$$

therefore S_1 is dependent on EC Cos θ. Hence, to convert load along these yarns into its constituent of tension (T), it can be seen that

$$S_1 = K_0 \ (EC \ Cos \ \theta) \ Cos \ \theta$$

$$= K_0 \ EC \ Cos^2 \ \theta \ \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \ (1)$$

where K_0 is a constant (strength per unit length) at zero angle of bias). K_0 is used because it can be obtained easily by performing a simple strength test.

Now $EC = W - DE$

therefore $EC = W - G \ Tan \ \theta$ .... (2)

Substituting equation (2) into equation (1) gives

$$S_1 = K_0 \ (W - G \ Tan \ \theta) \ Cos^2 \ \theta \ \ldots\ldots\ldots\ldots \ (3)$$

If FH <= O (ie. G Tan θ => W), the first zone does not exist.

5.2.2 WHEN THE RATIO OF G/W IS LESS THAN UNITY

If the ratio of G/W is less than 1, some of the weft yarns would be expected to fall into the first zone at certain angles of bias in addition to the warp yarns already considered. This situation is illustrated in Figure 5.1. In this case, the length of HF can be regarded as "first zone of warp" whose load carrying contribution is S_{1warp} and the length of HI can be regarded as "first zone of weft", whose contribution is S_{1weft}, where

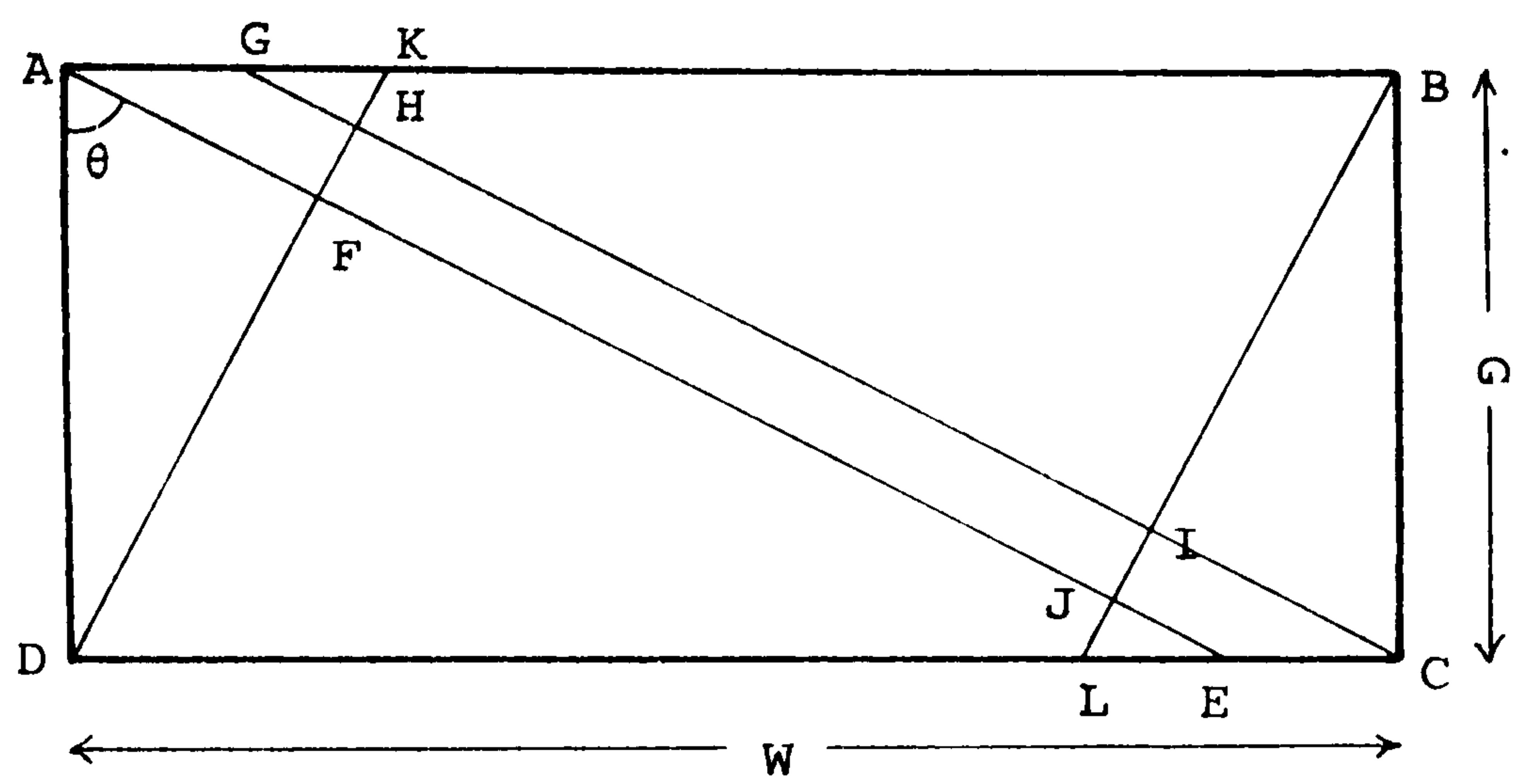
$$HI = DL \ Sin \ \theta$$

therefore S_{1weft} is dependent on $DL \ Sin\theta$. Hence, to convert load along these threads into its constituent component of T, it can be seen that

$$S_{1weft} = K_{90} \ (DL \ Sin \ \theta) \ Sin \ \theta$$

$$= K_{90} \ DL \ Sin^2 \ \theta \ \ldots\ldots\ldots\ldots\ldots\ldots \ (4)$$

Figure 5.1 The Physical Model of Seam Strength When the Ratio of G/W is such that $\frac{1}{2} < G/W < 1$.



W - width of sample

G - gauge length (jaw to seam)

θ - angle of bias

where K_{90} is a constant (strength per unit length at 90^0 angle of bias).

In this basic model for square-sett plain weave fabric, K_{90} is assumed to be equal to K_0, therefore

$$S_{1weft} = K_0 \ DL \ Sin^2 \theta \ \dots\dots\dots\dots\dots\dots\dots\dots \ (5)$$

Now $\quad DL = W - LC$

therefore $\quad DL = W - G \ Tan \ (90 - \theta) \ \dots\dots\dots\dots\dots\dots \ (6)$

Substituting equation (6) into (5), gives

$$S_{1weft} = K_0 \ (W - G \ Tan \ (90 - \theta)) Sin^2 \theta \ \dots\dots\dots \ (7)$$

Therefore the total breaking strength of the first zone (S_1) can be regarded as the sum of the loads in the two first zones.

$$S_1 = S_{1warp} + S_{1weft}$$
$$= K_0 \ (W - G \ Tan \ \theta) \ Cos^2 \theta + K_0 \ (W - G \ Tan \ (90-\theta)) Sin^2 \theta \ \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots \ (8)$$

5.3 BREAKING STRENGTH IN THE SECOND ZONE

5.3.1 WHEN THE RATIO OF G/W TENDS TO UNITY

In the second zone (q.v. Figure 4.4), the breaking strength (S_2) is considered to be dependent on the number of yarns which are gripped either by one jaw (or seam) only. In other words, S_2 is proportional to the remainder of the length of DH + HC (DH + HC - HF) and the remainder of the length of BI + AJ (BJ + AJ - IJ). Therefore the breaking strength of the second zone (S_2) is dependent on the length of DF + HC + IB + AJ (assuming the fabric is a square-sett plain weave fabric).

Now $DF = IB$

and $HC = AJ$

therefore S_2 is dependent on the length of $2(DF + AJ)$ or $2(DH + HC - HF)$. Thus S_2 can be derived as follows,

$$S_2 = 2\ K_\theta(DH + HC - HF) \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (9)$$

where $DH + HC = W(\cos\theta + \sin\theta)$

and $HF = (W - G \tan\theta) \cos\theta$

If $W < G \tan\theta$, $HF = 0$

Where K_θ is a constant (strength per unit length at different angles of bias), and $DC = W$.

5.3.2 WHEN THE RATIO OF G/W IS LESS THAN UNITY

Because the two first zones (S_{1warp} and S_{1weft}) exist in some cases, then S_2 is proportional to the remainder of the length of $2(DH + HC)$ and the length of $2(DH + HC - HF - HI)$ (q.v. Figure 5.1). Therefore S_2 can be derived as follows,

$$S_2 = 2\ K_\theta(DH + HC - HF - HI) \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (10)$$

where $DH + HC = W(\cos\theta + \sin\theta)$

and $HF = (W - G \tan\theta) \cos\theta$

If $W <= G \tan\theta$, $HF = 0$

Where $HI = (W - G \tan(90-\theta)) \sin\theta$

If $W <= G \tan(90-\theta)$, $HI = 0$

5.4 TOTAL SAMPLE STRENGTH (S) FOR SQUARE-SETT PLAIN-WEAVE FABRICS

Consideration of the preceding paragraph shows that the total strength of a sample will be the sum of the strengths of the first and second zones, viz,

$$S = S_1 + S_2 \quad \ldots\ldots \quad (11)$$

At the angles of 0^0 and 90^0, the second zone does not exist; $S_2 = 0$.

5.4.1 WHEN THE G/W RATIO TENDS TO UNITY

$$S = K_0(W - G \operatorname{Tan} \theta)\operatorname{Cos}^2 \theta + 2 K_\theta(DH + HC - HF) \quad \ldots\ldots \quad (12)$$

If G Tan θ => W, the first zone does not exist;

$S_1 = 0$, $HF = 0$

5.4.2 WHEN THE RATIO OF G/W IS LESS THAN UNITY

$$S = S_{1warp} + S_{1weft} + S_2$$
$$= K_0(W - G \operatorname{Tan} \theta)\operatorname{Cos}^2 \theta + K_0(W - G \operatorname{Cot} \theta)\operatorname{Sin}^2 \theta$$
$$+ 2 K_\theta (DH + HC - HF - HI) \quad \ldots\ldots \quad (13)$$

If G Tan θ => W, the first zone of warp does not exist; $HF=0$, $S_1warp=0$,

if G Cot θ => W, the first zone of weft does not exist, $HI=0$, $S_1weft=0$.

5 EVALUATION OF THE PARAMETERS K_0 AND K_θ

The mathematical model contains only two unknown parameters K_0 and K_θ. Their values can be found by the elimination of one zone: ie. if the second zone is eliminated, K_0 can be found; if the first zone is eliminated, K_θ can be found.

Figure 5.2 The Physical Model of Seam Strength When the First Zone has just Disappeared in a Seamed Sample.

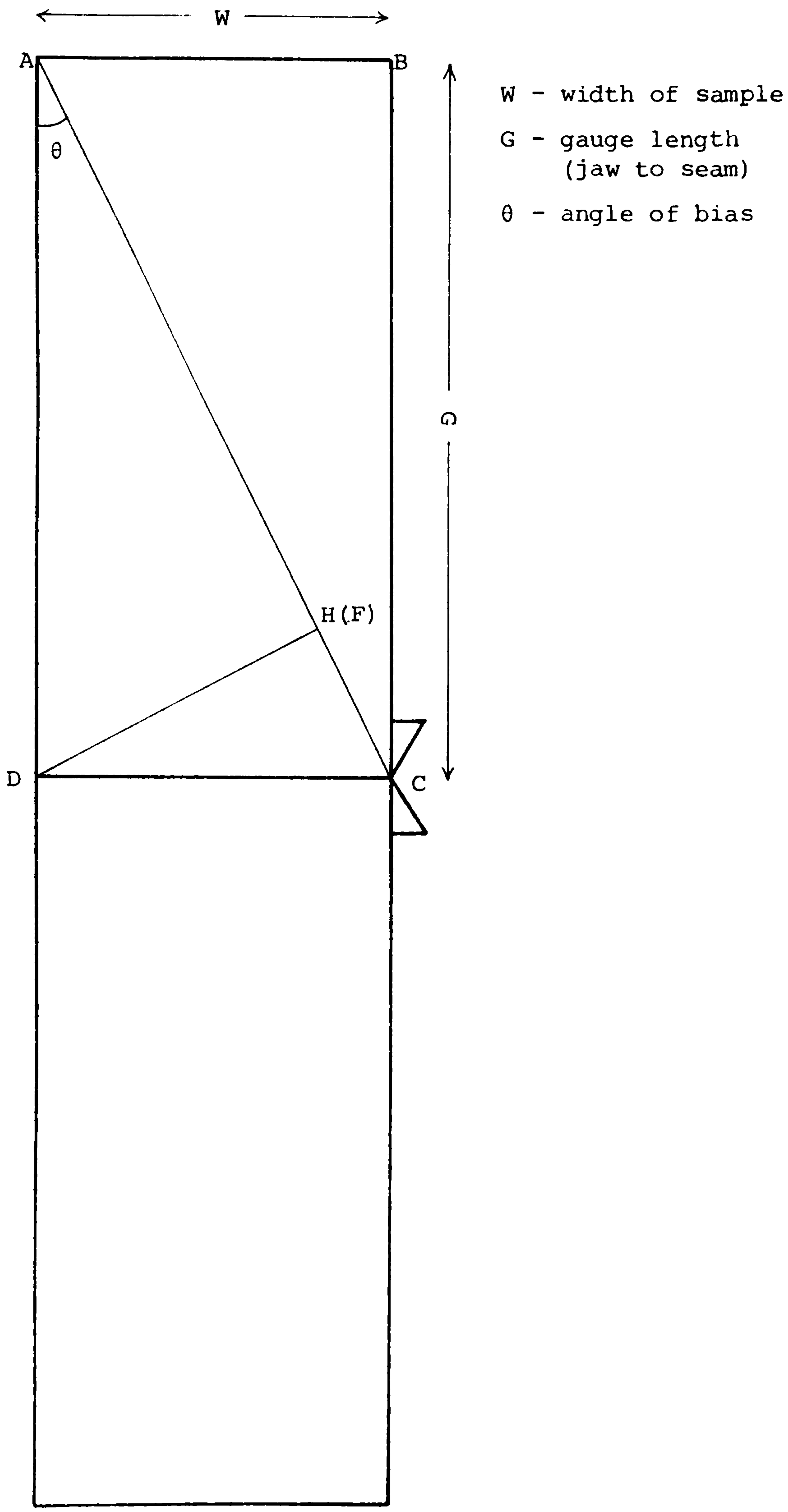


Table 5.1 The Gauge Length and the Ratio of G/W Used to Cause the First Zone just to Disappear.

angle of bias (degrees)	10	20	30	35	40	45
G/W ratio	5.67	2.747	1.73	1.43	1.19	1
G when W = 5 ($m\times10^{-2}$)	28.35	13.735	8.65	7.15	5.95	5

Note:- G is jaw to jaw for unseamed samples or jaw to seam for seamed samples.

5.5.1 EVALUATION OF THE CONSTANT K_0

K_0 can be found by dividing the mean breaking strength of samples (S_0) at 0^0 angle of bias by the width of the samples at any gauge length.

Therefore $K_0 = S_0/W$ (strength per unit length) .... (14)

where $K_0 = K_{90}$ for square-sett plain weave fabric.

5.5.2 EVALUATION OF THE CONSTANT K_θ

K_θ can be found by using the equation $G/W = \frac{1}{\text{Tan } \theta}$ if the first zone is eliminated as shown in Figure 5.2. Table 5.1 shows that the values of G/W ratio at different angles of bias could cause the first zone just to disappear.

In the experiments of K_θ evaluation, the width of sample used is 5 cm, the gauge length used to cause the first zone just to disappear is shown in Table 5.1. The values of K_θ can be found as follows, the mean breaking strength of the second zone at different angles of bias (SK_θ) is divided by the length of 2(DF + FC) (q.v. Figure 5.2), where 2(DF + FC) = 2 W(Cos θ + Sin θ).

$$K_\theta = \frac{SK_\theta}{2W(\text{Cos } \theta + \text{Sin } \theta)} \qquad \text{.....................} \quad (15)$$

Appendix 10 shows the calculations for finding the values of K_θ and the values of K_θ (0^0 to 45^0) under each of the three types of breaking condition for the square-sett fabric (Fabric A).

5.6 <u>CONCLUSIONS</u>

This mathematical model can explain the three suggestions made at the end of Chapter 4:

i) the angle of bias effect;

ii) the strengths at 0^0 and 90^0 are constant at different gauge lengths if the width remains constant (no gauge length effect at 0^0 and 90^0); and

iii) the strength should remain constant at different gauge lengths at the same angle after the first zone has vanished (the width remaining constant).

This basic model is only designed for square-sett plain weave fabrics, and the K_θ at different angles of different types of fabric have to be found by performing time consuming experiments. Therefore further modifications of the model are necessary in order to mitigate these mentioned inflexibilities.

CHAPTER 6 THE EXPERIMENTAL FIT OF THE BASIC MODEL

6.1 COMPARISON BETWEEN THE MATHEMATICAL MODEL AND THE EXPERIMENTAL DATA

Using the mathematical model, the breaking strengths under each of the three breaking conditions at different angles of bias, different gauge lengths and different sample widths can be calculated. Because of the basic assumption of the model (applicable only for square-sett plain-weave fabrics), only the calculated results and the experimental data for Fabric A (the only square-sett plain-weave fabric among the range of fabrics being used) are compared at this stage. The value of K_θ was obtained directly from the experimental strength of the second zone ($SK_{\theta exp}$) at each angle. The results of these calculations are plotted with the experimental data in Figures 6.1 to 6.17 and individual aspects of these results discussed in the following sections.

6.2 UNSEAMED FABRIC BREAKS OF THE SQUARE-SETT PLAIN-WEAVE FABRIC (FABRIC A)

Figures 6.1 to 6.5 show that the calculated and experimental results are in very good agreement. The results for 0^o, 90^o and 45^o angles of bias have the best agreement , except after the 45^o at the gauge of 2.5 m × 10^{-2}. The results at gauge lengths 10, 15, and 20 m × 10^{-2} show the best overall agreement, in other words, good agreement has been shown for long gauge lengths. At the shorter gauges (2.5 and 5 m × 10^{-2}), the model gives higher strengths than the experimental results at the angle approaching 45^o. The overall view shows that the model exhibits a similar trend to each of the experimental curves.

Figure 6.1 The Breaking Strength of Fabric A as a Function of Angle of Bias under the Unseamed Fabric Breaking Condition.

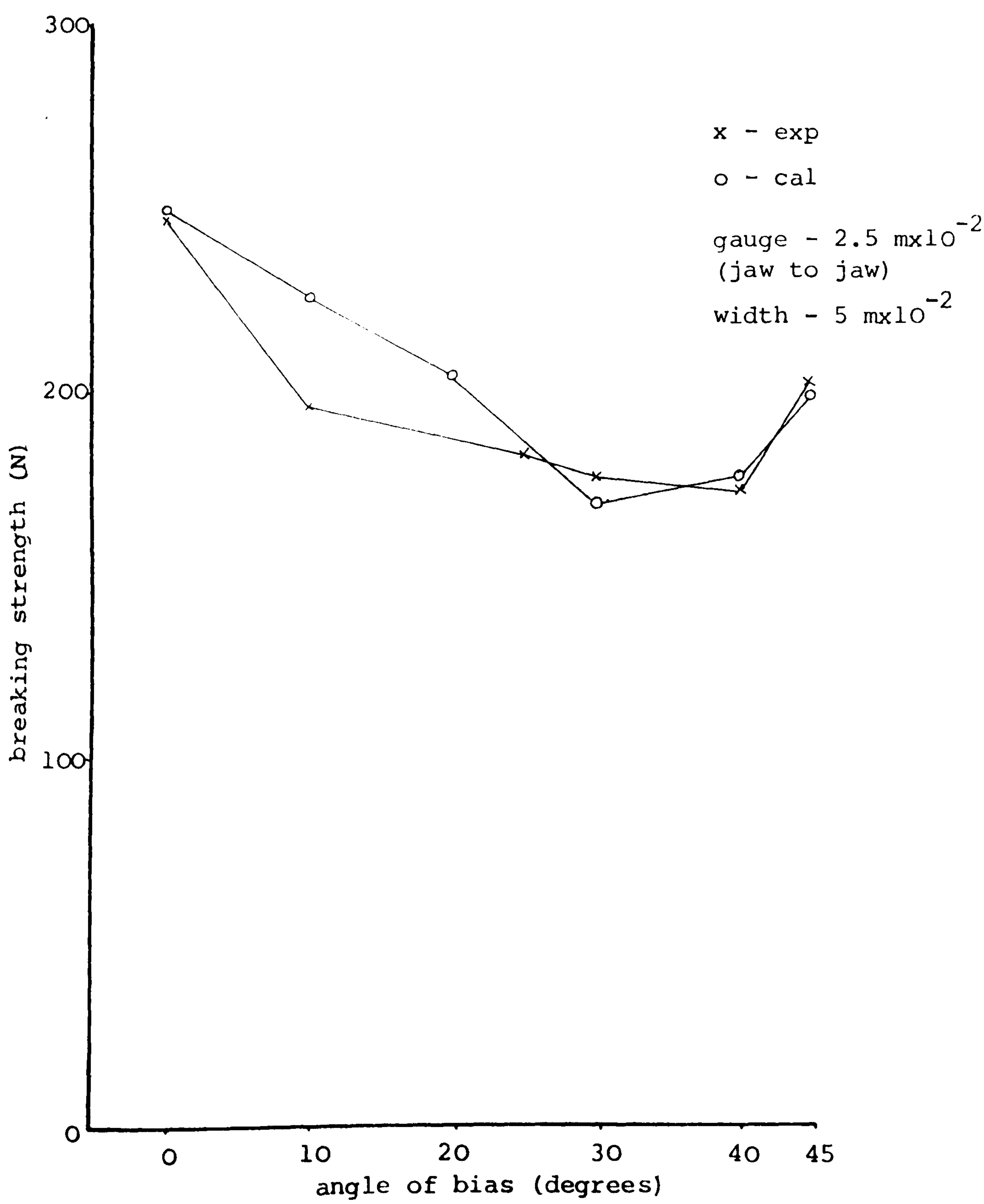


Figure 6.2 The Breaking Strength of Fabric A as a Function of Angle of Bias under the Unseamed Fabric Breaking Condition.

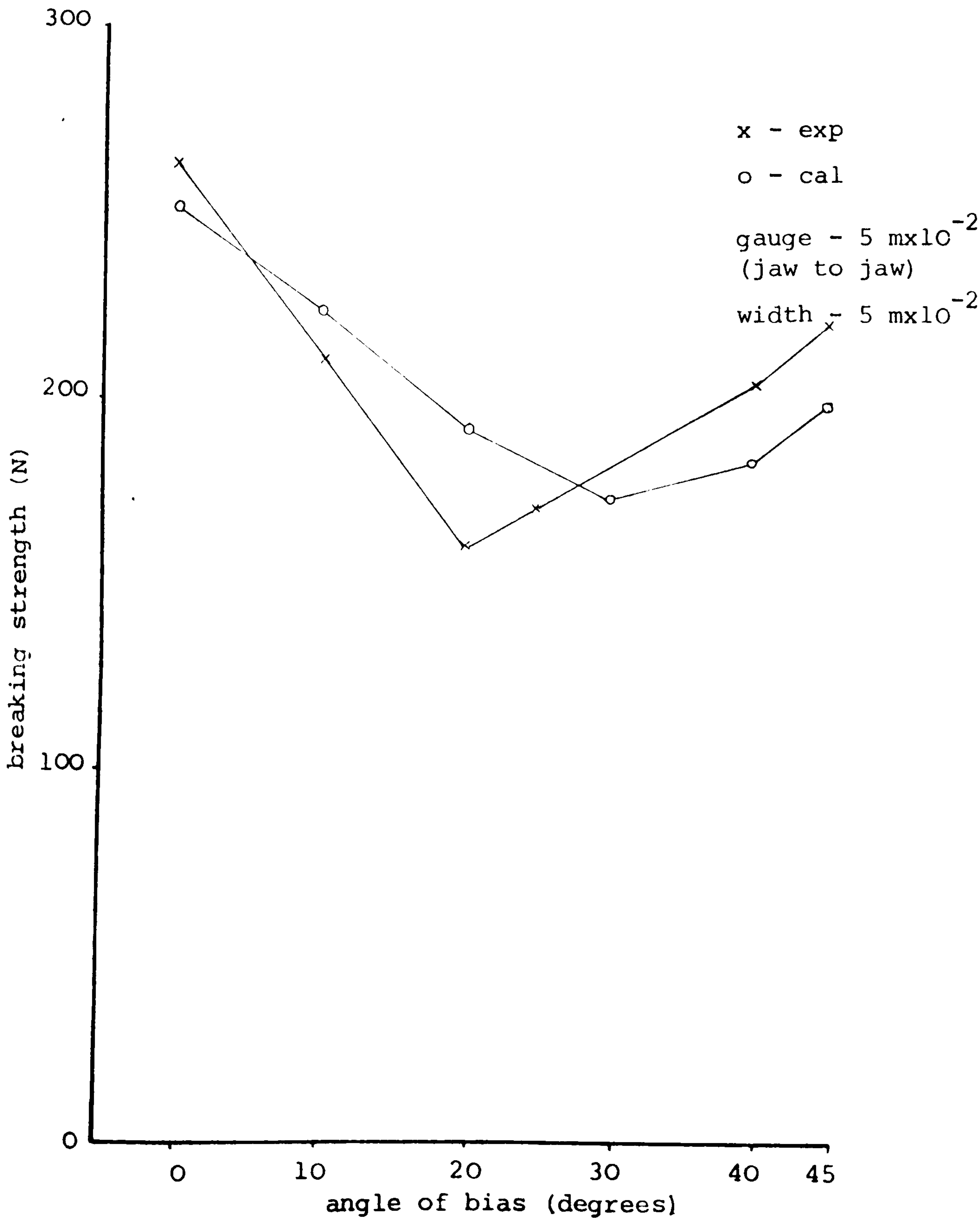


Figure 6.3 The Breaking Strength of Fabric A as a Function of Angle of Bias under the Unseamed Fabric Breaking Condition.

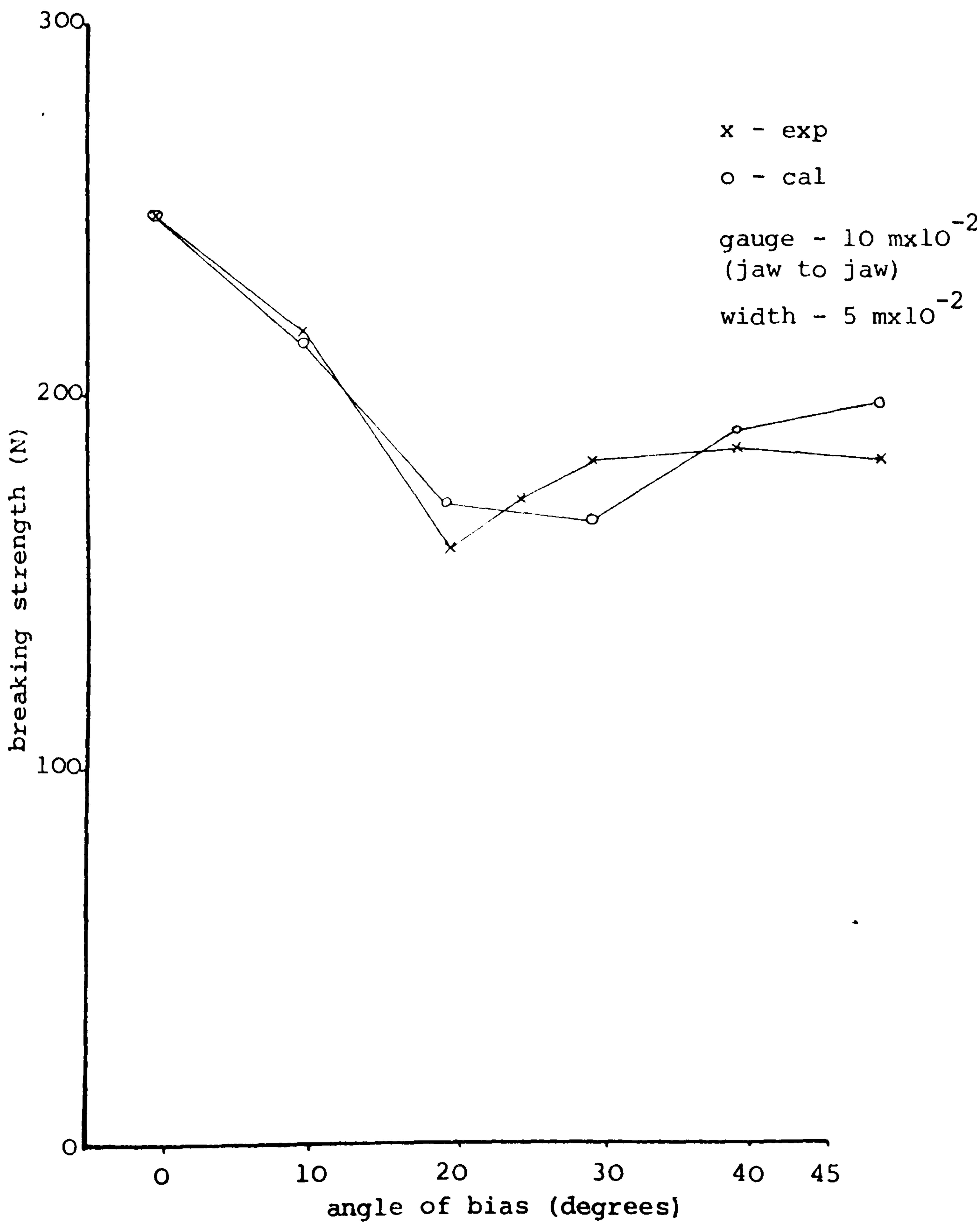


Figure 6.4 The Breaking Strength of Fabric A as a Function of Angle of Bias under the Unseamed Fabric Breaking Condition.

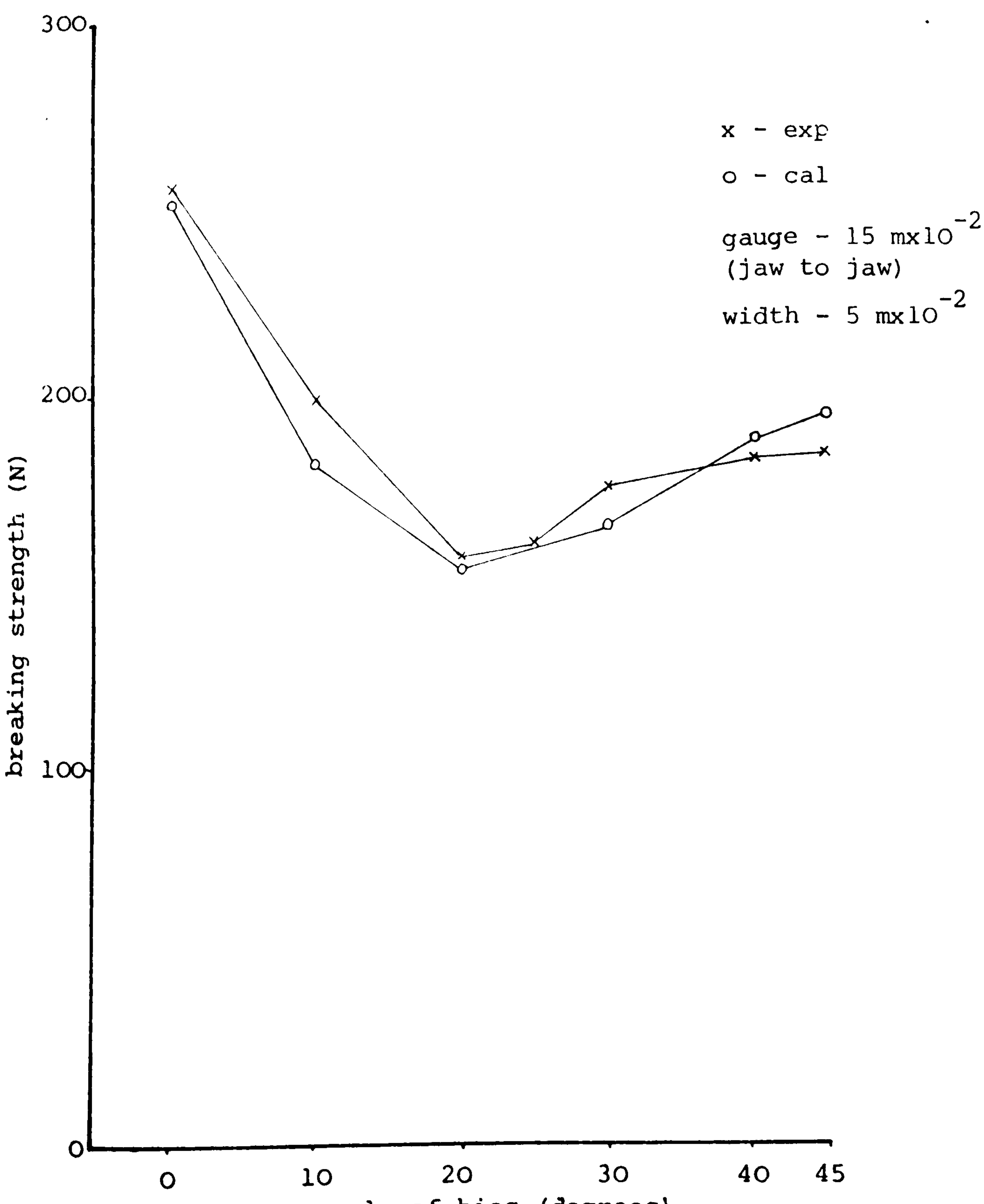
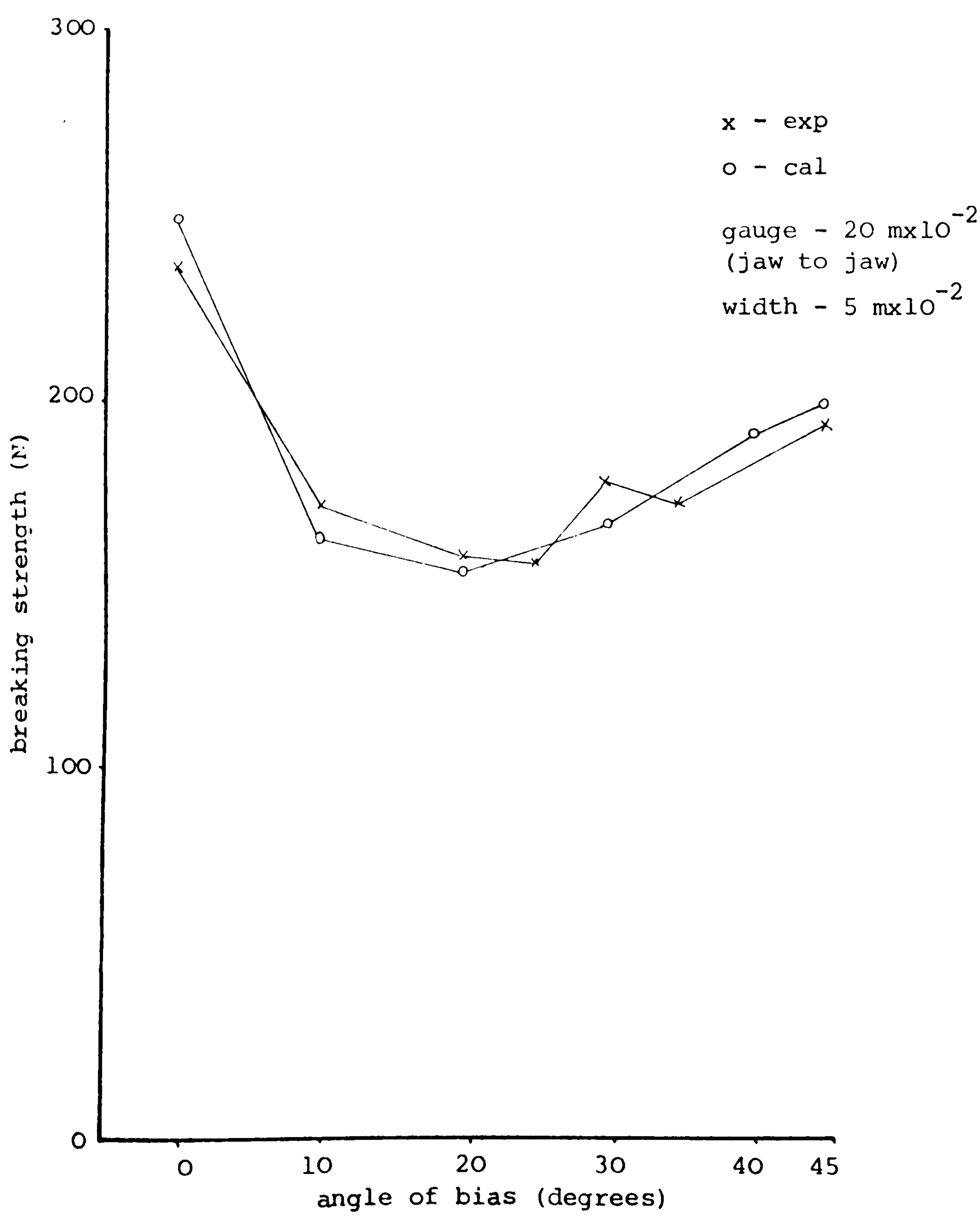


Figure 6.5 The Breaking Strength of Fabric A as a Function of Angle of Bias under the Unseamed Fabric Breaking Condition.



The model also shows the similar behaviour of a trough as was observed in Chapter 3; the angle at the trough tends to decrease (the trough between the range of 0 and 45^0) as the gauge length increases, although the movement of the experimental troughs is not as pronounced as for the calculated ones. This may be due to the experimental error.

6.3 TYPE II BREAKS OF THE SQUARE-SETT PLAIN-WEAVE FABRIC (FABRIC A)

Figures 6.6 to 6.11 illustrate that the calculated and experimental results are in good agreement. The movements of the calculated and experimental troughs are similar although they do not occur at the same angle.

The model predicts higher strengths than are the case for the range between 0^0 and the trough.

The overall results show that the model produces a similar trend of curves to the experimental data.

6.4 TYPE I BREAKS OF THE SQUARE-SETT PLAIN-WEAVE FABRIC (FABRIC A)

Figures 6.12 to 6.20 show good agreement between the calculated and experimental results. The agreement in results is similar to that for the Type II breaks. The model predicts higher strength for the range between 0^0 and the low trough and gives higher strength as the angle tends to 45^0 at low G/W ratio (less than half).

The movement of the calculated trough follows a similar pattern to the movements of the experimental troughs (the angle at

Figure 6.6 The Breaking Strength of Fabric A as a Function of Angle of Bias under the Type II Breaking Condition.

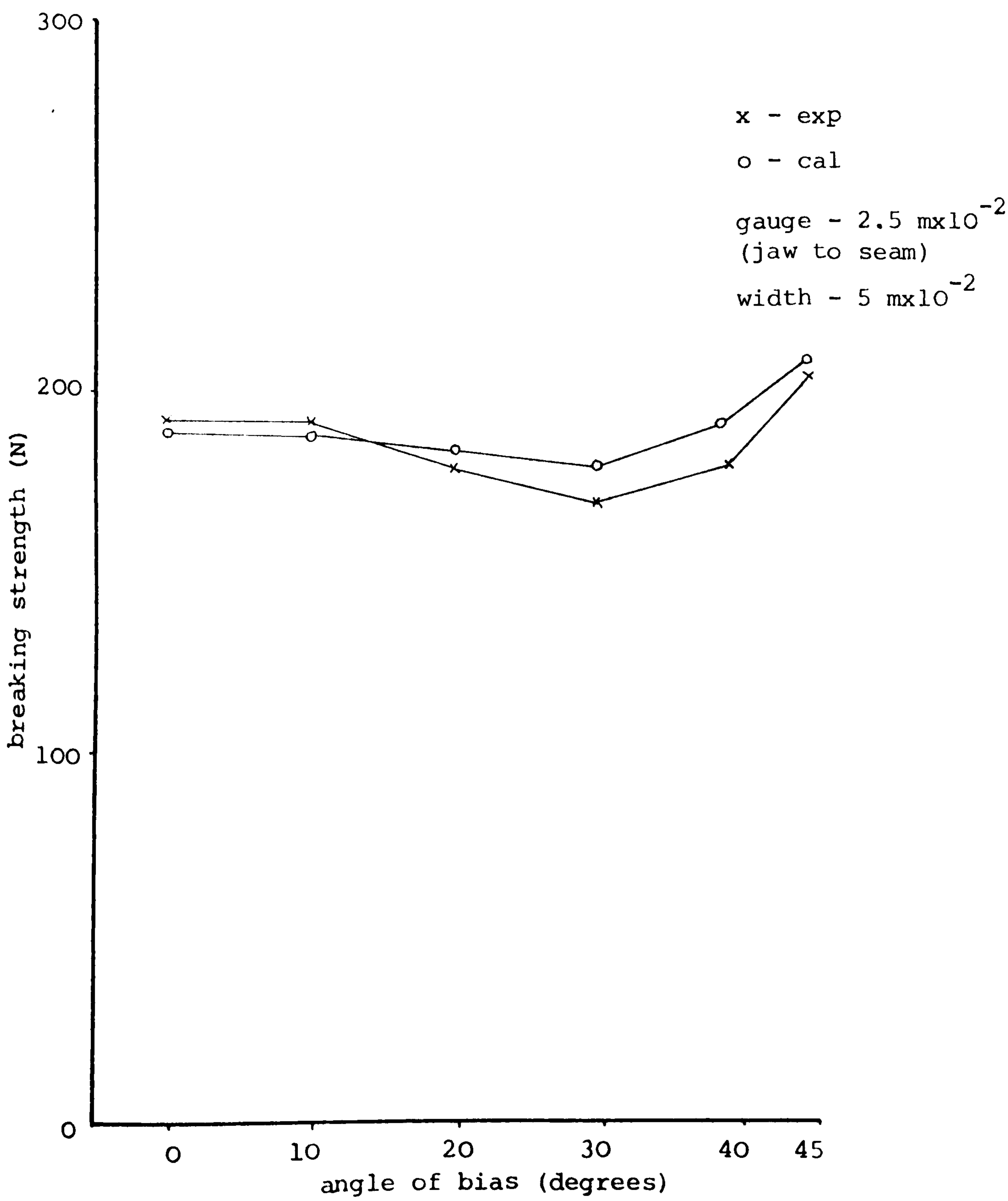


Figure 6.7 The Breaking Strength of Fabric A as a Function of Angle of Bias under the Type II Breaking Condition.

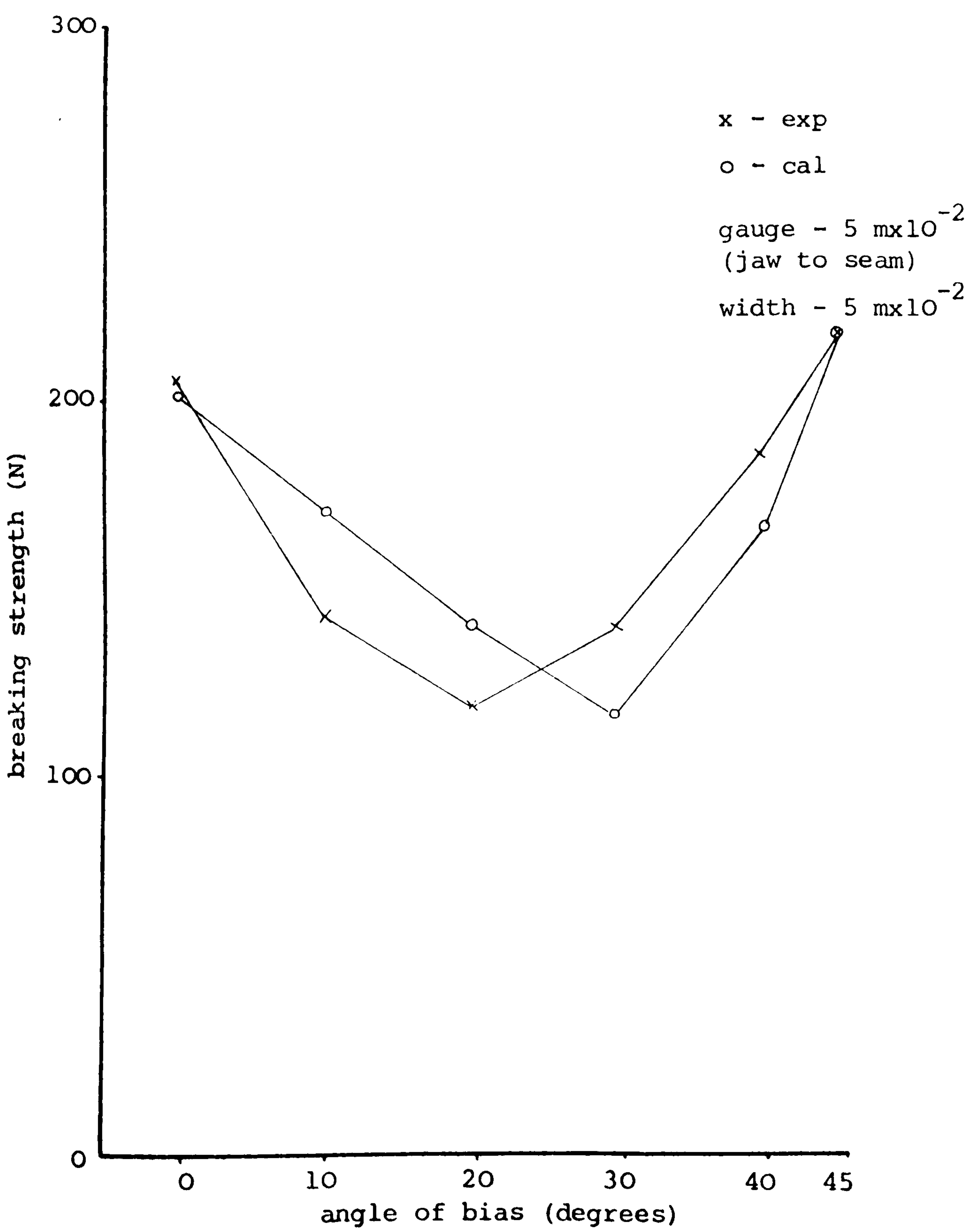


Figure 6.8 The Breaking Strength of Fabric A as a Function of Angle of Bias under the Type II Breaking Condition.

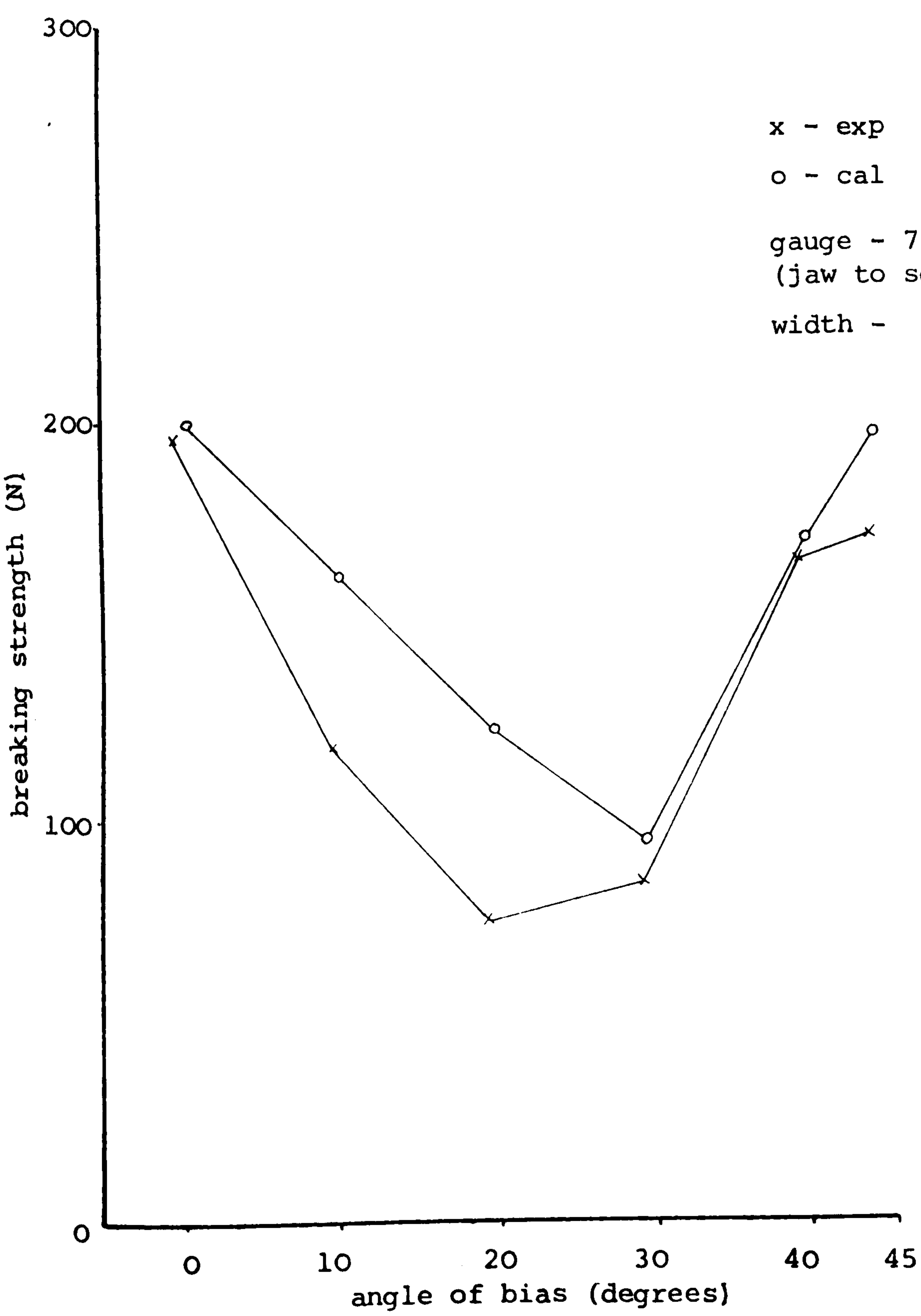


Figure 6.9 The Breaking Strength of Fabric A as a Function of Angle of Bias under the Type II Breaking Condition.

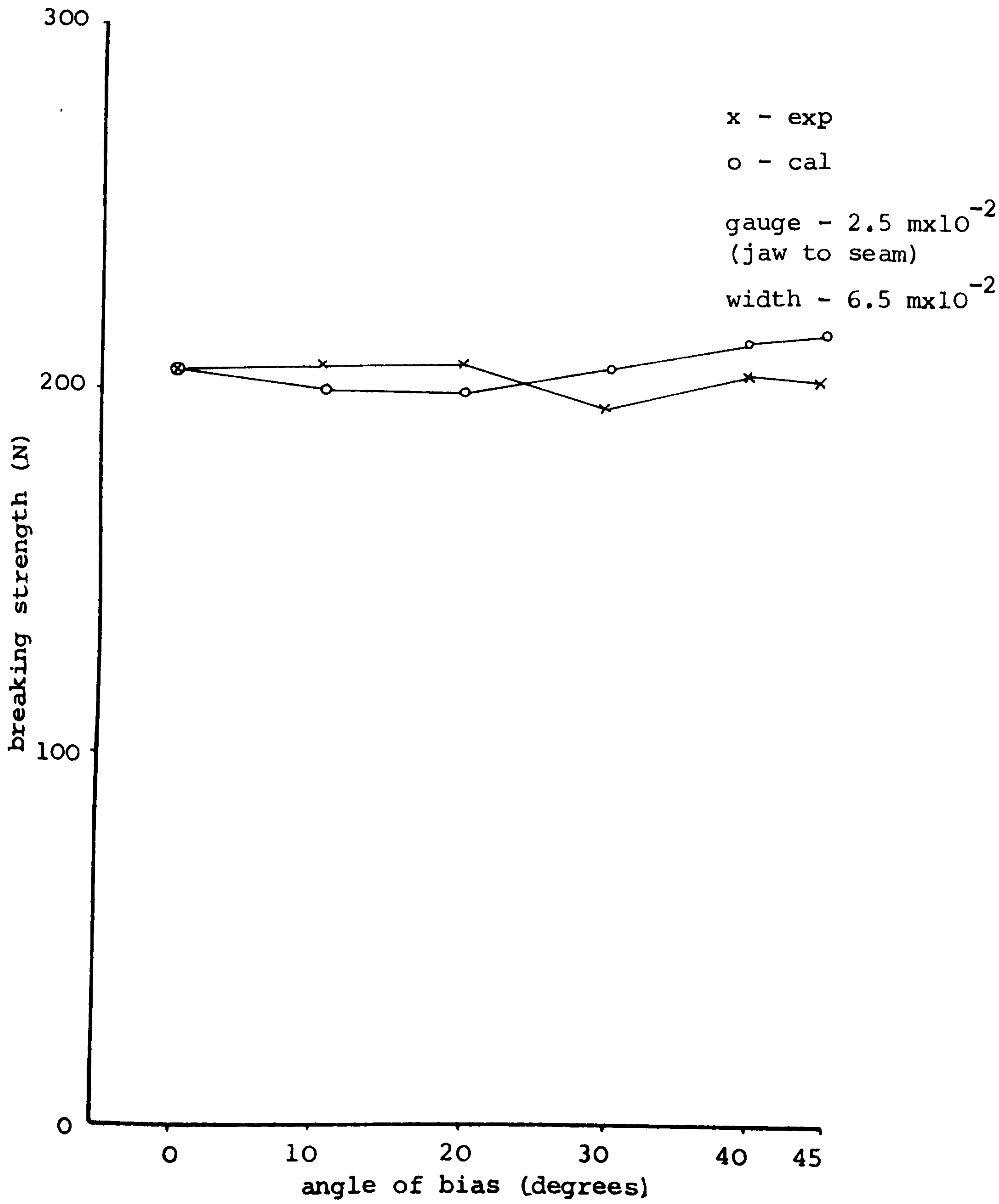


Figure 6.10 The Breaking Strength of Fabric A as a Function of Angle of Bias under the Type II Breaking Condition.

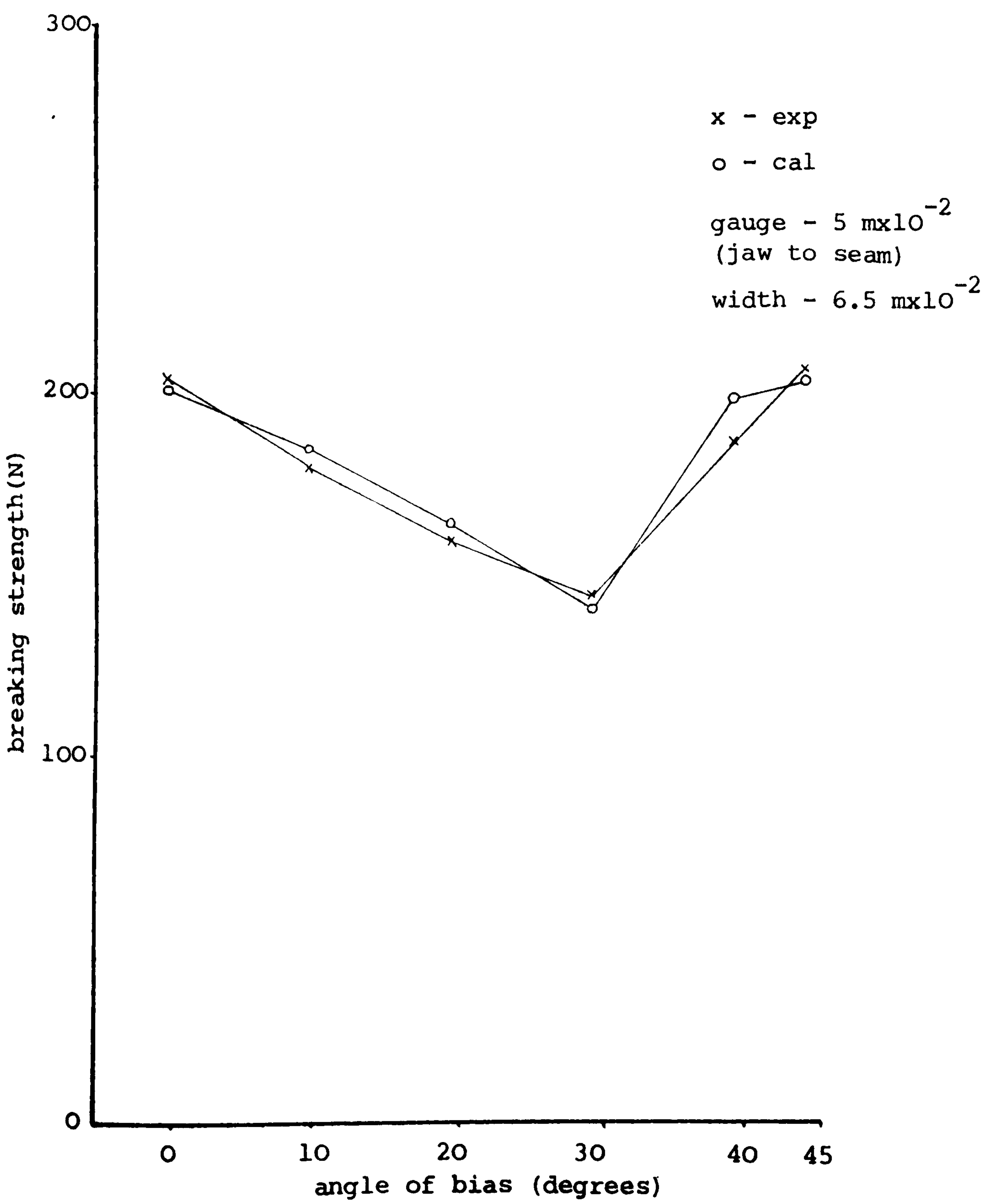


Figure 6.11 The Breaking Strength of Fabric A as a Function of Angle of Bias under the Type II Breaking Condition.

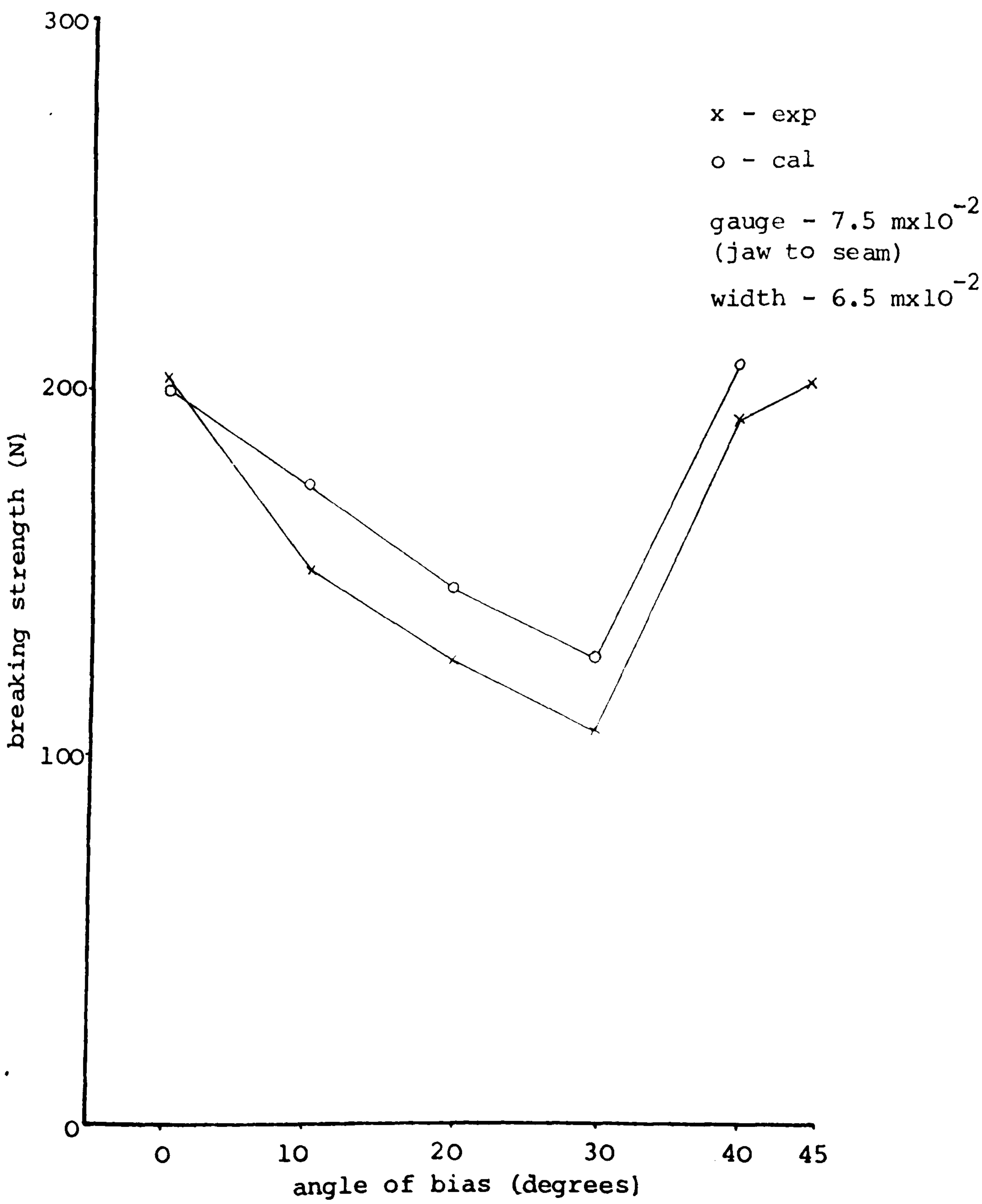


Figure 6.12 The Breaking Strength of Fabric A as a Function of Angle of Bias under the Type I Breaking Condition.

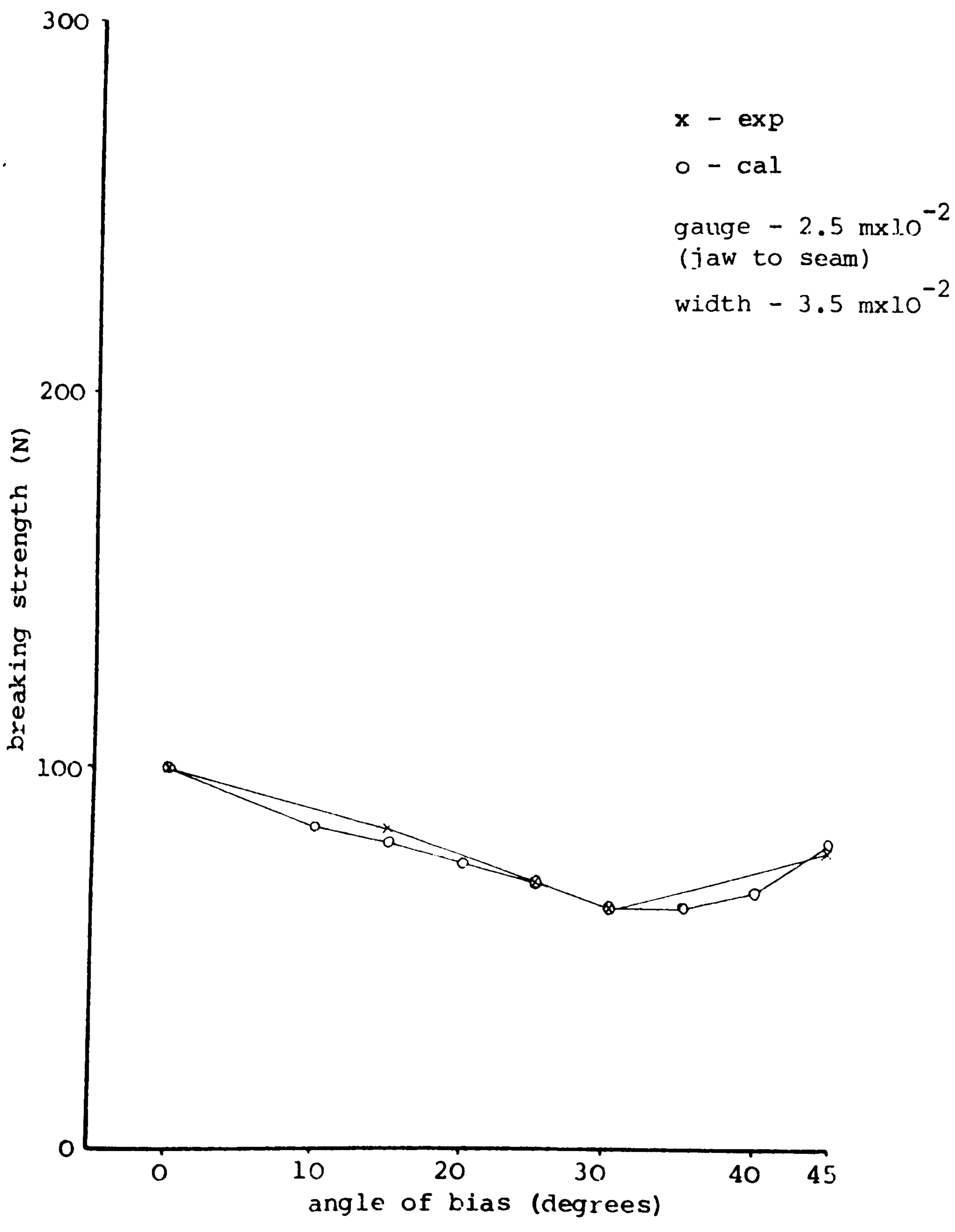


Figure 6.13 The Breaking Strength of Fabric A as a Function of Angle of Pias under the Type I Breaking Condition.

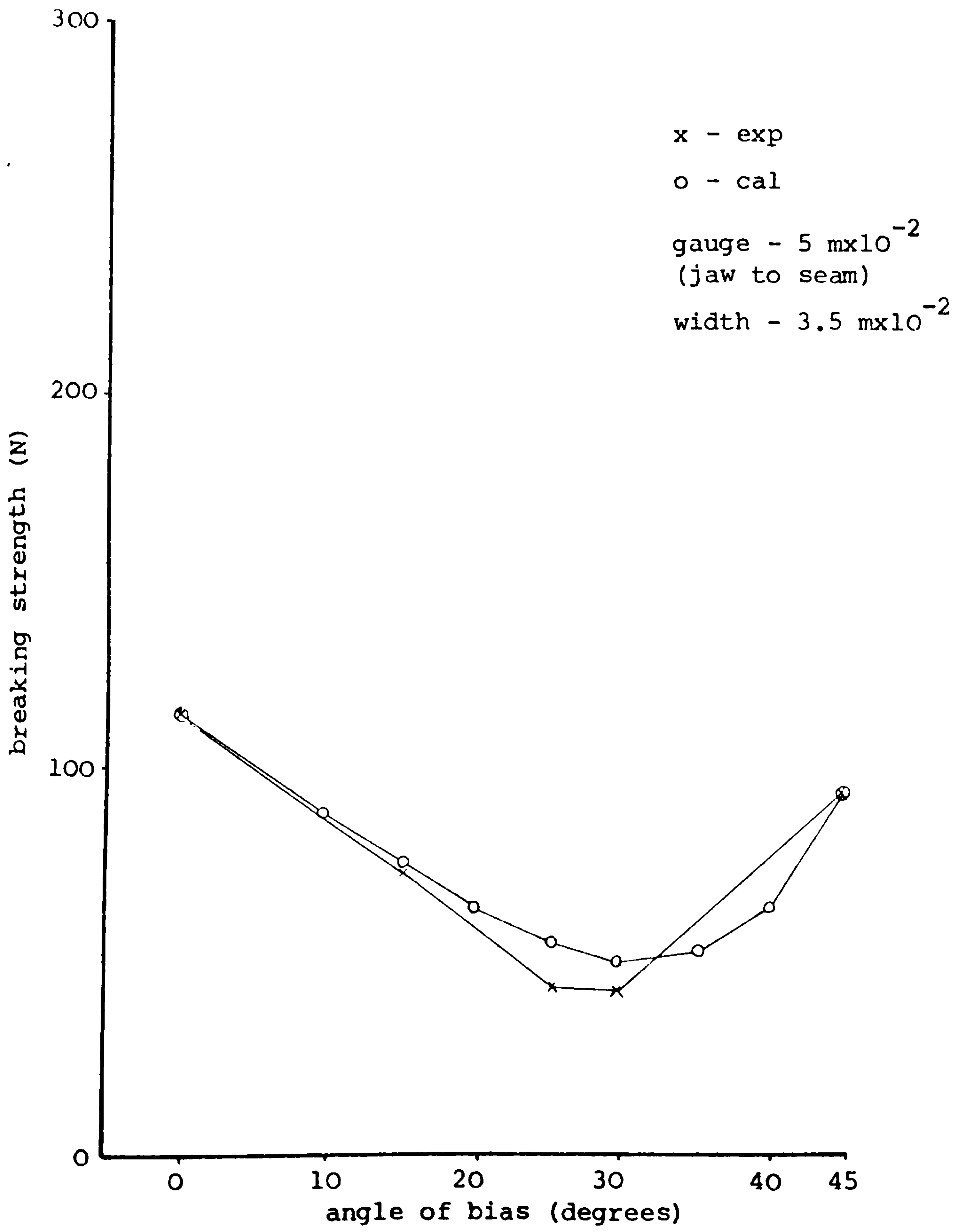


Figure 6.14   The Breaking Strength of Fabric A as a Function of Angle of Bias under the Type I Breaking Condition.

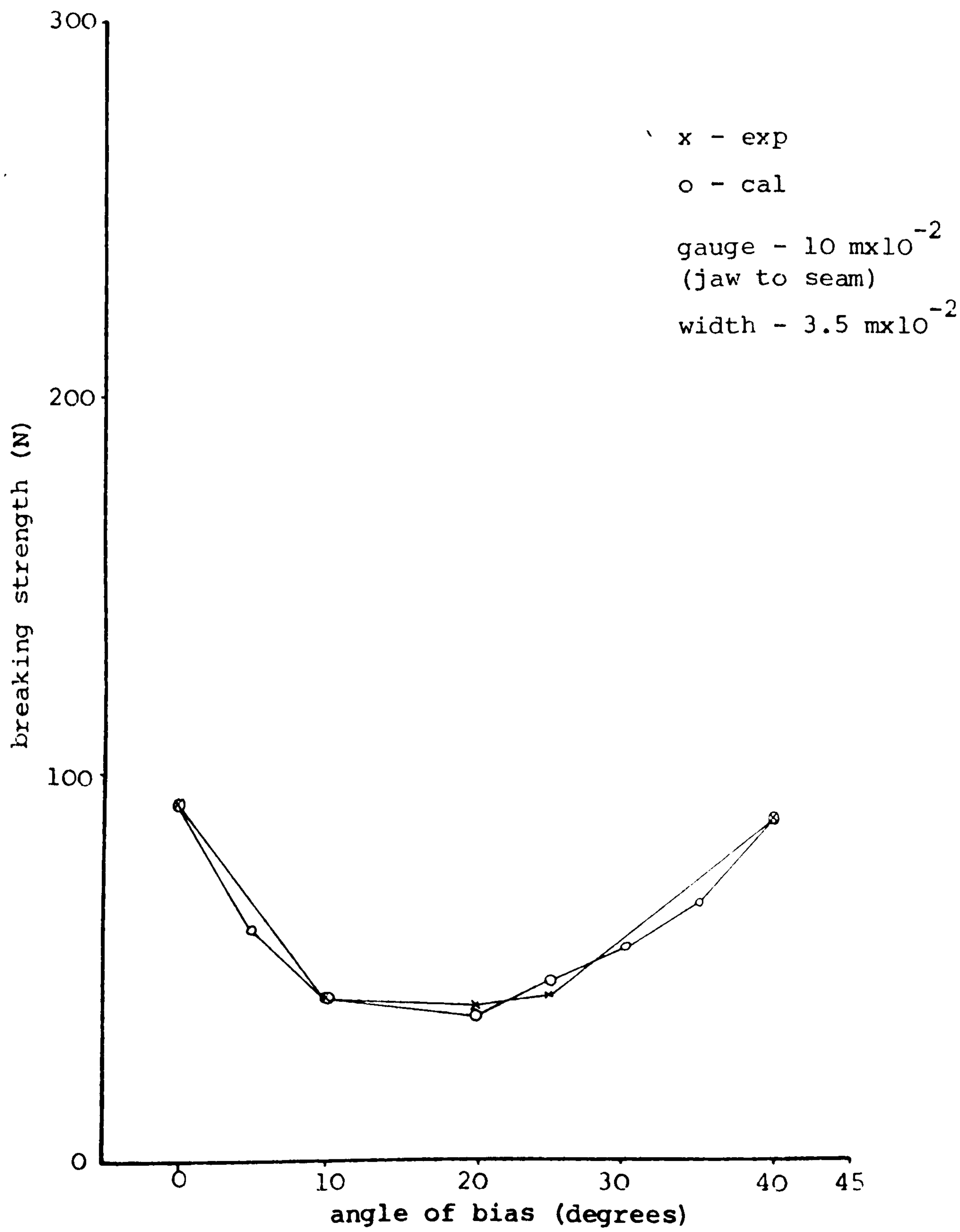


Figure 6.15 The Breaking Strength of Fabric A as a Function of Angle of Bias under the Type I Breaking Condition.

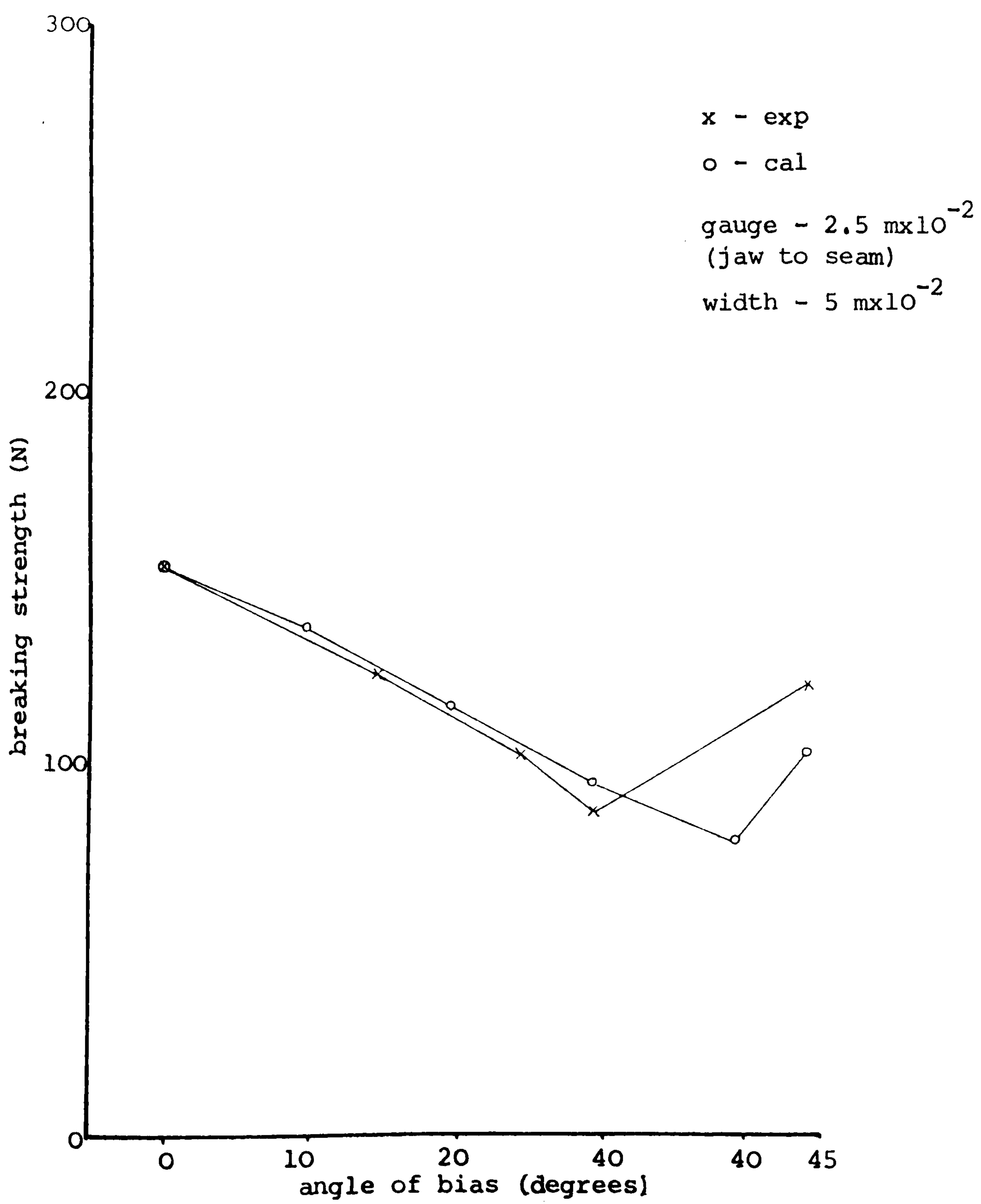


Figure 6.16 The Breaking Strength of Fabric A as a Function of Angle of Bias under the Type I Breaking Condition.

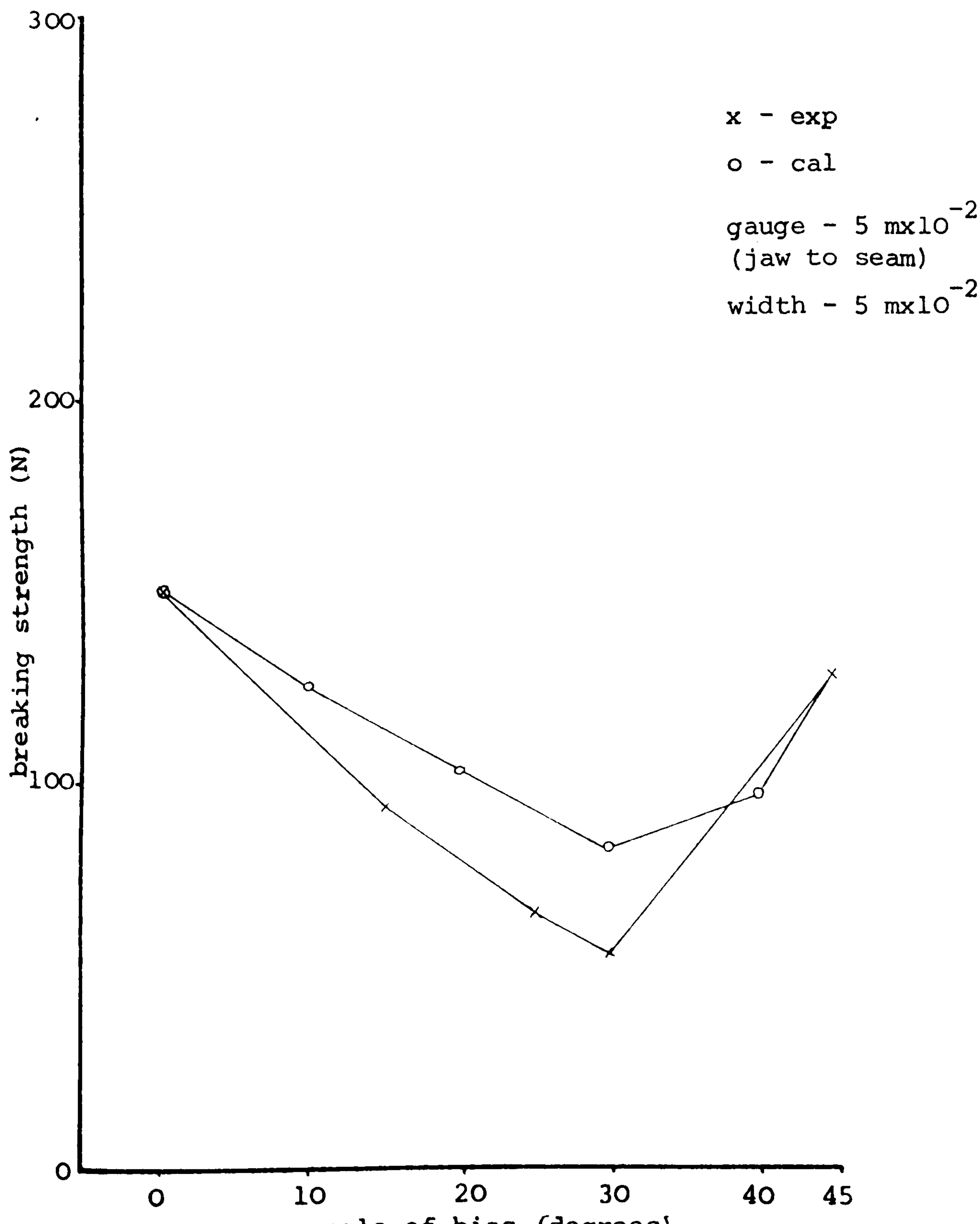


Figure 6.17 The Breaking Strength of Fabric A as a Function of Angle of Bias under the Type I breaking condition.

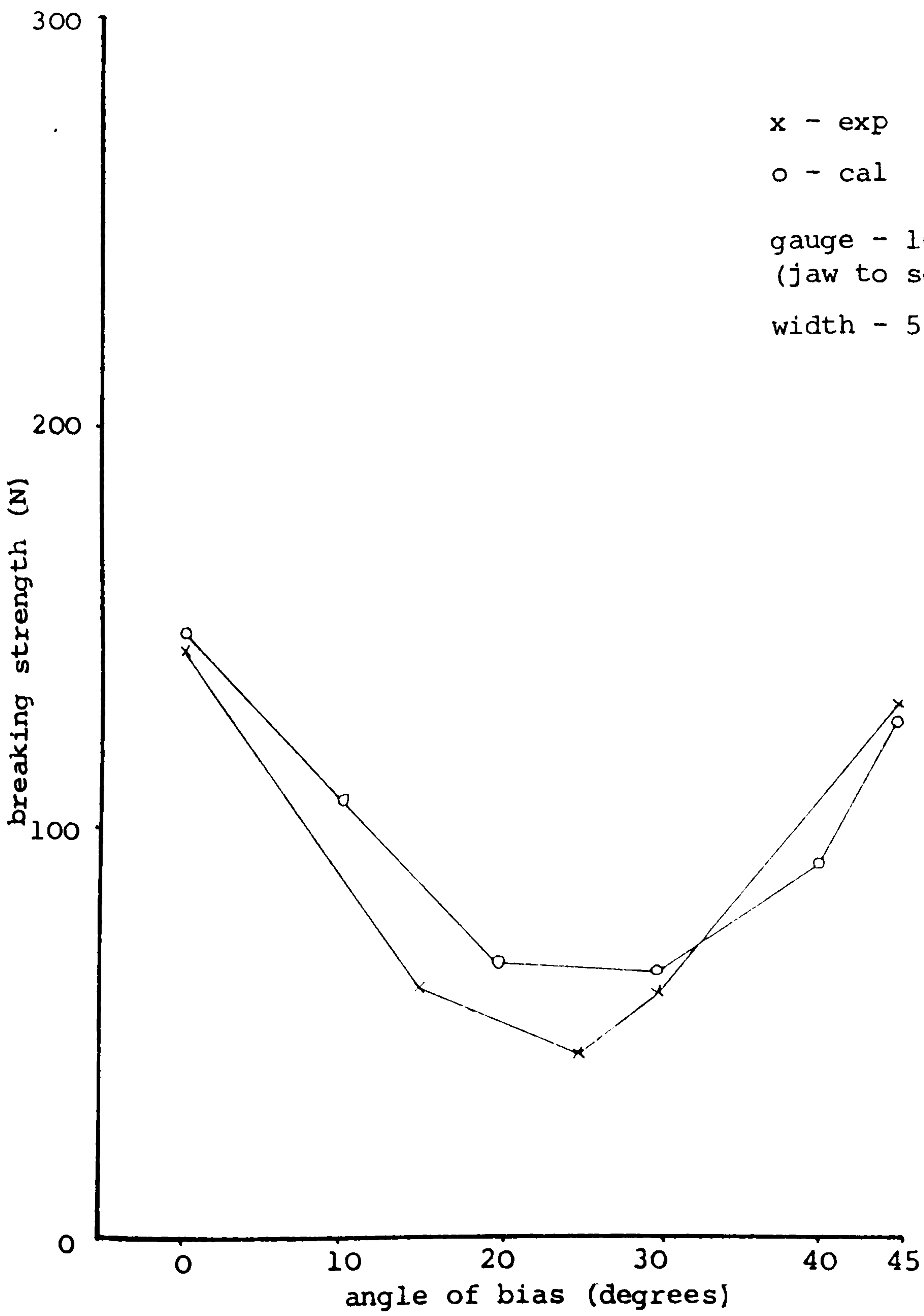


Figure 6.18 The Breaking Strength of Fabric A as a Function of Angle of Bias under the Type I Breaking Condition.

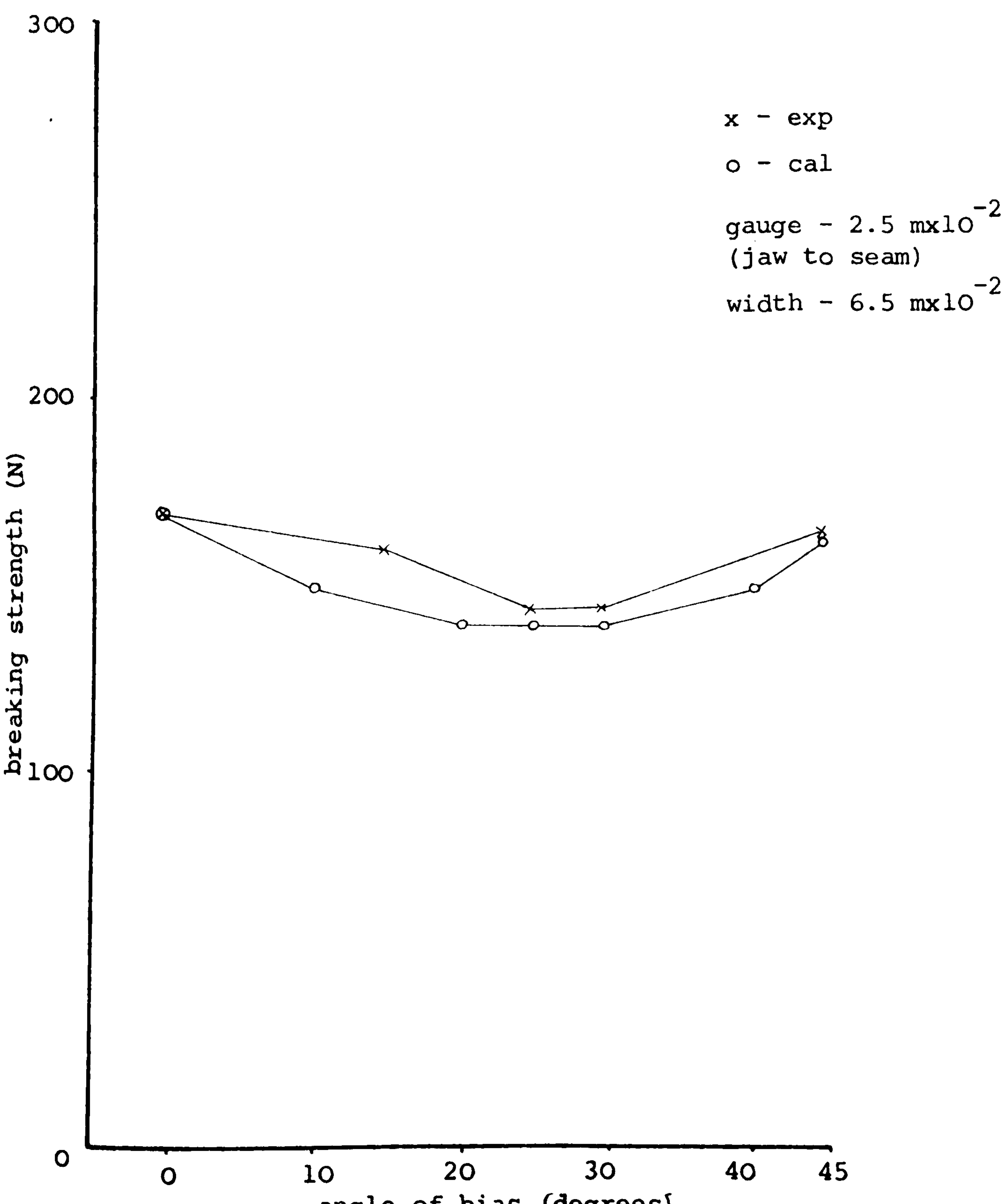


Figure 6.19 The Breaking Strength of Fabric A as a Function of Angle of Bias under the Type I Breaking Condition.

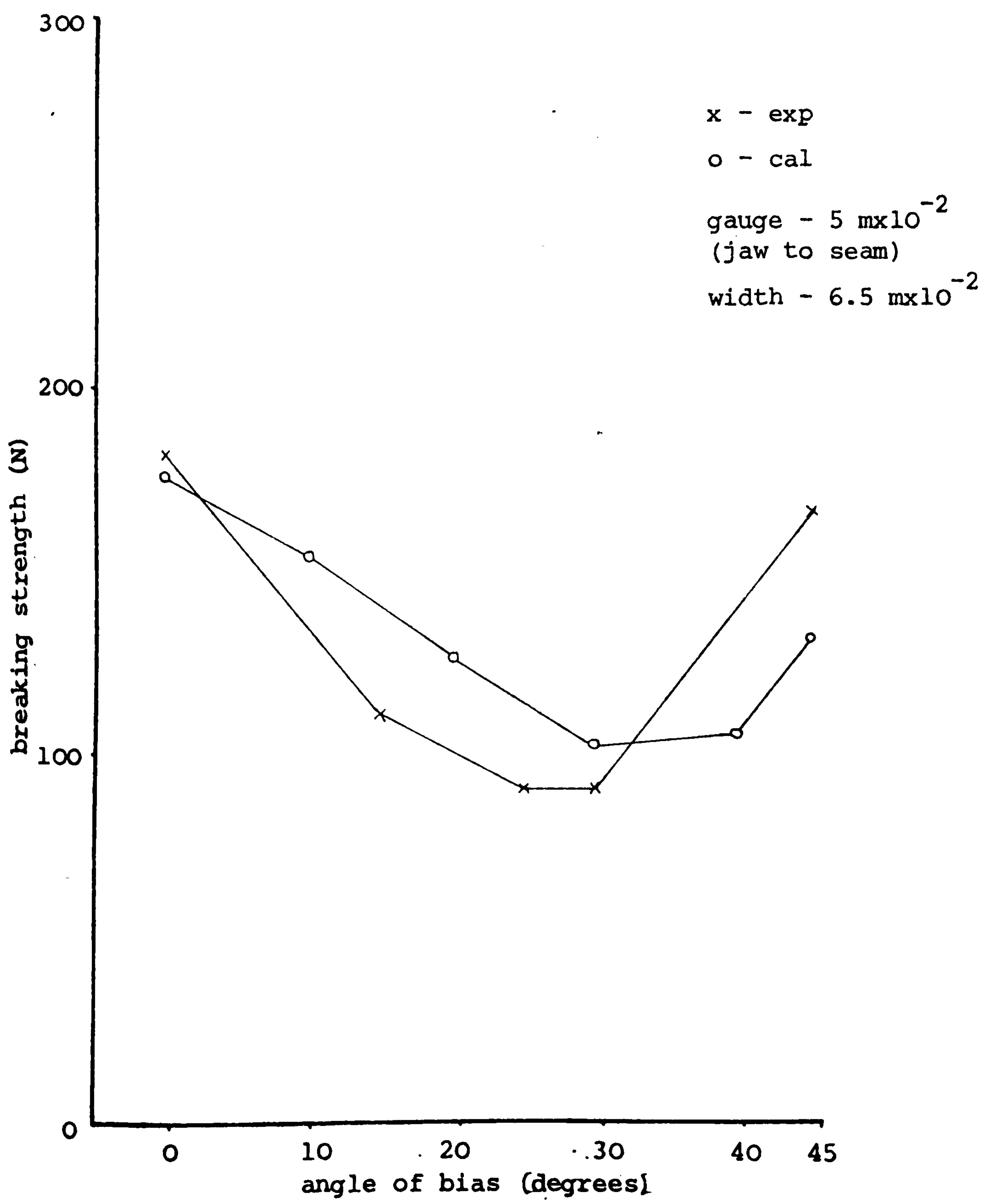
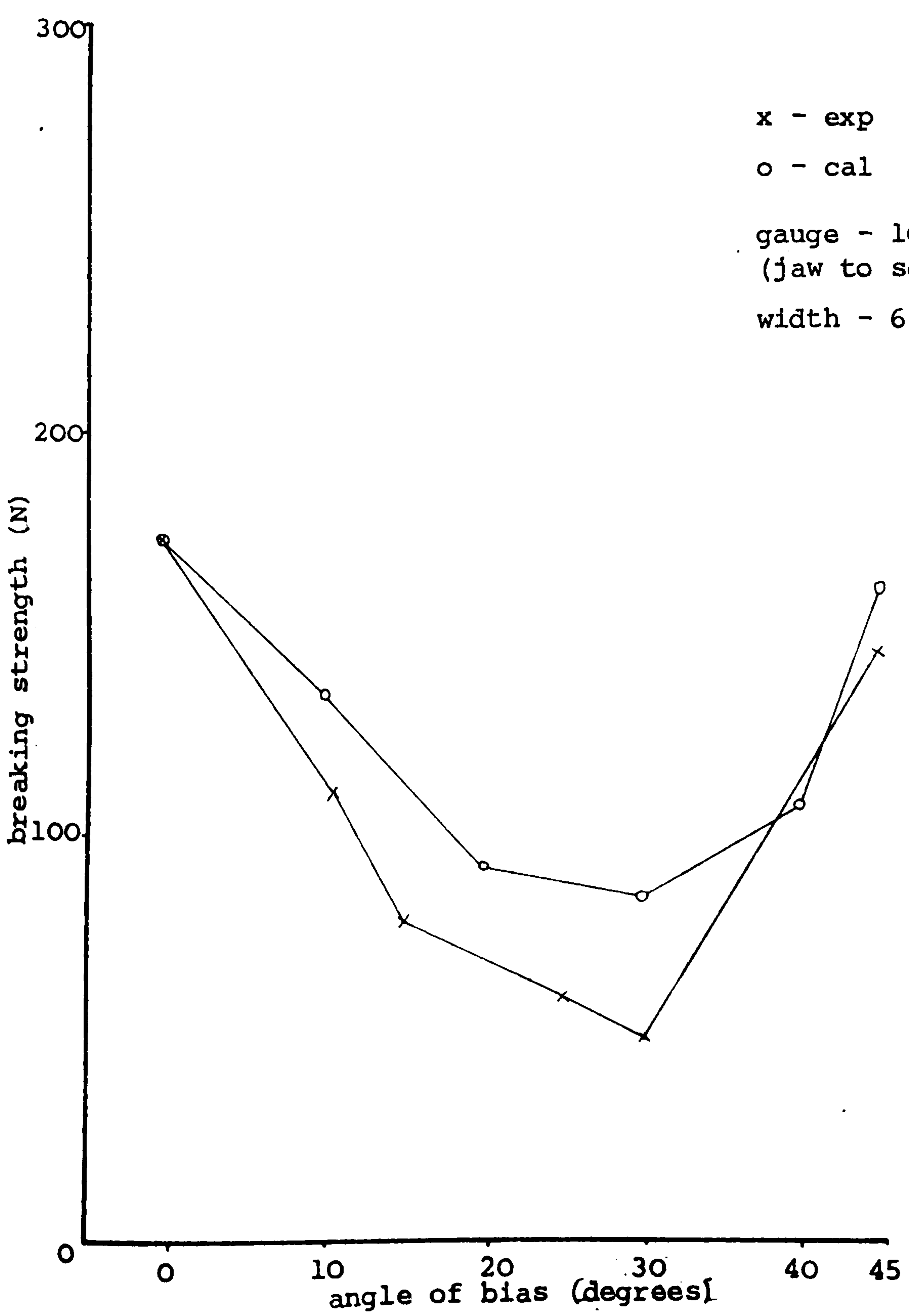


Figure 6.20 The Breaking Strength of Fabric A as a Function of Angle of Bias under the Type I breaking Condition.



the trough between 0^{0} and 45^{0} decreases as the gauge length increases).

6.5 CONCLUSIONS

The overall results, shown in Figures 6.1 to 6.20 illustrate that the mathematical model for predicting sample strength works quite well in general. On some occasions, however, between the values of 0^{0} and the trough, it predicts higher strengths than the experimental results.

The model has explained the following effects described in Chapter 4.

i) The angle of bias effect for which the model gives the same sort of curves (half 'W' shaped curve). The strength at 0^{0} (the strongest point) gradually decreases until it reaches its trough at about 25^{0} to 35^{0}, then gradually rises again to the other peak at 45^{0} (the second strongest value). The reduction of strength can extend to more than 50 percent; this being dependent on the G/W ratio (a higher G/W ratio gives a higher strength reduction around the trough). Almost no angle of bias effect exists at the G/W ratio of about half. The angle at the trough is also dependent on the G/W ratio (the angle at the trough decreases as the G/W ratio increases), and in the unseamed breaks, there is enough evidence to show that the movement of the trough stops when G/W ratio is greater than two.

ii) The model illustrates a gauge length effect on the strength (the strength decreases as the gauge length increases) except at 0^{0} and 90^{0}, until the first zone disappears. After the disappearance of the first zone, the strength remains constant at longer gauge lengths at the same angle, and of course, at the same width.

At this stage, it may be seen that the mathematical model is not flexible enough in practice because:

i) the model is applicable only to square-sett plain-weave fabric, and;

ii) the values of the parameter K_θ at different angles have to be determined by performing time-consuming strength tests at each angle for each fabric.

Therefore the next stage of the work requires a modification to the model in order to remove these inflexibilities.

In addition the model tends to over predict strengths in the range between 0^0 and the trough. Another possible area of modification is thus demonstrated. In the model shown in Figure 4.4, the strength of the second zone is proportional to the length of DF + HC. The length of HC includes the yarns in the first zone although they are gripped at one end only (proportional to the length of HC - EF). The suggested reason is that the yarns in the first zone are so dominant in the strength contribution in the length of EC, that the second zone yarns in the length of EC cannot find room to make a strength contribution. Therefore it is proposed that a second zone should be considered as being defined by the length of DF + EF instead of the length of DF + HC.

CHAPTER 7 MODIFICATION OF THE BASIC MODEL TO COVER NON-SQUARE-SETT AND NON-PLAIN-WEAVE FABRICS

7.1 FURTHER CONSIDERATION OF THE RATIO OF WARP AND WEFT STRENGTHS PER UNIT LENGTH

For non-square sett fabrics, the strengths in the warp direction and weft directions may be different (as is suggested by the experimental results illustrated in Figures 3.18a and 3.19). Such a difference may arise if the yarn number per unit length and yarn strengths are different and thus the ratio of $\frac{K_0}{K_{90}}$ will differ from unity.

Some modifications, therefore, should be made to the model. Separate values for yarns per unit length and yarn strengths have not been taken into account, only the yarn strength per unit length is considered because yarn strength per unit length can be obtained directly from a single strength test.

7.1.1 STRENGTH IN THE FIRST ZONE

There will be two parameters K_0 and K_{90}; if K_0 is the warp strength per unit length, it follows that from equation (14) $K_0 = S_0/W$ where S_0 is the mean breaking strength at 0^0 angle of bias (at all gauge lengths) and W is the width of the samples. If K_{90} is the weft strength per unit length, it follows that

$$K_{90} = S_{90}/W \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (16)$$

where S_{90} is the mean breaking strength at the angle of bias of 90^0 for all gauge lengths.

7.1.2 STRENGTH IN THE SECOND ZONE

In equation 9 (Chapter 5), only K_θ is used because it was assumed that $K_{\theta warp}$ was equal to $K_{\theta weft}$ for square-sett fabrics. Hence from equation (9) $S_2 = 2\,K_\theta\,(DF + HC)$. For a non-square-sett fabric however, the equation must be modified to read:

$$S_2 = 2(DF\ K_{\theta warp} + HC\ K_{\theta weft}) \quad \ldots\ldots\ldots\ldots\ldots (17)$$

The ratio of K_o and K_{90} is to be assumed as being proportional to the ratio of $K_{\theta warp}$ and $K_{\theta weft}$ for all θ

ie. $$\frac{K_o}{K_{90}} = \frac{K_{\theta warp}}{K_{\theta weft}} = \lambda \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (18)$$

Therefore once $K_{\theta warp}$ is known, $K_{\theta weft}$ can be found from equation 18. Substituting from equation 18 into 17, it follows that

$$S_2 = 2(DF\ K_{\theta warp} + HC\ \frac{K_{\theta warp}}{\lambda})$$

therefore $$S_2 = 2\ K_{\theta warp}\ (DF + \frac{HC}{\lambda}) \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots (19)$$

7.1.3 EVALUATION OF $K_{\theta warp}$

As before, the breaking strengths S_θ are found for cases when the first zone has just disappeared: reference to figure 4.2 will show that K_θ is found from

$$K_{\theta warp} = \frac{S_\theta}{2(DF + \frac{HC}{\lambda})} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots (20)$$

7.2 MODIFICATION OF THE METHOD OF EVALUATION OF THE STRENGTH OF THE SECOND ZONE (SK_θ)

The parameter $SK_{\theta warp}$ (or $SK_{\theta weft}$) used in the model has as presently constituted to be evaluated by performing time-consuming experiments for each angle. This will not be practical in an industrial situation. In order to widen the applicability of the model, it is necessary to enable SK_{θ} to be evaluated by using theoretical or empirical models from a knowledge of a few simple parameters of the sample (such as strength at peak and angle at peak).

Therefore, further examination of the experimental results for the breaking strength of the second zone for different types of fabric under the three types of breaking conditions (given in Figures 3.26 - 3.34) was undertaken. A general trend was noted for all the curves in all cases. Therefore it is desirable to fit a general empirical equation to all the curves or at least to the curves of each type of break.

7.2.1 DERIVATION OF THE EQUATION FOR THE EVALUATION OF THE SECOND ZONE STRENGTH

Several common equations for different shaped curves have been tried, such as

$$y = a_0 + a_1X + a_2X^3 + a + a_nX^n \quad \text{n th degree curve}$$

$$y = \frac{1}{a_0 + a_1{}^X} \quad \text{hyperbola}$$

$$y = ab^X + g \quad \text{modified exponential curve}$$

$$y = aX^b + g \quad \text{modified Gomperlz curve}$$

$$y = \frac{1}{(1 + X)^A}$$

Only an equation of the type $y = \frac{1}{(1 + X)^A}$ gave a good fit to the experimental breaking results for the second zone. Therefore this equation was chosen, and the details of the derivation of the equation are given in the following paragraph.

The equation $y = \frac{1}{(1 + X)^A}$ gives a cusp curve as shown in Figure 7.1. In order to give a mirror image on the other side of the curve, a absolute value of X is used, therefore, the equation can be written in the form

$$y = \frac{1}{(1 + |x|)^A} \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (21)$$

When the Y-axis of the curve moves along the X-axis, the shape of the curve would be changed as shown in Figure 7.2, but the basic trend of the curve would be maintained. If the X and Y are fixed variables,'A' will determine the shape of the curve. Some examples of curves with different values of 'A' are shown in Figure 7.3.

From these experiments, the curve shown in Figure 7.4 would appear to be appropriate for the model in question.

In the basic form of the curve shown in Figure 7.1, the maximum value is unity when it is equal to zero. In order to convert the basic equation, equation (21), to the appropriate form for use in these experiments, the strength of the peak replaces the unity in the numerator; as the maximum value, occurs when it is zero, the function 'X' is replaced by

$$\left|\frac{\theta - \theta p}{\theta p}\right|$$

where θ = angle of bias

θp = angle of bias at peak

therefore the equation can be written in the form

$$SK_{\theta} = \frac{Sp}{\left(1 + \left|\frac{\theta - \theta p}{\theta}\right|\right)^A} \quad \ldots\ldots\ldots\ldots\ldots \quad (22)$$

Where S_p is the breaking strength at peak.

Figure 7.1 The Curve of $Y = \frac{1}{(1 + |x|)^2}$

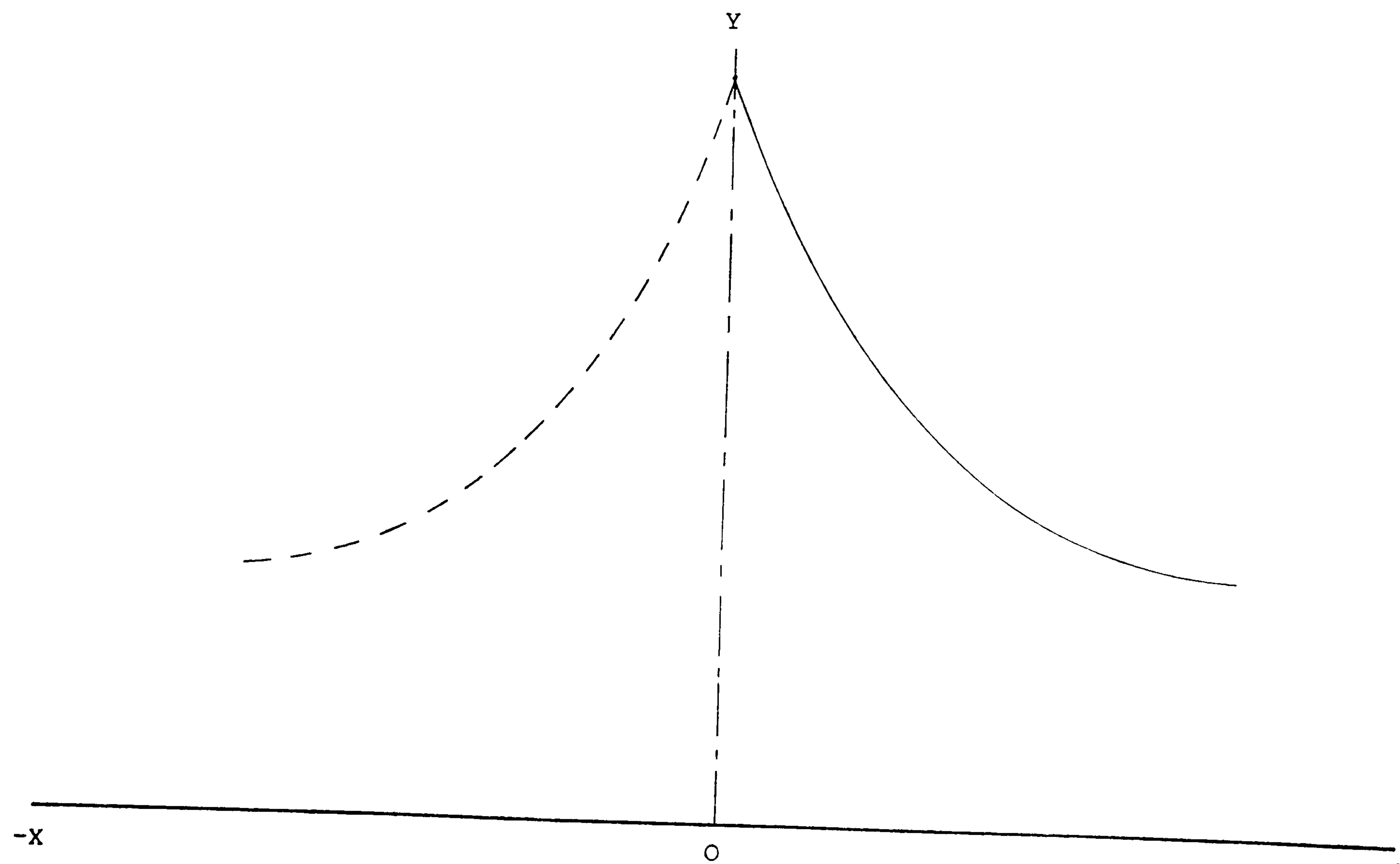


Figure 7.2 The Trends of the Curve of the Equation, $Y = \frac{1}{(1 + |x|)^{A}}$, when the Y-axis moves along the X-axis.

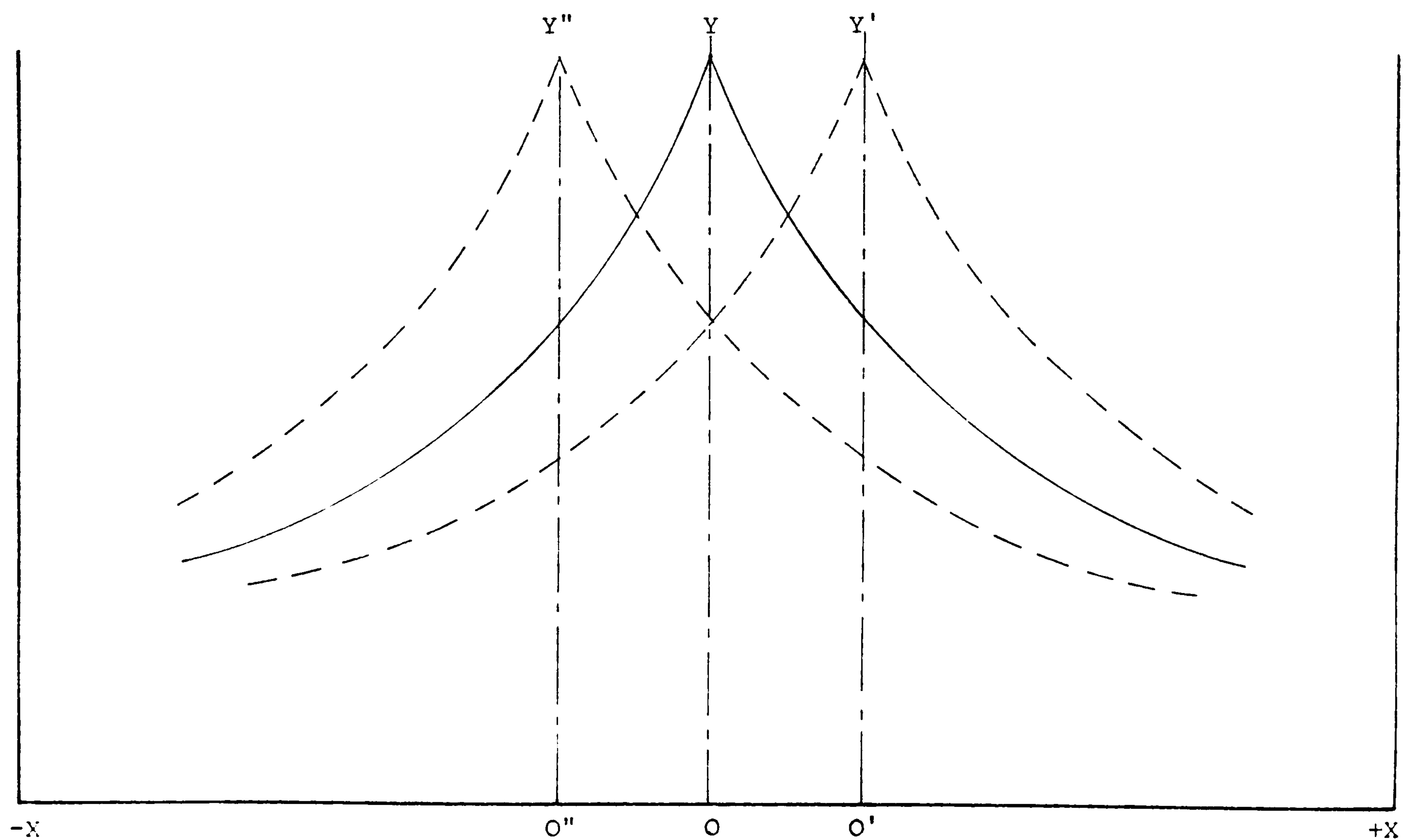


Figure 7.3 The Trends of the Curve, $Y = \frac{1}{(1 + |\frac{\theta - \theta p}{\theta p}|)^A}$, when the Parameter 'A' changes.

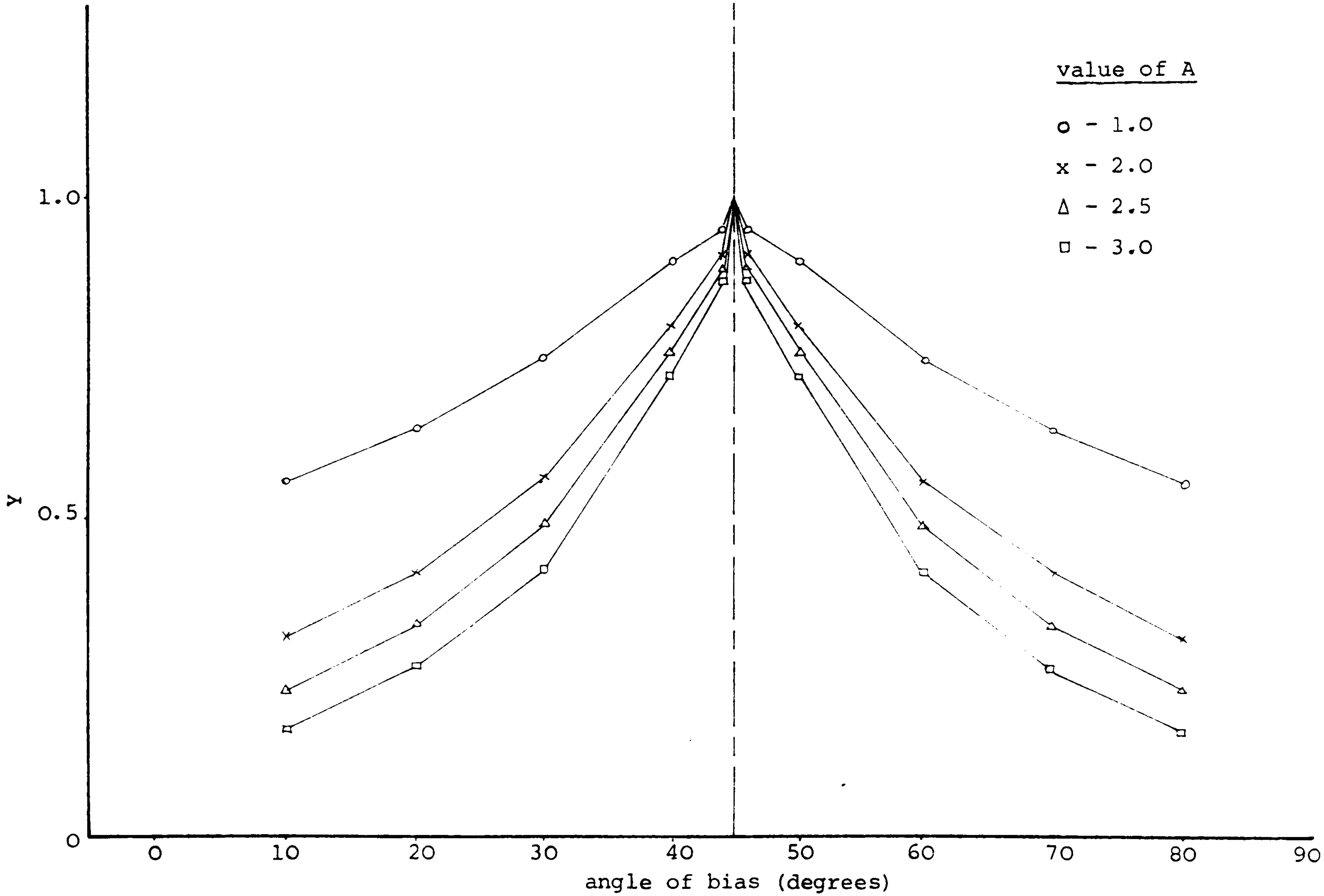
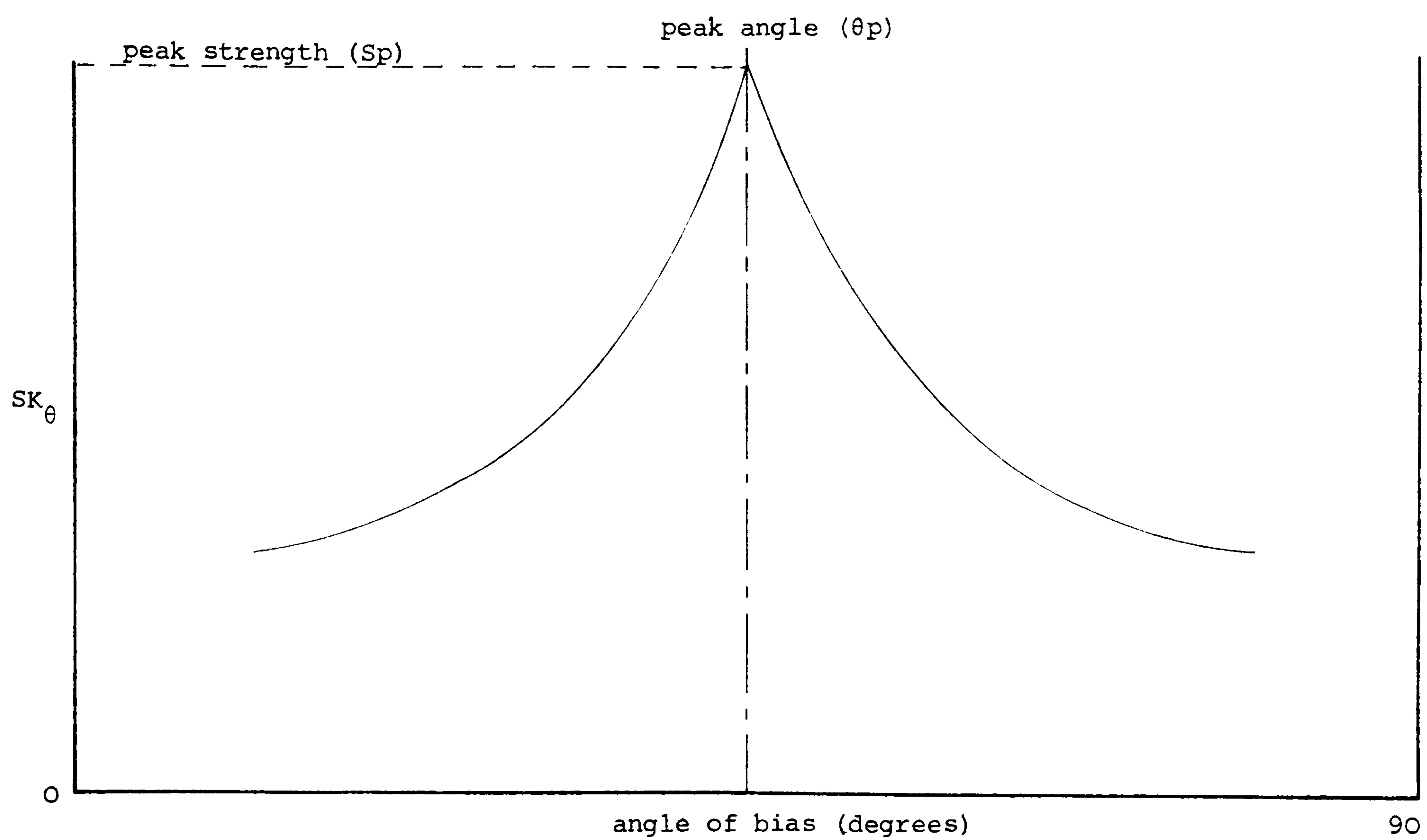


Figure 7.4 The Appropriate Curve for the Model.



The parameter 'A' for each curve of the experimental breaking strength results for the second zone can be, then, evaluated by using the curve fitting method of the Least Squares[26] , shown in Appendix 11.The evaluated values of the parameter 'A' for each strength curve of the second zone and the average values of parameter 'A' for each type of break are given in Table 7.1.

For the unseamed breaks, the results in Table 7.1 show that the parameter 'A' ranges from 0.5 to 1.4 with an average of 0.885. For the Type II breaks, the parameter 'A' ranges from 1.4 to 1.9 with an average of 1.65. For the Type I breaks, the parameter 'A' ranges from 1.16 to 2.68 with an average of 2.07.

Among the results of the values of 'A' which are from a wide range of fabric types only three values of 'A' differ markedly from their average values, those three values are, (i) 0.5 (Fabric E, Unseamed); (ii) 0.5 (Fabric H, Unseamed); and (iii) 1.16 (Fabric H, Type I). As mentioned in Chapter 3, the Fabrics E and H have complex structures and gave very distorted 'W' shaped curves on the unseamed breaks. It has already been suggested that they may have different load transfer mechanisms because of their complex structures.

However the results shown in Table 7.1, suggest that the average value of 'A' for the three different types of break can be used as a constant for each type of break for predicting the second zone strength for the general types of fabric which means that the warpways and weftways strengths, and the number of warp and weft yarns per unit length are not vastly different.

Table 7.1 - The evaluated values of parameter 'A' from the experimental results (for the determination of the curve's trend of the second zone) for different types of break and different types of fabric , and the average values of 'A' for different types of break

Fabric \ type of breaks	Unseamed	II	I
A	1.06	1.80	2.50
B	0.92	-	2.00
C	1.10	-	1.50
D	1.40	1.90	2.22
E	0.50	-	2.68
F	0.712	-	2.63
G	0.83	-	1.75
H	0.50	1.40	1.16
I	0.94	1.50	2.20
average	0.885	1.65	2.07

Note:- Unity will be used for the average value of the Unseamed breaks instead of 0.885 because the two values of 0.5 are too different to be considered together with the other values.

CHAPTER 8 MODIFIED MODEL AND ITS EXPERIMENTAL FIT

8.1 INTRODUCTION

As suggested in previous chapters, several modifications to the model were necessary. Those made are as follows.

i) λ which is equal to $\frac{K_0}{K_{90}} = \frac{K_\theta \text{ warp}}{K_\theta \text{ weft}}$, has been introduced in the model in order to widen its application to non-square-sett fabrics where K_0 does not equal K_{90}.

ii) K_θ (or SK_θ) can be predicted by using the equation

$$SK_\theta = \frac{Sp}{(1 + \left| \frac{\theta - \theta p}{\theta p} \right|)^A}$$

where $Sp \equiv$ the strength at the peak

$\theta p \equiv$ the angle at the peak

$A \equiv$ a constant

Parameter 'A' was suggested in Chapter 7 to be constant for each of the three break types with the following values: A = 1 for unseamed fabric breaks; A = 1.65 for Type II breaks; and A = 2 for Type I breaks.

iii) The length of (DF + EF) instead of (DF + HC) is considered as the second zone (q.v. Figure 4.2) when only one first zone exists or the length of (LJ + EJ) instead of (DF + CI) is considered as the second zone (q.v. Figure 5.1) when two first zones exists (a first zone of warp and a first zone of weft).

In order to make precise comparisons between the modifications, four sets of data from the model with different modifications are plotted in the same figure with the experimental data:

i) first set of data - experimental data;

ii) second set of data (modification A) - including the 'λ' for non-square-sett fabric and the predicted K_θ by using the actual parameter 'A', as shown in Table 7.1, found from its experimental SK_θ values (the strength in the second zone for different angles of bias);

iii) third set of data (modification B) - including the 'λ' for non-square-sett fabric, and the predicted K_θ by using the constant 'A' (average value of parameters 'A' shown in Table 7.1) for each type of break;

iv) fourth set of data (modification C) - including the 'λ' for non-square-sett fabric, the predicted K_θ by using the actual parameter 'A' (shown in Table 7.1) found from its experimental values of SK_θ, and the length of (DF + EF) for the second zone instead of (DF + HC)(where only one first zone exists) or the length of (LJ + EJ) for the second zone instead of (DF + CI)(where two first zones exist); and

v) fifth set of data (modification D) - including the 'λ' for non-square-sett fabric, the predicted K_θ by using the constant 'A' (average value of parameters 'A' for each type of break, and the length of (DF + EF) for the second zone instead of (DF + HC)(where only one first zone exists) or the length of (LJ + EJ) instead of (DF + CI)(when two first zones exist).

If the difference between the Parameter 'A' and the constant 'A' is less than 0.25, the graphs will only show two sets of data (modification A and C) because the other possibilities are too close together to be plotted.

The breakdown strengths of the predicted results from each modified model were tabulated and are shown in Appendices 12 to 14 for unseamed breaks, in Appendices 25 to 33 for Type II breaks, and in Appendices 34 to 50 for Type I breaks.

8.2 COMPARISON BETWEEN THE MODIFICATIONS AND THE EXPERIMENTAL RESULTS FOR THE UNSEAMED BREAKS

For Fabric A, the results given in Figures 8.1 to 8.5 show reasonably good agreement except for the modifications C and D at the short gauge length of $2.5 \text{ m} \times 10^{-2}$. The curves for the calculated and experimental results exhibit similar trends, although the values of calculated and experimental data around the trough are not really close.

The results also show that modifications C and D give lower strength around the two troughs for shorter gauge lengths (2.5, 5 and $10 \text{ m} \times 10^{-2}$) and give no difference at longer gauge lengths (15 and $20 \text{ m} \times 10^{-2}$) using the modifications A and B.

For other fabrics, the results (q.v. Figures 8.6 to 8.13) show good agreement at angles of 0^{0}, 90^{0}, and the range of angles between the two troughs. The calculated results show a higher strength than the experimental results at the range between 0^{0} and the first trough, and between 90^{0} and the second trough.

Modifications C and D produce a better fit than modifications A and B except for short gauge lengths.

Figure 8.1 The Breaking Strength of the Modified Models and the Experimental Results of Fabric A as a Function of Angle of Bias under the Unseamed Breaking Condition.

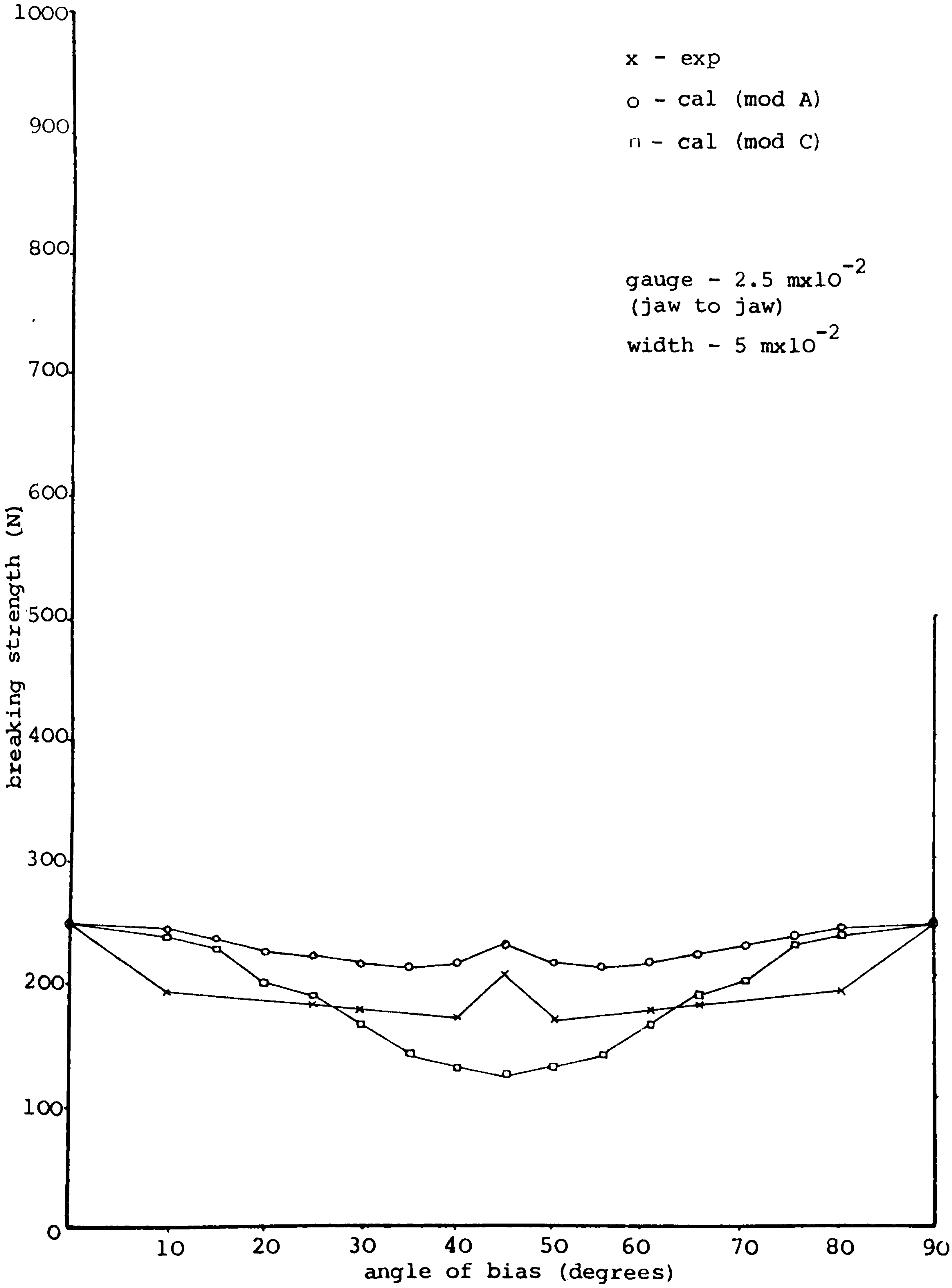


Figure 8.2 The Breaking Strength of the Modified Models and the Experimental Results of Fabric A as a Function of Angle of Bias under the Unseamed Breaking Condition.

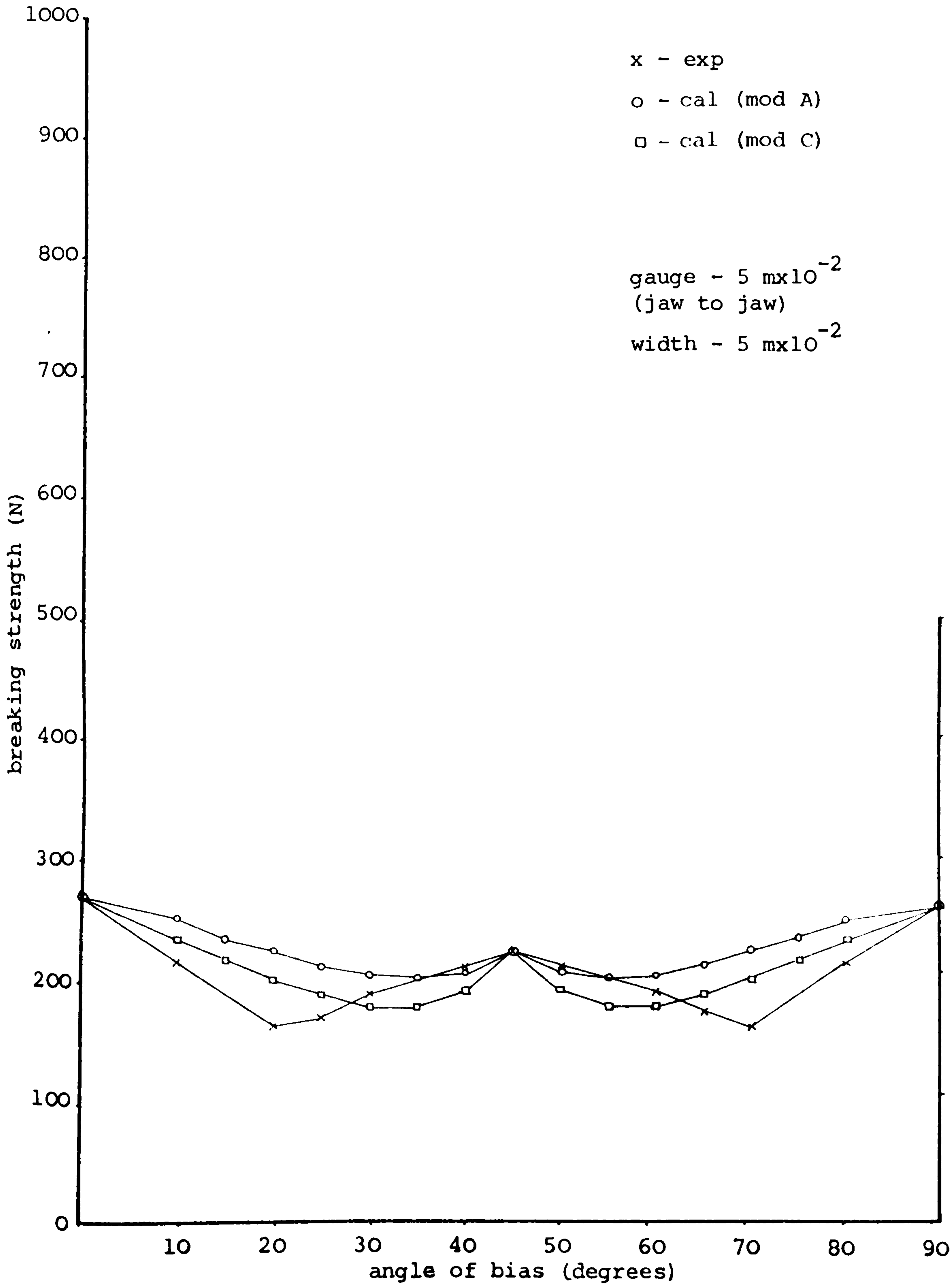


Figure 8.3 The Breaking Strength of the Modified Models and the Experimental Results of Fabric A as a Function of Angle of Bias under the Unseamed Breaking Condition.

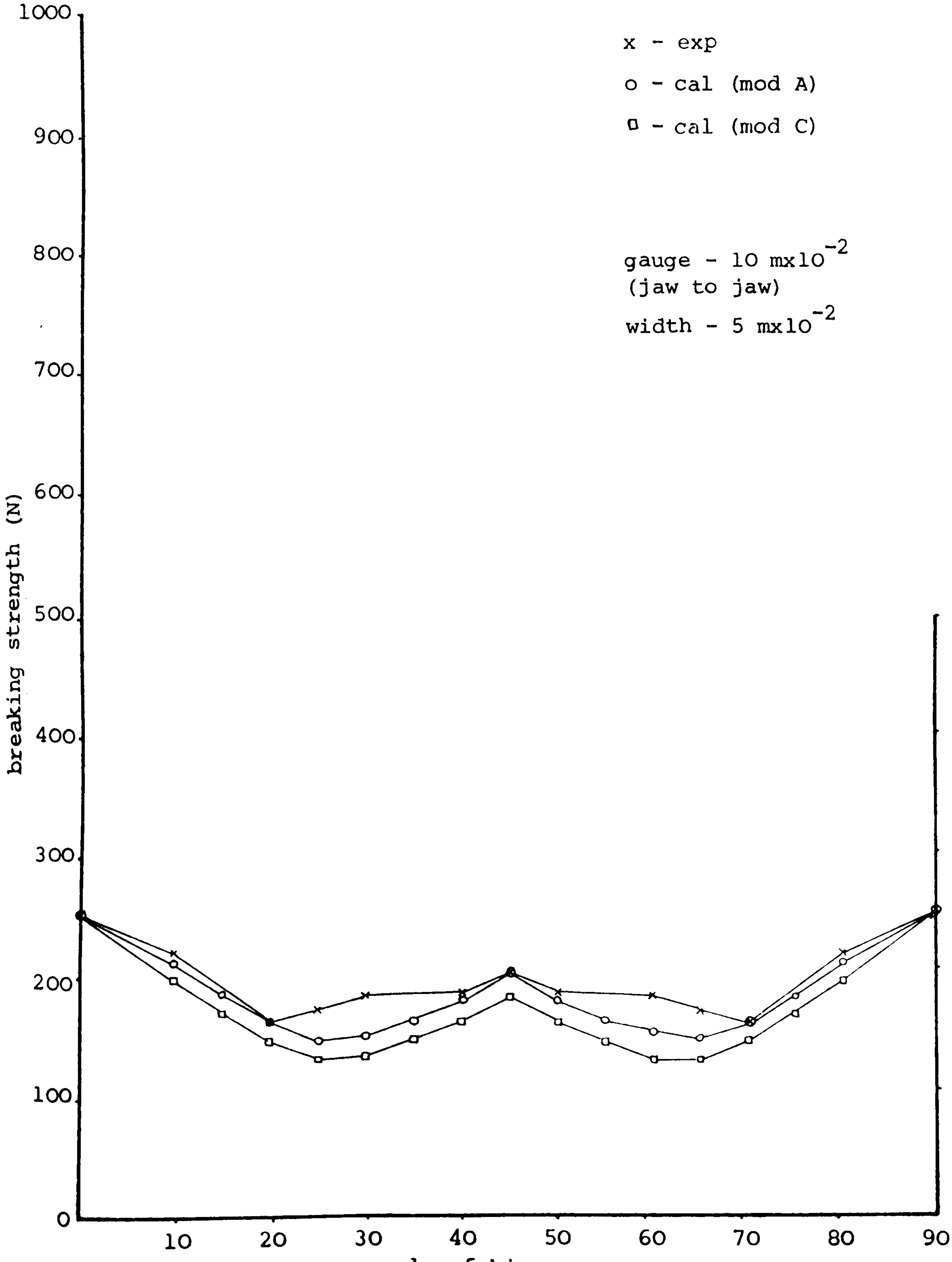


Figure 8.4 The Breaking Strength of the Modified Models and the Experimental Results of Fabric A as a Function of Angle of Bias under the Unseamed Breaking Condition.

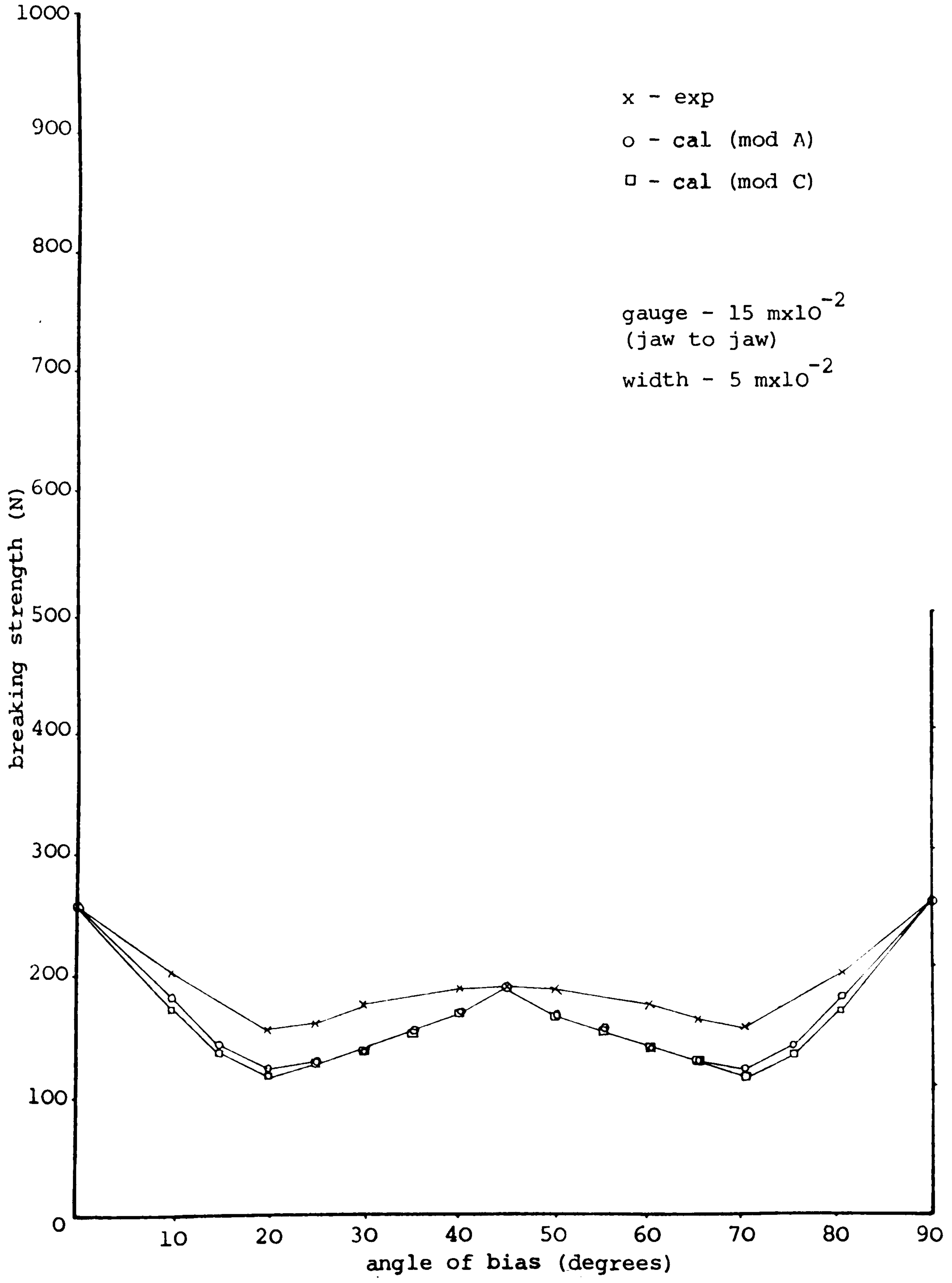


Figure 8.5 The Breaking Strength of the Modified Models and the Experimental Results of Fabric A as a Function of Angle of Bias under the Unseamed Breaking Condition.

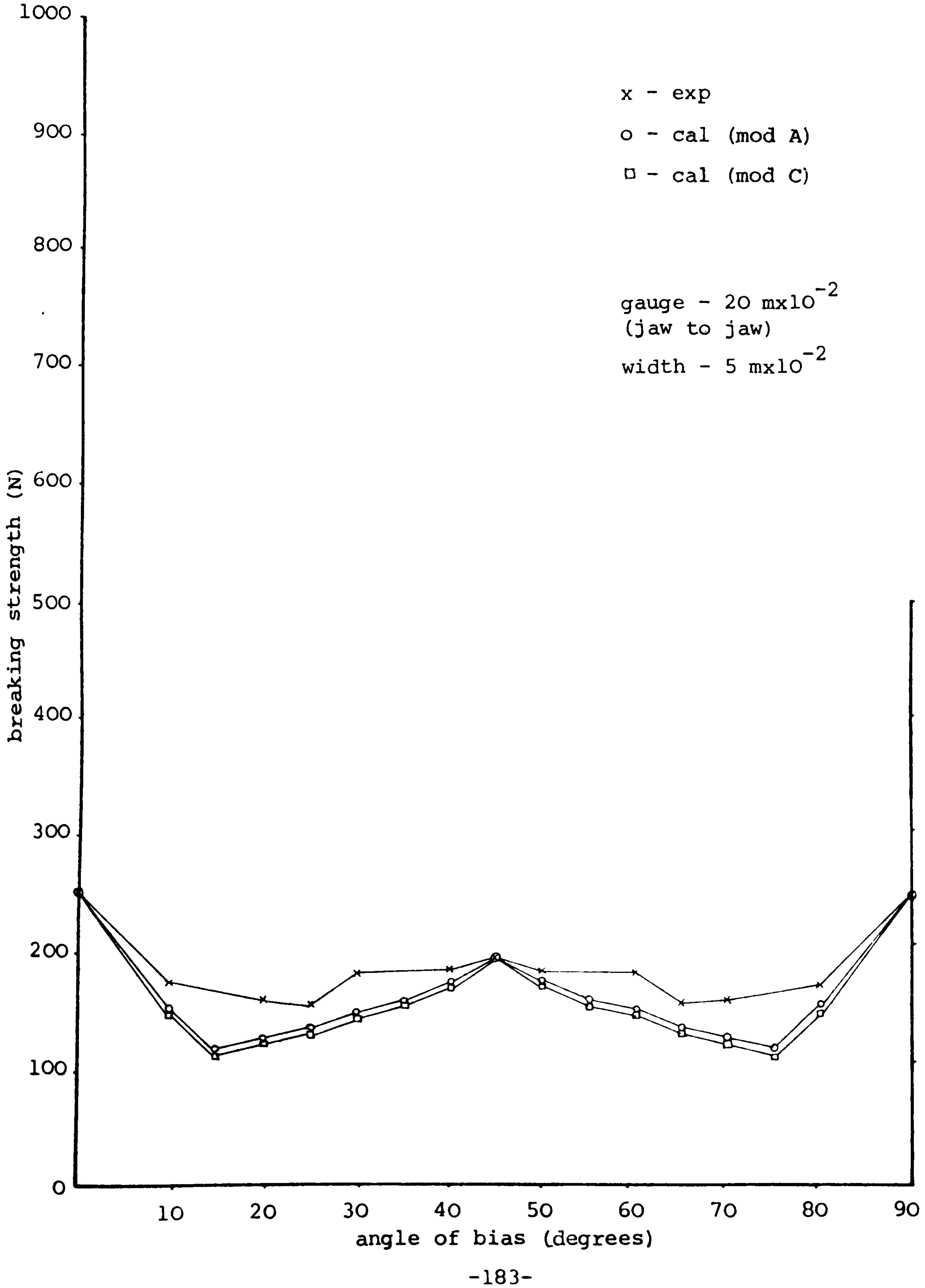


Figure 8.6 The Breaking Strength of the Modified Models and the Experimental Results of Fabric B as a Function of Angle of Bias under the Unseamed Breaking Condition.

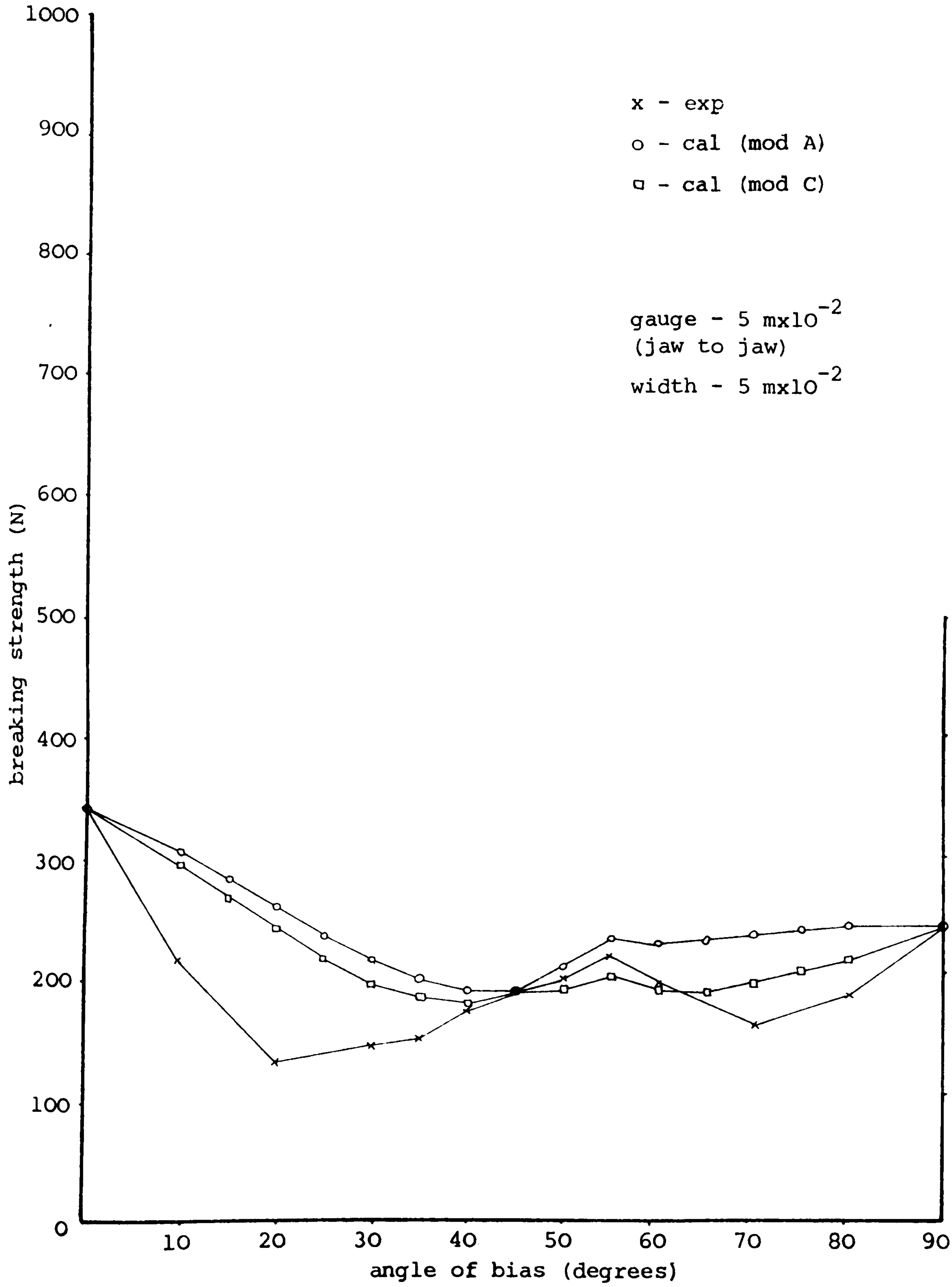


Figure 8.7 The Breaking Strength of the Modified Models and the Experimental Results of Fabric C as a Function of Angle of Bias under the Unseamed Breaking Condition.

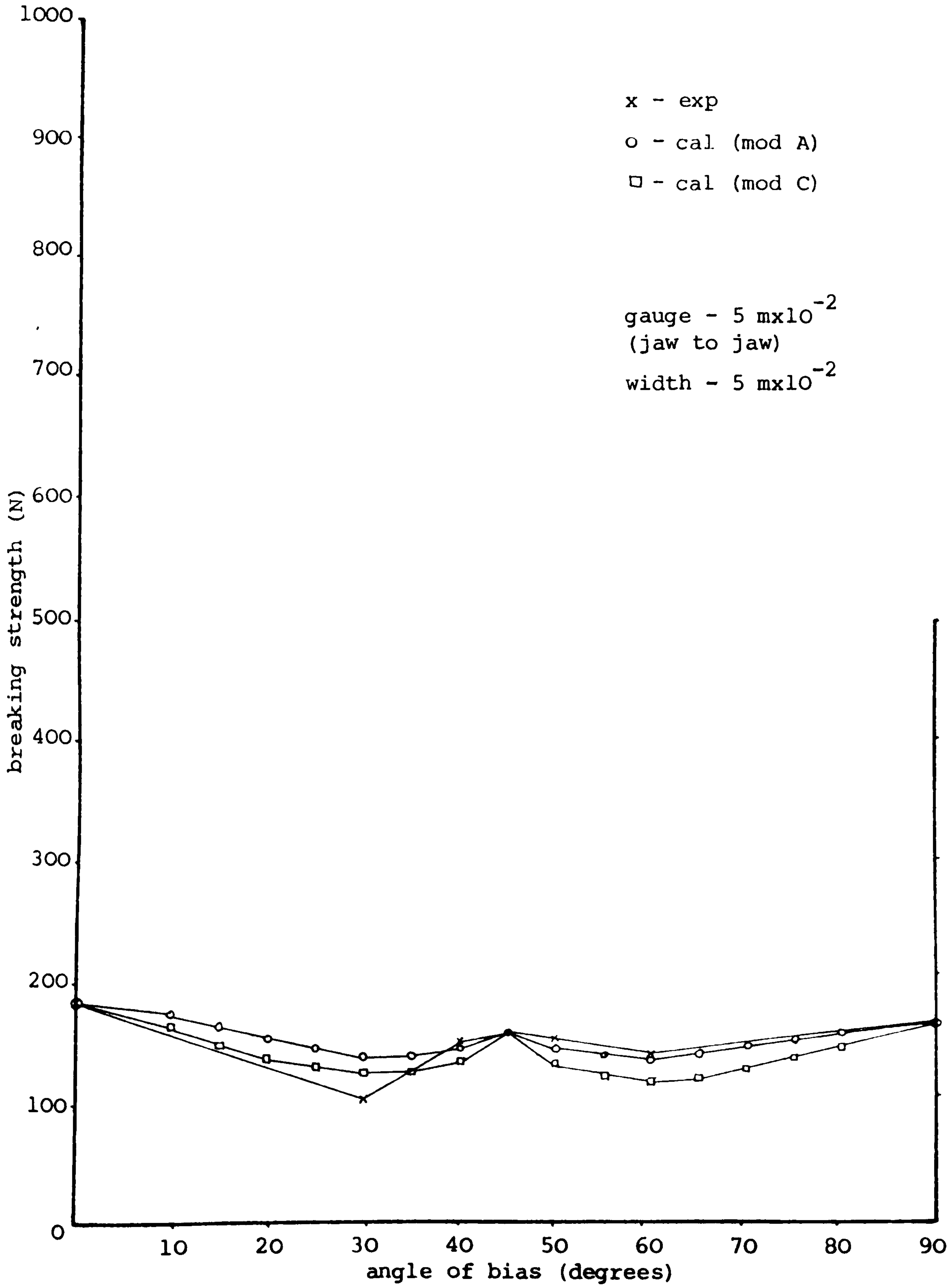


Figure 8.8 The Breaking Strength of the Modified Models and the Experimental Results of Fabric D as a Function of Angle of Bias under the Unseamed Breaking Condition.

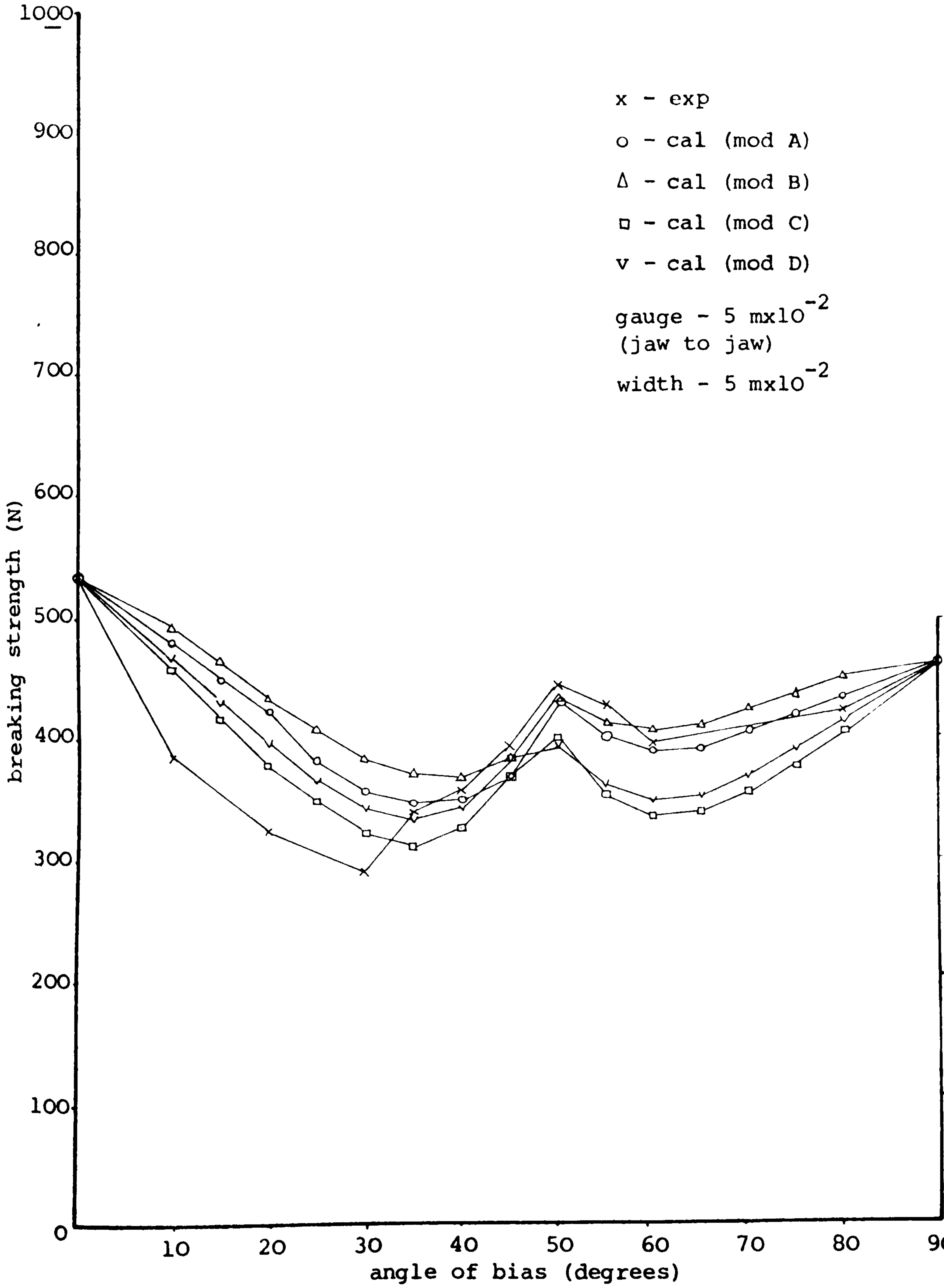


Figure 8.9 The Breaking Strength of the Modified Models and the Experimental Results of Fabric E as a Function of Angle of Bias under the Unseamed Breaking Condition.

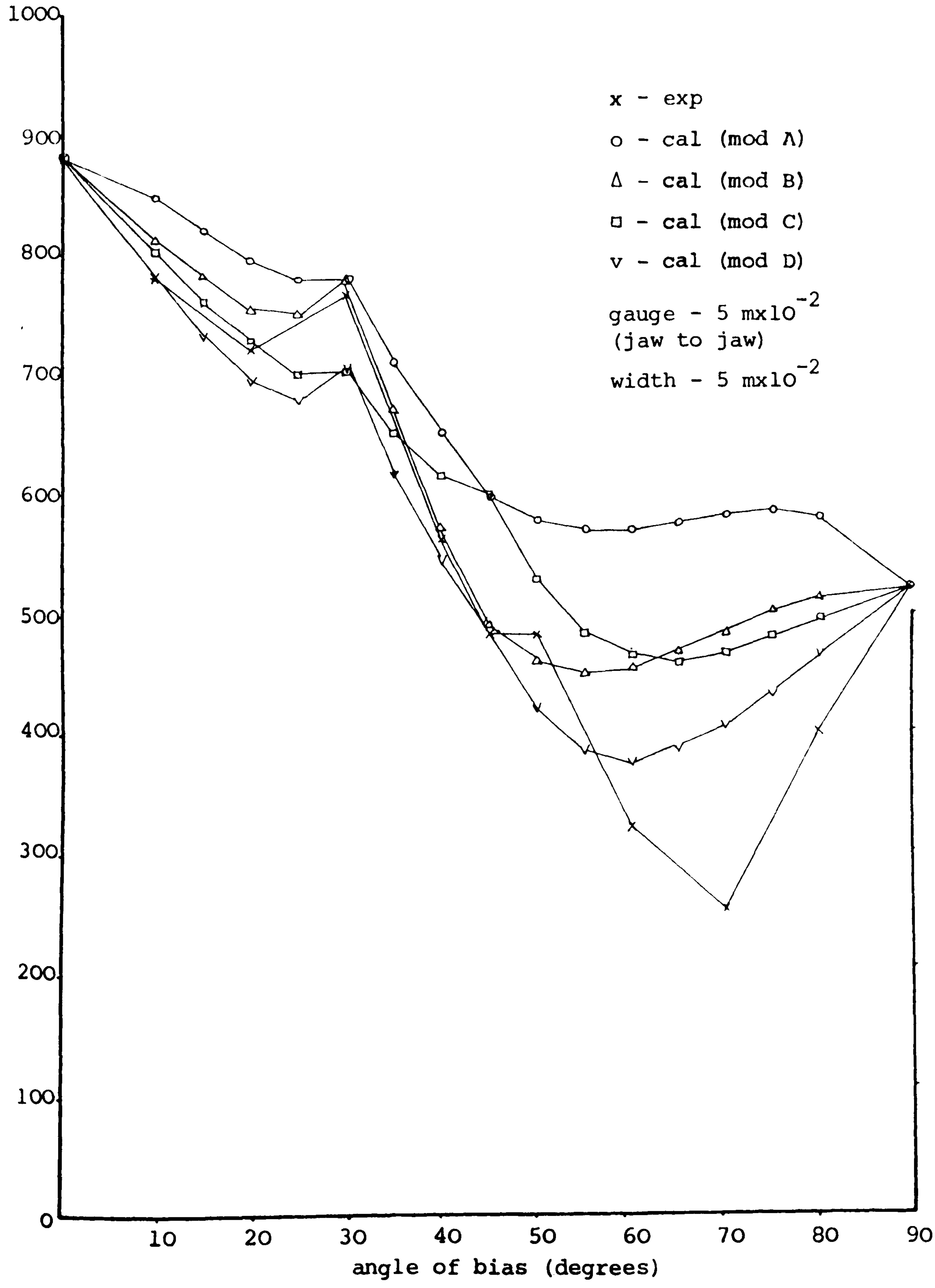


Figure 8.10 The Breaking Strength of the Modified Models and the Experimental Results of Fabric F as a Function of Angle of Bias under the Unseamed Breaking Condition.

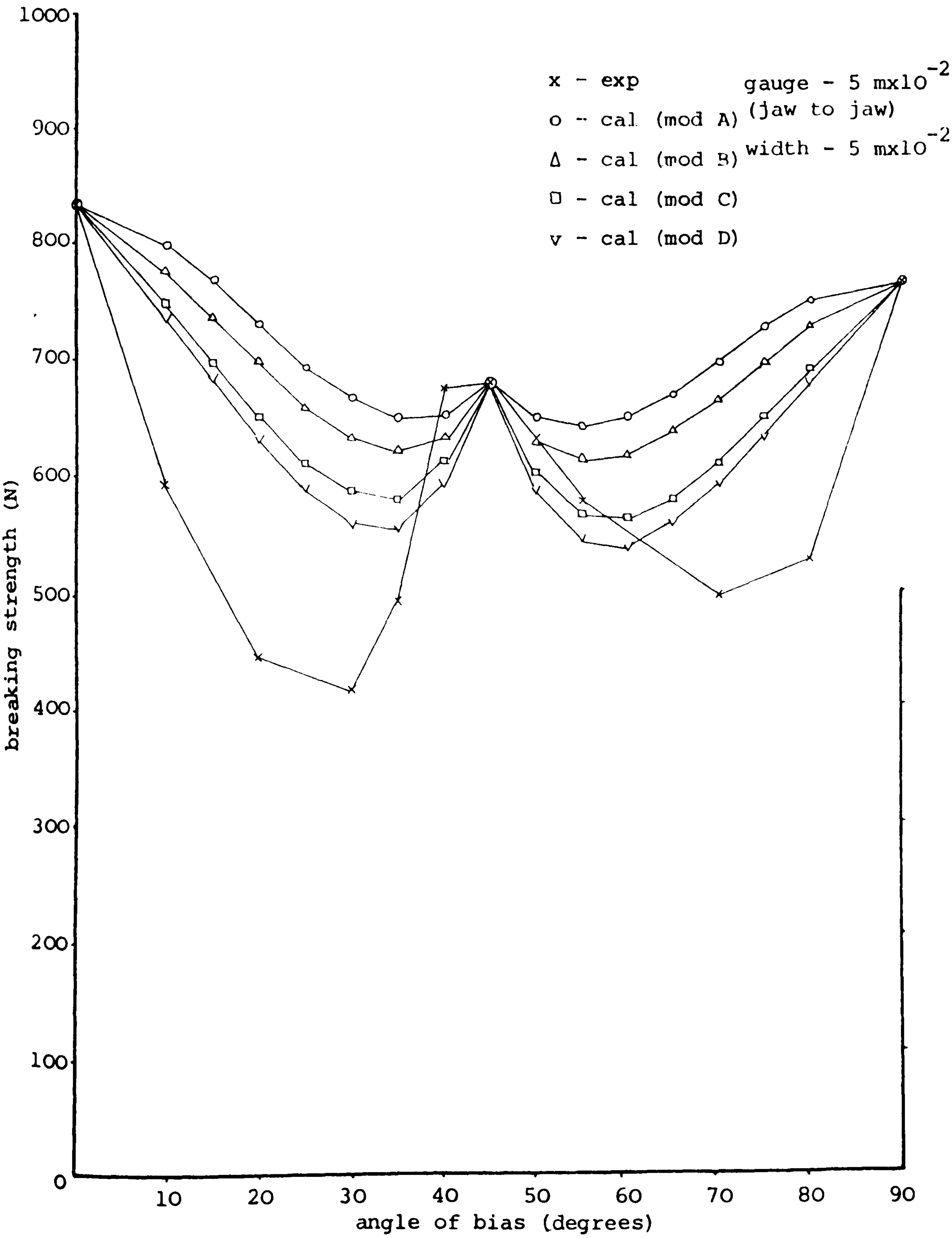


Figure 8.11 The Breaking Strength of the Modified Models and the Experimental Results of Fabric G as a Function of Angle of Bias under the Unseamed Breaking Condition.

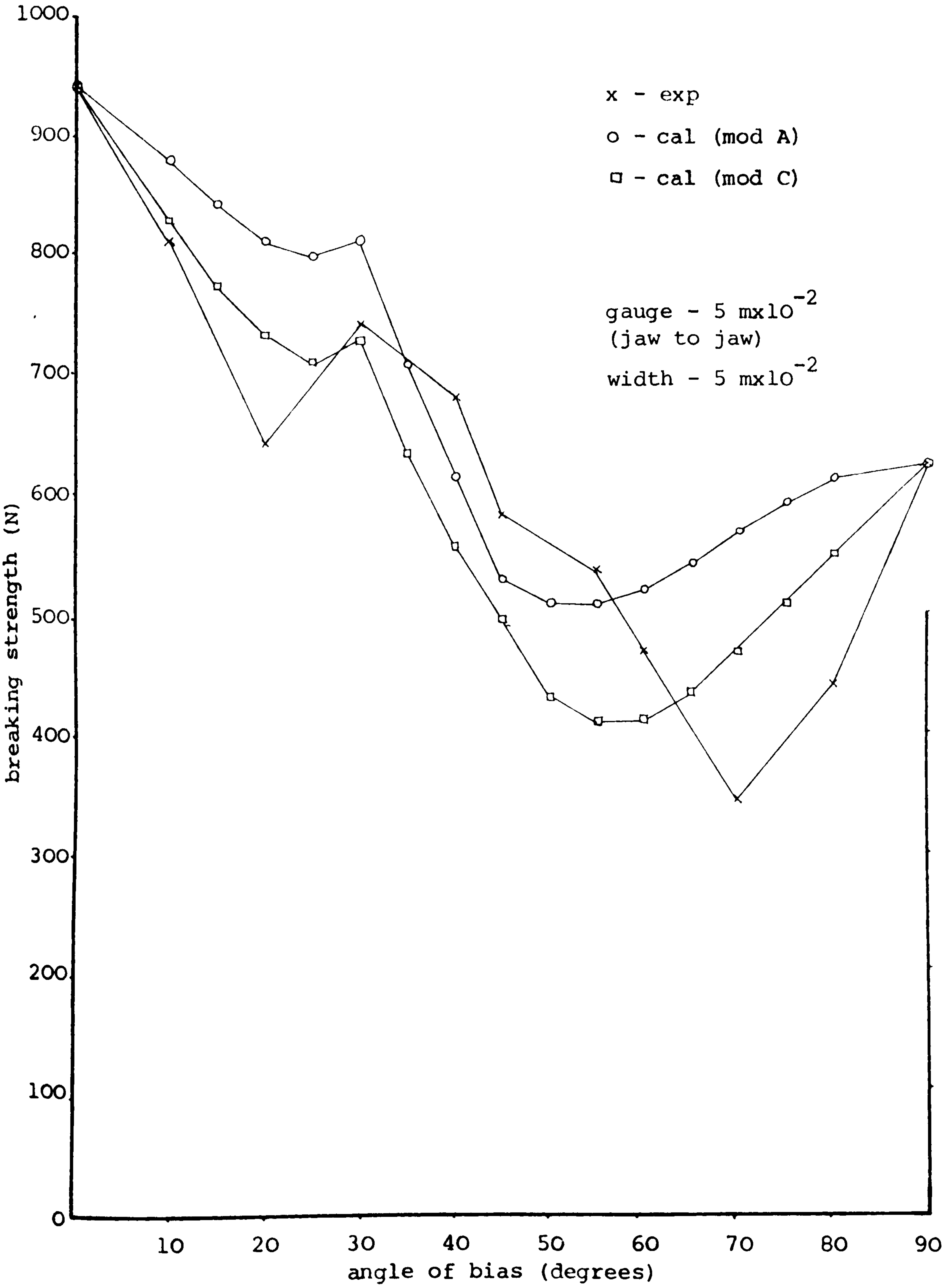


Figure 8.12 The Breaking Strength of the Modified Models and the Experimental Results of Fabric H as a Function of Angle of Bias under the Unseamed Breaking Condition.

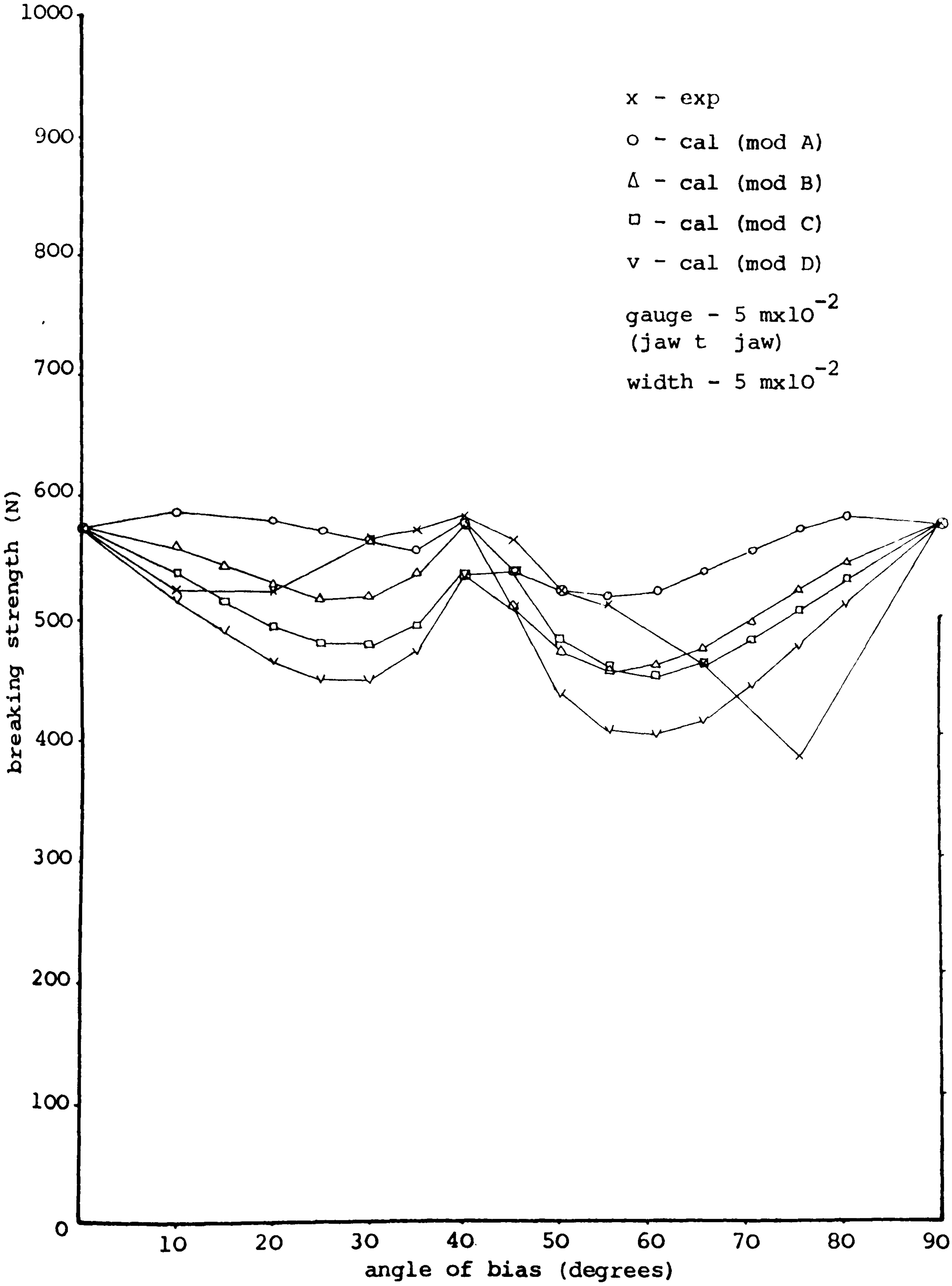
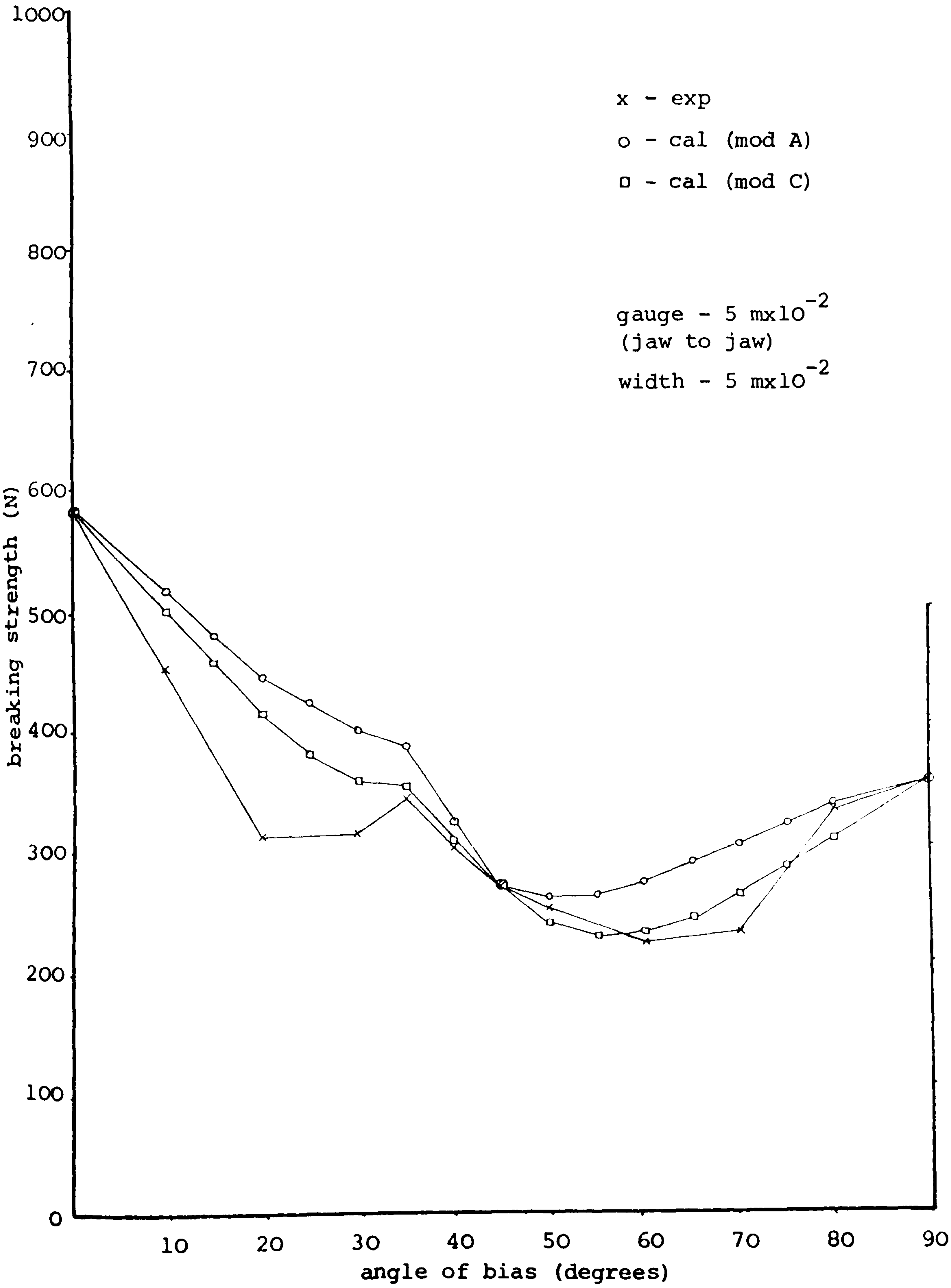


Figure 8.13 The Breaking Strength of the Modified Models and the Experimental Results of Fabric I as a Function of Angle of Bias under the Unseamed Breaking Condition.



The overall results show the calculated curves exhibiting similar trends to the experimental curves although the two are not really close around the troughs.

The model also gives a similar movement of the trough as the experimental results (the trough moves towards 0^0 (or 90^0) as the G/W ratio (or gauge length) increases and this movement stops when the G/W ratio is above two.

The results also show that the constant 'A' can be used over a wide range of fabrics for unseamed fabric breaks without affecting the results from the parameter 'A' unless the difference between the two values is great (as in the case of Fabrics E and G).

8.3 COMPARISON BETWEEN THE MODIFICATIONS AND THE EXPERIMENTAL RESULTS FOR THE TYPE II BREAKS

For Fabric A, the results (q.v. Figures 8.14 to 8.19) show that the modifications A and B provide a very good fit to the experimental results especially at short gauge lengths.

Modifications C and D do not work for short gauge lengths or, in other words, when the G/W ratio is less than one half. When the G/W ratio is greater than unity, they show a good fit with the experimental results.

For other fabrics with the results shown in Figures 8.20 to 8.22, modifications C and D provide a very good fit to the experimental results, except for predicting a strength that is slightly low at the peak. Modifications A and B give a good fit, but only give

Figure 8.14 The Breaking Strength of the Modified Models and the Experimental Results of Fabric A as a Function of Angle of Bias under the Type II Breaking Condition.

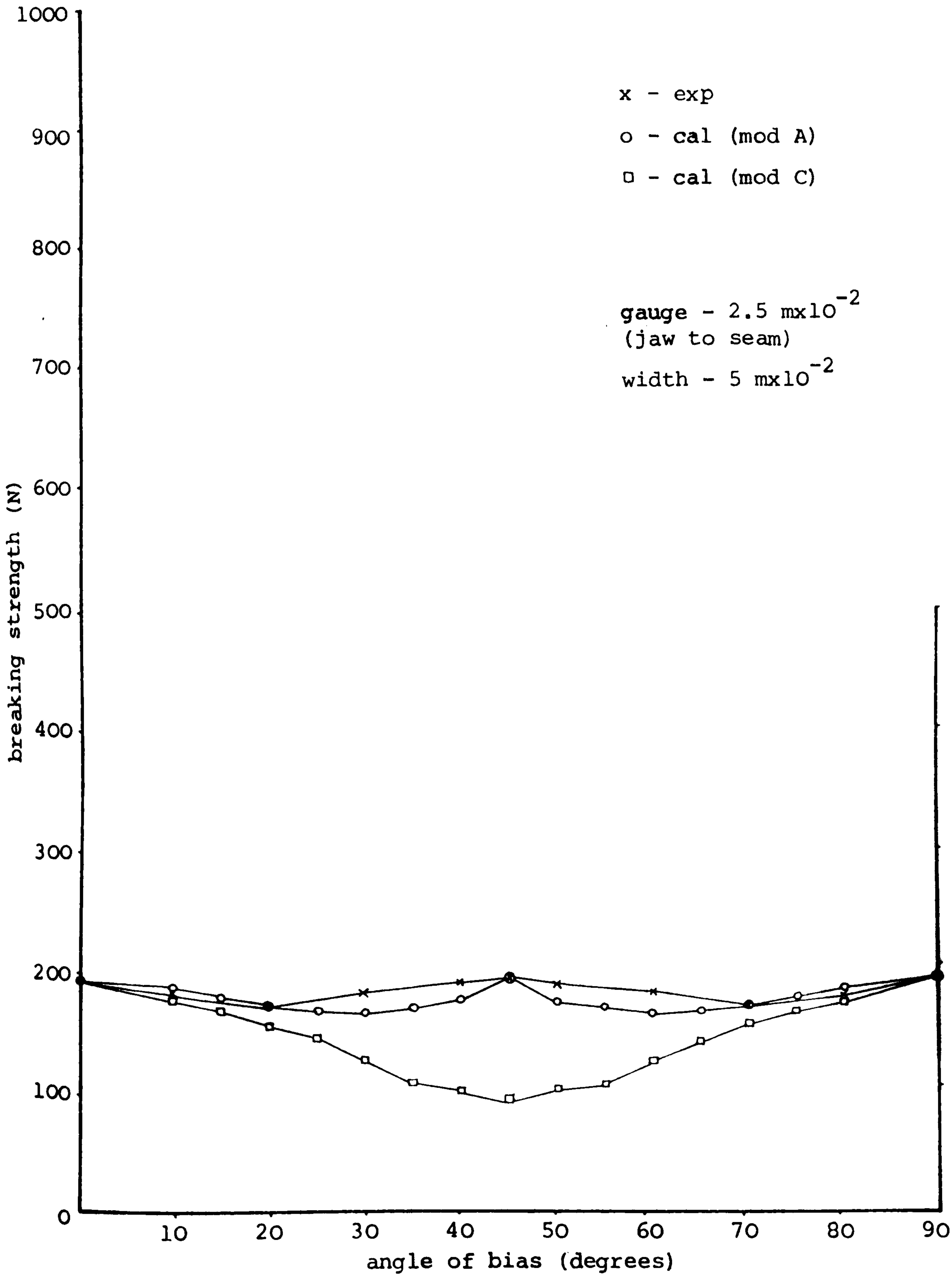


Figure 8.15 The Breaking Strength of the Modified Models and the Experimental Results of Fabric A as a Function of Angle of Bias under the Type II Breaking Condition.

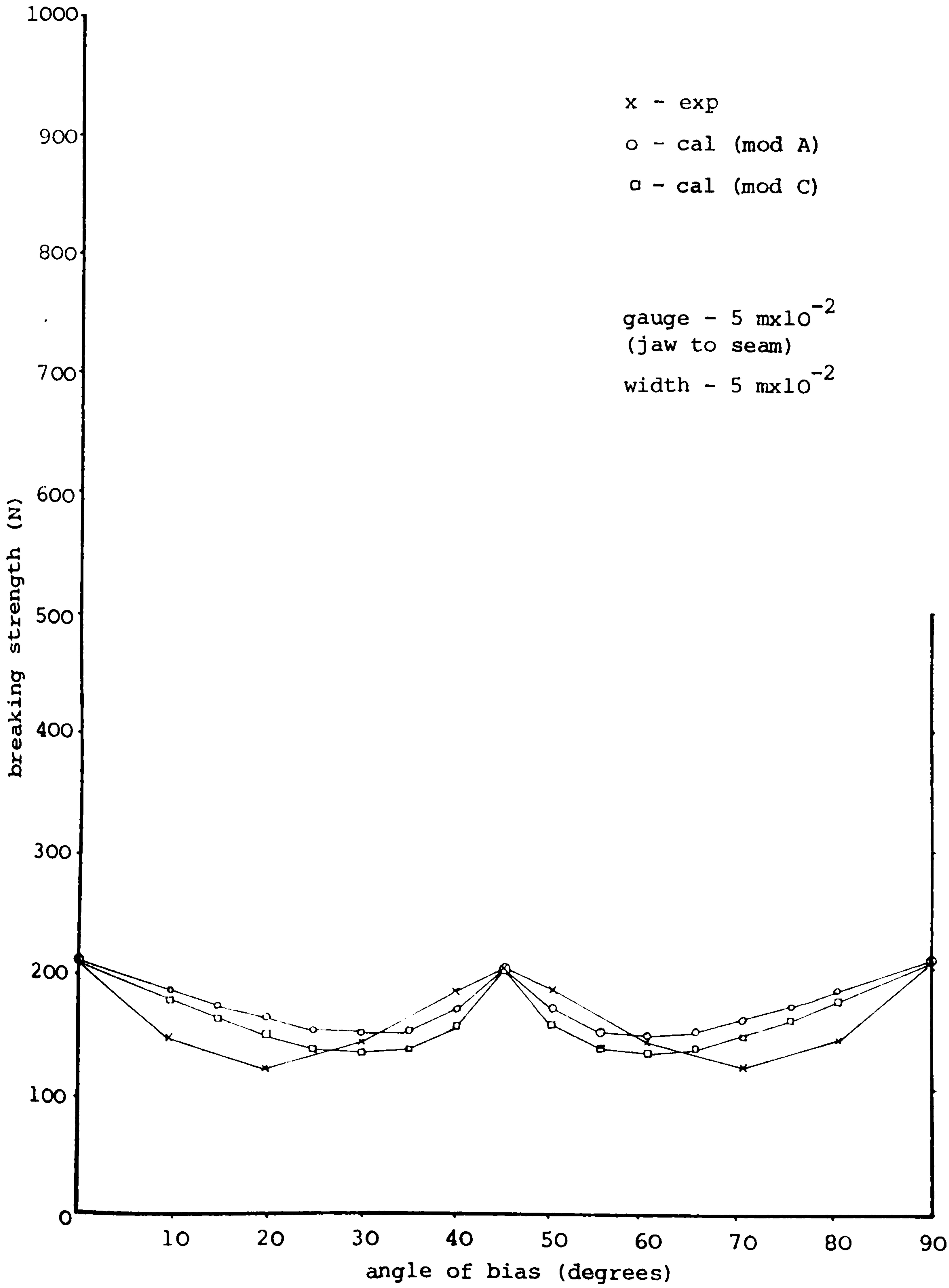


Figure 8.16 The Breaking Strength of the Modified Models and the Experimental Results of Fabric A as a Function of Angle of Bias under the Type II Breaking Condition.

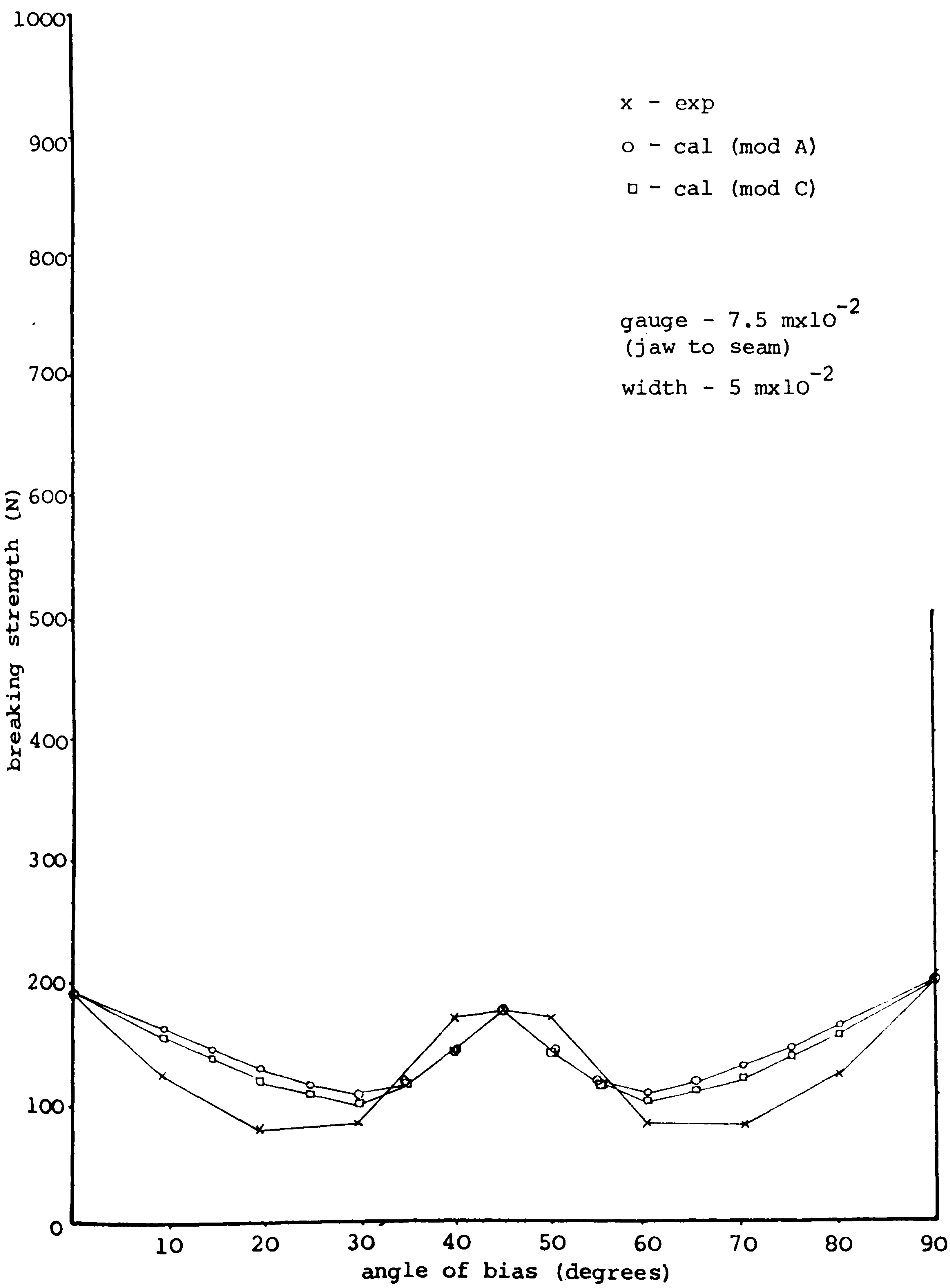


Figure 8.17 The Breaking Strength of the Modified Model and the Experimental Results of Fabric A as a Function of Angle of Bias under the Type II Breaking Condition.

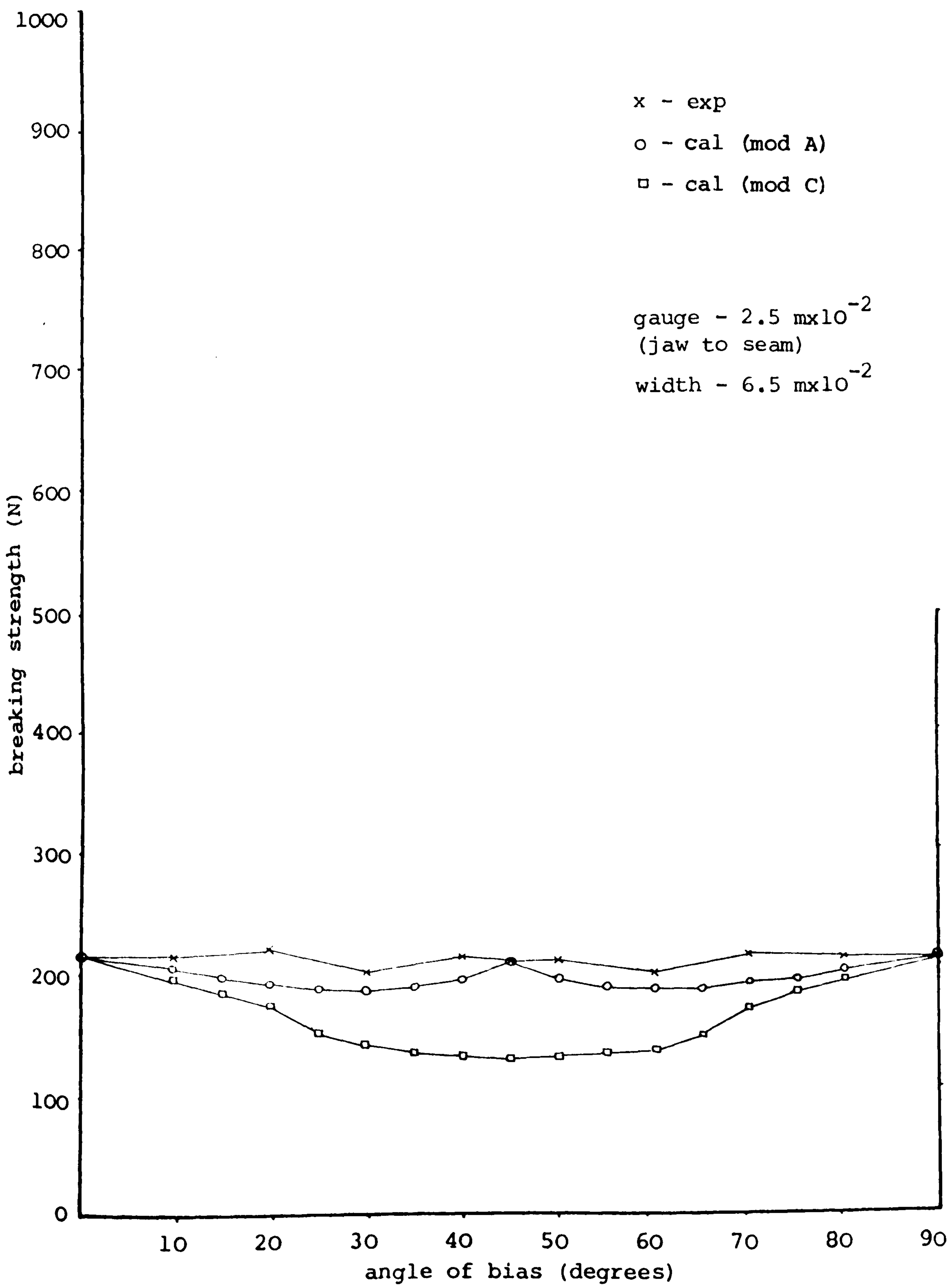


Figure 8.18 The Breaking Strength of the Modified Model and the Experimental Results of Fabric A as a Function of Angle of Bias under the Type II Breaking Condition.

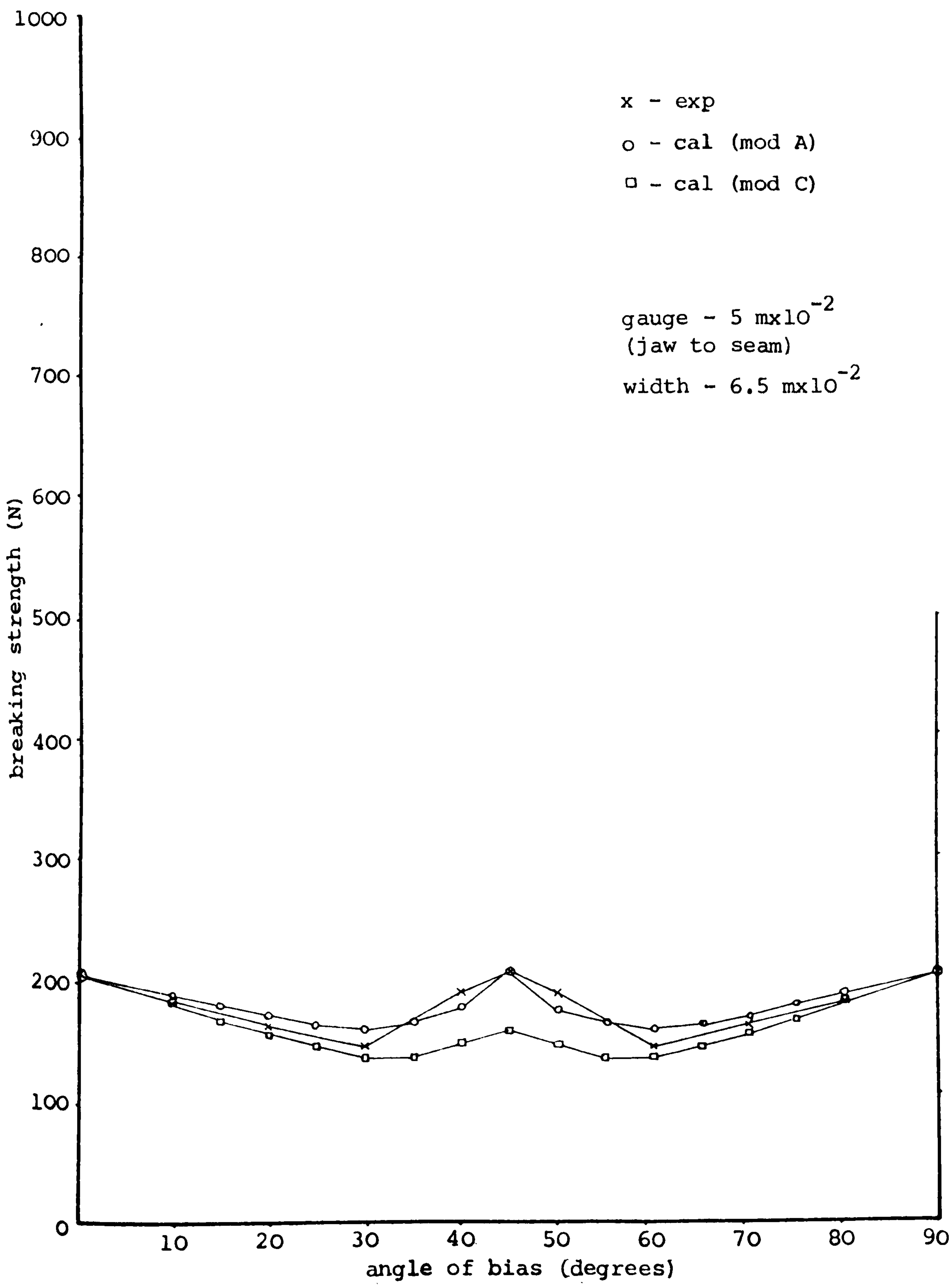


Figure 8.19 The Breaking Strength of the Modified Models and the Experimental Results of Fabric A as a Function of Angle of Bias under the Type II Breaking Condition.

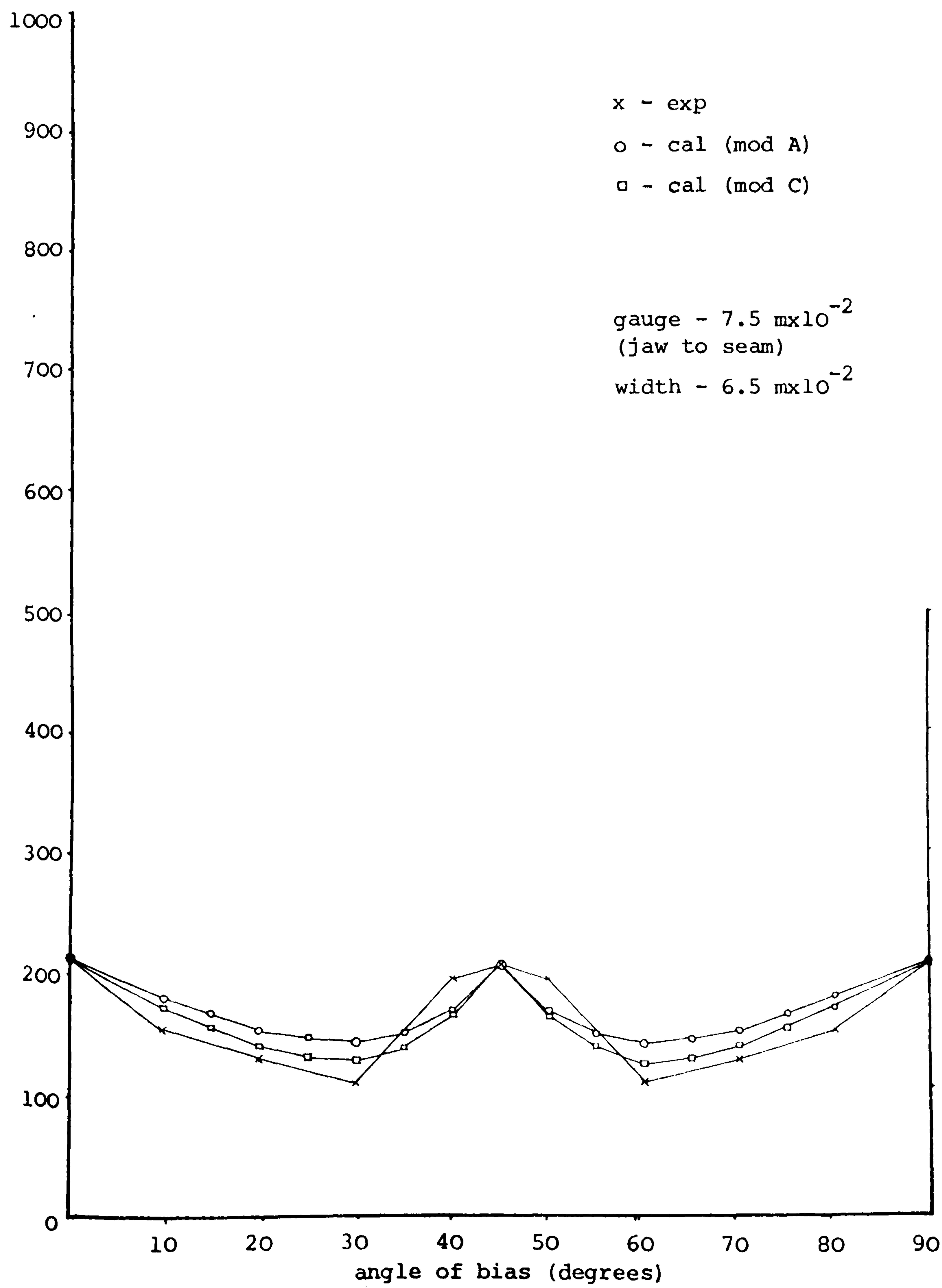


Figure 8.20 The Breaking Strength of the Modified Models and the Experimental Results of Fabric D as a Function of Angle of Bias under the Type II Breaking Condition.

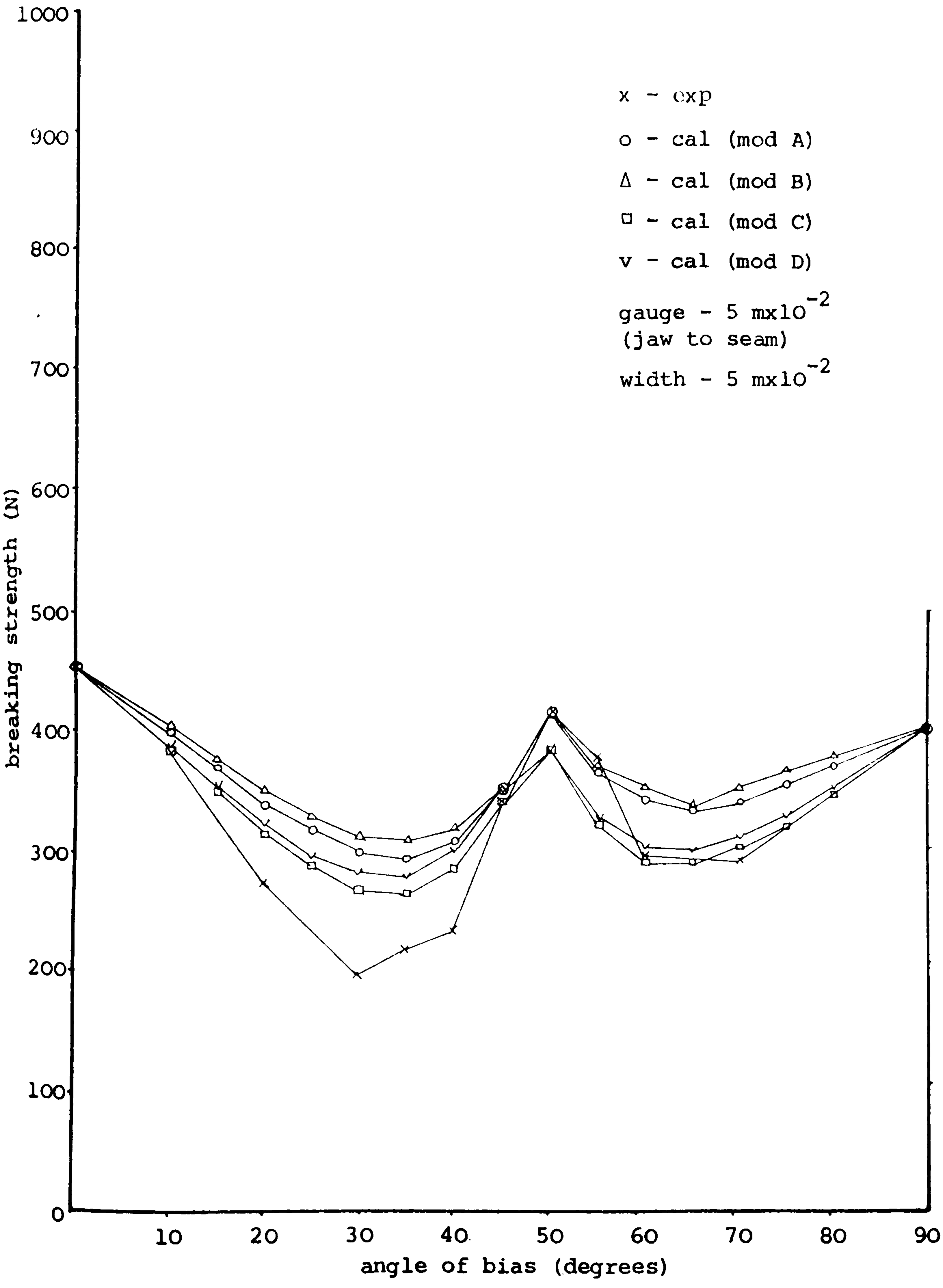


Figure 8.21 The Breaking Strength of the Modified Models and the Experimental Results of Fabric H as a Function of Angle of Bias under the Type II Breaking Condition.

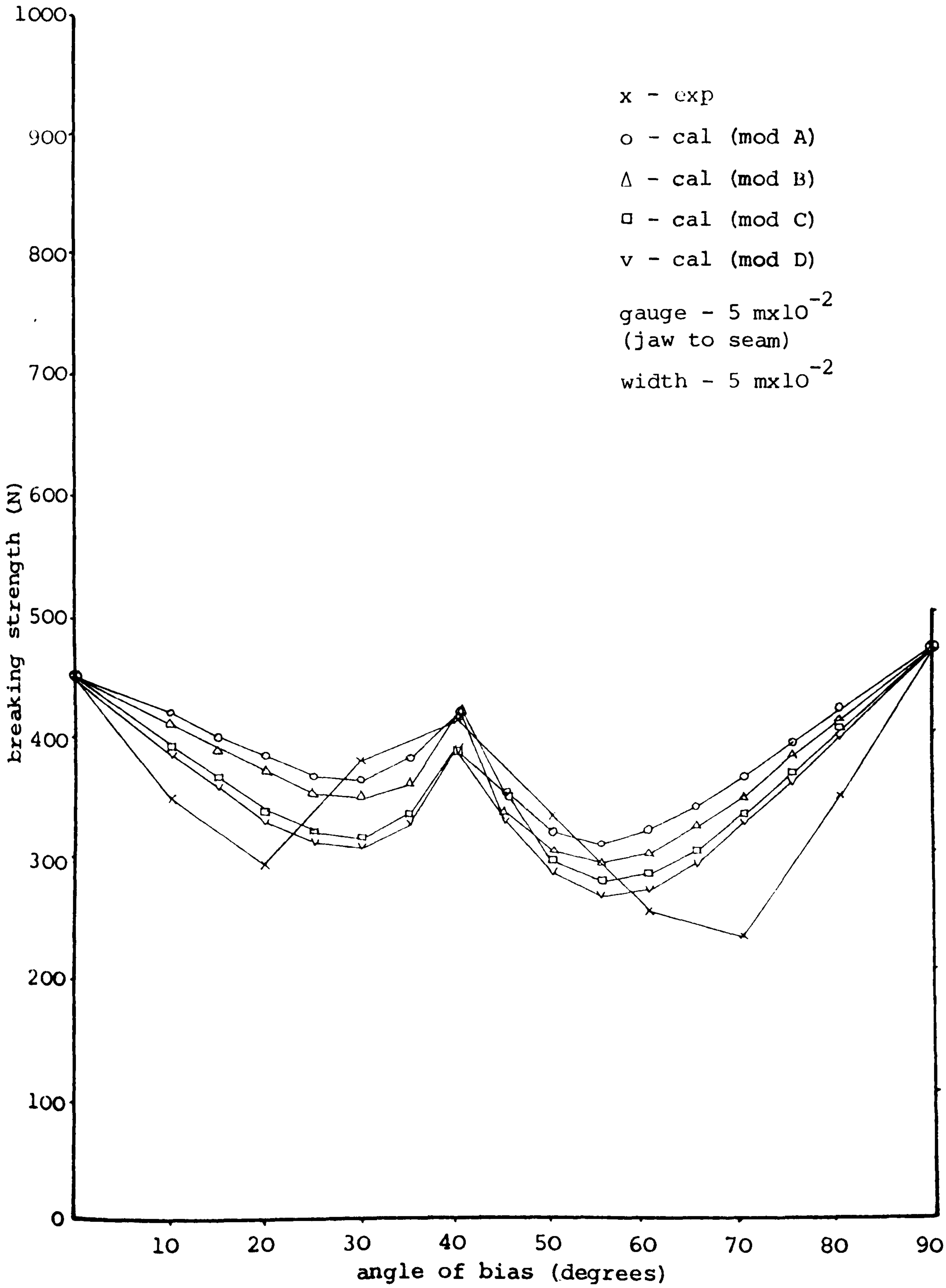
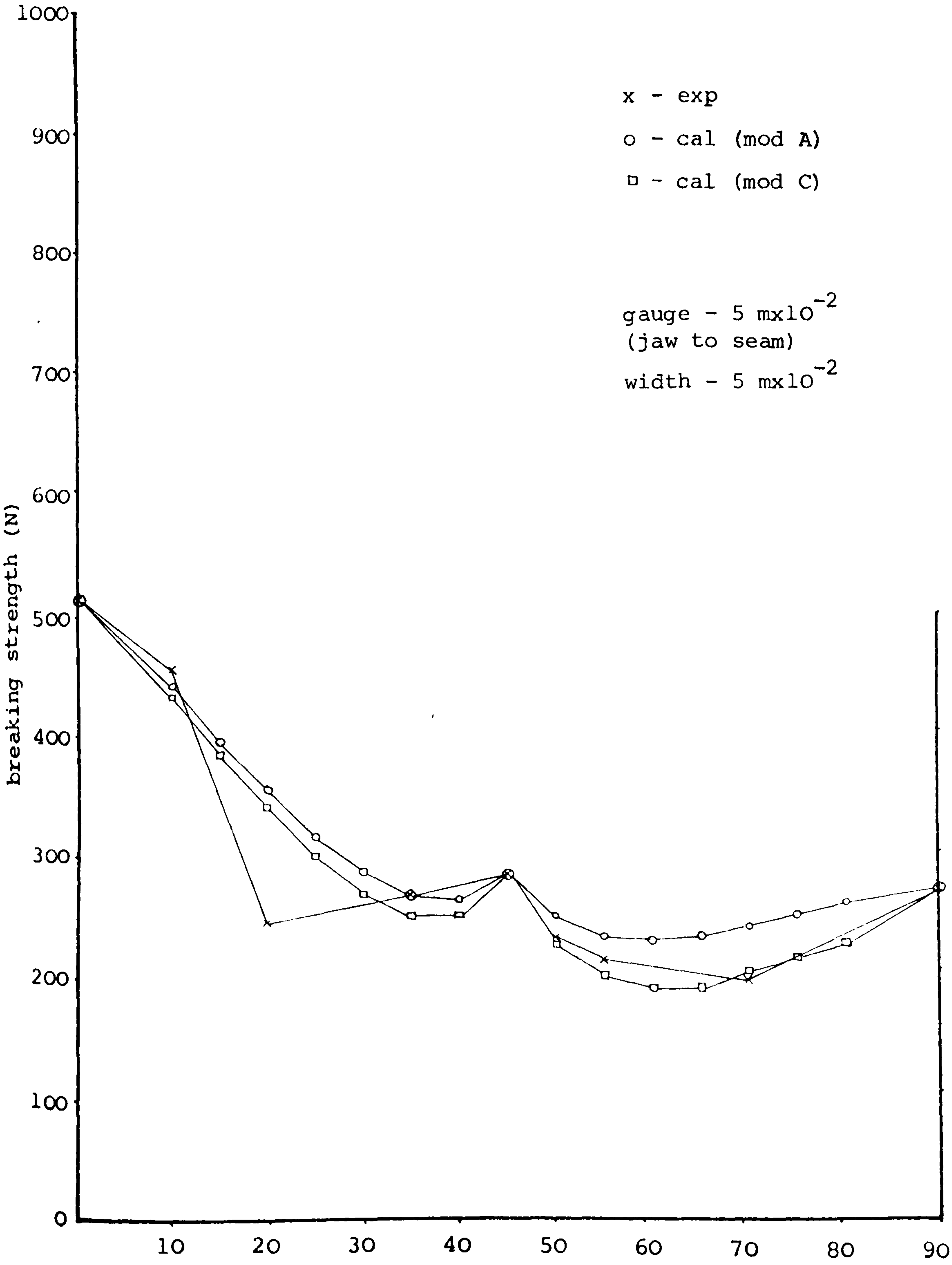


Figure 8.22 The Breaking Strength of the Modified Models and the Experimental Results of Fabric I as a Function of Angle of Bias under the Type II Breaking Condition.



higher strength than the modifications C and D around the troughs.

The model will give a deeper trough if the parameter 'A' is higher, therefore, the constant 'A' does not show a better fit to the experimental results over the parameter 'A', but it does show that the constant 'A' can be used over a wide range of fabrics for each type of break without affecting the results from the parameter 'A', unless the difference between the two values is greater than 0.5.

8.4 COMPARISON BETWEEN THE MODIFICATIONS AND THE EXPERIMENTAL RESULTS FOR TYPE I BREAKS

For Fabric A, as can be seen from the results shown in Figures 8.23 to 8.31, modifications A and B show a good fit at all gauge lengths and widths especially at short gauge lengths; in other words, for values of the G/W ratio less than unity. At the long gauge lengths, the modifications A and B illustrate a similar trend of curves to the experimental ones.

Modifications C and D only work at longer gauge lengths when the G/W ratio is greater than unity. Therefore the results of agreement are similar to those for Type II breaks; modifications A and B are good at short gauge lengths (G/W ratio less than unity); and modifications C and D are slightly better for long gauge lengths.

The overall results for Fabric A show a very accurate prediction of the angle at the two troughs, therefore the model has explained the gauge length effect proposed in Chapter 4.

Figure 8.23 The Breaking Strength of the Modified Models and the Experimental Results of Fabric A as a Function of Angle of Bias under the Type I Breaking Condition.

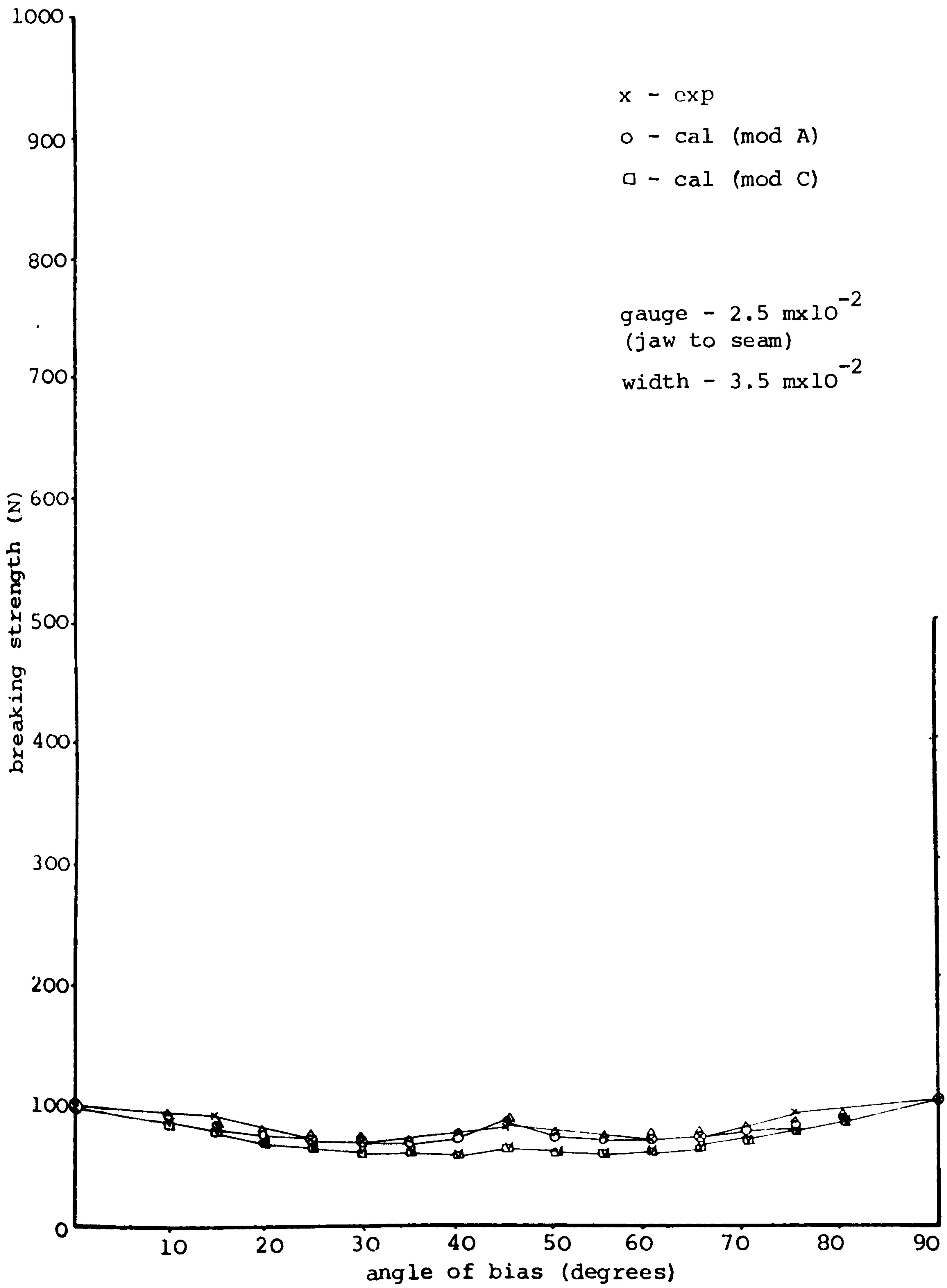


Figure 8.24 The Breaking Strength of the Modified Models and the Experimental Results of Fabric A as a Function of Angle of Bias under the Type I Breaking Condition.

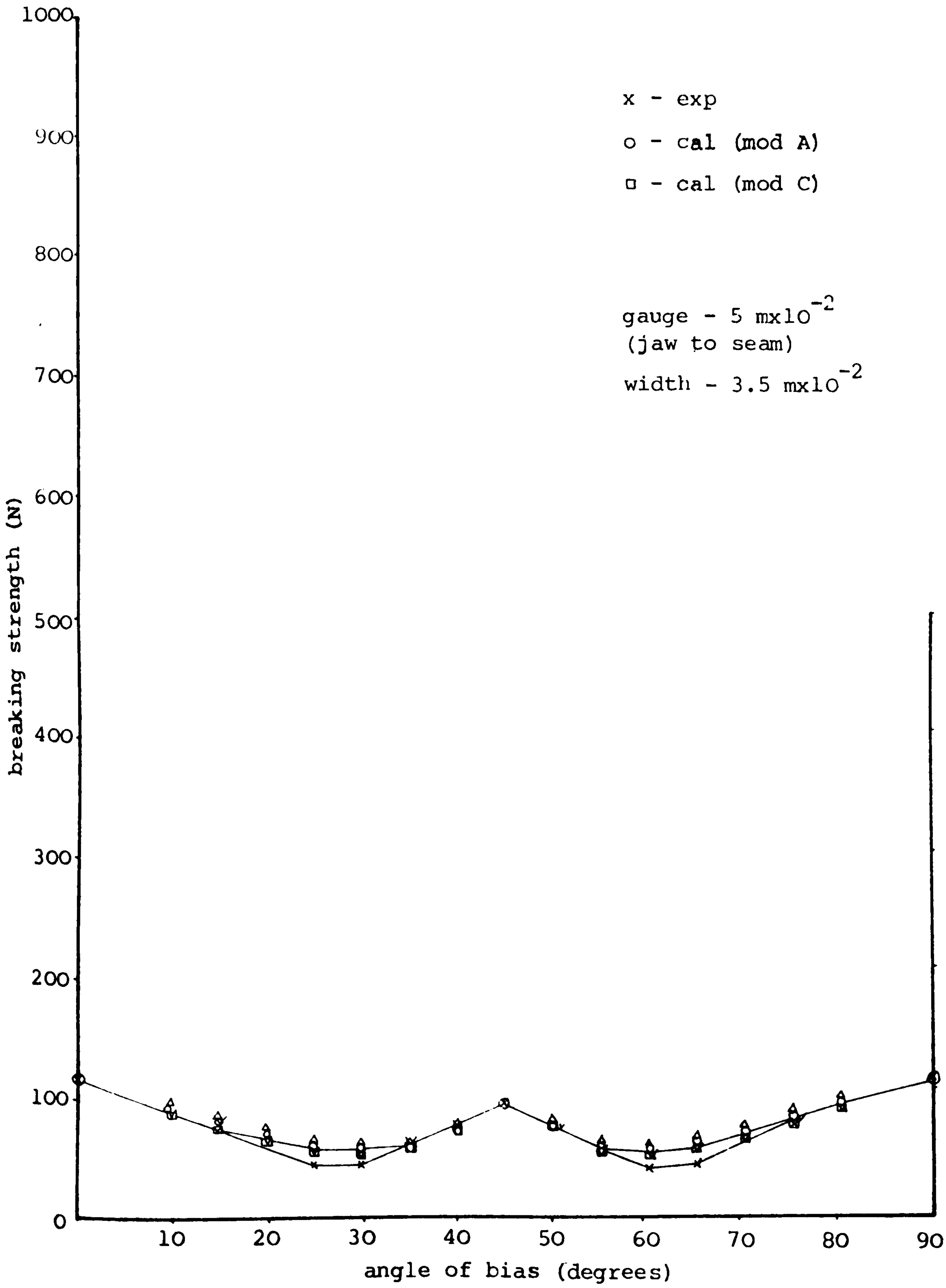


Figure 8.25 The Breaking Strength of the Modified Models and the Experimental Results of Fabric A as a Function of Angle of Bias under the Type I Breaking Condition.

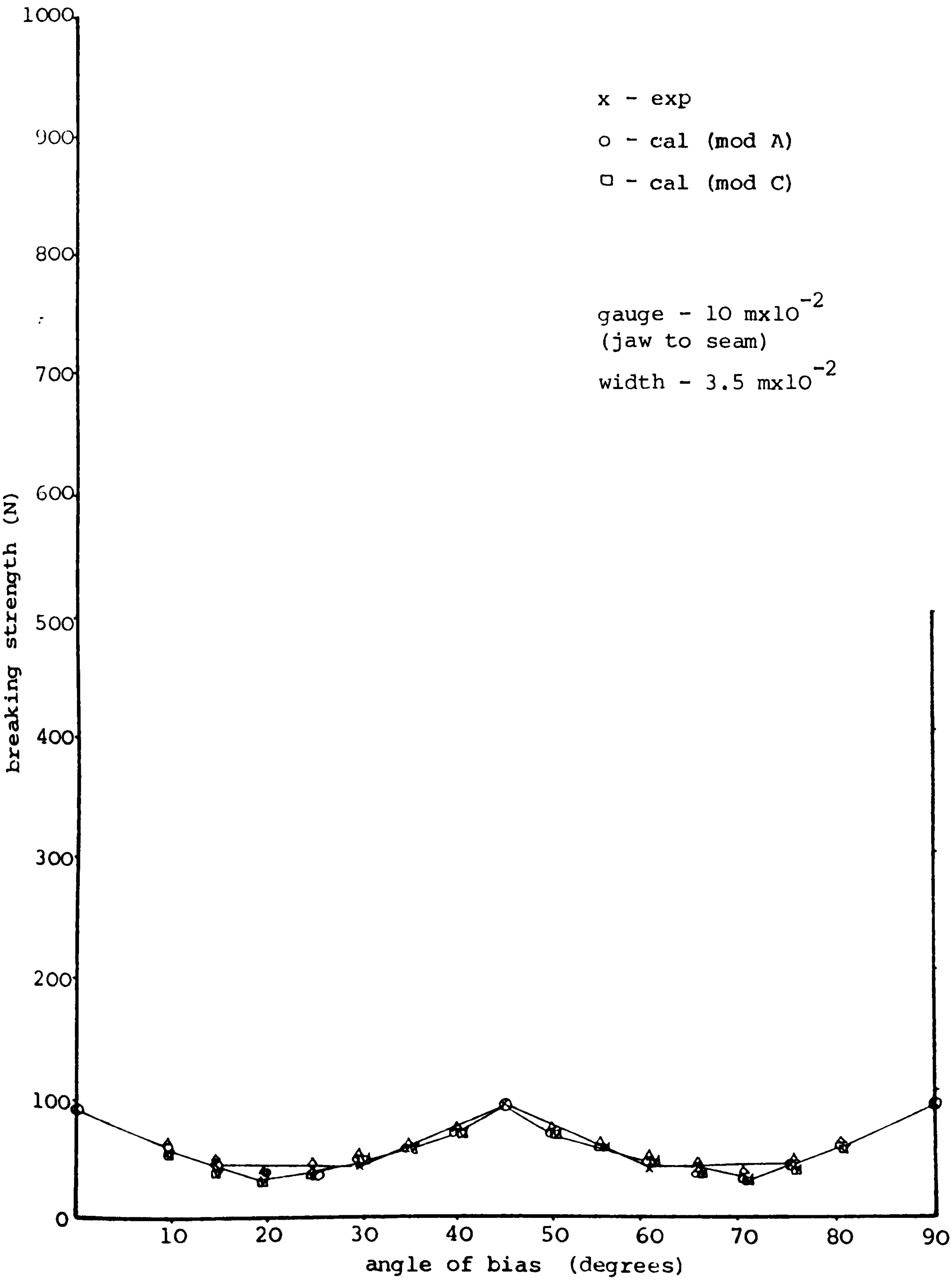


Figure 8.26 The Breaking Strength of the Modified Models and the Experimental Results of Fabric A as a Function of Angle of Bias under the Type I Breaking Condition.

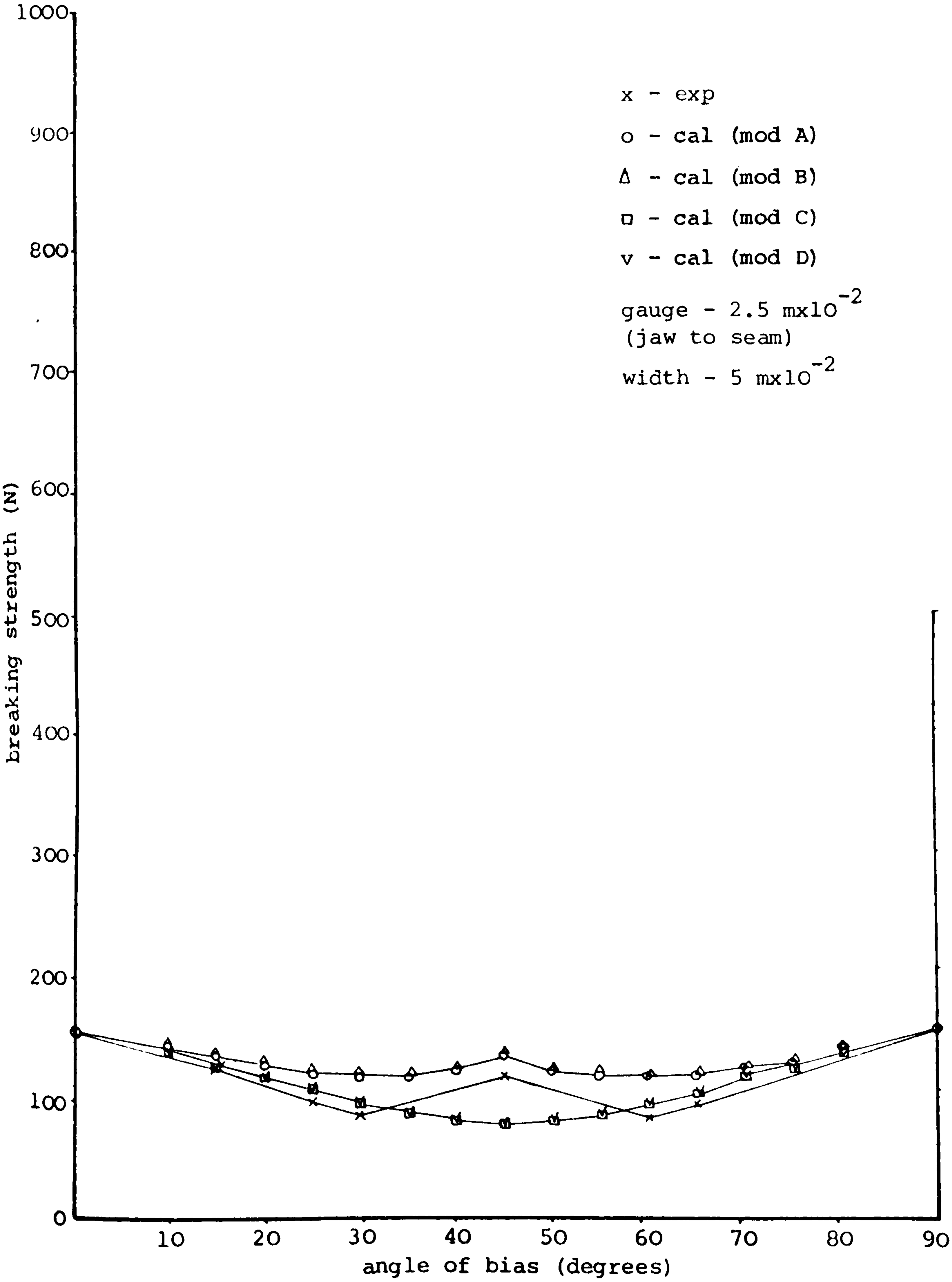


Figure 8.27 The Breaking Strength of the Modified Models and the Experimental Results of Fabric A as a Function of Angle of Bias under the Type I Breaking Condition.

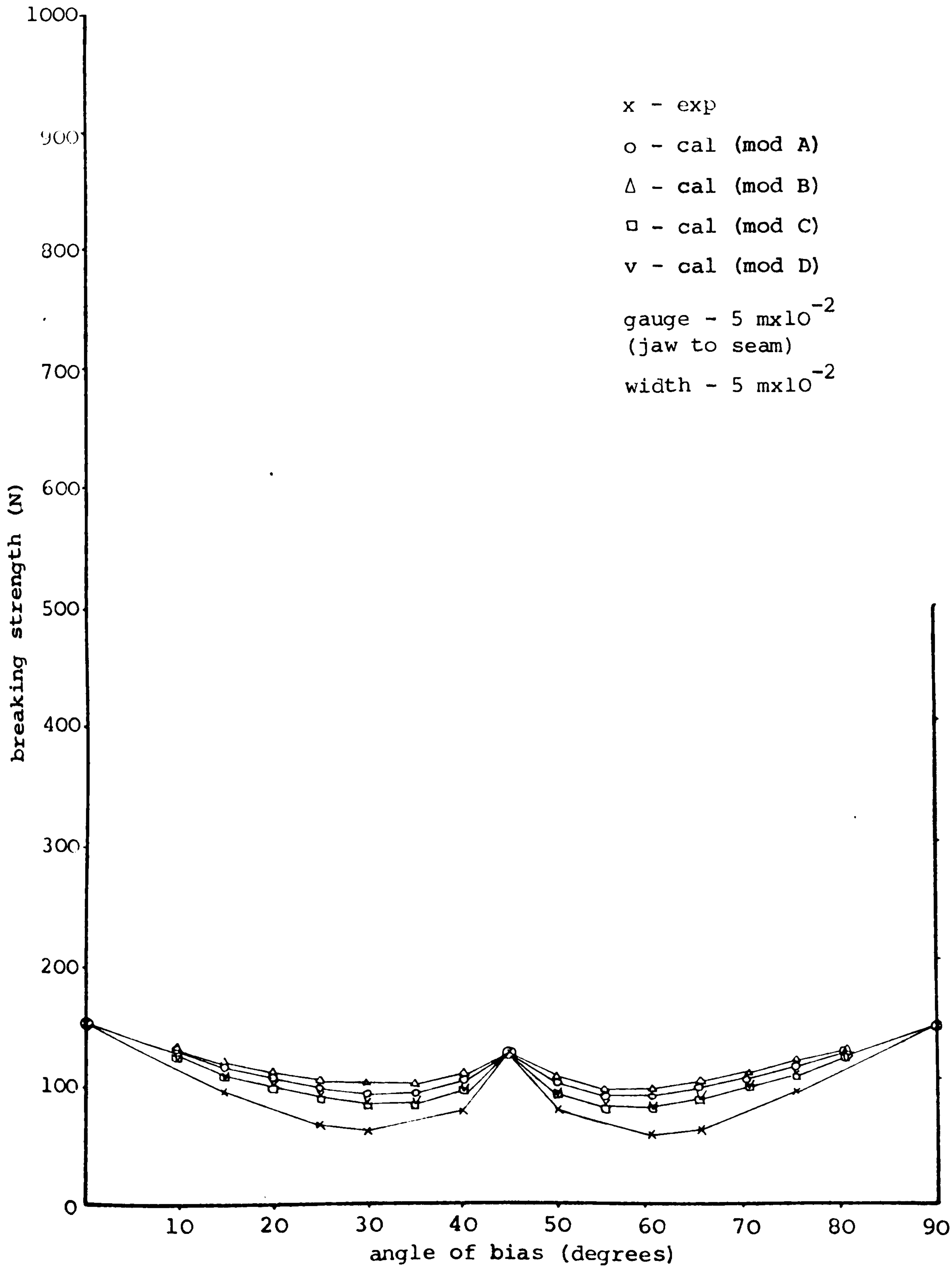


Figure 8.28 The Breaking Strength of the Modified Model and the Experimental Results of Fabric A as a Function of Angle of Bias under the Type I Breaking Condition.

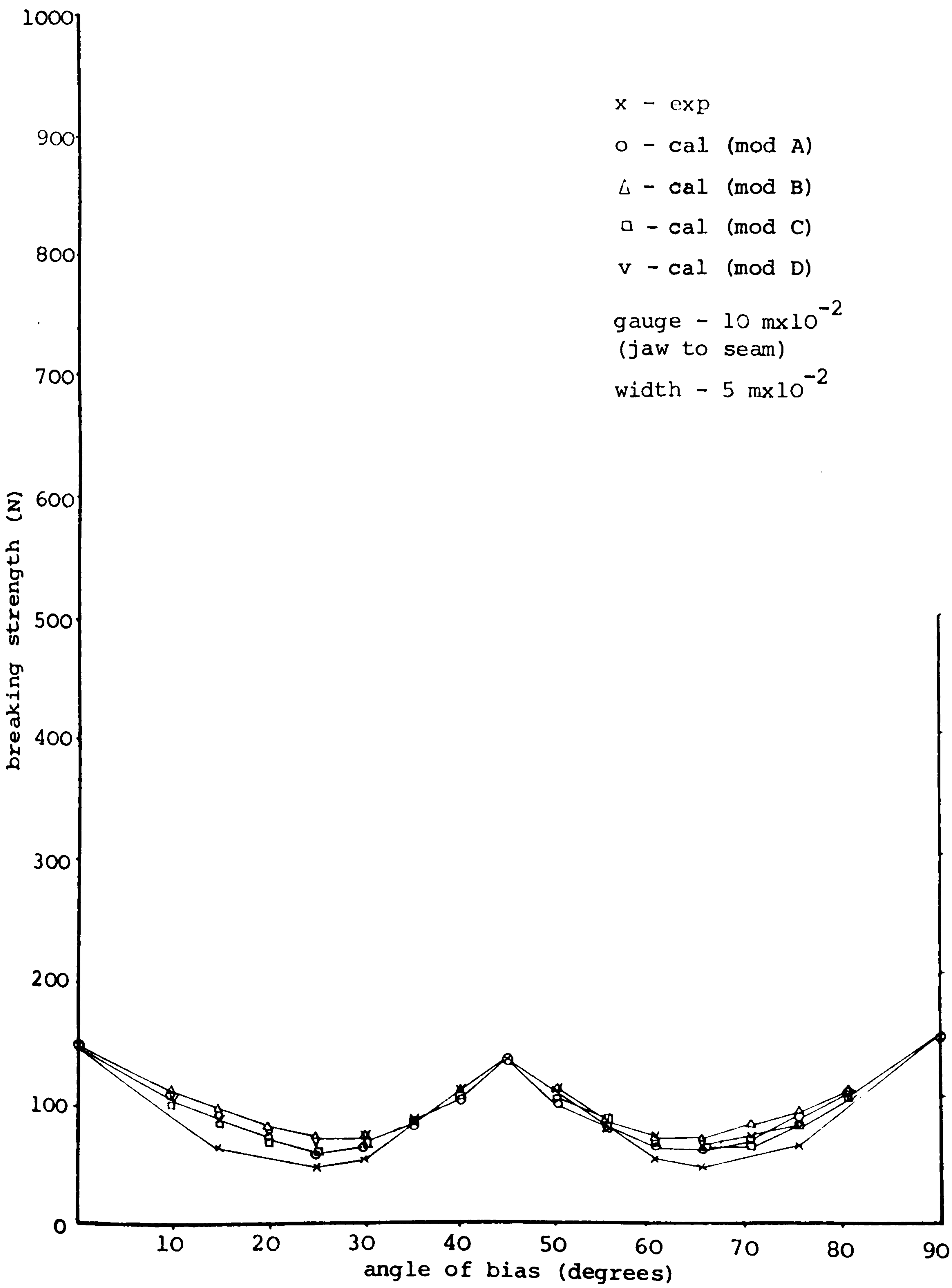


Figure 8.29 The Breaking Strength of the Modified Models and the Experimental Results of Fabric A as a Function of Angle of Bias under the Type I Breaking Condition.

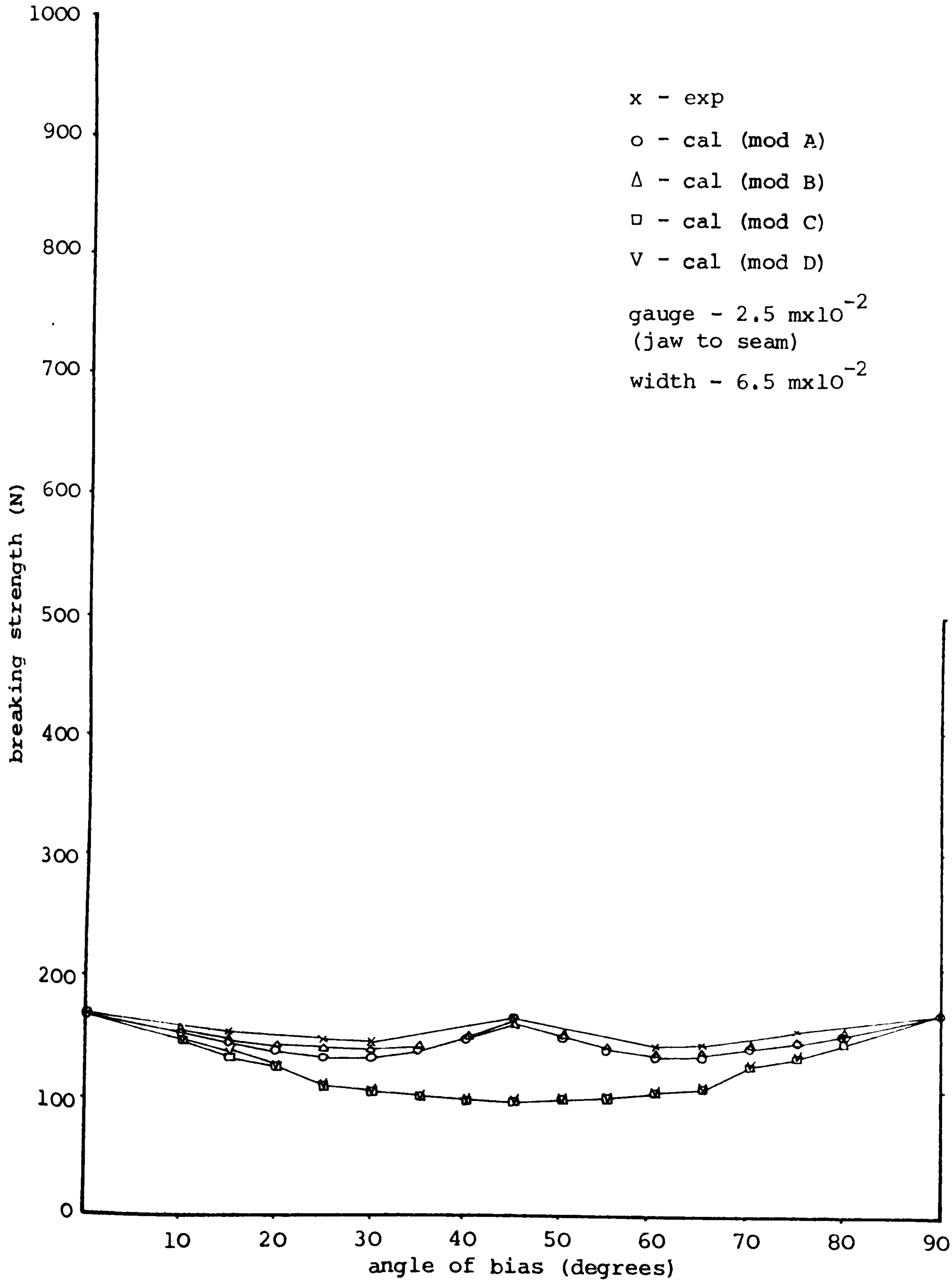


Figure 8.30 The Breaking Strength of the Modified Models and the Experimental Results of Fabric A as a Function of Angle of Bias under the Type I Breaking Condition.

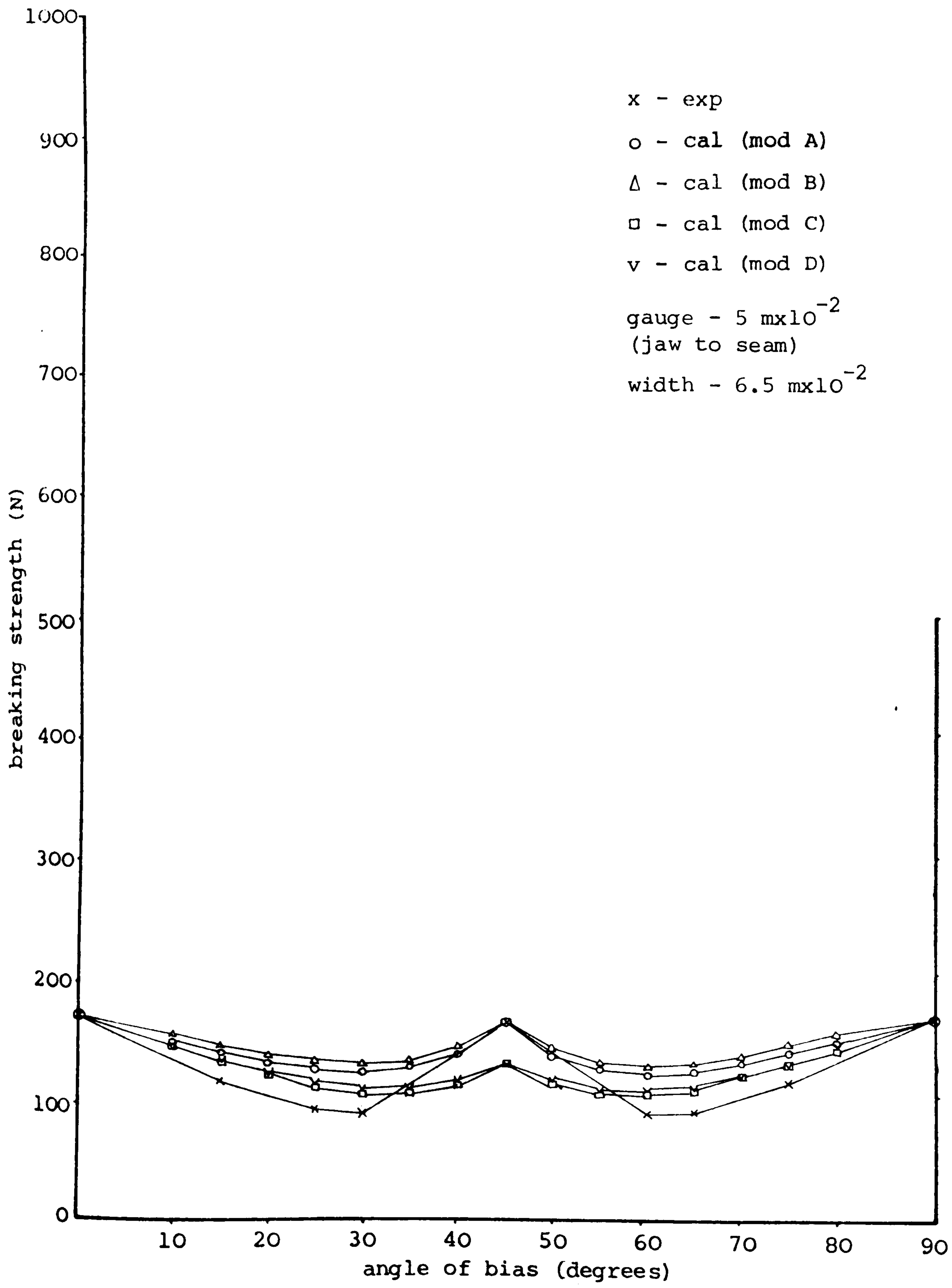
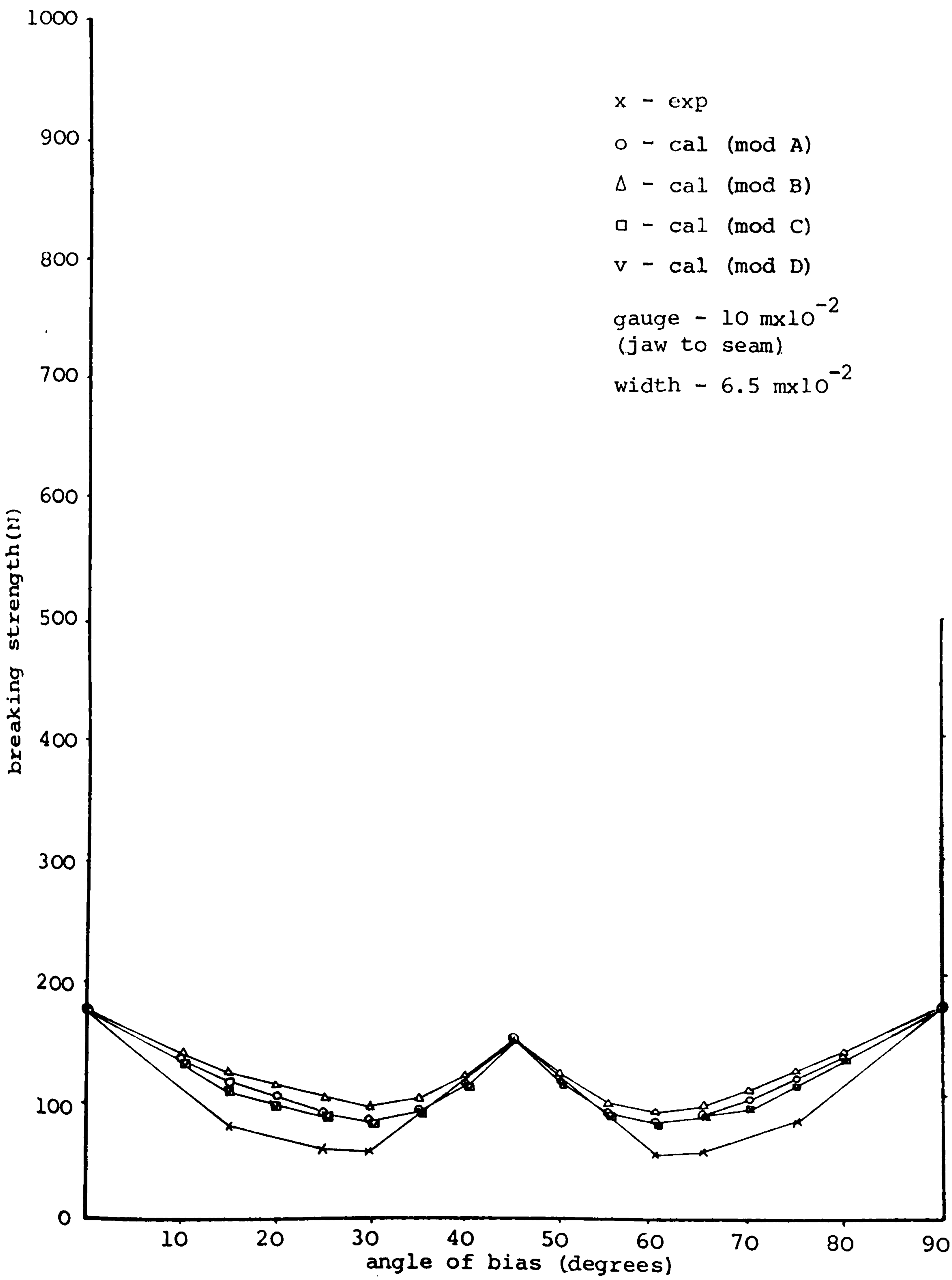


Figure 8.31 The Breaking Strength of the Modified Models and the Experimental Results of Fabric A as a Function of Angle of Bias under the Type I Breaking Condition.



For other fabrics, for which the results are shown in Figures 8.32 to 8.39, because the G/W ratio is unity, modifications C and D show slightly better agreement with the experimental results than do modifications A and B. However, all the modifications give higher strength over the range between 0^0 and the first trough and between 90^0 and the second trough. The explanation of this drawback of the model is that most of the woven fabrics are very flexible. In other words, the structure of woven fabrics would be distorted very easily by stress at an angle, especially at small angles to the warp or to the weft. The yarns in the first zone have a much lower extension at break than the yarns in the second zone, as can be seen by reference to the extension at break results in Chapter 3, therefore, most of the stress will be concentrated in the first zone than the second zone, thus, the strengths are lower at small angles of bias.

8.5 SUMMARY

The modified mathematical model has been shown to give a reasonable agreement for all types of fabric used in the experiments, and under three types of breaking condition. The model provides several agreements with the experimental results, they are as follows:

i) similar strengths at 0^0, 90^0 and the middle peak;

ii) the same movement of the trough when the G/W ratio varies (the angle at the trough moves toward 0^0 (or 90^0) as the G/W ratio increases, and the movement of the trough stops as the G/W ratio rises above two);

iii) 'W' shaped curves even for the two distorted 'W' shaped

Figure 8.32 The Breaking Strength of the Modified Models and the Experimental Results of Fabric B as a Function of Angle of Bias under the Type I Breaking Condition.

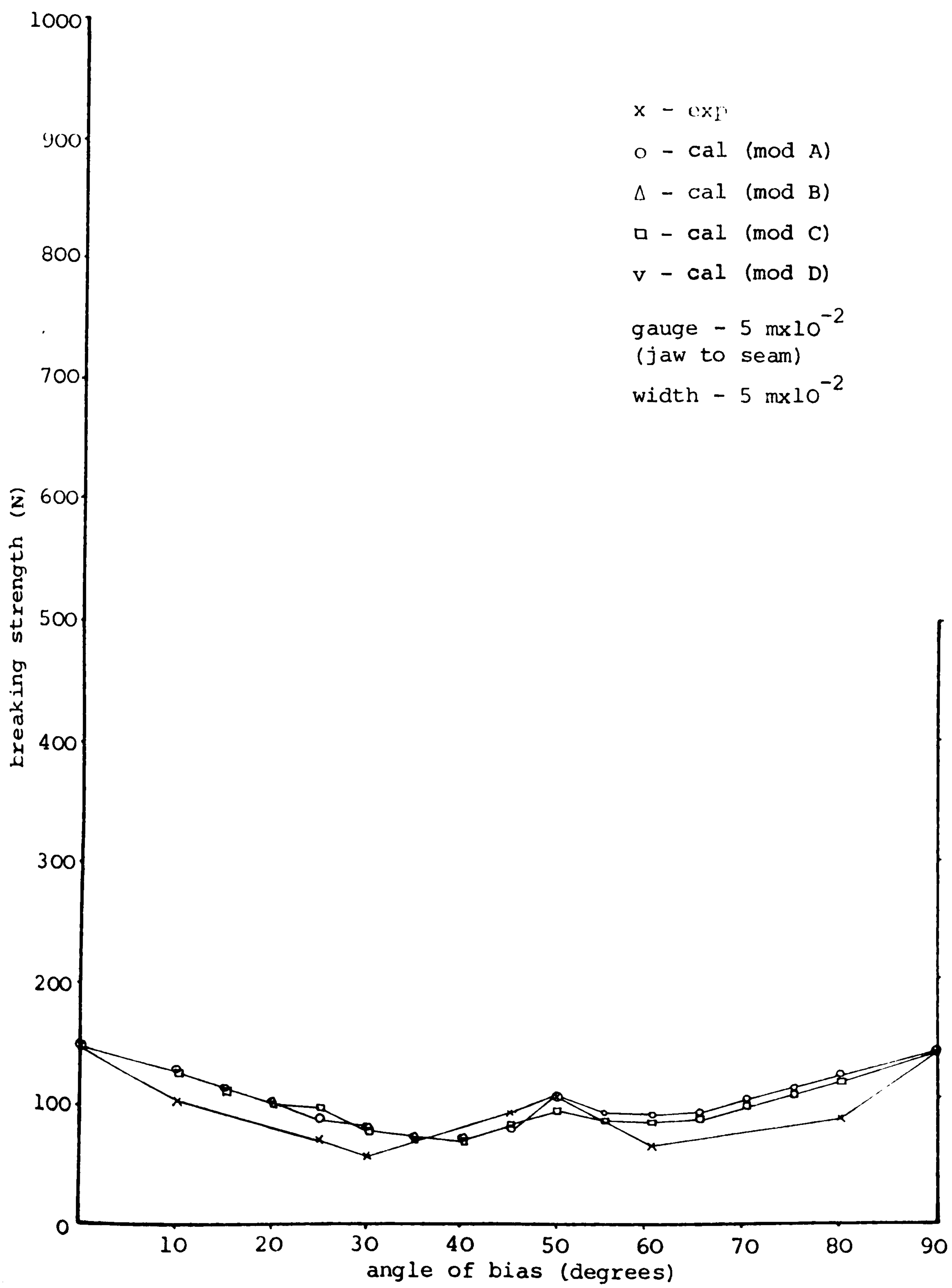


Figure 8.33 The Breaking Strength of the Modified Models and the Experimental Results of Fabric C as a Function of Angle of Bias under the Type I Breaking Condition.

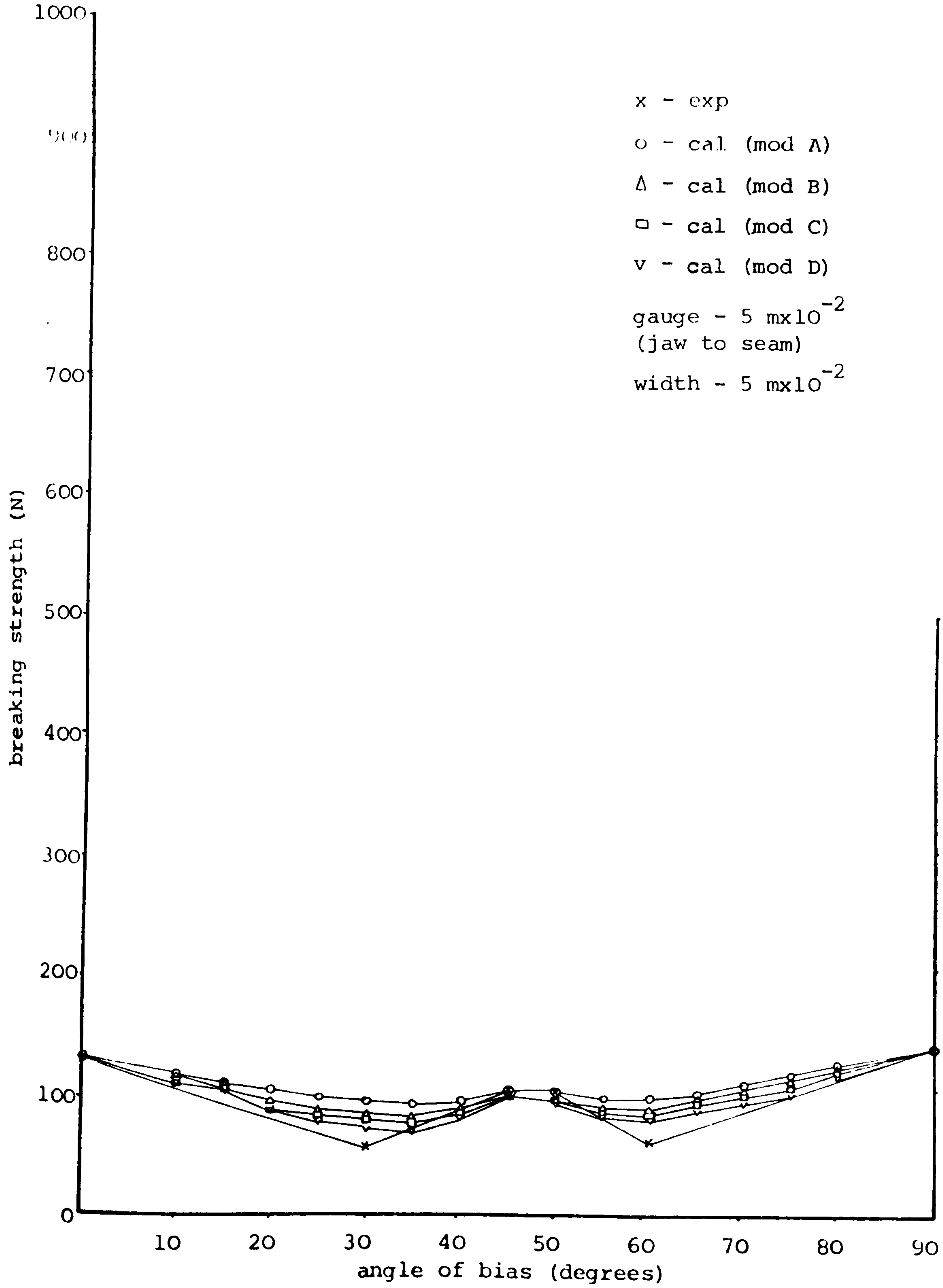


Figure 8.34 The Breaking Strength of the Modified Models and the Experimental Results of Fabric D as a Function of Angle of Bias under the Type I Breaking Condition.

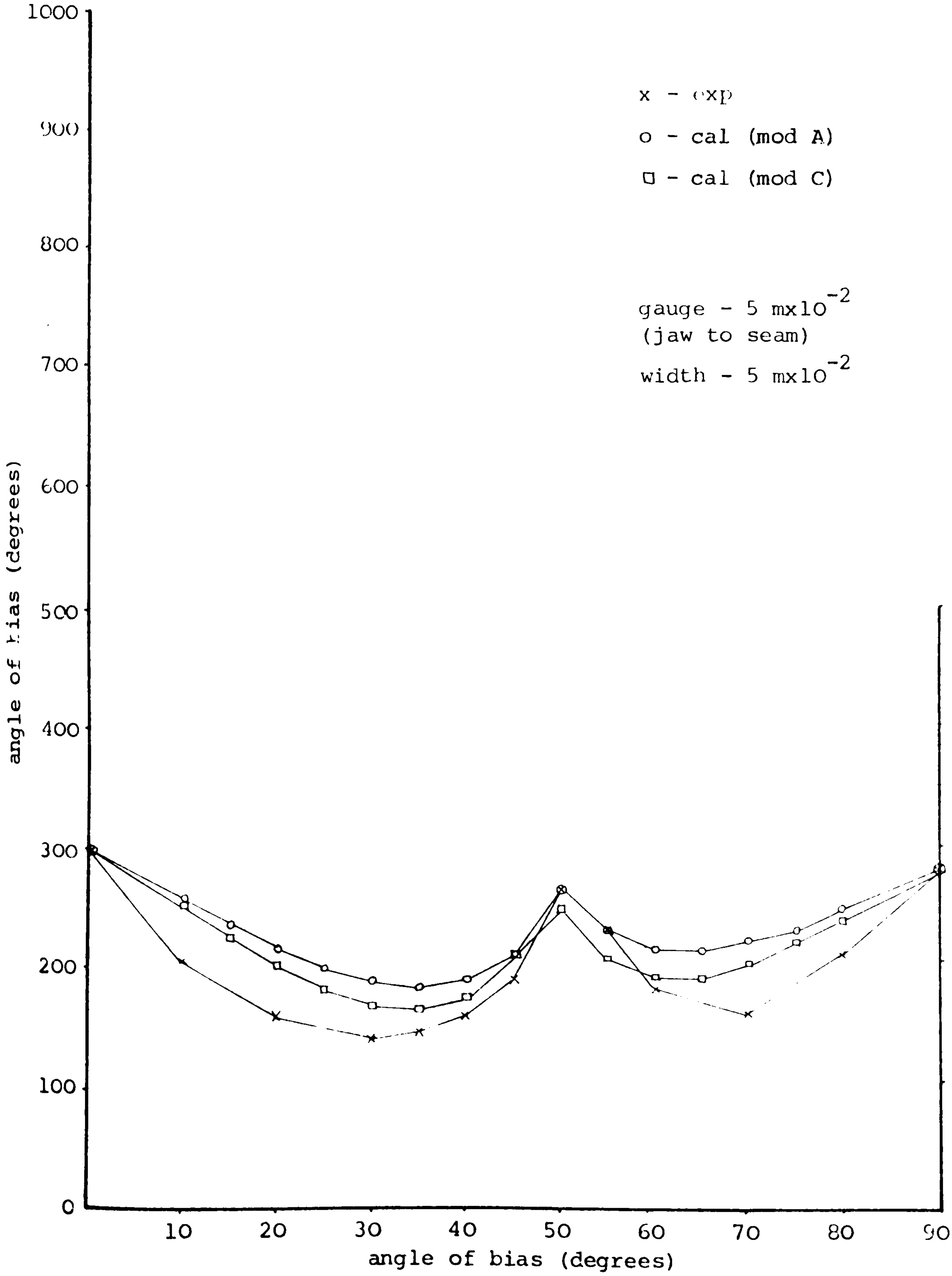


Figure 8.35 The Breaking Strength of the Modified Models and the Experimental Results of Fabric F as a Function of Angle of Bias under the Type I Breaking Condition.

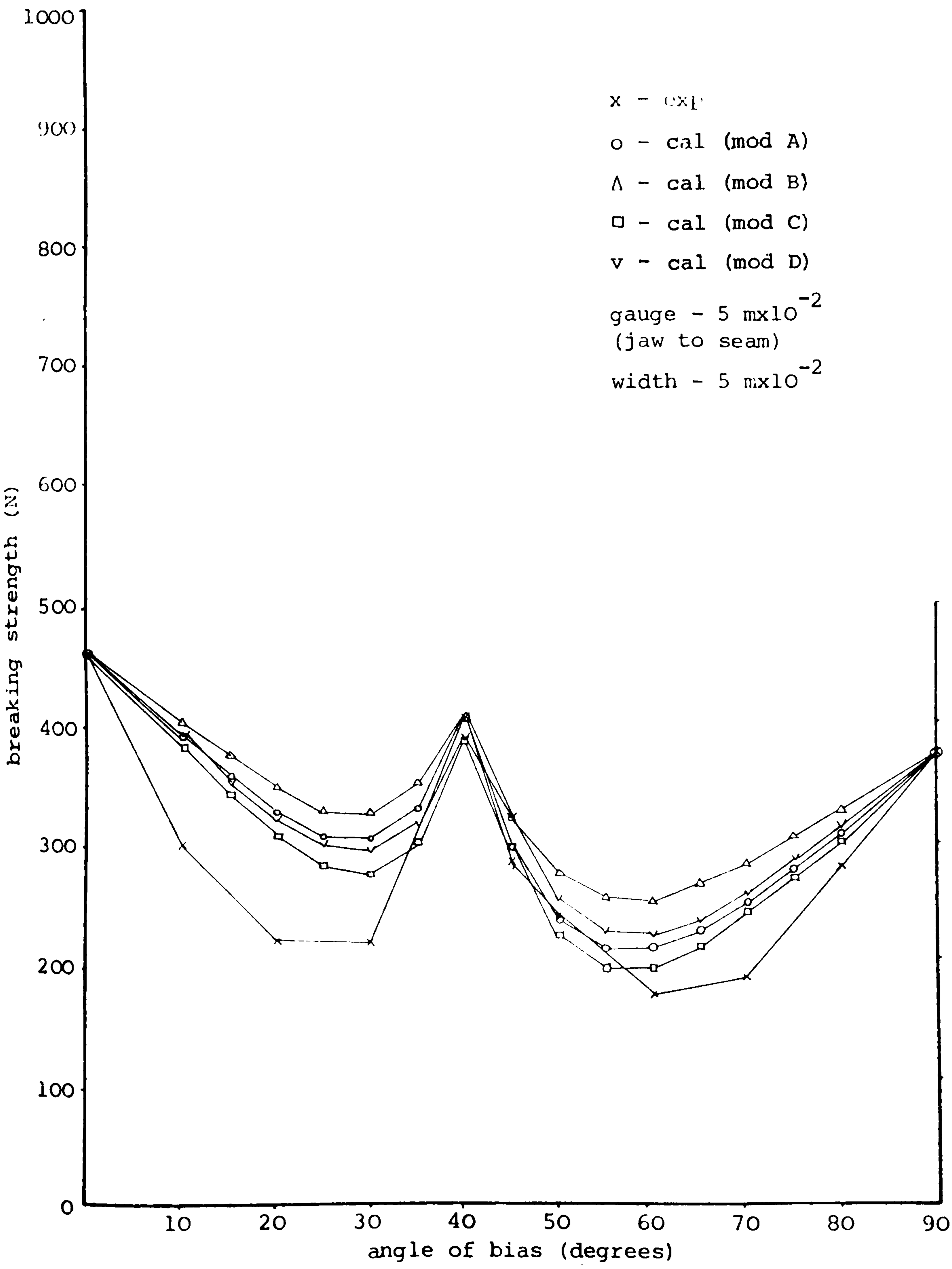


Figure 8.36 The Breaking Strength of the Modified Models and the Experimental Results of Fabric F as a Function of Angle of Bias under the Type I Breaking Conditon.

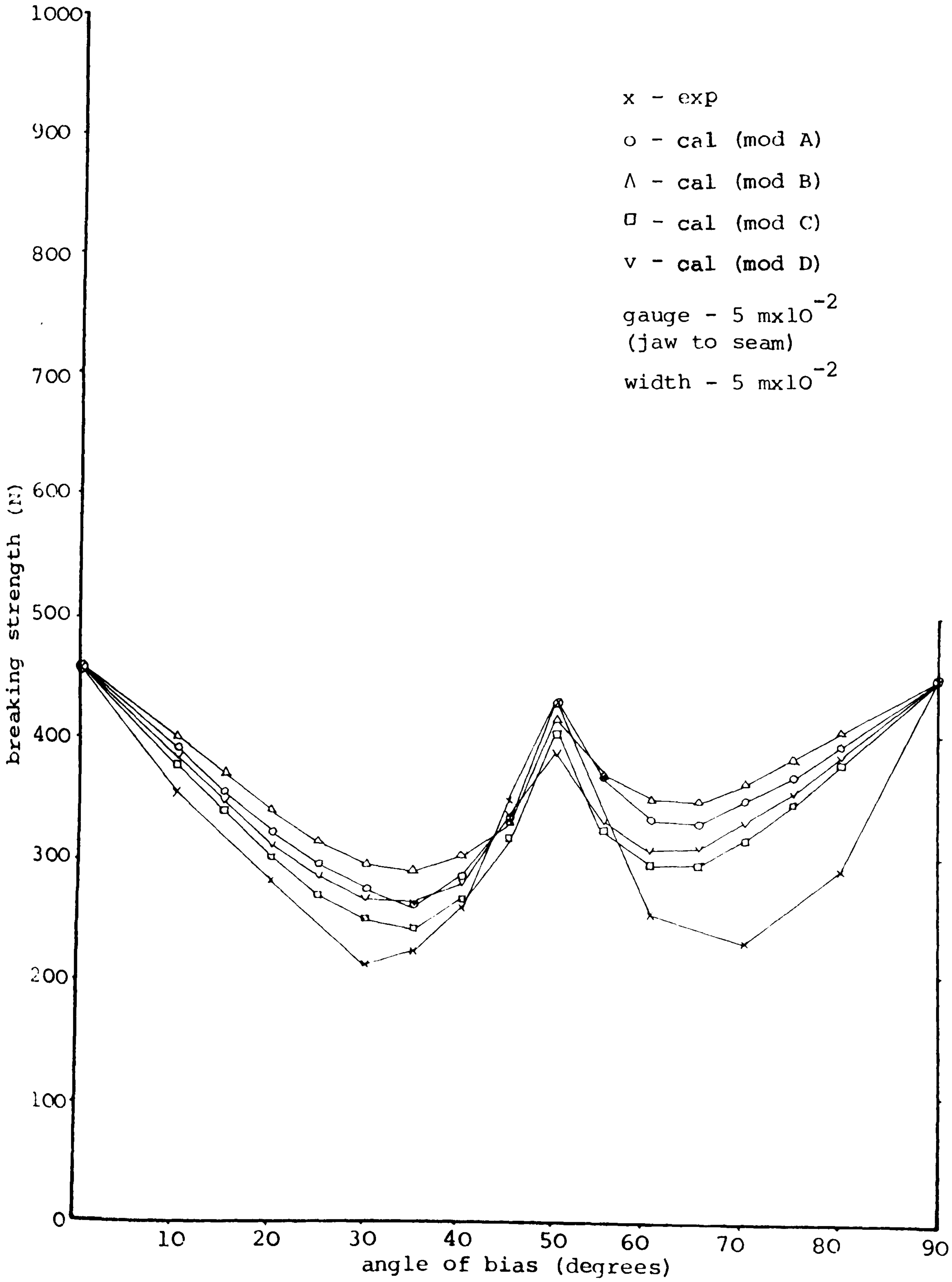


Figure 8.37 The Breaking Strength of the Modified Models and the Experimental Results of Fabric G as a Function of Angle of Bias under the Type I Breaking Condition.

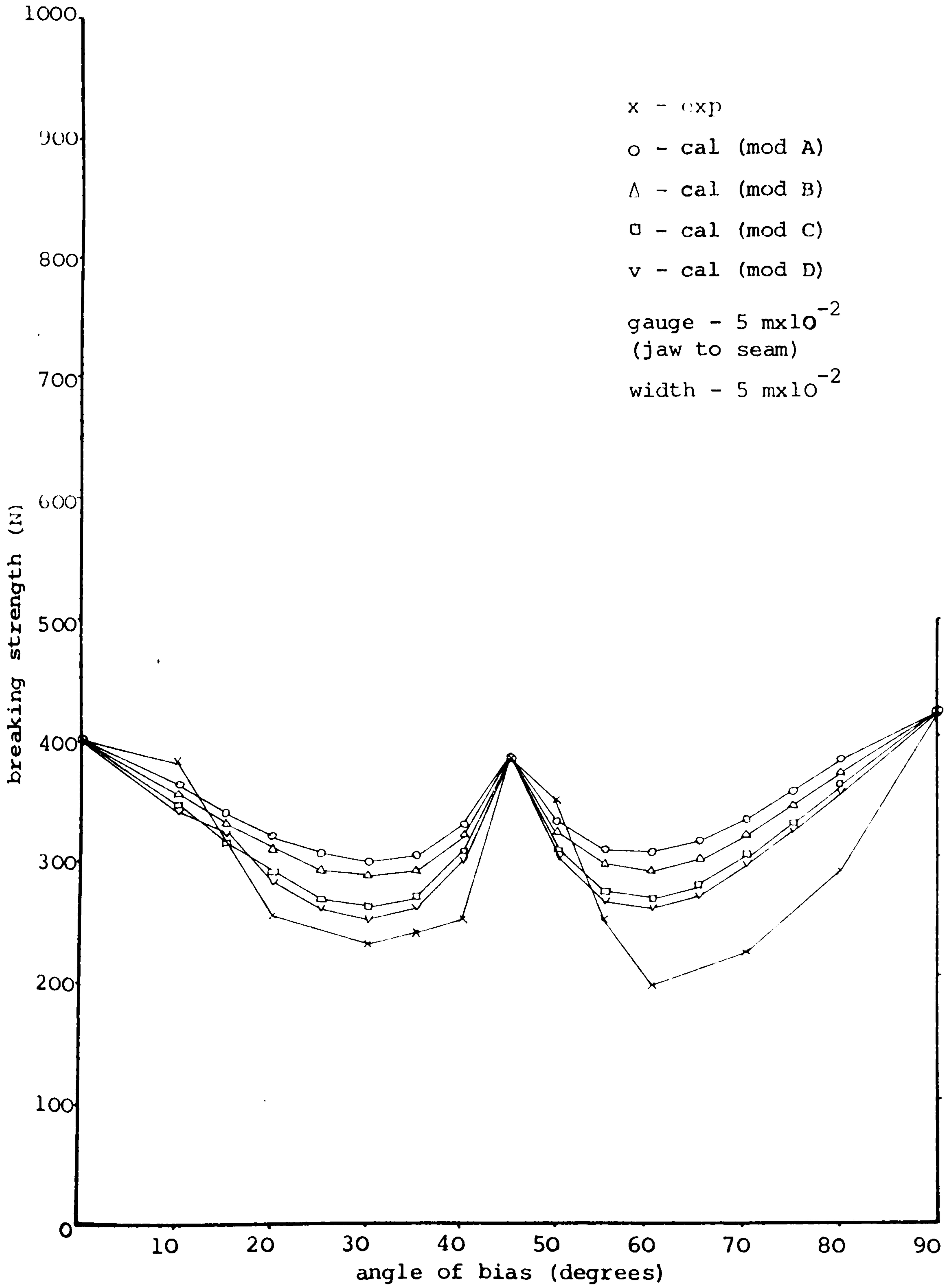


Figure 8.38 The Breaking Strength of the Modified Models and the Experimental Results of Fabric H as a Function of Angle of Bias under the Type I Breaking Condition.

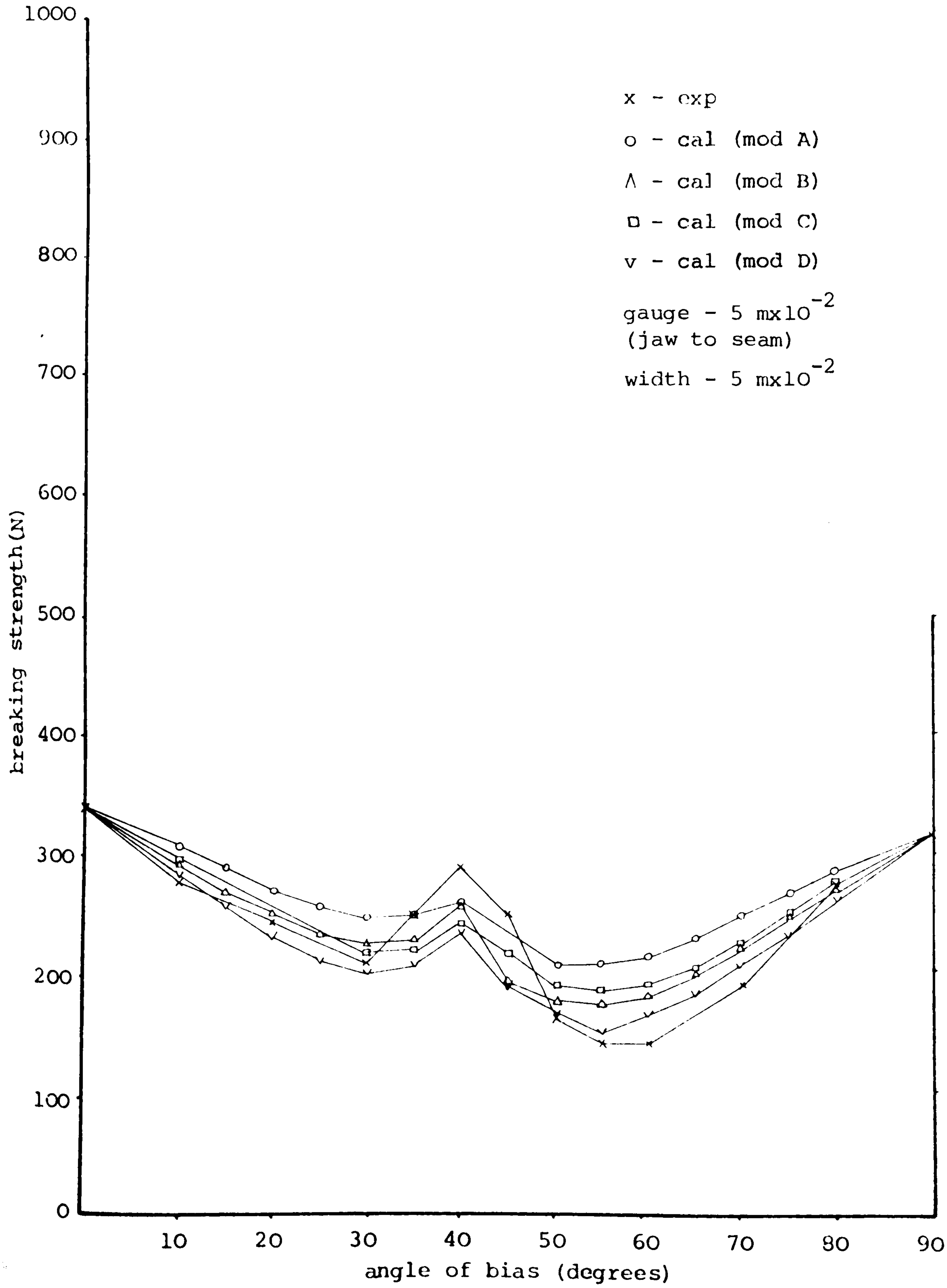
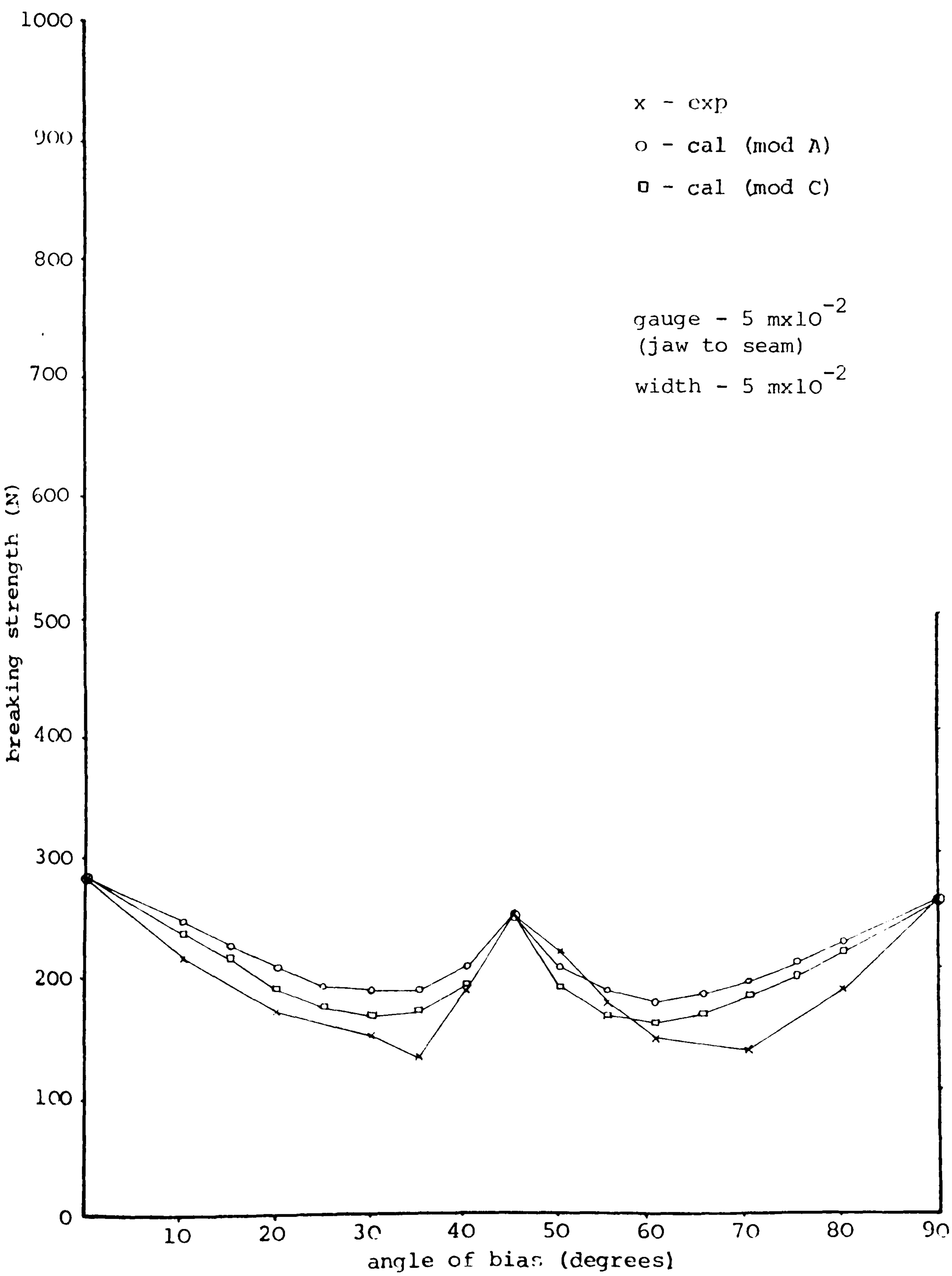


Figure 8.39 The Breaking Strength of the Modified Models and the Experimental Results of Fabric I as a Function of Angle of Bias under the Type I Breaking Condition.



curves under the unseamed breaking condition;

iv) about the same angle at the troughs even though the middle peak is not at 45^{0};

v) the level of strength at the trough increases when the angle of the middle peak moves to its side.

One of the drawbacks of the model is that it gives a higher strength than the experimental results especially at small angles of bias to warp and to weft, and the reason, as explained before, is the flexibility of woven fabrics and the difference between the extension at break of the first zone and second zone.

CHAPTER 9 INDUSTRIAL APPLICATIONS

9.1 THE ANGLE OF BIAS OF SEAMS FOUND IN GARMENTS

There is a large difference between individual garment production and the methods used in bulk manufacture. To produce garments in bulk manufacture one must produce a 'marker', which is a plan of the lay of the garment pattern pieces. This determines the actual length and width of the lay. The height of the lay is determined by the number of garments required and the height of the cutting blade to be used. The lay is prepared by spreading plies of cloth on top of the lay. When the lay has been cut,using the marker as a guide, the garments are separated into workable sized bundles. The production of the garment is broken down into a series of sewing operation with balanced times.

The function of most of the sewn seams is to hold pieces of fabric together, therefore those seams must be strong. Transverse strength, the only type considered in the present work can be increased by using a stronger thread and, within limits, by increasing the stitch rate. However, an ideal and optimum seam, apart from its strength,also demands minimum thickness and economy of sewing thread, otherwise, too high a stitch rate, too thick a sewing thread, seam type and stitch rate will produce an excessively bulky and uneconomical seam.

One of the main physical causes of seam failure in woven garments is transverse stress. Although the seam type, stitch type, thread tension, stitch rate, and sewing thread are controllable factors of seam durability, the angle of bias of the seam (in realtion to the fabric yarns) is believed to have a large influence on the load at which seams fail. This is especially true in such seams, as those at the back of the underarm seam and the central back seam on a pair of trousers.

In consequence a survey was undertaken in which the angles of bias found in seams in some common garments were measured. Five types of garments (shirt, boiler suit, jeans, overalls and trousers) were examined. The results, shown in Figures 9.1-9.5, can be divided into two distinct groups.

i) Little variation in the angle of bias of seams vis à vis the fabric yarn (ie. angles within the range from 0^0 to 10^0 or 80^0 to 90^0). For example, the inseam and outseam of trousers, and the side seam and underarm of shirts.

ii) Large variation in the angle of bias of seams vis à vis the fabric yarn (ie. angles within the range from 0^0 to 90^0). This happens, for example, at the armhole seam of a top, and at the front and back seams of trousers. These areas are generally recognised to be the weakest parts of a garment.

The survey also showed that the wide variation in the angle of bias (ie. where angles between 0^0 to 90^0 can be found (group (ii)) only occurs in a very small proportion of the seams of a whole garment.

The experimental results, obtained from seam strength tests at different angles of bias, show that the angle of bias of the seam affects the seam strength. The greatest effect is at angles of around 20^0 to 35^0 and 55^0 to 70^0 where almost half of the maximum strength is lost; this proves that the seams in the arm-hole or the back of a pair of trousers would be the weakest in the whole garment especially if such

Figure 9.1 The Angle of Bias Found in Two Shirts

Figure 9.1a

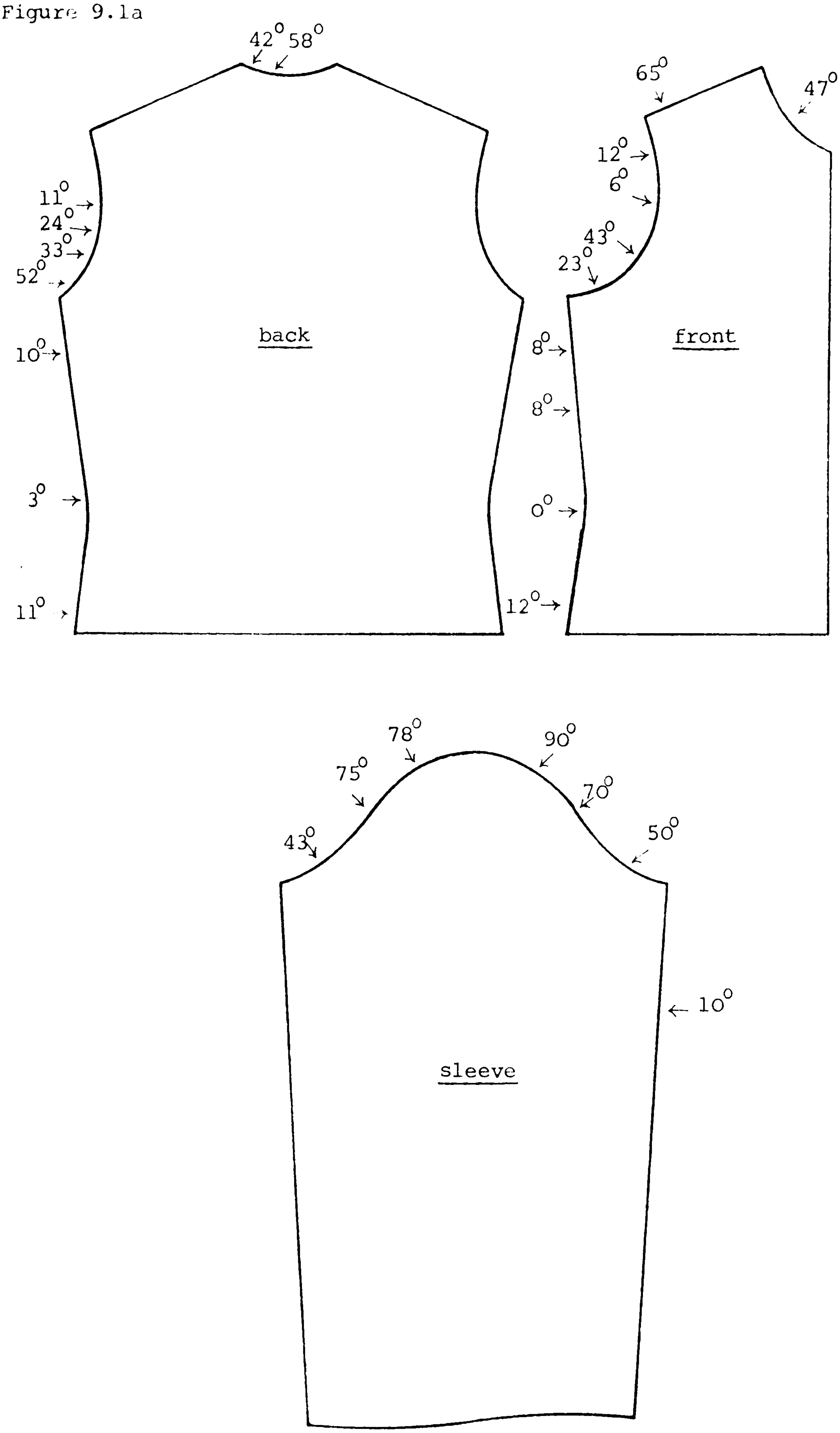
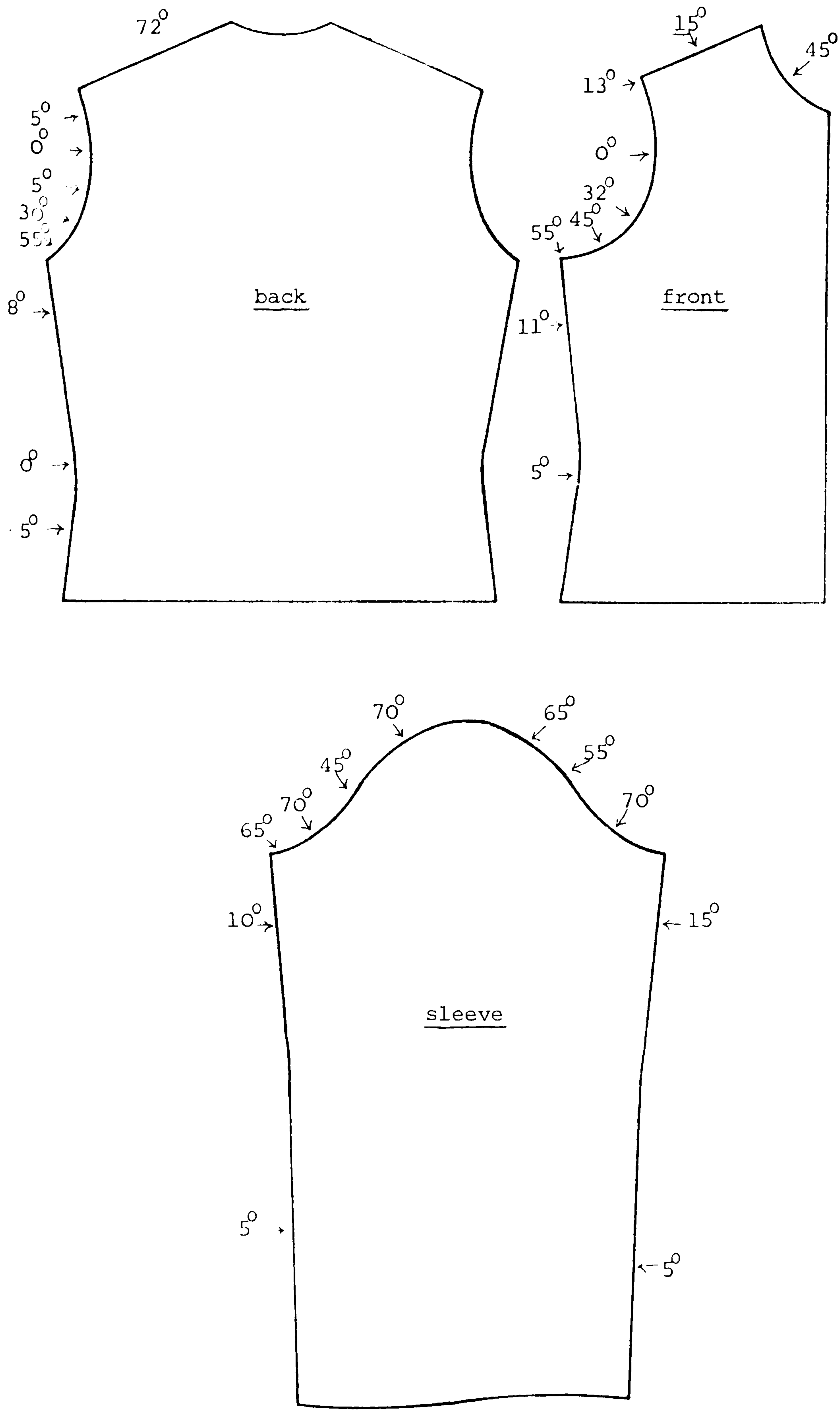


Figure 9.1b



back
front
sleeve
72°
5°
0°
5°
8°
0°
5°
15°
45°
13°
0°
32°
45°
55°
11°
5°
70°
65°
45°
55°
70°
65°
70°
10°
15°
5°
5°

Figure 9.2 The Angles of Bias Found in a Boiler Suit

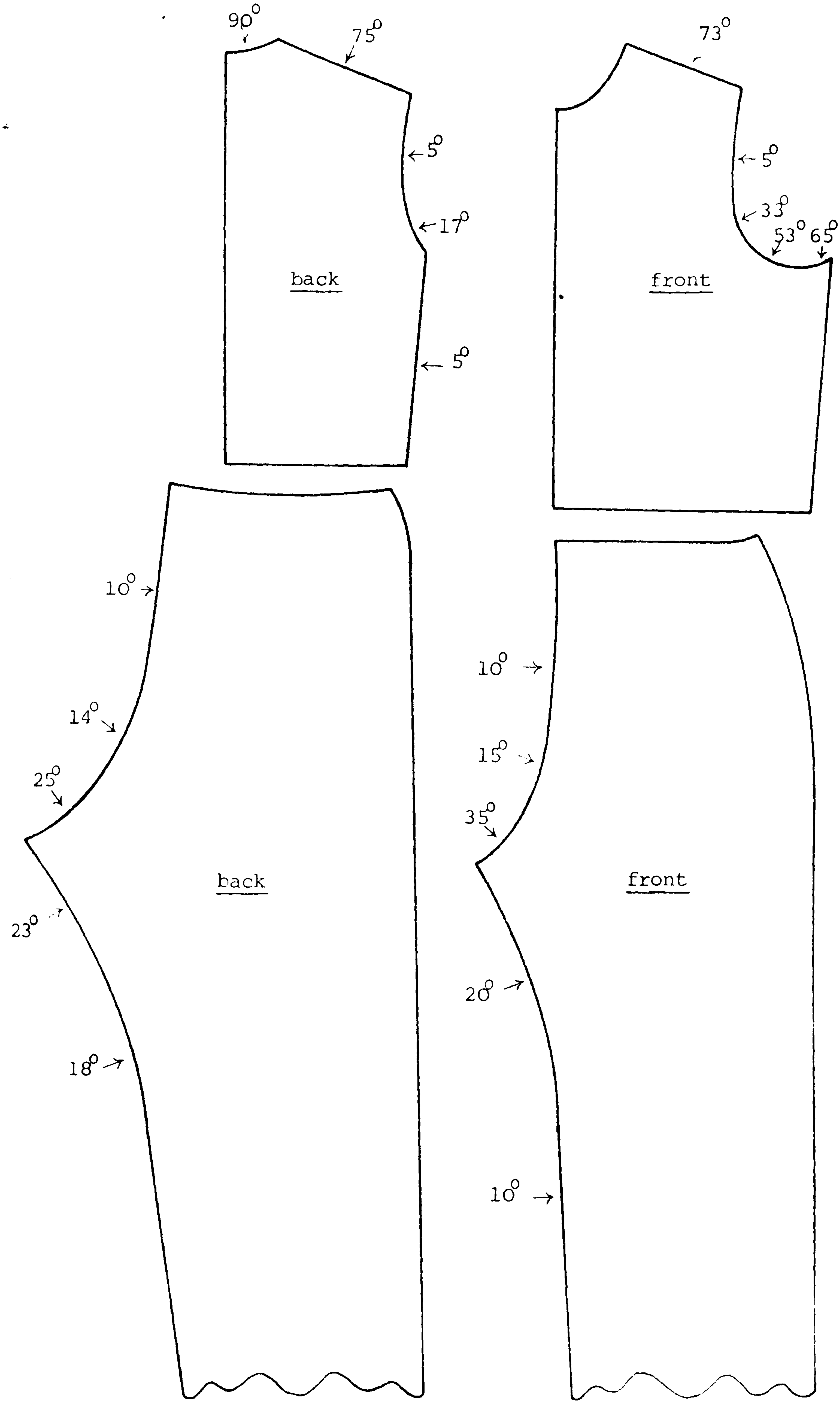


Figure 9.2 (contd)

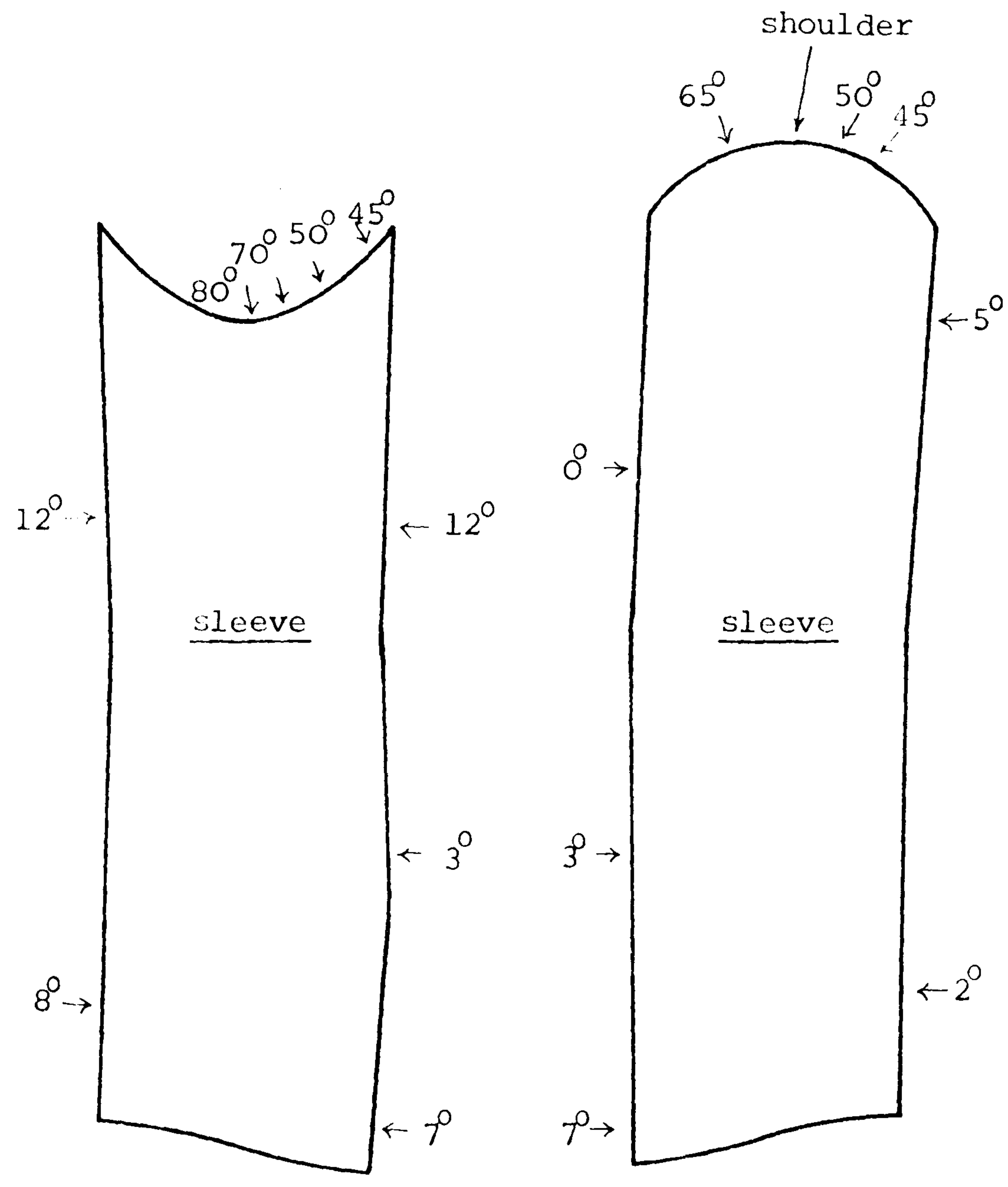


Figure 9.3 The Angles of Bias Found in a Pair of Jeans.

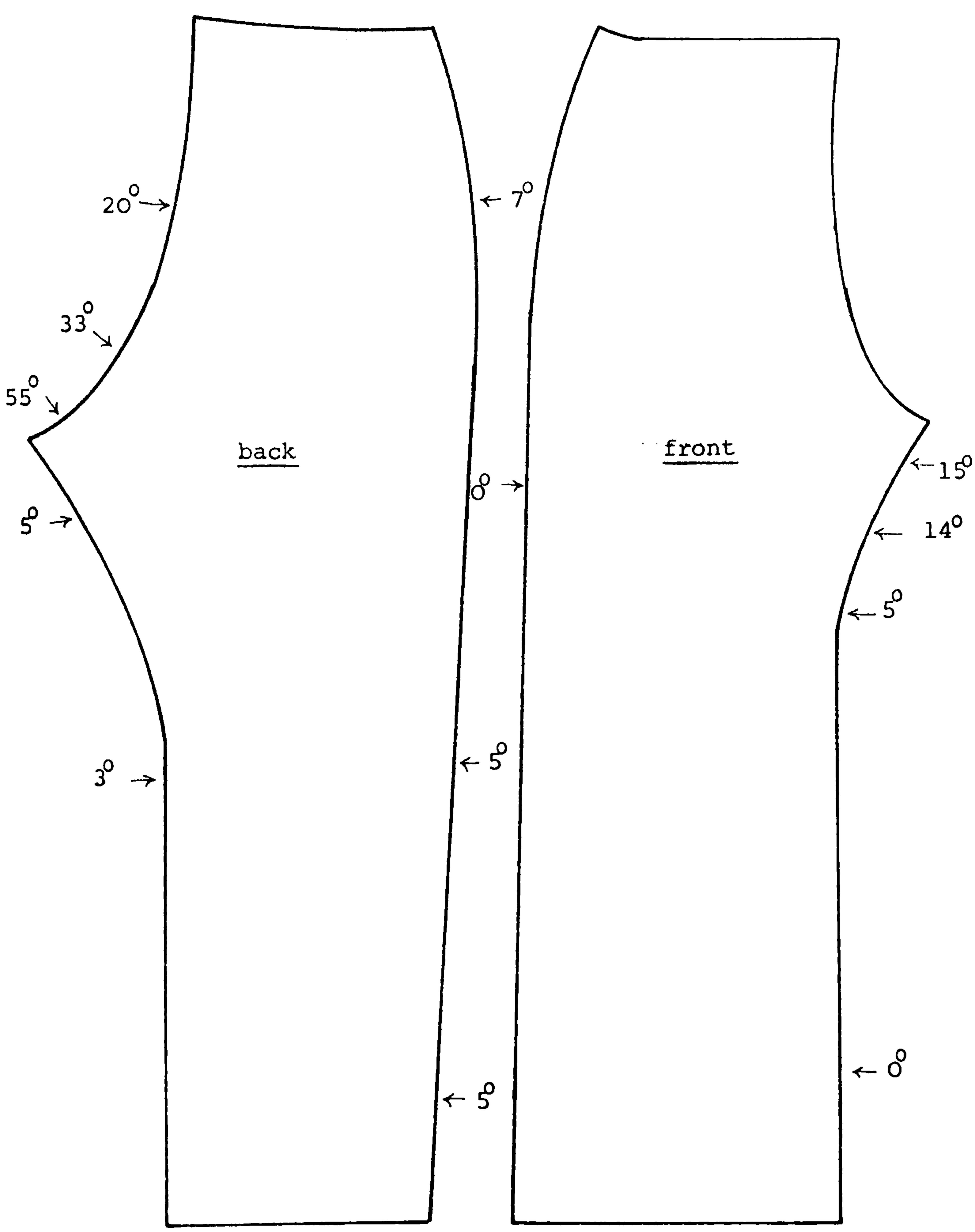


Figure 9.4 The Angles of Bias Found in an Overall.

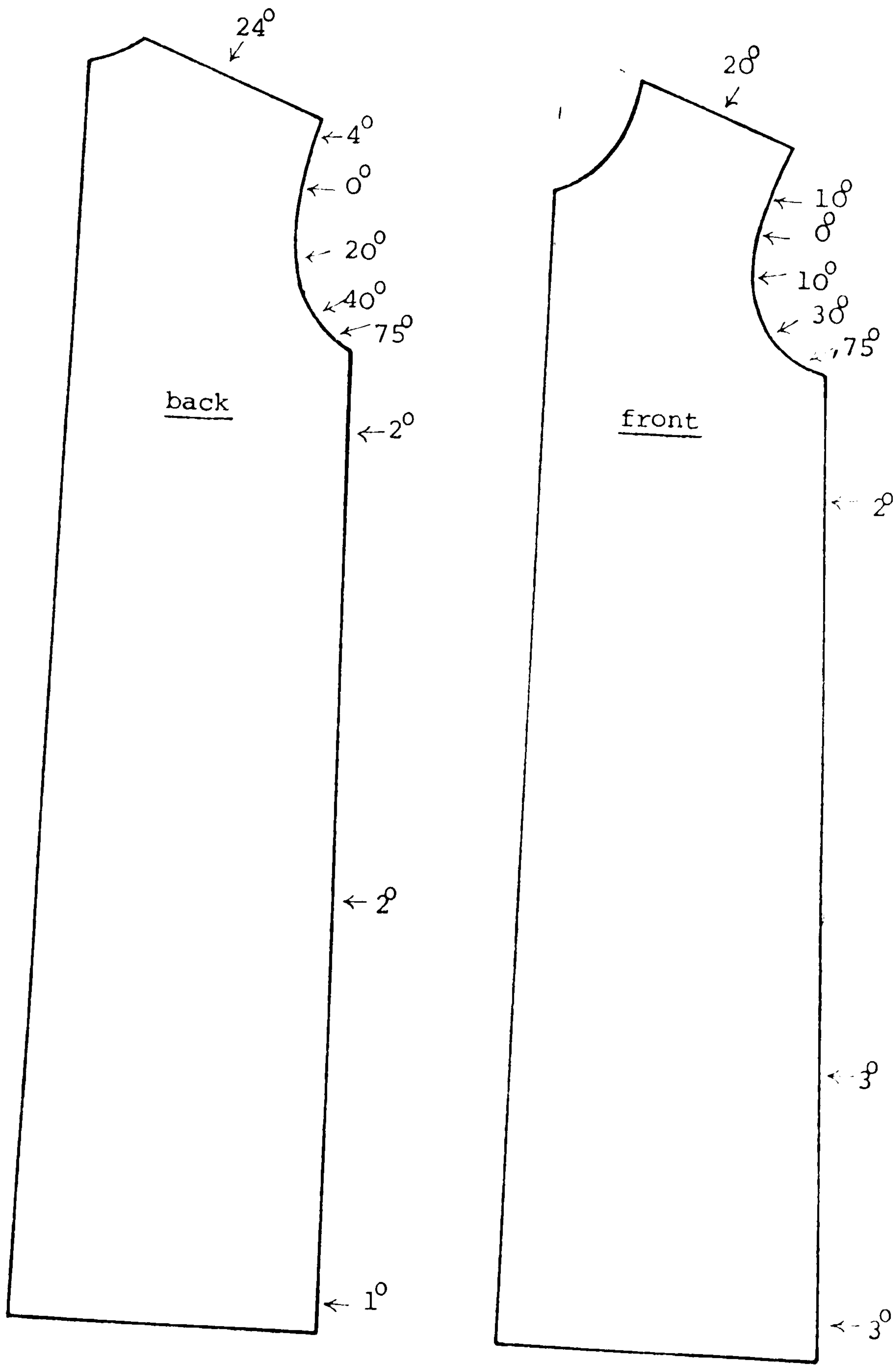


Figure 9.4 (contd)

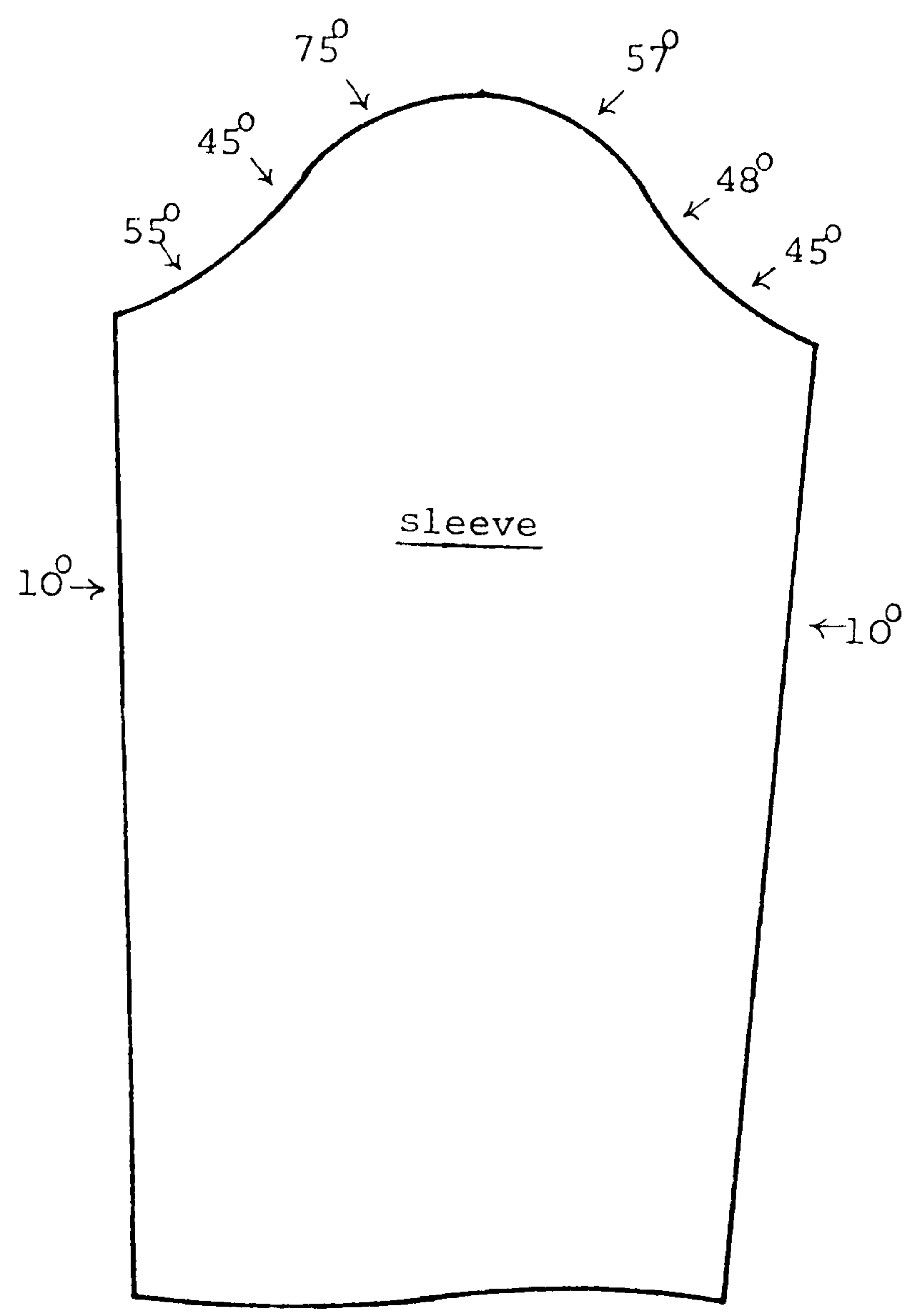
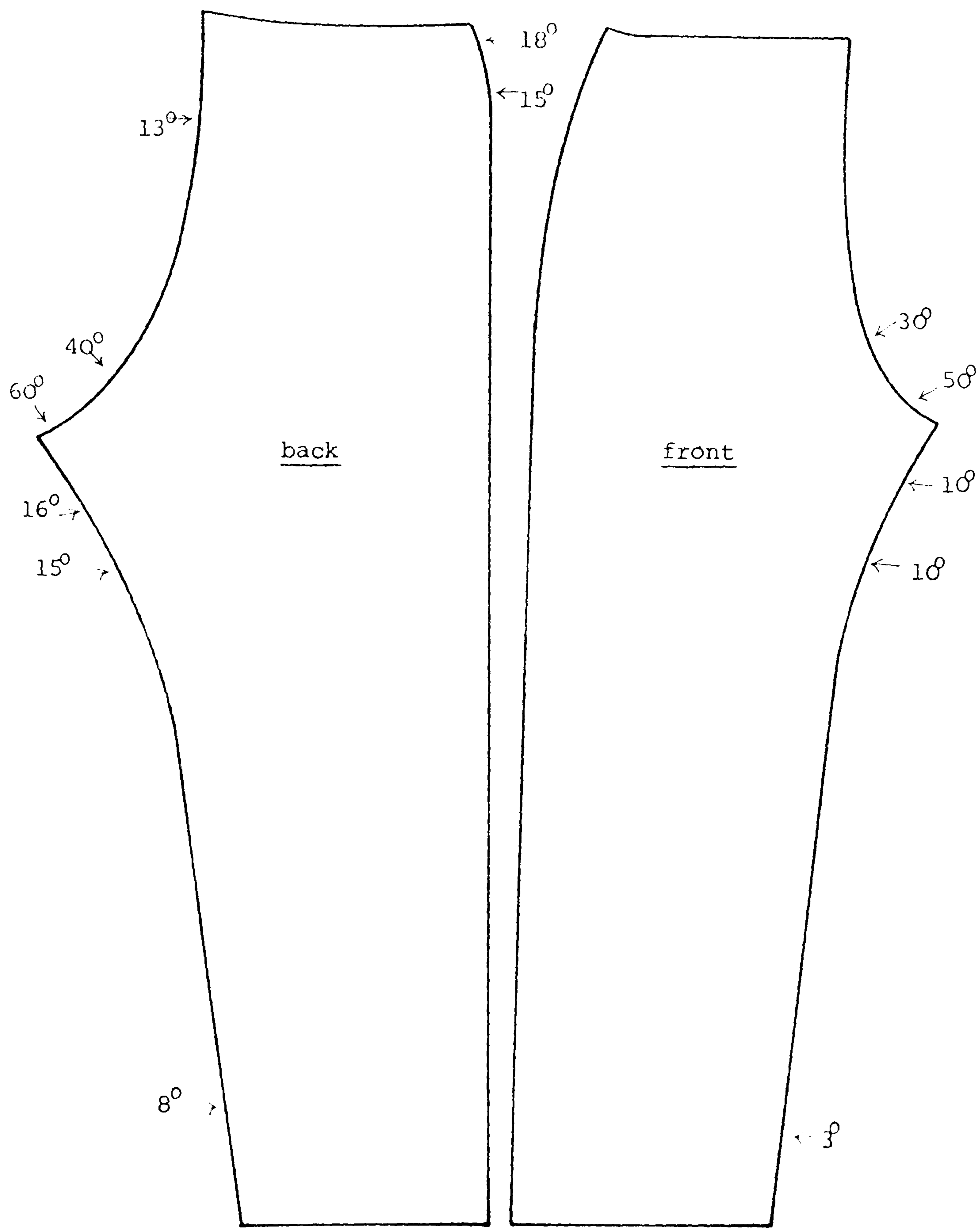


Figure 9.5 The Angles of Bias Found in a Pair of Trousers



seams were sewn with the same thread and the same stitch rate as all the other seams in the garment.

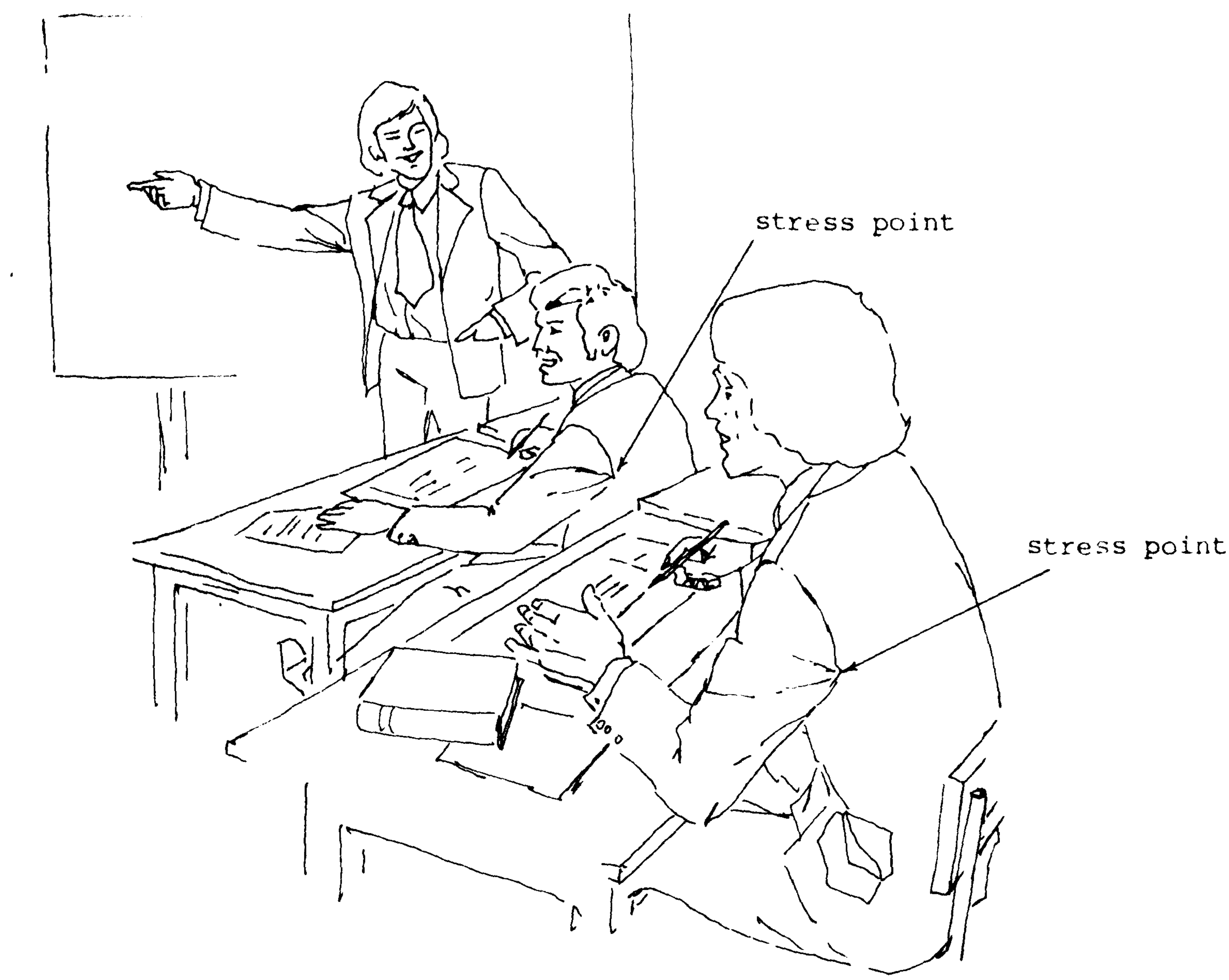
9.2 INDUSTRIAL APPLICATIONS

When designing different types of garment, the point on a garment most likely to be highly stressed (eg. armhole of a shirt) can be discovered by conducting a survey on the functions of the garment.For example, if a shirt is worn by an office worker who is always working at a desk and reaching for things from the desk, as shown in Figure 9.6, the stress point would be a few centimetres up from the armhole on the back of the shirt. It is suggested that the combination of the stress point falling in the weak region of the angle of bias can be avoided by various means. This can be achieved by recutting the garment pieces such that at the stress point the angle of bias of the seam has been moved to 45^{o}, and where a seam would have the second highest strength, and the highest extension at break, as demonstrated in the experimental results. The abvious alternatives to the above are that a str onger sewing thread or different stitch rate could be used.

Fashion is fast changing for cerain areas of clothing, therefore, most manufacturers are more interested in the final shape of the garments than in the potential advantages of avoiding certain weak angles of bias at seams. When problems such as seam strength were discussed with a industrial pattern cutter, his approach was either to change the fabric or to allow for more easing. It was found that a well shaped sleeve, for example, could not be recut to remove the weak angles.

This is not to mean that in the future that those who have both the time

Figure 9.6 The Stress Points on the Armhole Seam of a Jacket While the Wearers are Working at a Desk.



and the expertise could not design some basic models which could be used in such a fluid fashion industry.

Possibly, however, some of the current findings could be incorporated in the design of some workwear, sportswear or even some industrial textiles, such as parachutes or tents. Comfort and functionality are important in workwear and sportswear and it may well be that such attributes could be improved by optimum seam and pattern design.

The fashion element is becoming more important in workwear and sportswear, but this can be added by the use of colour or by small changes in the functional pattern outline (eg. the addition of extra seams for effect).

The present author's findings can also be incorporated in the area of fabric structure. In conventional woven fabric, the strength in the warpway direction is usually greater than in the weft-way direction either because weaker weft is used in order to economize or less picks per unit length are inserted in order to speed up the production.

The survey also showed that the stress in the weft-way direction of garments was considerably higher proportionally when compared with the warp-way direction. In the case of the armhole and side seam and the back seam, inside and outside seams of a pair of trousers, the stress is mainly concentrated on the weft-way direction rather than the warp. There are therefore two possibilities;

a) redesigning the structure of fabrics to suit certain end purposes; and

b) dependent on the base fabric, lay garment pieces across rather than down the length.

A greater understanding of both pattern design and the function of garments is needed before any attempt at redesigning any garment patterns could be made.

A survey of the literature shows that in clothing manufacturing, the raw materials cost about 50% of the total manufacturing cost. The profit margin is generally around 6-10% of the total manufacturing cost.

As can be seen above, a small reduction in consumption of materials could benefit the profit level considerably. Wastage of materials can occur throughout the manufacturing process from the design and development stage right through to garment completion. The only area, which is relevant to the present work, is sewing thread. Sewing thread contributes the second largest element among the material costs, and clothing manufacturers often do not have any standards against which to choose their sewing threads (in terms of tensile strength or extension at break) to match specific fabrics. Few manufacturers have scientific data to match threads to fabrics. This is a service which could help those people faced with so many new fabrics which may exhibit completely different properties compared with commoner fabrics.

The purpose of developing a mathematical model is to use it for predicting seam strength in a more realistic fashion (such as the seam strength around the armhole and the back of a pair of trousers) from a knowledge of a few simple parameters, such as, warp and weft direction strength, fabric sett and sewing thread strength. Such information should be obtainable from the suppliers directly. Using the model and such information, therefore, the manufacturers should be able to optimize the sewing thread and the fabric for producing an optimized garment in the terms of tensile strength and extension at break.

Recently, some of the clothing industries are using another approach to the problem of stress on seams of garments. A new material, called 'Lycra' elastane and developed by Du Pont, is used to blend using about 2% by weight with the original material. It provides enough elasticity for at least 25 percent stretch and complete recovery in the finished garment. In other words, stress on the seam will be reduced by about 25 percent. The percentage of stretch, which has been revealed by the Du Pont anatomical research, is the true 'stretch comfort' in clothing.

Because of the small percentage of Lycra in the clothing, there is no difference at all in appearance. It can only be experienced in wear.

Lycra has been used on many fabric bases; such as plains, flannels and tweeds in wool or polyester/wool; corduroy and indigo blue denim; flat woven cottons and linens.

9.3 SUMMARY

From the survey and the experimental results, the angle of bias effect has been revealed to be one of the important factors of seam strength.

Some scopes for industrial application have been suggested, they are as follows:

i) alter the garment patterns in order to move the weakest angles away from the most stressful part on a garment, but in the fast fashion world, there is that little can be done, except in the areas of workwear, sportswear and industrial textiles;

ii) using stronger sewing thread, higher stitch rate or stronger seam, but again, this would create problems in the appearance of garments;

iii) redesign the fabric structure to give the correct strength in garment (ie. give more strength in the weftway direction of shirting where the stress is most concentrated);

iv) dependent on the base fabric, lay garment pieces across rather than down the length; and

v) new materials, such as 'Lycra', could be used in the base fabric in order to give more stretch in the fabric, in other words, to release the stress in the seams in garments.

A greater understanding of both pattern design and the function of garments (such as motion study) is needed before attempts can be made on any of the above suggestions.

The mathematical model for predicting sample strength can be used as a tool in any of these suggestions, and also for clothing designers to know what the precise durability of the seams in their garments will be.

CHAPTER 10. CONCLUSIONS

10.1 SUMMARY OF EXPERIMENTAL AND THEORETICAL STUDIES

In order to provide a greater understanding of the effect of angle of bias on sample strength, nine woven fabrics, covering a wide range of fabric types from very loose structures, such as bandage fabric to very tight and complex structures, such as heavy drill fabric, were investigated under three types of breaking condition: unseamed fabric breaks; Type II breaks in which the fabric breaks without damage on the sewing thread and; Type I breaks in which the sewing thread breaks without damage to the fabric.

Gauge length effects and width effects were investigated only on Fabric A because Fabric A, a square-sett plain-weave fabric producing a mirror image of the angle of bias effect demonstrated by Gardner[19 20], thus avoids the interaction between the structure of fabric and the gauge length and width effect.

The strength results show a very marked angle of bias effect which means strength reduction between the angles of 0^{o} and 90^{o} and the middle peak especially for strong fabrics. The unseamed fabric strength has the highest overall strength level, and the Type II is the second highest.

Gauge length and width effects have been observed; the angle of bias effect reduces as the G/W ratio reduces(with no angle of bias effect when the G/W ratio is less than one half), and no gauge length effect on the angle of bias effect when the G/W ratio is greater than about two (the strength remains constant at the same angle when the gauge length increases and, of course, the width remains constant). The trough moves towards 0^{0} (or 90^{0}) as the G/W ratio increases, and the movement of the trough stops as the G/W ratio moves above two.

'W' shaped curves have occurred in the results, but not uniform 'W' shaped curves on non-square-sett fabrics, especially the two distorted 'W' shaped curves of Fabrics E and G under the unseamed fabric breaking conditions. An increase in the level of strength at the trough has been noticed as the angle of the middle peak moves to its side.

In the light of the observations made from the experimental breaking strength results and a careful examination of Gardner's model for predicting sample strength, another appropriate approach was undertaken to develop a model (physical and mathematical) only for square-sett plain-weave fabric at the first stage.

The model is divided into two strength contribution zones:

i) first zone - the strength is proportional to the number of yarns (or unit length = number of yarns / number of yarns per unit length) gripped by both ends (jaw to jaw for unseamed sample and jaw to seam for seamed sample); and

ii) second zone - the strength is proportional to the number of yarns gripped by one end only.

In order to predict the sample strength, the two zones have to be multiplied by a parameter 'K_{θ}' (strength (N) per unit length) which has to be found by performing strength tests at each angle of each fabric with different gauge lengths in order to eliminate one of the zones.

The calculated strengths from the model were compared with the experimental strength of Fabric A and they showed an encouraging agreement. The model has explained all those observations on the strength results of Fabric A made in Chapter 3.

Then further modifications of the model were needed in order to extend the application to non-square-sett fabric whereby the value of K_θ could be predicted from a theoretical or empirical model by knowing the peak angle and the peak strength therefore time-consuming strength tests would not be necessary; and some part of the second zone, which is overlapped with the experimental results.

For the application to non-square-sett fabrics, a term

$\lambda = \frac{K_0}{K_{90}} = \frac{K_{\theta warp}}{K_{\theta weft}}$ was introduced into the equation of the model.

For the prediction of K_θ, the equations

$$SK_\theta = \frac{Sp}{1 + \left|\frac{\theta - \theta p}{\theta p}\right|^A}$$

then $$K_\theta = \frac{SK_\theta}{\text{test width } (\cos\theta + \frac{\sin\theta}{\lambda})}$$

have been used for the predictions. The important parameter 'A' of the equation can be found by feeding sets of experimental strength results of the second zone at different angles of bias into the curves fitted by the method of Least Squares. The parameter

'A', for different fabrics and break types, was tabulated in Table 7.1, and a constant 'A' was suggested for each type of break ; with values of A = 1 for unseamed breaks; A = 1.65 for Type II breaks; and A = 2 for Type I breaks.

In order to remove some part of the second zone, the length of (DF + EF) instead of (DH + HC) was considered as the second zone (q.v. Figure 4.4) when only one first zone exists or the length of (IJ + EJ) instead of (DF + CI) (q.v. Figure 5.1) was considered as the second zone when two first zones exist (first zone of warp and first zone of weft).

Four sets of calculated data from four modifications (A, B, C and D) of the model were plotted in the same figures together with the experimental results in order to obtain precise comparisons between them.

Of course, 'λ' is included in those four modifications. The modifications are as follows:

i) modification A - including the parameter 'A';

ii) modification B - including the constant 'A';

iii) modification C - including the parameter 'A'; and the removal of some part of the second zone; and

iv) modification D - including the constant 'A' and the removal of some part of the second zone.

Although the results of the modified model do not show the same good agreement of higher strength around the trough as the basic model, the modified model does give a similar trend to that of the experimental results. The modified model has illustrated several agreements with the experimental results, they are as follows:

i) the same strength at 0^0,90^0 and the middle peak;

ii) the same movement of the trough when the G/W ratio varies (the angle at the trough moves toward 0^0 (or 90^0) as the G/W ratio increases, and the movement of the trough stops as the G/W ratio increases above two);

iii) the same 'W' shaped curves, even the two distorted 'W' shaped curves under the unseamed breaking condition;

iv) approximately similar angles of the troughs even the middle peak is not 45^0; and

v) the same increase in the level strength at the trough when the angle of the middle peak moves to its side.

10.2 INDUSTRIAL APPLICATIONS

A survey of the angle of bias in commonly used garments such as shirts, boiler suits, jeans, overalls and trousers, was undertaken. The results can be divided into two groups:

i) little variation was found in the angle of seams vis à vis the fabric yarn, (ie. angles within the range from 0^0 to 10^0 or 80^0 to 90^0), in, for example, the inseam and outseam of trousers, and the side seam and underseam of shirt; and

ii) large variation in the angle of seams vis à vis the fabric yarn (ie. angles within the range from 0^0 to 90^0) which happens, for example, at the armhole seam of a top and at the front and back seams of trousers.

The areas of a garment where the second group existed are generally be the weakest parts of a garment, therefore, the experimental results for the angle of bias effect in the present work have been proved to be one of the important factors causing weaknesses in parts of a garment.

The mathematical model for predicting sample strength which was developed to enable the clothing designers to determine the seam strengths on their garments from a knowledge of a few parameters. Some scope for industrial application then exists as a result of such an analysis; for example:

i) alter the garment patterns to move the weakest point away from the most stressed point of a seam of garments;

ii) use stronger sewing thread, or change the stitches per unit length of seams on those weak parts of garments;

iii) alter the fabric structure in cooperation with stress distribution on a garment in order to give the correct strength (ie. for example, higher strength in the weft-way direction for shirting where the stress is most concentrated);

iv) dependent on the base fabric lay garment pieces (patterns) across rather than down the length; or

v) use alternative materials for the fabric or sewing thread (ie. a new material ("Lycra" elastane) developed by Du Pont can give twenty-five percent stretch and complete recovery in the finished garment by blending only two percent by weight of Lycra with the original material.

However, due to the time limitation in the present project, greater understanding of both pattern design and the function of garments (motion study) was not undertaken to extend the industrial applications.

10.3 POSSIBLE EXTENSION TO THEORY

From the present experiments, the peak angle, the only limitation of the model, lies within the range of 35^{o} and 55^{o} apart from the two exceptions of Fabrics E and G under the Unseamed breaking condition. The two suggestions for affecting the peak angle, made in Chapter 3, were to change either the fabric sett if the strengths of warp and weft are about the same, or the ratio of the strength of warp to weft yarns.

A theory has been suggested for predicting the peak angle of the second zone by using fabric sett if the strengths of warp and weft (strength per unit length) are approximately the same. Figure 10.1 illustrates the behaviour of the strength in the second zone of a sample.

From equation 17,

$$S_2 = 2(DF\ K_{\theta warp} + HC\ K_{\theta weft})$$

where $DF = W \cos\theta$

and $HC = W \sin\theta$

therefore $S_2 = 2W \cos\theta\ K_{\theta warp} + 2W \sin\theta\ K_{\theta weft}$ .... (23)

The peak angle (maximum strength) of second zones can be evaluated when $\frac{dS_2}{d\theta} = 0$, then the differentiated form of equation 23 can be written,

$$\frac{dS_2}{d\theta} = -2W \sin\theta\ K_{\theta warp} + 2W \cos\theta\ K_{\theta weft}$$

$$= 0$$

therefore $\quad \sin\theta \, K_{\theta warp} = \cos\theta \, K_{\theta weft}$

$$\frac{K_{\theta weft}}{K_{\theta warp}} = \frac{\sin\theta}{\cos\theta}$$

$$= \tan\theta \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (24)$$

In the basic model for square-sett plain-weave fabrics,

$$\frac{K_{\theta weft}}{K_{\theta warp}} = \frac{K_{90}}{K_0} = 1$$

because $\quad \dfrac{K_{90}}{K_0} = \dfrac{\text{pick strength x weft no. per unit length}}{\text{end strength x warp no. per unit length}} = 1$

When the warp number per unit length is not equal to the weft number per unit length, but $K_{90} = K_0$ as suggested before,

therefore $\quad \dfrac{K_{90}}{K_0} = \dfrac{\text{pick strength x weft no. per unit length}}{\text{end strength x warp no. per unit length}} = 1$

, but $\quad \dfrac{K_{\theta weft}}{K_{\theta warp}} \neq \dfrac{K_{90}}{K_0}$ (when the $K_{\theta weft}$ and $K_{\theta warp}$ are strengths per unit length)

If $K_{\theta weft}$ and $K_{\theta warp}$ however represent strength per yarn,

therefore $\quad \dfrac{K_{\theta weft}}{K_{\theta warp}} = \dfrac{\text{pick strength}}{\text{end strength}}$

Hence, $\quad \dfrac{K_{90}}{K_0} = \dfrac{K_{\theta weft}}{K_{\theta warp}} \times \dfrac{\text{weft no. per unit length}}{\text{warp no. per unit length}} = 1$

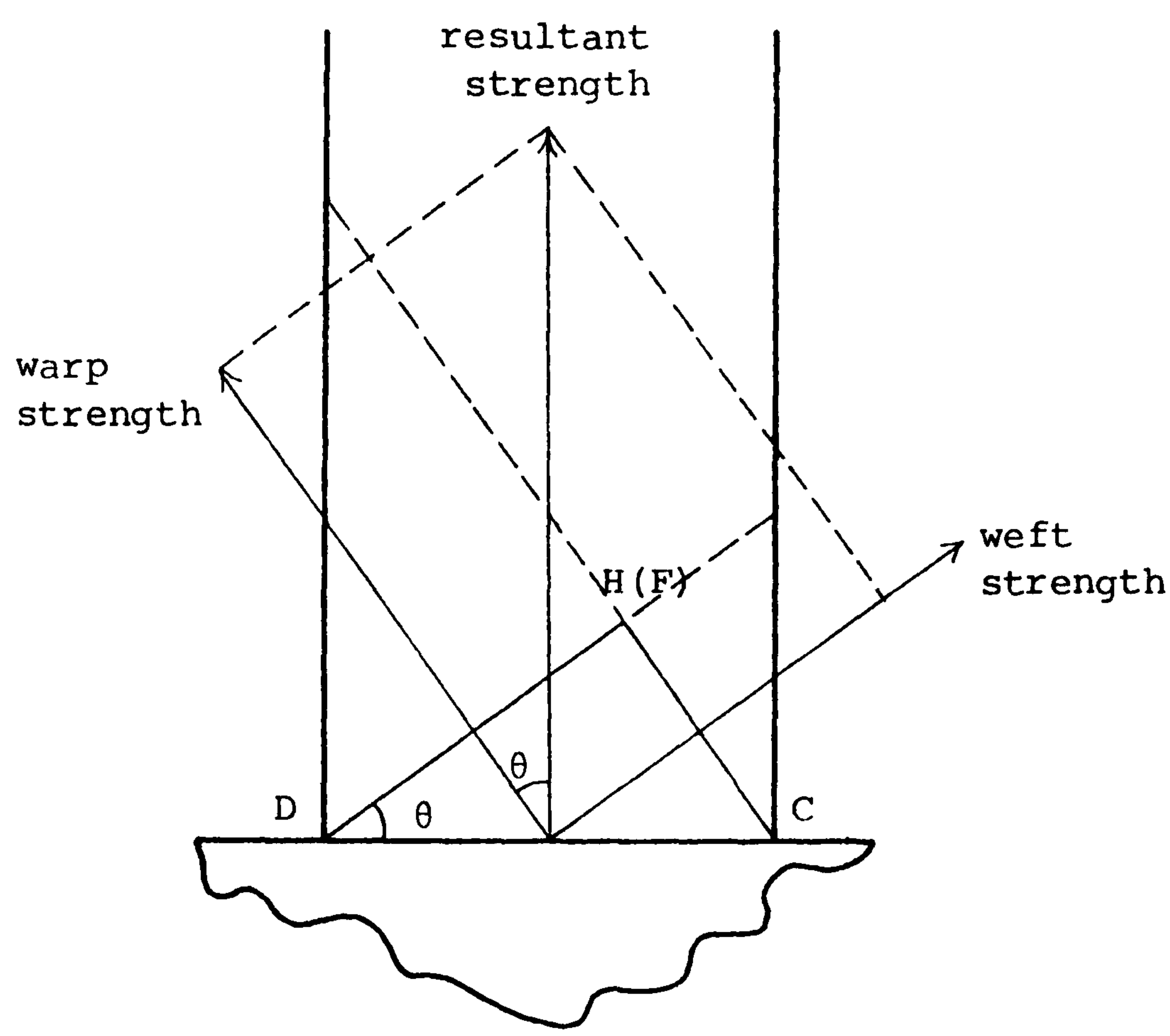
then $\quad K_{\theta warp} = \dfrac{K_{\theta weft} \text{ x weft no. per unit length}}{\text{warp no. per unit length}} \quad \ldots\ldots \quad (25)$

By substituting equation 25 into equation 24, the equation for the evaluation of peak angle, when $K_{90} \simeq K_0$, can be written in the form,

$$\tan\theta = \frac{K_{\theta weft}}{\dfrac{K_{\theta weft} \text{ x weft no. per unit length}}{\text{warp no. per unit length}}}$$

therefore $\quad \tan\theta = \dfrac{\text{warp no. per unit length}}{\text{weft no. per unit length}} \quad \ldots\ldots\ldots\ldots\ldots \quad (26)$

Figure 10.1   The Behaviour of the Strength in the Second Zone of a Sample.



As can be seen from Table 10.1, good agreement between the experimental and predicted peak angles is shown for Fabrics B, C, D, and H. Fabrics B, C and D showing the best agreement, are plain-weave fabrics with very close warp direction and weft direction strengths ($K_0 \simeq K_{90}$). Therefore, the results suggest the peak angle can be predicted by using fabric sett,

$$\text{Tan } \theta = \frac{\text{warp no. per unit length}}{\text{weft no per unit length}}$$

when the strengths of warp and weft direction (strength per unit length) are approximately the same ($K_0 \simeq K_{90}$) especially for plain-weave fabrics.

Now if only the strength of the weft yarn is equal to the strength of the warp yarn,

$$\frac{K_{90}}{K_0} = 1 \times \frac{\text{weft no. per unit length}}{\text{warp no. per unit length}}$$

From equation 18, $\frac{K_0}{K_{90}} = \frac{K_{\theta warp}}{K_{\theta weft}} = \lambda$

therefore $$\frac{K_{\theta weft}}{K_{\theta warp}} = \frac{\text{weft no. per unit length}}{\text{warp no. per unit length}} \quad \dots\dots\dots\dots\dots \quad (27)$$

By substituting equation 27 into equation 24, the equation for the evaluation of peak angle when pick strength ≃ end strength, can be written in the form,

$$\text{Tan } \theta = \frac{\text{weft no. per unit length}}{\text{warp no. per unit length}} = \frac{K_{90}}{K_0} \quad \dots\dots\dots\dots \quad (28)$$

Equation 26 is the reciprocal of equation 28.

Table 10.2 gives a comparison between the experimental and predicted

Table 10.1 Comparisons between the Experimental and Predicted Peak Angles by Using the Fabric Sett.

Breaks \ Fabric		B	C	D	E	F	G	H	I
U	exp	55	45	50	30	45	30	40	35
	pred	52	50	48	63	22	60	45	26
II	exp	-	-	50	-	-	-	40	45
	pred	-	-	48	-	-	-	45	26
I	exp	50	47	50	40	50	45	40	45
	pred	52	50	48	63	22	60	45	26

<u>units</u>

peak angle - degrees

Table 10.2 Comparisons between the Experimental and Predicted Peak Angles by Using Equation 28.

Breaks \ Fabric		E	G
U	exp	30	30
	pred	31	33
I	exp	40	45
	pred	39	47

<u>units</u>

peak angle - degrees

peak angle of Fabrics E and G by using the equation,

$$\text{Tan } \theta = \frac{\text{weft no. per unit length}}{\text{warp no. per unit length}} = \frac{K_{90}}{K_0}$$

when the pick strength is approximately equal to the end strength. For Fabrics E and G which are the only fabrics left with approximately the same strength in both warp and weft. Very good agreement between the experimental and predicted peak angles is shown; therefore equation 28 can predict the peak angle if only the strength of the weft is approximately equal to the strength of the warp.

Another possibility for predicting the peak angle, normally , when only the warp no. per unit length and the weft no. per unit length are approximately the same, is given by:

$$\frac{K_{90}}{K_0} = \frac{\text{pick strength}}{\text{end strength}} \times 1$$

From equation 18, $\frac{K_0}{K_{90}} = \frac{K_{\theta warp}}{K_{\theta weft}} = \lambda$

therefore $$\frac{K_{\theta weft}}{K_{\theta warp}} = \frac{\text{pick strength}}{\text{end strength}} \quad \text{.......................} \quad (29)$$

By substituting equation 29 into equation 24, the equation for the evaluation of peak angle, when only the warp no. per unit length and the weft no. per unit length are approximately the same, can be written in the form,

$$\text{Tan } \theta = \frac{\text{pick strength}}{\text{end strength}} = \frac{K_{90}}{K_0} \quad \text{....................} \quad (30)$$

However this possibility could not be tested because there were no samples amongst the fabrics used in the experiments with approximately the same warp and weft numbers per unit length.

Although some comparisons of the peak angles between the experimental and the predicted results has been made, that showed a good agreement, nevertheless the theory could not be thoroughly tested with the experimental results in the present work. A complex mechanism of load transfer for predicting the peak angle of the second zone would be involved when all the ratios of $\frac{K_{90}}{K_0}$, $\frac{\text{pick strength}}{\text{end strength}}$, and $\frac{\text{warp no. per unit length}}{\text{weft no. per unit length}}$ are not approximately equal to one, therefore further work is needed in order to widen the prediction of peak angle for different types of fabric, and of course, the application of the mathematical model for the prediction of sample strengths (seamed and unseamed).

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APPENDIX 1

THE BREAKING STRENGTH AND THE EXTENSION AT BREAK OF FABRIC AT A DIFFERENT ANGLE OF BIAS

UNDER THE UNSEAMED FABRIC BREAKING CONDITION AT THE WIDTH OF 5 m x 10^{-2}

angle of bias \ gauge		breaking strength (N)					extension at break (m x 10^{-2})				
		2.5	5.0	10.0	15.0	20.0	2.5	5.0	10.0	15.0	20.0
0^0	m	247	266	252	256	249	0.36	0.46	0.4	0.668	0.8
	r	255-270	255-275	245-260	250-260	240-255	0.34-0.4	0.42-0.5	0.4-0.44	0.6-0.7	0.7-0.9
10^0	m	192	213	218	199	170	0.58	0.58	0.6	0.9	1.24
	r	180-195	200-225	200-230	180-205	160-195	0.5-0.6	0.56-0.6	0.6	0.9-1.0	1.1-1.3
20^0	m	-	159	160	156	157	-	1.04	0.9	1.5	2.02
	r		150-175	145-175	150-160	150-165		0.96-1.04	0.8-1.04	1.3-1.7	1.8-2.1
25^0	m	182	166	174	160	155	0.48	1.0	1.2	1.68	2.44
	r	170-195	155-170	165-185	145-170	140-180	0.44-0.5	0.96-1.0	1.16-1.3	1.5-1.8	2.3-2.5
30^0	m	177	190	182	173	179	0.68	1.34	1.4	2.2	2.78
	r	170-190	175-200	170-185	155-175	165-190	0.64-0.8	1.3-1.4	1.4	2.1-2.3	2.7-2.9
40^0	m	173	208	185	185	180	0.72	1.56	1.6	2.38	2.96
	r	165-190	190-225	185-195	175-205	175-190	0.66- .84	1.5-1.7	1.5-1.6	2.3-2.4	2.8-3.2
45^0	m	204	221	200	185	192	0.9	1.86	1.44	2.3	2.94
	r	200-220	200-225	195-205	170-200	170-210	0.8-1.0	1.6-2.0	1.4-1.5	2.0-2.6	2.8-3.1

units

gauge - m x 10^{-2} (jaw to jaw)
angle of bias - degrees

m - mean of 5 results
r - range (min to max)

APPENDIX 2a

THE BREAKING STRENGTH OF DIFFERENT TYPES OF FABRICS AT DIFFERENT ANGLES OF BIAS UNDER THE UNSEAMED FABRIC BREAKING CONDITION AT THE GAUGE OF 10 m x 10^{-2} AND THE WIDTH OF 5 m x 10^{-2}

angle of bias \ Fabric		B	C	D	E	F	G	H	I
0^0	m	340	180	530	880	835	940	570	580
	r	330-355	175-190	510-540	860-905	820-860	930-950		570-595
10^0	m	215	-	380	780	590	810	520	450
	r	205-230			750-795	560-620	790-830		440-470
20^0	m	130	-	320	720	440	640	520	310
	r	125-135			705-730	410-470	610-660		300-330
30^0	m	145	100	285	763	412	740	560	315
	r	135-150	95-100		750-775	400-450	730-750		290-330
35^0	m	150	-	315	-	490	-	570	340
	r	135-170				460-520			325-350
40^0	m	175	145	350	560	675	680	580	300
	r	160-185	130-150		545-575	630-700	660-690		280-320
45^0	m	190	155	390	480	677	580	560	270
	r	180-195	145-160		475-500	650-700	560-610		250-280
50^0	m	200	150	440	480	630	-	520	250
	r	190-210	150		475-510	620-650			230-260
55^0	m	220	-	425	-	575	537	510	-
	r	215-230				540-590	520-570		
60^0	m	195	135	390	300	560	470	460	220
	r	180-215	125-135		285-325	520-600	440-500		210-240
70^0	m	160	-	300	250	493	345	380	230
	r	155-165			245-270	470-530	330-370		200-240
80^0	m	185	-	420	400	525	440		330
	r	175-195		400-440	375-420	480-550	420-470		320-340
90^0	m	240	160	460	520	765	625	575	350
	r	230-245	150-165	430-500	505-535	730-790	600-640		350-360

<u>unit</u>

angle of bias - degrees

m - mean of 5 results

r - range (min to max)

APPENDIX 2b

THE EXTENSION AT BREAK OF DIFFERENT TYPES OF FABRIC AT DIFFERENT ANGLES OF BIAS UNDER THE UNSEAMED FABRIC BREAKING CONDITION AT THE GAUGE OF 10 m x 10^{-2} AND THE WIDTH OF 5 m x 10^{-2}

angle of bias \ Fabric		B	C	D	E	F	G	H	I
0	m	0.6	0.55	0.5	2.3	0.3	1.0	0.5	0.75
	r	0.6	0.55	0.5	2.1-2.5	0.2-0.4	0.95-1.0	0.45-0.6	0.7-0.8
10^0	m	0.7	-	0.6	2.2	0.55	1.0	0.6	0.8
	r	0.7		0.6	2.0-2.4	0.5-0.6	1.0	0.55-0.65	0.75-0.85
20^0	m	1.2	-	0.95	2.6	0.82	1.2	0.9	1.1
	r	1.0-1.2		0.9-1.0	2.35-2.75	0.75-0.9	1.15-1.25	0.85-0.95	1.0-1.2
30^0	m	1.5	1.3	1.55	3.1	1.3	1.8	1.35	1.8
	r	1.5	1.2-1.3	1.55-1.60	2.95-3.15	1.2-1.45	1.8	1.3-1.35	1.8-1.9
35^0	m	1.8	-	1.9	-	1.5	-	1.54	1.8
	r	1.6-1.85		1.8-2.0		1.4-1.5		1.45-1.6	1.8-2.0
40^0	m	2.0	1.75	2.15	2.8	1.8	2.25	1.65	2.2
	r	1.9-2.1	1.7-1.8	2.1-2.2	2.5-3.0	1.7-1.9	2.2-2.3	1.6-1.7	2.1-2.3
45^0	m	1.9	1.9	2.3	2.8	2.1	2.0	1.75	2.15
	r	1.7-2.0	1.8-2.0	2.1-2.4	2.7-3.0	1.9-2.2	3.0	1.65-1.85	2.10-2.2
50^0	m	2.2	1.8	2.6	2.4	2.0	1.75	1.9	1.7
	r	2.0-2.3	1.8	2.5-2.7	2.35-2.5	1.9-2.0	1.6-1.8	1.85-1.95	1.65-1.8
55^0	m	2.1	-	2.55	-	1.9	1.9	1.7	1.4
	r	2.1-2.15		2.5-2.6		1.8-2.0	1.8-2.0	1.55-1.8	1.3-1.45
60^0	m	2.0	1.75	2.5	2.0	1.8	1.9	1.65	1.6
	r	1.8-2.1	1.7-1.8	2.4-2.5	1.85-2.1	1.7-2.0	1.8-2.0	1.5-1.7	1.6-1.7
70^0	m	1.5	-	-	1.4	1.6	1.2	0.85	0.95
	r	1.4-1.5			1.3-1.5	1.4-1.7	1.2	0.8-0.95	0.9-1.0
80^0	m	1.4		1.7	0.85	1.3	0.9	1.25	0.825
	r	1.4		1.7	0.8-0.9	1.2-1.4	0.85-1.0	1.2-1.3	0.8-0.85
90^0	m	1.0	0.75	1.5	0.9	1.25	0.8	1.1	0.8
	r	0.9-1.1	0.7-0.8	1.4-1.6	0.85-1.0	1.2-1.3	0.7-0.9	1.0-1.15	0.8-0.85

unit

angle of bias - degrees

m - mean of 5 results
r - range (min to max)

APPENDIX 3a

THE BREAKING STRENGTH OF FABRIC A AT DIFFERENT ANGLES OF BIAS UNDER THE

TYPE II BREAKING CONDITION

width		5.0			6.5		
angle of bias \ gauge		5	10	15	5	10	15
0^0	m	191	206	194	205	203	204
	r	185-200	185-220	185-210	200-210	190-210	200-210
10^0	m	178	142	119	206	179	151
	r	160-200	135-150	110-125	195-210	175-190	145-160
20^0	m	169	118	75	215	160	126
	r	155-190	110-130	70-80	195-225	150-170	120-140
30^0	m	181	140	80	195	143	107
	r	165-200	120-150	75-90	180-215	135-160	95-120
40^0	m	188	183	166	207	186	193
	r	185-195	175-190	150-175	195-220	160-205	185-200
45^0	m	191	201	171	204	206	203
	r	180-205	195-203	165-175	195-215	195-215	190-215

<u>units</u>

width - m x 10^{-2}

gauge - m x 10^{-2} (jaw to jaw)

angle of bias degrees

m - mean of 5 results
r - range (min to max)

APPENDIX 3b

THE EXTENSION AT BREAK OF FABRIC A AT DIFFERENT ANGLES OF BIAS UNDER THE

TYPE II BREAKING CONDITION

width		5.0			6.5		
angle of bias \ gauge		5	10	15	5	10	15
0^0	m	0.62	0.91	1.25	0.33	0.89	1.13
	r	0.55-0.7	0.85-1.05	1.2-1.35	0.32-0.37	0.85-0.92	1.1-1.2
10^0	m	0.65	1.07	1.36	0.81	1.06	1.2
	r	0.62-0.72	1.02-1.15	1.25-1.4	0.75-0.9	1.0-1.15	1.1-1.3
20^0	m	0.73	1.25	2.4	0.83	1.23	1.66
	r	0.67-0.75	1.15-1.3	2.25-2.5	0.8-0.87	1.15-1.3	1.45-1.85
30^0	m	0.83	1.7	3.24	0.96	1.69	2.55
	r	0.8-0.87	1.6-1.8	3.1-3.35	0.87-1.0	1.5-1.75	2.4-2.75
40^0	m	1.8	2.11	4.17	1.2	2.12	3.08
	r	1.25-1.37	2.05-2.15	4.0-4.25	1.17-1.2	2.01-2.17	3.05-3.3
45^0	m	1.3	2.31	4.36	1.27	2.16	3.16
	r	1.25-1.35	2.25-2.35	4.25-4.5	1.2-1.4	2.05-2.2	3.05-3.37

m - mean of 5 results
r - range (min to max)

units

width - m x 10^{-2}

gauge - m x 10^{-2} (jaw to jaw)

angle of bias - degrees

APPENDIX 4

THE BREAKING STRENGTH AND THE EXTENSION AT BREAK OF DIFFERENT TYPES OF FABRIC AT DIFFERENT ANGLES OF BIAS UNDER THE TYPE II BREAKING CONDITION AT THE GAUGE OF 10 m x 10^{-2} AND THE WIDTH OF 5 m x 10^{-2}

angle of bias \ Fabric		breaking strength (N)			extension at break ($m \times 10^{-2}$)		
		D	H	I	D	H	I
0^0	m	450	450	510	1.1	4.8	1.45
	r	435-470	440-460	505-510	1.0-1.2	4.7-5.0	1.35-1.5
10^0	m	380	345	450	1.25	4.6	1.4
	r	370-400	335-355	430-460	1.15-1.3	4.4-5.1	1.35-1.5
20^0	m	270	290	242	1.8	4.7	2.55
	r	255-275	275-310	230-250	1.65-1.9	4.45-4.9	2.4-2.7
30^0	m	195	375	-	2.7	7.3	-
	r	185-205	360-390		2.5-2.8	7.1-7.6	
35^0	m	215	-	267	3.5	9.0	3
	r	200-220		245-285	3.4-3.65	8.5-9.2	2.85-4.1
40^0	m	230	410	-	3.9	9.3	3.5
	r	225-240	405-420		3.8-3.4	9.1-9.6	3.4-3.7
45^0	m	340	-	280	4.1	8.7	4.2
	r	325-350		270-290	3.9-4.3	8.5-9.1	4-4.3
50^0	m	410	330	230	4.5	8.0	4
	r	400-415	320-335	230-240	4.35-4.6	7.7-8.3	3.9-4.2
55^0	m	375	308	212	4.35	7.5	4.1
	r	365-385	290-320	200-230	4.3-4.45	7.2-8.0	3.9-4.3
60^0	m	295	250	-	4	7.0	-
	r	285-305	245-260		3.8-4.1	6.6-7.4	
70^0	m	293	230	196	-	5.4	3.5
	r	285-300	220-245	180-215		5.1-5.9	3.4-3.6
80^0	m		345	230	3.25	4.8	2
	r		340-355	220-250	3.2-3.4	4.5-5.1	2
90^0	m	400	470	265	2.1	4.7	19
	r	390-410	455-490	255-270	2.0-2.2	4.5-5.2	1.8-2.0

APPENDIX 5a

THE BREAKING STRENGTH OF FABRIC A AT DIFFERENT ANGLES OF BIAS UNDER THE TYPE I BREAKING CONDITION

width		3.5			5.0			6.5		
angle of bias \ gauge		5	10	20	5	10	20	5	10	20
0^0	m	99	115	94	153	147	140	164	166	172
	r	94-112	111-119	78-107	140-165	136-165	134-151	160-175	150-175	160-184
15^0	m	87.5	75	42	125	95	60	155	113	77
	r	81-95	66-81	38-50	120-129	87-108	56-75	147-162	104-123	72-83
20^0	m r	-	-	-	-	-	-	-	-	-
25^0	m	68	42	41	97	65	43	145	89	58
	r	63-75	34-55	40-51	93-116	62-70	40-45	137-166	79-104	52-65
30^0	m	66	41	42	84	57	52	146	86	52
	r	58-71	35-48	39-47	80-87	52-68	38-58	138-167	80-96	46-57
40^0	m	-	-	-	-	87.5	-	-	-	-
	r					75-95				
45^0	m	79	94	93	116	125	132	163	165	151
	r	73-88	90-110	84-110	96-125	108-133	115-150	146-175	157-170	145-164

<u>units</u>

width m x 10^{-2}

gauge - mx 10^{-2}

angle of bias - degrees

m - mean of 5 results

r - range (min to max)

APPENDIX 5b

THE EXTENSION AT BREAK OF FABRIC A AT DIFFERENT ANGLES OF BIAS UNDER THE TYPE I BREAKING CONDITION

width		3.5			5.0			6.5		
angle of bias \ gauge		5	10	20	5	10	20	5	10	20
0^0	m	0.4	0.55	0.94	0.43	0.66	0.89	0.4	0.5	0.96
	r	0.35-0.45	0.5-0.6	0.9-1.00	0.4-0.45	0.6-0.7	0.8-0.95	0.4-0.45	0.5	0.9-1.0
15^0	m	0.42	0.61	1.03	0.48	0.82	1.15	0.52	0.775	1.17
	r	0.4-0.45	0.55-0.65	1.0-1.15	0.45-0.5	0.75-0.85	1.13-1.3	0.48-0.55	0.7-0.8	1.1-1.2
20^0	m	-	-	-	-	-	-	0.65	0.85	-
	r							0.6-0.65	0.8-0.9	
25^0	m	0.57	0.9	1.86	0.61	0.88	1.7	0.68	1.0	1.8
	r	0.55-0.6	0.8-1.0	1.8-1.95	0.6-0.7	0.85-0.9	1.6-1.8	0.65-0.75	0.95-1.05	1.7-1.85
30^0	m	0.64	1.1	2.16	0.7	0.98	2.57	0.74	1.2	1.94
	r	0.6-0.7	1.0-1.25	2.0-2.3	0.65-0.7	0.9-1.05	2.5-2.7	0.7-0.85	1.15-1.3	1.85-2.0
40^0	m	-	-	-	-	3.4	-	-	-	-
	r					3.3-3.4				
45^0	m	0.85	1.57	2.9	0.97	1.59	3.25	0.95	1.75	3.37
	r	0.8-0.9	1.5-1.7	2.7-3.1	0.9-1.0	1.5-1.7	3.15-3.3	0.9-1.0	1.7-1.9	3.3-3.5

m - mean of 5 results
r - range (min to max)

units

width - m x 10^{-2}

gauge - m x 10^{-2} (jaw to jaw)

angle of bias - degrees

APPENDIX 6a

THE BREAKING STRENGTH OF DIFFERENT TYPES OF FABRIC AT DIFFERENT ANGLES OF BIAS UNDER THE TYPE I BREAKING CONDITION AT THE GAUGE (JAW TO JAW) OF 10 m x 10^{-2} AND THE WIDTH OF 5 m x 10^{-2} EXCEPT FABRIC B

angle of bias \ Fabric		B G=2.5 W=5	B G=5 W=5	B G=10 W=5	C	D	E	F	G	H	I
0^0	m	155	149	152	132	300	460	455	400	340	280
	r	150-160	140-160	140-170	125-140	275-315	440-465	430-480	380-420	325-350	270-280
10^0	m	116	99	58	-	205	300	355	383	280	214
	r	110-130	85-110	55-65		200-215	295-310	330-380	370-390	275-285	210-225
20^0	m	-	-	-	-	160	220	280	255	244	167
	r					155-170	215-225	260-290	250-270	255-270	165-175
25^0	m	98	70	42	-	-	-	-	-	-	-
	r	80-110	65-75	40-50							
30^0	m	97	55	41	56	140	218	210	230	206	150
	r	85-105	50-60	35-45	55-60	120-155	210-235	190-230	220-250	180-230	150-160
35^0	m	-	-	-	-	145	-	220	240	250	130
	r					140-155		200-220	220-250	235-260	125-135
40^0	m	-	-	-	90	160	410	260	250	290	184
	r				90-95	155-175	400-430	240-290	230-300	280-310	175-190
45^0	m	96	90	85	101	190	285	352	385	250	250
	r	90-105	80-100	70-90	85-110	175-205	265-300	330-370	270-410	230-280	250-255
50^0	m	—	103	—	100	265	240	430	348	160	220
	r		100-110		95-110	255-275	235-245	420-440	320-370	155-170	200-225
55^0	m	-	-	-	-	230	-	-	252	140	176
	r					220-245			230-270	125-150	170-180
60^0	m	104	63	51	60	180	175	255	195	140	145
	r	90-110	55-75	50-55	50-60	170-195	170-185	240-270	180-210	135-165	140-150
70^0	m	-	-	-	-	160	190	230	222	195	137
	r					145-170	185-200	220-240	200-240	175-200	125-150
80^0	m	101	85	59		210	280	287	293	270	186
	r	100-105	75-95	55-60		190-230	270-290	250-300	290-310	250-285	180-190
90^0	m	140	143	155	137	280	375	450	423	315	260
	r	130-150	125-150	140-170	125-145	275-295	370-385	430-460	410-440	290-335	250-275

units

width and gauge (jaw to seam) - m x 10^{-2}

m - mean of 5 results

r - range (min to max)

APPENDIX 6b

THE EXTENSION AT BREAK OF DIFFERENT TYPES OF FABRIC AT DIFFERENT ANGLES OF BIAS UNDER THE TYPE I BREAKING CONDITION AT THE GAUGE (JAW TO JAW) OF 10 m x 10^{-2} AND THE WIDTH OF 5 m x 10^{-2}, EXCEPT FABRIC B

angle of bias \ Fabric		B G=5 W=5	B G=10 W=5	B G=20 W=5	C	D	E	F	G	H	I
0°	m	1.0	1.1	1.5	1.8	0.95	1.5	0.85	1.65	3.9	1.0
	r	1.0	1.1	1.4-1.6	1.6-2.0	0.8-1.0	1.3-1.7	0.8-0.9	1.6-1.7	3.7-4.2	1.0
10°	m	1.1	1.45	2.1	-	1.2	1.8	1.1	1.8	3.5	1.0
	r	1.1	1.4-1.5	2.0-2.1		1.05-1.25	1.7-2.0	1.1	1.7-1.8	3.4-3.6	1.0
20°	m	-	-	-	-	1.6	2.3	1.6	2.2	3.9	1.45
	r					1.5-1.7	2.15-2.4	1.5-1.65	2.1-2.4	3.5-4.4	1.4-1.6
25°	m	1.3	1.7	3.8	-	-	-	-	-	-	-
	r	1.2-1.3	1.6-1.8	3.6-4.0							
30°	m	1.4	2.4	5.0	2.6	2.3	3.3	2.3	2.85	4.7	2.35
	r	1.3-1.5	2.3-2.5	4.7-5.5	2.5-2.8	2.25-2.4	3.1-3.5	2.25-2.35	2.75-2.9	4.6-4.8	2.4-2.5
35°	m	-	-	-	-	2.8	-	2.65	3.3	5.2	2.55
	r					2.7-2.85		2.6-2.75	3.2-3.5	5.1-5.3	2.5-2.6
40°	m				3.8	3.4	4.0	3.0	3.6	5.4	3.2
	r				3.7-3.9	3.3-3.45	3.8-4.3	2.95-3.2	3.3-3.8	5.2-5.6	3.1-3.25
45°	m	2.3	4.0	7.2	4.2	3.9	3.8	3.9	4.9	4.9	4.25
	r	2.2-2.4	3.7-4.2	7.0-7.5	4.0-4.3	3.8-4.05	3.3-4.1	3.7-4.2	4.8-5.1	4.8-5.1	4.2-4.3
50°	m	-	-	-	4.2	4.2	3.8	4.75	4.65	3.4	4.15
	r				4.1-4.3	4.0-4.3	3.5-4.2	4.6-4.9	4.5-4.8	3.3-3.6	4.1-4.2
55°	m	-	-	-	-	4.0	-	-	4.2	3.2	4.0
	r					3.8-4.3			4.0-4.3	3.1-3.4	3.95-4.15
60°	m	2.3	3.5	6.5	3.1	3.7	2.7	3.5	3.95	3.0	3.6
	r	2.25-2.3	3.4-3.7	6.2-6.7	3.0-3.2	3.5-3.9	2.5-3.0	3.4-3.65	3.8-4.0	2.9-3.1	3.4-3.8
70°	m	-	-	-	-	2.7	2.5	2.75	2.75	2.2	2.2
	r					2.5-3.0	2.4-2.9	2.6-2.9	2.6-2.9	2.2	2.1-2.2
80°	m	2.0	3.2	5.5	-	2.6	2.3	2.3	2.3	1.7	1.7
	r	2.0-2.2	3.1-3.4	5.3-5.7		2.5-2.65	2.0-2.5	2.15-2.4	2.2-2.4	1.5-1.8	1.6-1.75
90°	m	2.0	3.0	4.8	2.1	2.2	2.0	2.0	2.1	1.5	1.6
	r	1.9-2.1	2.8-3.1	4.6-5.0	2.0-2.2	2.0-2.35	1.8-2.3	1.95-2.1	1.95-2.15	1.4-1.6	1.55-1.8

units

width and extension at break(jaw to jaw) - m x 10^{-2}

m - mean of 5 results

r - range (min to max)

APPENDIX 7

THE BREAKING STRENGTH OF THE SECOND ZONE OF DIFFERENT TYPES OF FABRIC AT DIFFERENT ANGLES OF BIAS UNDER THE UNSEAMED FABRIC BREAKING CONDITION AT THE WIDTH OF 5 m x 10^{-2}

angle of bias \ Fabric		A	B	C	D	E	F	G	H	I
10^0	m	125	75	-	130	690	370	590	450	360
	r	120-130	70-80		115-140	685-710	350-400	560-620	430-460	340-380
20^0	m	160	90	-	165	680	390	560	530	310
	r	150-160	75-95		155-170	670-695	380-400	555-575	500-540	300-350
30^0	m	168	140	100	215	730	520	575	540	350
	r	160-175	130-155	95-105	200-230	715-750	515-535	560-585	530-550	330-360
35^0	m	-	-	-	250	-	-	610	580	370
	r				240-270			605-620	560-600	350-390
40^0	m	188	180	145	290	580	610	630	570	420
	r	180-195	175-195	140-155	280-310	570-595	600-625	625-645	560-580	300-330
45^0	m	200	190	155	350	520	678	570	-	270
	r	195-205	180-200	140-165	345-300	505-530	670-695	565-585		250-280
50^0	m	-	230	150	420	500	710	540	540	250
	r		225-240	145-160	410-435	490-515	705-725	530-555	520-570	240-270
55^0	m	-	-	-	350	-	680	500	540	230
	r				340-365		670-695	480-510	520-575	210-250
60^0	m	-	220	135	290	360	560	460	-	230
	r		210-230	130-140	275-315	350-375	555-575	455-470		220-240
70^0	m	-	115	-	215	310	435	320	440	-
	r		110-120		205-230	300-325	420-455	315-335	420-480	
80^0	m		75		145	167	490	310	380	230
	r		70-77		140-155	150-185	460-520	300-330	340-400	230-250

<u>unit</u>

angle of bias - degrees

m - mean of 5 results
r - range (min to max)

APPENDIX 8

THE BREAKING STRENGTH OF THE SECOND ZONE OF DIFFERENT TYPES OF FABRIC AT DIFFERENT ANGLES OF BIAS UNDER THE TYPE II BREAKING CONDITION AT THE WIDTH OF $5\ m \times 10^{-2}$

angle of bias \ Fabric		A	D	H	I
10^0	m	78	120	175	155
	r	75-85	100-130	150-190	150-162
20^0	m	80	110	142	140
	r	75-85	105-120	130-150	130-150
30^0	m	90	168	187	-
	r	85-100	155-175	170-205	
35^0	m	-	190	-	202
	r		180-205		195-210
40^0	m	162	255	410	247
	r	150-170	240-280	390-425	210-270
45^0	m	200	340	435	280
	r	190-205	325-350	425-445	270-290
50^0	m	-	410	235	269
	r		400-405	220-250	260-275
55^0	m	-	335	-	226
	r		320-350		205-240
60^0	m	-	280	122	-
	r		270-295	110-130	
70^0	m	-	145	142	126
	r		130-155	130-160	115-140
80^0	m	-	142	180	145
	r		135-155	160-190	125-155

<u>unit</u>

angle of bias - degrees

m - mean of 5 results

r - range (min to max)

APPENDIX 9

THE BREAKING STRENGTH OF THE SECOND ZONE OF DIFFERENT TYPES OF FABRIC AT DIFFERENT ANGLES OF BIAS UNDER THE TYPE I BREAKING CONDITION AT THE WIDTH OF 5 m x 10^{-2}

angle of bias \ Fabric		A	B	C	D	E	F	G	H	I
10^0	m	40	38	33	90	170	110	158	165	117
	r	35-45	35-40	30-35	85-90	150-175	100-120	150-160	160-170	110-130
20^0	m	56	38	35	95	155	110	150	170	101
	r	55-60	35-40	30-40	90-100	150-160	105-110	130-160	165-180	90-110
30^0	m	43	45	-	117	190	140	155	255	-
	r	35-50	40-50		100-125	185-200	130-150	150-160	250-265	
35^0	m	-	-	-	140	-	177	170	280	130
	r				135-145		165-190	160-180	270-285	115-140
40^0	m	91	60	80	163	410	240	290	250	160
	r	85-100	55-70	75-85	160-170	370-420	240-250	250-300	255-270	150-200
45^0	m	140	90	107	191	285	352	385	245	250
	r	130-155	80-100	85-110	170-210	275-300	330-370	370-410	230-255	250
50^0	m	-	97	100	270	235	417	380	180	260
	r		80-110	95-110	250-280	220-245	410-420	350-400	170-200	250-280
55^0	m	-	-	-	247	-	250	242	157	170
	r				230-260		240-260	230-270	145-160	150-190
60^0	m	-	62	-	187	125	245	182	-	-
	r		60-65		180-200	115-135	220-260	180-190		
70^0	m		50	45	127	143	162	150	145	105
	r		40-55	40-50	115-140	140-150	150-180	140-170	140-155	90-110
80^0	m		43	40	120	180	186	170	120	97
	r		40-45	35-45	110-130	170-195	170-200	150-180	115-125	80-100

unit

angle of bias - degrees

m - mean of 5 results
r - range (min to max)

APPENDIX 10 Evaluation of K_θ

Evaluation of constant K_θ (N/cm) at different angles of bias,

$$K_\theta = S_\theta / 2(DF + FE)$$

$$= S_\theta / 2W(\cos \Theta + \sin \Theta)$$

where S_θ is the mean breaking load at the angle of bias of Θ when the first zone has just disappeared.

Calculations and Results

a) Unseamed sample breaks of Fabric A

K_{10} = 12.5 x 9.81 / (2 x 5(Cos 10 + Sin 10)) = 10.7 N/mx10^{-2}
K_{20} = 15 x 9.81 / (2 x 5(Cos 20 + Sin 20)) = 11.7 N/mx10^{-2}
K_{30} = 16.75 x 9.81 / (2 x 5(Cos 30 + Sin 30)) = 12 N/mx10^{-2}
K_{40} = 19 x 9.81 / (2 x 5(Cos 40 + Sin 40)) = 13.5 N/mx10^{-2}
K_{45} = 20 x 9.81 / (2 x 5(Cos 45 + Sin 45)) = 14 N/mx10^{-2}

b) Type II breaks of Fabric A

K_{10} = 7.8 x 9.81 / (2 x 5(Cos 10 + Sin 10)) = 0.67 N/mx10^{-2}
K_{20} = 8 x 9.81 / (2 x 5(Cos 20 + Sin 20)) = 0.62 N/mx10^{-2}
K_{30} = 9 x 9.81 / (2 x 5(Cos 30 + Sin 30)) = 0.66 N/mx10^{-2}
K_{40} = 17 x 9.81 / (2 x 5(Cos 40 + Sin 40)) = 1.23 N/mx10^{-2}
K_{45} = 20 x 9.81 / (2 x 5(Cos 45 + Sin 45)) = 1.41 N/mx10^{-2}

c) Type I breaks of Fabric A

K_{10} = 4 x 9.81 / (2 x 5(Cos 10 + Sin 10)) = 0.345 N/mx10^{-2}
K_{20} = 4.3 x 9.81 / (2 x 5(Cos 20 + Sin 20)) = 0.335 N/mx10^{-2}
K_{30} = 6.6 x 9.81 / (2 x 5(Cos 30 + Sin 30)) = 0.483 N/mx10^{-2}
K_{40} = 9.1 x 9.81 / (2 x 5(Cos 40 + Sin 40)) = 0.645 N/mx10^{-2}
K_{45} = 1.5 x 9.81 / (2 x 5(Cos 45 + Sin 45)) = 0.88 N/mx10^{-2}

APPENDIX 11 Method of Least Squares for Calculating the Parameter 'A'.

Step 1 In the equation

from (23) $$SK_\theta = \frac{Sp}{(1 + |\frac{\theta - \theta p}{\theta p}|)^A}$$

$$\frac{SK_\theta}{Sp} = (1 + |\frac{\theta - \theta p}{\theta p}|)^{-A}$$

Let $y = \frac{SK_\theta}{Sp}$ and $X = \frac{\theta - \theta p}{\theta p}$, therefore the equation is changed back to the basic form $y = (1 + X)^{-A}$.

By expanding $(1 + X)^{-A}$ in a series of terms in ascending powers of X as

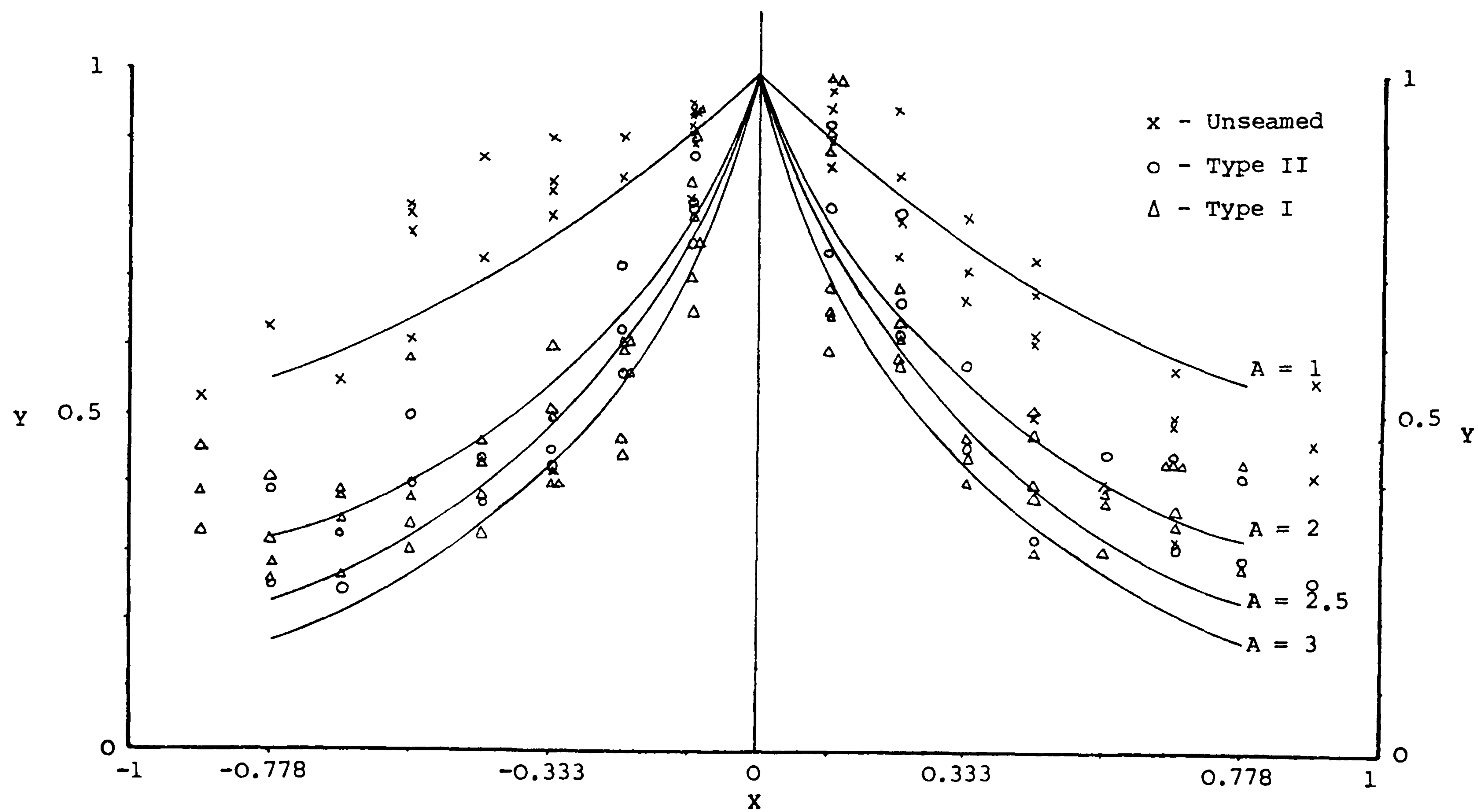
$$y = 1 - AX + \frac{A(A - 1)}{1.2} X^2 - \frac{A(A - 1)(A - 2)}{1.2.3} X^3 +$$

Using the equation $SK_\theta = \frac{1}{(1 + |\frac{\theta - \theta p}{\theta}|)^A}$, a range of parameter 'A' can be tried for each type of breaking conditions, shown in the Figures A1. The results show that the range of parameter 'A' is approximately from one and three.

Therefore the third power of X is assumed the appropriate expansion of the expression. Therefore the expansion of the expression can be written

$$y = 1 - AX + \frac{A(A - 1)}{2.1} X^2 - \frac{A(A - 1)(A - 2)}{1.2.3} X^3$$

Figure A1 The Range of Parameter 'A' for the Experimental Results of the Second Zone Strength.



Step 2 Method of selected points

From the curve shown in Figure 3.26 to 3.34, the values of SKθ, Sp and θp of each curve were read.

Step 3 This is the Method of Least Squares

The equation can be written in general form

$$y = A_1 + A_2X_1 + A_3X_2 + A_4X_3 +$$

By making suitable substitutions, such as $a_1 = 1$,

$$X_1 = X,\ X_2 = X^2,\ X_3 = -X^3,\ A_3 = \frac{a(a-1)}{2.1} \text{ and } A_4 = \frac{a(a-1)(a-2)}{1.2.3},$$

therefore $y = 1 - A_1X + A_2X^2 - A_3X^3$

The function 'S' assumed to be the sum of the squares of all errors, then becomes.

$$S = \sum_{i=1}^{N} (y_i - A_1 - A_2X_{1i} - A_3X_{2i} - \ldots - A_{n+1}X_{ni})^2$$

By taking partial derivatives of the above equation, the following normal equations can be be formed:

$$\frac{\partial S}{\partial \theta_1} = -2\sum_{i=1}^{N} (y_i - A_1 - A_2X_{1i} - A_3X_{2i} - \ldots - A_{n+1}X_{ni}) = 0$$

$$\frac{\partial S}{\partial a_2} = -2\sum_{i=1}^{N} X_{1i}(y_i - A_1 - A_2X_{1i} - A_3X_{2i} \ldots - A_{n+1}X_{ni}) = 0$$

$$\frac{\partial S}{\partial a_{n+1}} = -2\sum_{i=1}^{N} X_{ni}(y_i - A_1 - A_2X_{1i} - A_3X_{2i} - \ldots - A_n + X_{ni}) = 0_1$$

ɔove equations can be simplified to the following form

(Note: The limits i=1 to i=N have been omitted from the summation and the subscripts on the variables have also been omitted for simplicity).

$$\Sigma y = A_1\Sigma 1 + A_2\Sigma X1 + A_3\Sigma X_2 + \ldots + A_{n+1}\Sigma X_n$$

$$\Sigma X_1 y = A\Sigma X_1 + A_2\Sigma X_1{}^2 + A_3\Sigma X_1 X_2 + \ldots. + A_{n+1}\Sigma X_1 X_n$$

$$\Sigma X_{ny} = A_1\Sigma X_n + A_2\Sigma X_1 X_n + A_3\Sigma X_2 X_n + \ldots A_{n+1}\Sigma X_n{}^2$$

The notation $\Sigma 1$ means N

Step 4 Method of Least Squares applied to these experiments

An example of a polynomial equation is

$$y = A_0 + A_1 X + A_2 X^2 + \ldots A_n X^n$$

This is converted into the appropriate form

$$\text{Let } A_0 = 1,\ A_i = -A,\ A_2 = \frac{A(A-1)}{2.1} \text{ and } A_3 = \frac{A(A-1)(A-2)}{1.2.3}$$

$$y = 1 - AX + \frac{A(A-1)}{2} X^2 - \frac{A(A-1)(A-2)}{2.3} X^3$$

The normal equations thus become

$$\Sigma y = \Sigma 1 - A\Sigma X + \frac{A(A-1)}{2}\Sigma X^2 - \frac{A(A-1)(A-3)}{2.3}\Sigma X^3$$

$$\Sigma Xy = \Sigma X - A\Sigma X^2 + \frac{A(A-1)}{2}\Sigma X^3 - \frac{A(A-1)(A-3)}{2.3}\Sigma X^4$$

$$\Sigma X^2 y = \Sigma X^2 - A\Sigma X^3 + \frac{A(A-1)}{2}\Sigma X^4 - \frac{A(A-1)(A-3)}{2.3}\Sigma X^5$$

Step 5 Summation of the selected points

Angle of bias (θ)	SK_θ	$\left(\frac{\theta - \theta p}{\theta p}\right) = X$	$\left(\frac{SK_\theta}{p}\right) = y$	X^2	X^3	X^4	X^5	ΣXy	$5X^2y$
0									
10									
20									
30									
40									
45									
50									
60									
70									
80									
	ΣX	Σy	ΣX^2	ΣX^3	ΣX^4	ΣX^5	ΣXy	ΣX^2y	

Evaluating the sums of the data, the parameter 'A' can be found from the solution of the three equations in Step 4.

Appendices 12 - 24 Calculated Breaking Strengths of Unseamed Fabric Breaks Using Modifications A,B,C,D to the Theoretical Model

APPENDIX 12A

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS: MODIFICATION - A; FABRIC - A; BREAK TYPE - U; PARAMETER 'A' - 1.06 ; G - 2.5 CM; W - 5 CM; PEAK ANGLE - 45 DEGREES; AND PEAK STRENGTH - 204 N; STRENGTH OF WARP - 247 N; STRENGTH OF WEFT - 247 N; AT THE TESTING WIDTH OF 5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	247	49.4	247	0	247
10	110.856	9.5699	218.45	24.9144	243.364
15	118.705	9.693	199.61	37.6123	237.222
20	127.712	9.96498	178.459	51.0985	229.558
25	138.149	10.3964	155.64	65.8741	221.515
30	150.382	11.0095	140.177	75.1033	215.28
35	164.912	11.8415	131.072	82.3736	213.446
40	182.443	12.9503	125.49	91.1413	216.631
45	204	14.425	123.598	101.919	225.517
50	182.443	12.9494	125.456	91.1542	216.61
55	164.912	11.8399	131.005	82.3982	213.403
60	150.382	11.0071	140.079	75.1403	215.219
65	138.149	10.3934	155.525	65.9219	221.447
70	127.712	9.96129	178.356	51.1492	229.505
75	118.705	9.68855	199.524	37.6669	237.191
80	110.856	9.56457	218.389	24.9744	243.363
90	247	49.4	247	0	247

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 12B

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS; MODIFICATION - B; FABRIC - A; BREAK TYPE - U; PARAMETER 'A' - - 1 ; G - 2.5 CM; W - 5 CM; PEAK ANGLE - 45 DEGREES; AND PEAK STRENGTH - 204 N; STRENGTH OF WARP - 247 N; STRENGTH OF WEFT - 247 N; AT THE TESTING WIDTH OF 5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	247	49.4	247	0	247
10	114.75	9.90604	218.45	25.7895	244.24
15	122.4	9.99468	199.61	38.783	238.393
20	131.143	10.2327	178.459	52.4713	230.93
25	141.231	10.6283	155.64	67.3437	222.984
30	153	11.2012	140.177	76.4109	216.588
35	166.909	11.985	131.072	83.3714	214.444
40	183.6	13.0325	125.49	91.7193	217.209
45	204	14.425	123.598	101.919	225.517
50	183.6	13.0316	125.456	91.7323	217.188
55	166.909	11.9833	131.005	83.3963	214.402
60	153	11.1988	140.079	76.4485	216.527
65	141.231	10.6252	155.525	67.3925	222.917
70	131.143	10.2289	178.356	52.5233	230.879
75	122.4	9.99009	199.524	38.8393	238.364
80	114.75	9.90052	218.389	25.8516	244.24
90	247	49.4	247	0	247

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 12C

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS;
MODIFICATION - C; FABRIC - A; BREAK TYPE - UNSEAMED; PARAMETER 'A' - 1.06 ;
G - 2.5 CM; W - 5 CM; PEAK ANGLE - 45 DEGREES;
PEAK STRENGTH - 204 N; STRENGTH OF WARP - 247 N;
STRENGTH OF WEFT - 247 N; AT THE TESTING WIDTH OF 5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	247	49.4	247	0	247
10	110.856	9.5699	218.45	9.76841	228.218
15	118.705	9.693	199.61	15.8951	215.505
20	127.712	9.96498	178.459	23.2289	201.688
25	138.149	10.3964	155.64	32.1913	187.832
30	150.382	11.0095	140.177	23.078	163.255
35	164.912	11.8415	131.072	10.4237	141.496
40	182.443	12.9503	125.49	2.66185	128.152
45	204	14.425	123.598	0	123.598
50	182.443	12.9494	125.456	2.66185	128.117
55	164.912	11.8399	131.005	10.4237	141.429
60	150.382	11.0071	140.079	23.078	163.157
65	138.149	10.3934	155.525	32.1913	187.716
70	127.712	9.96129	178.356	23.2289	201.585
75	118.705	9.68855	199.524	15.8951	215.42
80	110.856	9.56457	218.389	9.76841	228.157
90	247	49.4	247	0	247

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 12D

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS;
MODIFICATION - D; FABRIC - A; BREAK TYPE - UNSEAMED; PARAMETER 'A' - 1 ;
G - 2.5 CM; W - 5 CM; PEAK ANGLE - 45 DEGREES;
PEAK STRENGTH - 204 N; STRENGTH OF WARP - 247 N;
STRENGTH OF WEFT - 247 N; AT THE TESTING WIDTH OF 5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	247	49.4	247	0	247
10	114.75	9.90604	218.45	10.1115	228.562
15	122.4	9.99468	199.61	16.3898	216
20	131.143	10.2327	178.459	23.8529	202.312
25	141.231	10.6283	155.64	32.9095	188.55
30	153	11.2012	140.177	23.4798	163.657
35	166.909	11.985	131.072	10.55	141.622
40	183.6	13.0325	125.49	2.67873	128.168
45	204	14.425	123.598	0	123.598
50	183.6	13.0316	125.456	2.67873	128.134
55	166.909	11.9833	131.005	10.55	141.555
60	153	11.1988	140.079	23.4798	163.558
65	141.231	10.6252	155.525	32.9095	188.434
70	131.143	10.2289	178.356	23.8529	202.209
75	122.4	9.99009	199.524	16.3898	215.914
80	114.75	9.90052	218.389	10.1115	228.5
90	247	49.4	247	0	247

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 13A

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM
THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS;
MODIFICATION - A; FABRIC - A; BREAK TYPE - U; PARAMETER 'A' - 1.06 ;
G - 5 CM; W - 5 CM; PEAK ANGLE - 45 DEGREES;
AND PEAK STRENGTH - 221 N; STRENGTH OF WARP - 266 N;
STRENGTH OF WEFT - 266 N; AT THE TESTING WIDTH OF 5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	266	53.2	266	0	266
10	120.094	10.3674	212.521	35.9875	248.508
15	128.598	10.5007	181.73	54.3289	236.059
20	138.355	10.7954	149.459	73.809	223.268
25	149.661	11.2627	116.69	95.1515	211.841
30	162.914	11.9269	84.4151	119.215	203.63
35	178.654	12.8283	53.6152	147.096	200.711
40	197.647	14.0295	25.2249	180.284	205.509
45	221	15.6271	.211739	220.824	221.036
50	197.647	14.0286	25.1912	180.297	205.488
55	178.654	12.8265	53.5554	147.118	200.673
60	162.914	11.9244	84.3375	119.244	203.582
65	149.661	11.2595	116.603	95.1875	211.791
70	138.355	10.7914	149.373	73.8516	223.224
75	128.598	10.4959	181.652	54.3789	236.031
80	120.094	10.3616	212.461	36.0462	248.507
90	266	53.2	266	0	266

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 13B

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS;
MODIFICATION - B; FABRIC - A; BREAK TYPE - U; PARAMETER 'A' - 1 ;
G - 5 CM; W - 5 CM; PEAK ANGLE - 45 DEGREES;
AND PEAK STRENGTH - 221 N; STRENGTH OF WARP - 266 N;
STRENGTH OF WEFT - 266 N; AT THE TESTING WIDTH OF 5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	266	53.2	266	0	266
10	124.313	10.7315	212.521	37.2516	249.772
15	132.6	10.8276	181.73	56.0199	237.749
20	142.071	11.0854	149.459	75.7918	225.251
25	153	11.514	116.69	97.2742	213.964
30	165.75	12.1346	84.4151	121.29	205.705
35	180.818	12.9837	53.6152	148.877	202.492
40	198.9	14.1185	25.2249	181.428	206.652
45	221	15.6271	.211739	220.824	221.036
50	198.9	14.1175	25.1912	181.44	206.632
55	180.818	12.9819	53.5554	148.9	202.455
60	165.75	12.132	84.3375	121.32	205.658
65	153	11.5106	116.603	97.3111	213.914
70	142.071	11.0813	149.373	75.8356	225.208
75	132.6	10.8226	181.652	56.0714	237.723
80	124.313	10.7256	212.461	37.3123	249.773
90	266	53.2	266	0	266

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 13C

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM
THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS;
MODIFICATION - C; FABRIC - A; BREAK TYPE - UNSEAMED; PARAMETER 'A' - 1.06 ;
G - 5 CM; W - 5 CM; PEAK ANGLE - 45 DEGREES;
PEAK STRENGTH - 221 N; STRENGTH OF WARP - 266 N;
STRENGTH OF WEFT - 266 N; AT THE TESTING WIDTH OF 5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	266	53.2	266	0	266
10	120.094	10.3674	212.521	21.1649	233.686
15	128.598	10.5007	181.73	34.4393	216.169
20	138.355	10.7954	149.459	50.3292	199.789
25	149.661	11.2627	116.69	69.7479	186.438
30	162.914	11.9269	84.4151	94.0005	178.416
35	178.654	12.8283	53.6152	125.013	178.628
40	197.647	14.0295	25.2249	165.726	190.951
45	221	15.6271	.211739	220.648	220.86
50	197.647	14.0286	25.1912	165.726	190.917
55	178.654	12.8265	53.5554	125.013	178.568
60	162.914	11.9244	84.3375	94.0005	178.338
65	149.661	11.2595	116.603	69.7479	186.351
70	138.355	10.7914	149.373	50.3292	199.702
75	128.598	10.4959	181.652	34.4393	216.091
80	120.094	10.3616	212.461	21.1649	233.626
90	266	53.2	266	0	266

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 13D

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM
THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS;
MODIFICATION - D; FABRIC - A; BREAK TYPE - UNSEAMED; PARAMETER 'A' - 1 ;
G - 5 CM; W - 5 CM; PEAK ANGLE - 45 DEGREES;
PEAK STRENGTH - 221 N; STRENGTH OF WARP - 266 N;
STRENGTH OF WEFT - 266 N; AT THE TESTING WIDTH OF 5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	266	53.2	266	0	266
10	124.313	10.7315	212.521	21.9083	234.429
15	132.6	10.8276	181.73	35.5112	217.241
20	142.071	11.0854	149.459	51.6813	201.141
25	153	11.514	116.69	71.3039	187.994
30	165.75	12.1346	84.4151	95.6372	180.052
35	180.818	12.9837	53.6152	126.527	180.142
40	198.9	14.1185	25.2249	166.777	192.002
45	221	15.6271	.211739	220.648	220.86
50	198.9	14.1175	25.1912	166.777	191.968
55	180.818	12.9819	53.5554	126.527	180.082
60	165.75	12.132	84.3375	95.6372	179.975
65	153	11.5106	116.603	71.3039	187.907
70	142.071	11.0813	149.373	51.6813	201.054
75	132.6	10.8226	181.652	35.5112	217.163
80	124.313	10.7256	212.461	21.9083	234.369
90	266	53.2	266	0	266

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 14A

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS;
MODIFICATION - A; FABRIC - A; BREAK TYPE - U; PARAMETER 'A' - 1.06 ;
G - 10 CM; W - 5 CM; PEAK ANGLE - 45 DEGREES;
AND PEAK STRENGTH - 200 N; STRENGTH OF WARP - 252 N;
STRENGTH OF WEFT - 252 N; AT THE TESTING WIDTH OF 5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	252	50.4	252	0	252
10	108.683	9.38226	158.262	48.8518	207.114
15	116.378	9.50294	109.194	73.7497	182.944
20	125.208	9.76959	60.6361	100.193	160.829
25	135.44	10.1925	14.0624	129.165	143.227
30	147.433	10.7936	0	147.433	147.433
35	161.678	11.6094	0	161.678	161.678
40	178.866	12.6964	0	178.866	178.866
45	200	14.1421	0	200	200
50	178.866	12.6955	0	178.866	178.866
55	161.678	11.6077	0	161.678	161.678
60	147.433	10.7913	0	147.433	147.433
65	135.44	10.1896	14.052	129.169	143.221
70	125.208	9.76597	60.6009	100.21	160.811
75	116.378	9.49857	109.147	73.7784	182.926
80	108.683	9.37703	158.217	48.8936	207.111
90	252	50.4	252	0	252

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 15A

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS; MODIFICATION - A; FABRIC - A; BREAK TYPE - U; PARAMETER 'A' - 1.06 ; G - 15 CM; W - 5 CM; PEAK ANGLE - 45 DEGREES; AND PEAK STRENGTH - 185 N; STRENGTH OF WARP - 256 N; STRENGTH OF WEFT - 256 N; AT THE TESTING WIDTH OF 5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	256	51.2	256	0	256
10	100.531	8.67859	117.017	60.2506	177.267
15	107.65	8.79022	46.9565	90.958	137.914
20	115.817	9.03687	0	115.817	115.817
25	125.282	9.42807	0	125.282	125.282
30	136.376	9.9841	0	136.376	136.376
35	149.552	10.7387	0	149.552	149.552
40	165.451	11.7442	0	165.451	165.451
45	185	13.0815	0	185	185
50	165.451	11.7434	0	165.451	165.451
55	149.552	10.7371	0	149.552	149.552
60	136.376	9.98197	0	136.376	136.376
65	125.282	9.42534	0	125.282	125.282
70	115.817	9.03352	0	115.817	115.817
75	107.65	8.78618	46.9365	90.7692	137.706
80	100.531	8.67375	116.984	60.2787	177.262
90	256	51.2	256	0	256

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 15B

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS; MODIFICATION - B; FABRIC - A; BREAK TYPE - U; PARAMETER 'A' - 1 ; G - 15 CM; W - 5 CM; PEAK ANGLE - 45 DEGREES; AND PEAK STRENGTH - 185 N; STRENGTH OF WARP - 256 N; STRENGTH OF WEFT - 256 N; AT THE TESTING WIDTH OF 5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	256	51.2	256	0	256
10	104.063	8.98342	117.017	62.3669	179.383
15	111	9.06381	46.9565	93.789	140.745
20	118.929	9.27964	0	118.929	118.929
25	128.077	9.6384	0	128.077	128.077
30	138.75	10.1579	0	138.75	138.75
35	151.364	10.8687	0	151.364	151.364
40	166.5	11.8187	0	166.5	166.5
45	185	13.0815	0	185	185
50	166.5	11.8178	0	166.5	166.5
55	151.364	10.8672	0	151.364	151.364
60	138.75	10.1558	0	138.75	138.75
65	128.077	9.63561	0	128.077	128.077
70	118.929	9.2762	0	118.929	118.929
75	111	9.05964	46.9365	93.8005	140.737
80	104.063	8.97841	116.984	62.3959	179.38
90	256	51.2	256	0	256

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 15C

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM
THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS;
MODIFICATION - C; FABRIC - A; BREAK TYPE - UNSEAMED; PARAMETER 'A' - 1.06 ;
G - 15 CM; W - 5 CM; PEAK ANGLE - 45 DEGREES;
PEAK STRENGTH - 185 N; STRENGTH OF WARP - 256 N;
STRENGTH OF WEFT - 256 N; AT THE TESTING WIDTH OF 5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	256	51.2	256	0	256
10	100.531	8.67859	117.017	53.1517	170.168
15	107.65	8.79022	46.9565	86.4879	133.444
20	115.817	9.03687	0	115.817	115.817
25	125.282	9.42807	0	125.282	125.282
30	136.376	9.9841	0	136.376	136.376
35	149.552	10.7387	0	149.552	149.552
40	165.451	11.7442	0	165.451	165.451
45	185	13.0815	0	185	185
50	165.451	11.7434	0	165.451	165.451
55	149.552	10.7371	0	149.552	149.552
60	136.376	9.98197	0	136.376	136.376
65	125.282	9.42534	0	125.282	125.282
70	115.817	9.03352	0	115.817	115.817
75	107.65	8.78618	46.9365	86.4879	133.424
80	100.531	8.67375	116.904	53.1517	170.135
90	256	51.2	256	0	256

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 15D

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM
THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS;
MODIFICATION - D; FABRIC - A; BREAK TYPE - UNSEAMED; PARAMETER 'A' - 1 ;
G - 15 CM; W - 5 CM; PEAK ANGLE - 45 DEGREES;
PEAK STRENGTH - 185 N; STRENGTH OF WARP - 256 N;
STRENGTH OF WEFT - 256 N; AT THE TESTING WIDTH OF 5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	256	51.2	256	0	256
10	104.063	8.98342	117.017	55.0186	172.035
15	111	9.06381	46.9565	89.1797	136.136
20	118.929	9.27964	0	118.929	118.929
25	128.077	9.6384	0	128.077	128.077
30	138.75	10.1579	0	138.75	138.75
35	151.364	10.8687	0	151.364	151.364
40	166.5	11.8187	0	166.5	166.5
45	185	13.0815	0	185	185
50	166.5	11.8178	0	166.5	166.5
55	151.364	10.8672	0	151.364	151.364
60	138.75	10.1558	0	138.75	138.75
65	128.077	9.63561	0	128.077	128.077
70	118.929	9.2762	0	118.929	118.929
75	111	9.05964	46.9365	89.1797	136.116
80	104.063	8.97841	116.984	55.0186	172.002
90	256	51.2	256	0	256

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 16A

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM
THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS;
MODIFICATION - A; FABRIC - A; BREAK TYPE - U; PARAMETER 'A' - 1.06 ;
G - 20 CM; W - 5 CM; PEAK ANGLE - 45 DEGREES;
AND PEAK STRENGTH - 192 N; STRENGTH OF WARP - 249 N;
STRENGTH OF WEFT - 249 N; AT THE TESTING WIDTH OF 5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	249	49.8	249	0	249
10	104.335	9.00697	71.256	78.1629	149.419
15	111.723	9.12202	0	111.723	111.723
20	120.199	9.37881	0	120.199	120.199
25	130.022	9.78481	0	130.022	130.022
30	141.536	10.3619	0	141.536	141.536
35	155.211	11.145	0	155.211	155.211
40	171.711	12.1886	0	171.711	171.711
45	192	13.5765	0	192	192
50	171.711	12.1877	0	171.711	171.711
55	155.211	11.1434	0	155.211	155.211
60	141.536	10.3597	0	141.536	141.536
65	130.022	9.78198	0	130.022	130.022
70	120.199	9.37533	0	120.199	120.199
75	111.723	9.11063	0	111.723	111.723
80	104.335	9.00175	71.236	78.1812	149.417
90	249	49.8	249	0	249

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^ 2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 16B

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS; MODIFICATION - B; FABRIC - A; BREAK TYPE - U; PARAMETER 'A' - 1 ; G - 20 CM; W - 5 CM; PEAK ANGLE - 45 DEGREES; AND PEAK STRENGTH - 192 N; STRENGTH OF WARP - 249 N; STRENGTH OF WEFT - 249 N; AT THE TESTING WIDTH OF 5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	249	49.8	249	0	249
10	108	9.32333	71.256	80.9084	152.164
15	115.2	9.40676	0	115.2	115.2
20	123.429	9.63077	0	123.429	123.429
25	132.923	10.0031	0	132.923	132.923
30	144	10.5423	0	144	144
35	157.091	11.28	0	157.091	157.091
40	172.8	12.2659	0	172.8	172.8
45	192	13.5765	0	192	192
50	172.8	12.265	0	172.8	172.8
55	157.091	11.2784	0	157.091	157.091
60	144	10.54	0	144	144
65	132.923	10.0002	0	132.923	132.923
70	123.429	9.62719	0	123.429	123.429
75	115.2	9.40244	0	115.2	115.2
80	108	9.31814	71.236	80.9273	152.163
90	249	49.8	249	0	249

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 16C

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM
THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS;
MODIFICATION - C; FABRIC - A; BREAK TYPE - UNSEAMED; PARAMETER 'A' - 1.06 ;
G - 20 CM; W - 5 CM; PEAK ANGLE - 45 DEGREES;
PEAK STRENGTH - 192 N; STRENGTH OF WARP - 249 N;
STRENGTH OF WEFT - 249 N; AT THE TESTING WIDTH OF 5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	249	49.8	249	0	249
10	104.335	9.00697	71.256	73.5504	144.806
15	111.723	9.12282	0	111.723	111.723
20	120.199	9.37881	0	120.199	120.199
25	130.022	9.78481	0	130.022	130.022
30	141.536	10.3619	0	141.536	141.536
35	155.211	11.145	0	155.211	155.211
40	171.711	12.1886	0	171.711	171.711
45	192	13.5765	0	192	192
50	171.711	12.1877	0	171.711	171.711
55	155.211	11.1434	0	155.211	155.211
60	141.536	10.3597	0	141.536	141.536
65	130.022	9.78198	0	130.022	130.022
70	120.199	9.37533	0	120.199	120.199
75	111.723	9.11863	0	111.723	111.723
80	104.335	9.00195	71.236	73.5504	144.786
90	249	49.8	249	0	249

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 16D

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM
THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS;
MODIFICATION - D; FABRIC - A; BREAK TYPE - UNSEAMED; PARAMETER 'A' - 1 ;
C - 20 CM; W - 5 CM; PEAK ANGLE - 45 DEGREES;
PEAK STRENGTH - 192 N; STRENGTH OF WARP - 249 N;
STRENGTH OF WEFT - 249 N; AT THE TESTING WIDTH OF 5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	249	49.8	249	0	249
10	108	9.32333	71.256	76.1338	147.39
15	115.2	9.40676	0	115.2	115.2
20	123.429	9.63077	0	123.429	123.429
25	132.923	10.0031	0	132.923	132.923
30	144	10.5423	0	144	144
35	157.091	11.28	0	157.091	157.091
40	172.8	12.2659	0	172.8	172.8
45	192	13.5765	0	192	192
50	172.8	12.265	0	172.8	172.8
55	157.091	11.2784	0	157.091	157.091
60	144	10.54	0	144	144
65	132.923	10.0002	0	132.923	132.923
70	123.429	9.62719	0	123.429	123.429
75	115.2	9.40244	0	115.2	115.2
80	108	9.31814	71.236	76.1338	147.37
90	249	49.8	249	0	249

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 17A

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS;
MODIFICATION - A; FABRIC - B; BREAK TYPE - U; PARAMETER 'A' - .92 ;
G - 5 CM; W - 5 CM; PEAK ANGLE - 55 DEGREES;
AND PEAK STRENGTH - 220 N; STRENGTH OF WARP - 340 N;
STRENGTH OF WEFT - 240 N; AT THE TESTING WIDTH OF 5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	340	68	340	0	340
10	126.928	11.4624	271.643	33.9374	305.58
15	133.061	11.585	232.286	51.124	283.41
20	139.847	11.8408	191.038	69.051	260.089
25	147.398	12.2365	149.152	88.1753	237.328
30	155.852	12.7859	107.899	109.006	216.905
35	165.386	13.5117	68.5307	132.147	200.678
40	176.224	14.4468	32.2423	158.346	190.588
45	188.658	15.6391	.230875	188.508	188.739
50	203.075	17.1565	22.7289	188.098	210.827
55	220	19.0972	48.3207	186.856	235.177
60	203.075	18.269	76.094	155.849	231.942
65	188.658	17.7525	105.206	128.032	233.238
70	176.224	17.5214	134.772	102.297	237.07
75	165.386	17.5725	163.897	77.6749	241.571
80	155.852	17.9261	191.694	53.2121	244.906
90	240	48	240	0	240

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 17B

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS;
MODIFICATION - B; FABRIC - B; BREAK TYPE - U; PARAMETER 'A' - 1 ;
G - 5 CM; W - 5 CM; PEAK ANGLE - 55 DEGREES;
AND PEAK STRENGTH - 220 N; STRENGTH OF WARP - 340 N;
STRENGTH OF WEFT - 240 N; AT THE TESTING WIDTH OF 5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	340	68	340	0	340
10	121	10.9271	271.643	32.3524	303.995
15	127.368	11.0893	232.286	48.9369	281.223
20	134.444	11.3834	191.038	66.3834	257.422
25	142.353	11.8177	149.152	85.1574	234.31
30	151.25	12.4084	107.899	105.787	213.686
35	161.333	13.1805	68.5307	128.908	197.439
40	172.857	14.1708	32.2423	155.32	187.562
45	186.154	15.4315	.230875	186.006	186.237
50	201.667	17.0375	22.7289	186.793	209.522
55	220	19.0972	48.3207	186.856	235.177
60	201.667	18.1423	76.094	154.767	230.861
65	186.154	17.5168	105.206	126.332	231.538
70	172.857	17.1866	134.772	100.343	235.115
75	161.333	17.1418	163.897	75.7713	239.668
80	151.25	17.3967	191.694	51.6407	243.335
90	240	48	240	0	240

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 17C

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM
THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS;
MODIFICATION - C; FABRIC - B; BREAK TYPE - UNSEAMED; PARAMETER 'A' - .92 ;
G - 5 CM; W - 5 CM; PEAK ANGLE - 55 DEGREES;
PEAK STRENGTH - 220 N; STRENGTH OF WARP - 340 N;
STRENGTH OF WEFT - 240 N; AT THE TESTING WIDTH OF 5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	340	68	340	0	340
10	126.928	11.4624	271.643	22.3692	294.012
15	133.061	11.585	232.286	35.6346	267.921
20	139.847	11.8408	191.038	50.8721	241.911
25	147.398	12.2365	149.152	68.693	217.845
30	155.852	12.7859	107.899	89.9263	197.825
35	165.386	13.5117	68.5307	115.729	184.259
40	176.224	14.4468	32.2423	147.764	180.006
45	188.658	15.6391	.230875	188.358	188.589
50	203.075	17.1565	22.7289	170.278	193.007
55	220	19.0972	48.3207	153.944	202.265
60	203.075	18.269	76.094	117.174	193.268
65	188.658	17.7525	105.206	87.922	193.128
70	176.224	17.5214	134.772	64.1051	198.878
75	165.386	17.5725	163.897	44.2916	208.188
80	155.852	17.9261	191.694	27.4668	219.161
90	240	48	240	0	240

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 17D

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM
THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS;
MODIFICATION - D; FABRIC - B; BREAK TYPE - UNSEAMED; PARAMETER 'A' - 1 ;
G - 5 CM; W - 5 CM; PEAK ANGLE - 55 DEGREES;
PEAK STRENGTH - 220 N; STRENGTH OF WARP - 340 N;
STRENGTH OF WEFT - 240 N; AT THE TESTING WIDTH OF 5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	340	68	340	0	340
10	121	10.9271	271.643	21.3245	292.967
15	127.368	11.0893	232.286	34.1101	266.396
20	134.444	11.3834	191.038	48.9068	239.945
25	142.353	11.8177	149.152	66.3419	215.494
30	151.25	12.4084	107.899	87.2707	195.17
35	161.333	13.1805	68.5307	112.892	181.423
40	172.857	14.1708	32.2423	144.94	177.182
45	186.154	15.4315	.230875	185.857	186.088
50	201.667	17.0375	22.7289	169.097	191.826
55	220	19.0972	48.3207	153.944	202.265
60	201.667	18.1423	76.094	116.361	192.455
65	186.154	17.5168	105.206	86.7548	191.961
70	172.857	17.1866	134.772	62.8802	197.653
75	161.333	17.1418	163.897	43.2062	207.103
80	151.25	17.3967	191.694	26.6557	218.35
90	240	48	240	0	240

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 18A

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM
THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS;
MODIFICATION - A; FABRIC - C; BREAK TYPE - U; PARAMETER 'A' - 1.1 ;
G - 5 CM; W - 5 CM; PEAK ANGLE - 45 DEGREES;
AND PEAK STRENGTH - 155 N; STRENGTH OF WARP - 180 N;
STRENGTH OF WEFT - 160 N; AT THE TESTING WIDTH OF 5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	180	36	180	0	180
10	82.3126	7.22611	143.811	23.6899	167.501
15	88.3686	7.38925	122.975	36.1067	159.082
20	95.3362	7.666	101.138	49.5012	150.639
25	103.433	8.06886	78.963	64.3814	143.344
30	112.953	8.61977	57.123	81.3715	138.495
35	124.299	9.35315	36.2809	101.289	137.57
40	138.038	10.3214	17.0695	125.265	142.334
45	155	11.6046	.135328	154.877	155.012
50	138.038	10.4274	15.1526	126.575	141.728
55	124.299	9.54776	32.2138	103.432	135.646
60	112.953	8.8938	50.7293	84.0015	134.731
65	103.433	8.41928	70.1372	67.2265	137.364
70	95.3362	8.09514	89.8483	52.3257	142.174
75	88.3686	7.90482	109.264	38.6829	147.947
80	82.3126	7.84213	127.796	25.7692	153.565
90	160	32	160	0	160

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 18B

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS;
MODIFICATION - B; FABRIC - C; BREAK TYPE - U; PARAMETER 'A' - 1 ;
G - 5 CM; W - 5 CM; PEAK ANGLE - 45 DEGREES;
AND PEAK STRENGTH - 155 N; STRENGTH OF WARP - 180 N;
STRENGTH OF WEFT - 160 N; AT THE TESTING WIDTH OF 5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	180	36	180	0	180
10	87.1875	7.65407	143.811	25.0929	168.904
15	93	7.77652	122.975	37.9991	160.974
20	99.6429	8.0123	101.138	51.7374	152.875
25	107.308	8.37109	78.963	66.793	145.756
30	116.25	8.87135	57.123	83.7464	140.869
35	126.818	9.54274	36.2809	103.342	139.623
40	139.5	10.4307	17.0695	126.591	143.661
45	155	11.6046	.135328	154.877	155.012
50	139.5	10.5378	15.1526	127.916	143.068
55	126.818	9.74129	32.2138	105.529	137.742
60	116.25	9.15337	50.7293	86.4532	137.182
65	107.308	8.73464	70.1372	69.7446	139.882
70	99.6429	8.46083	89.8483	54.6895	144.538
75	93	8.31911	109.264	40.7103	149.975
80	87.1875	8.30657	127.796	27.2954	155.091
90	160	32	160	0	160

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 18C

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM
THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS;
MODIFICATION - C; FABRIC - C; BREAK TYPE - UNSEAMED; PARAMETER 'A' - 1.1 ;
G - 5 CM; W - 5 CM; PEAK ANGLE - 45 DEGREES;
PEAK STRENGTH - 155 N; STRENGTH OF WARP - 180 N;
STRENGTH OF WEFT - 160 N; AT THE TESTING WIDTH OF 5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	180	36	180	0	180
10	82.3126	7.22611	143.811	14.5064	158.317
15	88.3686	7.38925	122.975	23.6657	146.641
20	95.3362	7.666	101.138	34.6804	135.818
25	103.433	8.06886	78.963	48.2039	127.167
30	112.953	8.61977	57.123	65.1737	122.297
35	124.299	9.35315	36.2809	86.9775	123.258
40	138.038	10.3214	17.0695	115.744	132.814
45	155	11.6046	.135328	154.753	154.889
50	138.038	10.4274	15.1526	115.744	130.897
55	124.299	9.54776	32.2138	86.9775	119.191
60	112.953	8.8938	50.7293	65.1737	115.903
65	103.433	8.41928	70.1372	48.2039	118.341
70	95.3362	8.09514	89.8483	34.6804	124.529
75	88.3686	7.90482	109.264	23.6657	132.93
80	82.3126	7.84213	127.796	14.5064	142.302
90	160	32	160	0	160

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 18D

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM
THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS;
MODIFICATION - D; FABRIC - C; BREAK TYPE - UNSEAMED; PARAMETER 'A' - 1 ;
G - 5 CM; W - 5 CM; PEAK ANGLE - 45 DEGREES;
PEAK STRENGTH - 155 N; STRENGTH OF WARP - 180 N;
STRENGTH OF WEFT - 160 N; AT THE TESTING WIDTH OF 5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	180	36	180	0	180
10	87.1875	7.65407	143.811	15.3656	159.176
15	93	7.77652	122.975	24.906	147.881
20	99.6429	8.0123	101.138	36.2471	137.385
25	107.308	8.37109	78.963	50.0095	128.972
30	116.25	8.87135	57.123	67.0758	124.199
35	126.818	9.54274	36.2809	88.7405	125.021
40	139.5	10.4307	17.0695	116.97	134.04
45	155	11.6046	.135328	154.753	154.889
50	139.5	10.5378	15.1526	116.97	132.123
55	126.818	9.74129	32.2138	88.7405	120.954
60	116.25	9.15337	50.7293	67.0758	117.805
65	107.308	8.73464	70.1372	50.0095	120.147
70	99.6429	8.46083	89.8403	36.2471	126.095
75	93	8.31911	109.264	24.906	134.17
80	87.1875	8.30657	127.796	15.3656	143.162
90	160	32	160	0	160

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 19A

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM
THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS;
MODIFICATION - A; FABRIC - D!; BREAK TYPE - U; PARAMETER 'A' - 1.4 ;
G - 5 CM; W - 5 CM; PEAK ANGLE - 50 DEGREES;
AND PEAK STRENGTH - 420 N; STRENGTH OF WARP - 530 N;
STRENGTH OF WEFT - 460 N; AT THE TESTING WIDTH OF 5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	530	106	530	0	530
10	184.445	16.2441	423.443	52.6632	476.106
15	199.812	16.7841	362.093	81.1031	443.196
20	217.511	17.5915	297.795	112.332	410.127
25	238.079	18.7018	232.502	147.566	380.068
30	262.223	20.1722	168.195	188.314	356.51
35	290.89	22.0885	106.827	236.551	343.378
40	325.384	24.5771	50.2601	294.968	345.228
45	367.536	27.8255	.394047	367.243	367.637
50	420	32.1163	43.5637	385.527	429.091
55	367.536	28.6088	92.6146	306.486	399.1
60	325.384	25.9917	145.847	242.769	388.615
65	290.89	24.0497	201.644	189.904	391.548
70	262.223	22.6444	258.314	144.748	403.061
75	238.079	21.6897	314.135	104.964	419.099
80	217.511	21.1386	367.413	68.6923	436.106
90	460	92	460	0	460

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 19B

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM
THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS;
MODIFICATION - B; FABRIC - D; BREAK TYPE - U; PARAMETER 'A' - 1 ;
G - 5 CM; W - 5 CM; PEAK ANGLE - 50 DEGREES;
AND PEAK STRENGTH - 420 N; STRENGTH OF WARP - 530 N;
STRENGTH OF WEFT - 460 N; AT THE TESTING WIDTH OF 5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	530	106	530	0	530
10	233.333	20.5497	423.443	66.6218	490.065
15	247.059	20.7528	362.093	100.281	462.373
20	262.5	21.23	297.795	135.566	433.361
25	280	21.9948	232.502	173.549	406.051
30	300	23.0783	168.195	215.444	383.639
35	323.077	24.5326	106.827	262.725	369.552
40	350	26.4365	50.2601	317.283	367.543
45	381.818	28.9068	.394047	381.514	381.908
50	420	32.1163	43.5637	385.527	429.091
55	381.818	29.7205	92.6146	318.396	411.01
60	350	27.9581	145.847	261.135	406.982
65	323.077	26.7108	201.644	210.917	412.561
70	300	25.9067	258.314	165.601	423.915
75	280	25.5088	314.135	123.446	437.581
80	262.5	25.5108	367.413	82.9003	450.314
90	460	92	460	0	460

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 19C

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM
THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS;
MODIFICATION - C; FABRIC - D; BREAK TYPE - UNSEAMED; PARAMETER 'A' - 1.4 ;
G - 5 CM; W - 5 CM; PEAK ANGLE - 50 DEGREES;
PEAK STRENGTH - 420 N; STRENGTH OF WARP - 530 N;
STRENGTH OF WEFT - 460 N; AT THE TESTING WIDTH OF 5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	530	106	530	0	530
10	184.445	16.2441	423.443	32.5059	455.949
15	199.812	16.7841	362.093	53.5109	415.604
20	217.511	17.5915	297.795	79.124	376.919
25	238.079	18.7018	232.502	110.954	343.456
30	262.223	20.1722	168.195	151.301	319.497
35	290.89	22.0885	106.827	203.549	310.376
40	325.384	24.5771	50.2601	272.833	323.093
45	367.536	27.8255	.394047	366.951	367.345
50	420	32.1163	43.5637	352.169	395.732
55	367.536	28.6088	92.6146	257.182	349.796
60	325.384	25.9917	145.847	187.745	333.592
65	290.89	24.0497	201.644	135.566	337.21
70	262.223	22.6444	258.314	95.3887	353.703
75	238.079	21.6897	314.135	63.7593	377.894
80	217.511	21.1386	367.413	38.3332	405.747
90	460	92	460	0	460

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 19D

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS;
MODIFICATION - D; FABRIC - D; BREAK TYPE - UNSEAMED; PARAMETER 'A' - 1 ;
G - 5 CM; W - 5 CM; PEAK ANGLE - 50 DEGREES;
PEAK STRENGTH - 420 N; STRENGTH OF WARP - 530 N;
STRENGTH OF WEFT - 460 N; AT THE TESTING WIDTH OF 5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	530	106	530	0	530
10	233.333	20.5497	423.443	41.1217	464.565
15	247.059	20.7528	362.093	66.1641	428.257
20	262.5	21.23	297.795	95.4896	393.285
25	280	21.9948	232.502	130.491	362.993
30	300	23.0783	168.195	173.099	341.294
35	323.077	24.5326	106.827	226.072	332.899
40	350	26.4365	50.2601	293.474	343.734
45	381.818	28.9068	.394047	381.21	381.604
50	420	32.1163	43.5637	352.169	395.732
55	381.818	29.7205	92.6146	267.176	359.79
60	350	27.9581	145.847	201.949	347.795
65	323.077	26.7100	201.644	150.566	352.211
70	300	25.9067	250.314	109.131	359.445
75	280	25.5088	314.135	74.9059	389.121
80	262.5	25.5108	367.413	46.2619	413.675
90	460	92	460	0	460

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 20A

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM
THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS;
MODIFICATION - A; FABRIC - E; BREAK TYPE - U; PARAMETER 'A' - .5 ;
G - 5 CM; W - 5 CM; PEAK ANGLE - 30 DEGREES;
AND PEAK STRENGTH - 730 N; STRENGTH OF WARP - 880 N;
STRENGTH OF WEFT - 520 N; AT THE TESTING WIDTH OF 5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	880	176	880	0	880
10	565.456	52.0016	703.076	143.587	846.662
15	596.043	53.2741	601.211	219.251	820.462
20	632.199	55.3706	494.452	301.138	795.59
25	675.849	58.4638	386.041	392.893	778.935
30	730	62.851	279.268	499.721	778.989
35	675.849	58.3578	177.373	532.284	709.658
40	632.199	55.1685	83.4507	563.924	647.375
45	596.043	52.9788	.557321	595.568	596.125
50	565.456	51.6105	49.2459	527.739	576.985
55	539.141	50.9655	104.695	465.095	569.789
60	516.188	51.0044	164.87	405.813	570.683
65	495.937	51.7388	227.946	348.025	575.97
70	477.897	53.2328	292.007	289.878	581.885
75	461.693	55.6167	355.109	229.302	584.411
80	447.032	59.1152	415.337	163.684	579.021
90	520	104	520	0	520

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 20B

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS; MODIFICATION - B; FABRIC - E; BREAK TYPE - U; PARAMETER 'A' - 1 ; G - 5 CM; W - 5 CM; PEAK ANGLE - 30 DEGREES; AND PEAK STRENGTH - 730 N; STRENGTH OF WARP - 880 N; STRENGTH OF WEFT - 520 N; AT THE TESTING WIDTH OF 5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	880	176	880	0	880
10	438	40.2802	703.076	111.222	814.297
15	486.667	43.4981	601.211	179.018	780.229
20	547.5	47.9524	494.452	260.793	755.245
25	625.714	54.127	386.041	363.749	749.79
30	730	62.851	279.268	499.721	778.989
35	625.714	54.0289	177.373	492.8	670.173
40	547.5	47.7773	83.4507	488.373	571.824
45	486.667	43.257	.557321	486.279	486.837
50	438	39.9773	49.2459	408.785	458.031
55	398.182	37.6405	104.695	343.495	448.19
60	365	36.0656	164.87	286.953	451.823
65	336.923	35.1496	227.946	236.436	464.382
70	312.857	34.849	292.007	189.77	481.777
75	292	35.1751	355.109	145.023	500.133
80	273.75	36.2005	415.337	100.236	515.572
90	520	104	520	0	520

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 20C

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS:
MODIFICATION - C; FABRIC - E; BREAK TYPE - UNSEAMED; PARAMETER 'A' - .5 ;
G - 5 CM; W - 5 CM; PEAK ANGLE - 30 DEGREES;
PEAK STRENGTH - 730 N; STRENGTH OF WARP - 880 N;
STRENGTH OF WEFT - 520 N; AT THE TESTING WIDTH OF 5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	880	176	880	0	880
10	565.456	52.0016	703.076	99.6535	802.729
15	596.043	53.2741	601.211	159.624	760.835
20	632.199	55.3706	494.452	229.975	724.427
25	675.849	58.4638	386.041	314.971	701.013
30	730	62.851	279.268	421.207	700.475
35	675.849	58.3578	177.373	472.922	650.296
40	632.199	55.1685	83.4507	530.096	613.547
45	596.043	52.9788	.557321	595.094	595.651
50	565.456	51.6105	49.2459	474.133	523.379
55	539.141	50.9655	104.695	377.262	481.956
60	516.188	51.0044	164.87	297.839	462.709
65	495.937	51.7388	227.946	231.126	459.072
70	477.897	53.2328	292.007	173.845	465.852
75	461.693	55.6167	355.109	123.644	478.754
80	447.032	59.1152	415.337	78.783	494.12
90	520	104	520	0	520

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 2OD

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS;
MODIFICATION - D; FABRIC - E; BREAK TYPE - UNSEAMED; PARAMETER 'A' - 1 ;
G - 5 CM; W - 5 CM; PEAK ANGLE - 30 DEGREES;
PEAK STRENGTH - 730 N; STRENGTH OF WARP - 880 N;
STRENGTH OF WEFT - 520 N; AT THE TESTING WIDTH OF 5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	880	176	880	0	880
10	438	40.2802	703.076	77.1913	780.267
15	486.667	43.4981	601.211	130.333	731.543
20	547.5	47.9524	494.452	199.164	693.616
25	625.714	54.127	386.041	291.607	677.648
30	730	62.851	279.268	421.207	700.475
35	625.714	54.0289	177.373	437.041	615.215
40	547.5	47.7773	83.4507	459.077	542.528
45	486.667	43.257	.557321	405.892	406.449
50	438	39.9773	49.2459	367.262	416.507
55	398.182	37.6405	104.695	278.626	383.321
60	365	36.0656	164.87	210.604	375.474
65	336.923	35.1496	227.946	157.019	384.965
70	312.857	34.849	292.007	113.808	405.815
75	292	35.1751	355.109	78.1996	433.309
80	273.75	36.2005	415.337	48.2445	463.581
90	520	104	520	0	520

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 21A

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS; MODIFICATION - A; FABRIC - F; BREAK TYPE - U; PARAMETER 'A' - .712 ; G - 5 CM; W - 5 CM; PEAK ANGLE - 45 DEGREES; AND PEAK STRENGTH - 677 N; STRENGTH OF WARP - 835 N; STRENGTH OF WEFT - 765 N; AT THE TESTING WIDTH OF 5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	835	167	835	0	835
10	449.444	39.2928	667.123	130.677	797.8
15	470.579	39.1183	570.467	193.907	764.374
20	494.272	39.4487	469.168	258.409	727.576
25	521.053	40.2853	366.3	326.079	692.379
30	551.61	41.6614	264.987	398.968	663.955
35	586.864	43.6464	168.303	479.491	647.795
40	628.072	46.3547	79.1833	570.705	649.889
45	677	49.9646	.63683	676.461	677.098
50	628.072	46.7075	72.4483	575.15	647.598
55	586.864	44.3184	154.022	487.034	641.056
60	551.61	42.6401	242.549	408.545	651.094
65	521.053	41.5762	335.343	336.768	672.111
70	494.272	41.0756	429.587	269.335	698.922
75	470.579	41.1254	522.42	204.152	726.572
80	449.444	41.7512	611.025	139.171	750.196
90	765	153	765	0	765

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 21B

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS; MODIFICATION - B; FABRIC - F; BREAK TYPE - U; PARAMETER 'A' - 1 ; G - 5 CM; W - 5 CM; PEAK ANGLE - 45 DEGREES; AND PEAK STRENGTH - 677 N; STRENGTH OF WARP - 835 N; STRENGTH OF WEFT - 765 N; AT THE TESTING WIDTH OF 5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	835	167	835	0	835
10	380.813	33.2926	667.123	110.722	777.845
15	406.2	33.7666	570.467	167.379	737.846
20	435.214	34.7352	469.168	227.533	696.701
25	468.692	36.237	366.3	293.311	659.612
30	507.75	38.3488	264.987	367.245	632.232
35	553.909	41.1954	168.303	452.566	620.869
40	609.3	44.9693	77.1833	553.648	632.831
45	677	49.9646	.63683	676.461	677.098
50	609.3	45.3115	72.4403	557.96	630.408
55	553.909	41.8297	154.022	459.684	613.706
60	507.75	39.2497	242.547	376.06	618.61
65	468.692	37.3983	335.343	302.926	638.27
70	435.214	36.1677	429.587	237.154	666.741
75	406.2	35.4992	522.42	176.223	698.643
80	380.813	35.3757	611.025	117.919	728.944
90	765	153	765	0	765

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 21C

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM
THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS;
MODIFICATION - C; FABRIC - F; BREAK TYPE - UNSEAMED; PARAMETER 'A' - .712 ;
G - 5 CM; W - 5 CM; PEAK ANGLE - 45 DEGREES;
PEAK STRENGTH - 677 N; STRENGTH OF WARP - 835 N;
STRENGTH OF WEFT - 765 N; AT THE TESTING WIDTH OF 5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	835	167	835	0	835
10	449.444	39.2928	667.123	79.2082	746.331
15	470.579	39.1183	570.467	126.024	696.491
20	494.272	39.4487	469.168	179.801	648.969
25	521.053	40.2853	366.3	242.831	609.131
30	551.61	41.6614	264.987	318.277	583.264
35	586.864	43.6464	168.303	410.656	578.959
40	628.072	46.3547	79.1833	526.636	605.819
45	677	49.9646	.63683	675.922	676.559
50	628.072	46.7075	72.4483	526.636	599.084
55	586.864	44.3184	154.022	410.656	564.678
60	551.61	42.6401	242.549	318.277	560.827
65	521.053	41.5762	335.343	242.831	578.174
70	494.272	41.0756	429.587	179.801	609.389
75	470.579	41.1254	522.42	126.024	648.444
80	449.444	41.7512	611.025	79.2082	690.233
90	765	153	765	0	765

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 21D

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS;
MODIFICATION - D; FABRIC - F"; BREAK TYPE - UNSEAMED; PARAMETER 'A' - 1 ;
G - 5 CM; W - 5 CM; PEAK ANGLE - 45 DEGREES;
PEAK STRENGTH - 677 N; STRENGTH OF WARP - 835 N;
STRENGTH OF WEFT - 765 N; AT THE TESTING WIDTH OF 5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	835	167	835	0	835
10	380.813	33.2926	667.123	67.1128	734.236
15	406.2	33.7666	570.467	108.783	679.25
20	435.214	34.7352	469.168	158.318	627.486
25	468.692	36.237	366.3	218.429	584.729
30	507.75	38.3488	264.987	292.97	557.957
35	553.909	41.1954	168.303	387.596	555.899
40	609.3	44.9693	79.1833	510.896	590.079
45	677	49.9646	.63683	675.922	676.559
50	609.3	45.3115	72.4483	510.896	583.344
55	553.909	41.8297	154.022	387.596	541.618
60	507.75	39.2497	242.549	292.97	535.519
65	468.692	37.3983	335.343	218.429	553.772
70	435.214	36.1677	429.587	158.318	587.905
75	406.2	35.4992	522.42	108.783	631.203
80	380.813	35.3757	611.025	67.1128	678.137
90	765	153	765	0	765

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 22A

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM
THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS;
MODIFICATION - A; FABRIC - G; BREAK TYPE - U; PARAMETER 'A' - .83 ;
C 5 CM; W - 5 CM; PEAK ANGLE - 30 DEGREES;
AND PEAK STRENGTH - 740 N; STRENGTH OF WARP - 940 N;
STRENGTH OF WEFT - 625 N; AT THE TESTING WIDTH OF 5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	940	188	940	0	940
10	484.281	44.0166	751.013	127.191	878.203
15	528.538	46.446	642.202	200.039	842.242
20	582.817	49.9394	528.165	284.23	812.395
25	651.127	54.8427	412.362	385.698	778.06
30	740	61.7463	298.309	513.769	812.078
35	651.127	54.2367	189.467	517.701	707.168
40	582.817	48.8336	89.1405	522.383	611.524
45	528.538	44.8921	.622978	528.117	528.74
50	484.281	42.0282	59.1898	447.721	500.911
55	447.447	40.0064	125.835	382.045	507.88
60	416.272	38.6834	198.161	322.079	520.24
65	389.515	37.9801	273.973	267.341	541.315
70	366.278	37.8677	350.97	215.783	566.753
75	345.893	38.365	426.814	165.516	592.33
80	327.852	39.5452	499.203	114.574	613.777
90	625	125	625	0	625

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 22B

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS; MODIFICATION - B; FABRIC - G; BREAK TYPE - U; PARAMETER 'A' - 1 ; G - 5 CM; W - 5 CM; PEAK ANGLE - 30 DEGREES; AND PEAK STRENGTH - 740 N; STRENGTH OF WARP - 940 N; STRENGTH OF WEFT - 625 N; AT THE TESTING WIDTH OF 5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	940	188	940	0	940
10	444	40.3555	751.013	116.611	867.624
15	493.333	43.3524	642.202	186.715	828.918
20	555	47.5558	528.165	270.664	798.829
25	634.286	53.4241	412.362	375.722	788.084
30	740	61.7463	298.309	513.769	812.078
35	634.286	52.8339	189.467	504.311	693.778
40	555	46.5028	89.1405	497.45	586.591
45	493.333	41.9019	.622978	492.941	493.564
50	444	38.5325	59.1898	412.315	471.505
55	403.636	36.0893	125.835	344.639	470.474
60	370	34.3835	198.161	281.277	494.439
65	341.538	33.3021	273.973	234.413	508.386
70	317.143	32.7879	380.97	156.836	537.806
75	296	32.8311	426.814	141.642	568.456
80	277.5	33.4718	499.203	96.9774	596.18
90	625	125	625	0	625

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 22D

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM
THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS;
MODIFICATION - D; FABRIC - G; BREAK TYPE - U; PARAMETER 'A' - 1 ;
G - 5 CM; W - 5 CM; PEAK ANGLE - 30 DEGREES;
PEAK STRENGTH - 740 N; STRENGTH OF WARP - 940 N;
STRENGTH OF WEFT - 625 N; AT THE TESTING WIDTH OF 5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	940	188	940	0	940
10	444	40.3555	751.013	78.2487	829.261
15	493.333	43.3524	642.202	132.118	774.32
20	555	47.5558	528.165	201.892	730.057
25	634.286	53.4241	412.362	295.601	707.964
30	740	61.7463	298.307	426.977	725.286
35	634.286	52.8339	189.467	443.839	633.306
40	555	46.5028	89.1405	465.366	554.506
45	493.333	41.9019	.622978	492.548	493.171
50	444	38.5325	59.1890	372.293	431.482
55	403.636	36.0893	125.835	282.443	408.278
60	370	34.3835	198.161	213.489	411.65
65	341.538	33.3021	273.973	159.17	433.143
70	317.143	32.7879	350.97	115.367	466.337
75	296	32.8311	428.814	77.2709	506.085
80	277.5	33.4718	499.203	40.9054	540.108
90	625	125	625	0	625

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^ 2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 23A

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS;
MODIFICATION - A; FABRIC - H; BREAK TYPE - U; PARAMETER 'A' - .5 ;
G - 5 CM; W - 5 CM; PEAK ANGLE - 40 DEGREES;
AND PEAK STRENGTH - 570 N; STRENGTH OF WARP - 575 N;
STRENGTH OF WEFT - 575 N; AT THE TESTING WIDTH OF 5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	575	115	575	0	575
10	430.879	37.1966	459.396	129.118	588.514
15	447.145	36.512	392.837	188.906	581.743
20	465.403	36.314	323.08	248.282	571.361
25	486.098	36.5812	252.243	309.051	561.294
30	509.823	37.3243	182.476	373.072	555.548
35	537.401	38.5883	115.897	442.471	558.369
40	570	40.4603	54.5274	519.928	574.456
45	537.401	38	.457706	536.973	537.431
50	509.823	36.1863	54.4546	465.071	519.526
55	486.098	34.8996	115.768	400.29	516.058
60	465.403	34.065	182.308	340.65	522.959
65	447.145	33.64	252.056	284.393	536.449
70	430.879	33.6078	322.892	229.997	552.889
75	416.269	33.9752	392.669	176.024	568.693
80	403.051	34.7748	459.267	120.975	580.242
90	575	115	575	0	575

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 23B

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS;
MODIFICATION - B; FABRIC - H; BREAK TYPE - U; PARAMETER 'A' - 1 ;
G - 5 CM; W - 5 CM; PEAK ANGLE - 40 DEGREES;
AND PEAK STRENGTH - 570 N; STRENGTH OF WARP - 575 N;
STRENGTH OF WEFT - 575 N; AT THE TESTING WIDTH OF 5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	575	115	575	0	575
10	325.714	28.118	459.396	97.6037	557
15	350.769	28.6424	392.837	148.19	541.027
20	380	29.6503	323.08	202.721	525.801
25	414.545	31.1965	252.243	263.559	515.802
30	456	33.3839	182.476	333.685	516.162
35	506.667	36.3814	115.897	417.166	533.063
40	570	40.4603	54.5274	519.928	574.456
45	506.667	35.8267	.457706	506.263	506.721
50	456	32.366	54.4546	415.972	470.427
55	414.545	29.7624	115.768	341.369	457.137
60	380	27.814	182.308	278.14	460.448
65	350.769	26.3894	252.056	223.096	475.152
70	325.714	25.4051	322.892	173.861	496.754
75	304	24.812	392.669	128.55	521.219
80	285	24.5895	459.267	85.5425	544.809
90	575	115	575	0	575

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 23C

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS;
MODIFICATION - C; FABRIC - H; BREAK TYPE - UNSEAMED; PARAMETER 'A' - .5 ;
G - 5 CM; W - 5 CM; PEAK ANGLE - 40 DEGREES;
PEAK STRENGTH - 570 N; STRENGTH OF WARP - 575 N;
STRENGTH OF WEFT - 575 N; AT THE TESTING WIDTH OF 5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	575	115	575	0	575
10	430.879	37.1966	459.396	75.9364	535.332
15	447.145	36.512	392.837	119.748	512.585
20	465.403	36.314	323.08	169.3	492.379
25	486.098	36.5812	252.243	226.54	478.783
30	509.823	37.3243	182.476	294.166	476.643
35	537.401	38.5883	115.897	376.044	491.942
40	570	40.4603	54.5274	477.943	532.471
45	537.401	38	.457706	536.546	537.003
50	509.823	36.1863	54.4546	427.485	481.94
55	486.098	34.8996	115.768	340.145	455.913
60	465.403	34.065	182.308	268.536	450.844
65	447.145	33.64	252.056	208.387	460.442
70	430.879	33.6078	322.892	156.741	479.633
75	416.269	33.9752	392.669	111.48	504.149
80	403.051	34.7748	459.267	71.032	530.299
90	575	115	575	0	575

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 23D

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM
THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS;
MODIFICATION - D; FABRIC - H; BREAK TYPE - UNSEAMED; PARAMETER 'A' - 1 ;
G - 5 CM; W - 5 CM; PEAK ANGLE - 40 DEGREES;
PEAK STRENGTH - 570 N; STRENGTH OF WARP - 575 N;
STRENGTH OF WEFT - 575 N; AT THE TESTING WIDTH OF 5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	575	115	575	0	575
10	325.714	28.118	459.396	57.4025	516.799
15	350.769	28.6424	392.837	93.9384	486.775
20	380	29.6503	323.08	138.233	461.312
25	414.545	31.1965	252.243	193.194	445.437
30	456	33.3839	182.476	263.11	445.587
35	506.667	36.3814	115.897	354.538	470.435
40	570	40.4603	54.5274	477.943	532.471
45	506.667	35.8267	.457706	505.86	506.318
50	456	32.366	54.4546	382.354	436.809
55	414.545	29.7624	115.768	290.077	405.845
60	380	27.814	182.308	219.259	401.567
65	350.769	26.3894	252.056	163.472	415.527
70	325.714	25.4051	322.892	118.485	441.377
75	304	24.812	392.669	81.4133	474.082
80	285	24.5895	459.267	50.2272	509.494
90	575	115	575	0	575

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 24A

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM
THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS;
MODIFICATION - A; FABRIC - I; BREAK TYPE - U; PARAMETER 'A' - .94 ;
G - 5 CM; W - 5 CM; PEAK ANGLE - 35 DEGREES;
AND PEAK STRENGTH - 340 N; STRENGTH OF WARP - 580 N;
STRENGTH OF WEFT - 350 N; AT THE TESTING WIDTH OF 5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	580	116	580	0	580
10	204.852	18.8014	463.391	52.3236	515.714
15	222.312	19.8127	396.253	82.1825	478.435
20	243.148	21.2163	325.889	116.296	442.185
25	268.462	23.1172	254.436	156.579	411.015
30	299.893	25.6814	184.063	205.799	389.862
35	340	29.177	116.905	268.222	385.128
40	299.893	25.9873	55.0016	267.732	322.734
45	268.462	23.6756	.370217	268.248	268.619
50	243.148	21.9999	33.1463	226.73	259.876
55	222.312	20.8133	70.4676	191.431	261.899
60	204.852	20.0266	110.97	160.595	271.565
65	190.005	19.5901	153.425	132.811	286.236
70	177.219	19.4847	196.543	106.939	303.482
75	166.091	19.7201	239.016	81.9434	320.959
80	156.314	20.3388	279.554	56.7586	336.312
90	350	70	350	0	350

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 24B

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS; MODIFICATION - B; FABRIC - I; BREAK TYPE - U; PARAMETER 'A' - 1 ; G - 5 CM; W - 5 CM; PEAK ANGLE - 35 DEGREES; AND PEAK STRENGTH - 340 N; STRENGTH OF WARP - 580 N; STRENGTH OF WEFT - 350 N; AT THE TESTING WIDTH OF 5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	580	116	580	0	580
10	198.333	18.2031	463.391	50.6585	514.049
15	216.364	19.2826	396.253	79.9837	476.236
20	238	20.7671	325.889	113.834	439.723
25	264.444	22.7712	254.436	154.235	408.672
30	297.5	25.4765	184.063	204.157	388.22
35	340	29.177	116.905	268.222	385.128
40	297.5	25.78	55.0016	265.596	320.597
45	264.444	23.3212	.370217	264.234	264.604
50	238	21.5341	33.1463	221.929	255.075
55	216.364	20.2564	70.4676	186.309	256.777
60	198.333	19.3893	110.97	155.484	266.454
65	183.077	18.8758	153.425	127.969	281.394
70	170	18.691	196.543	102.582	299.125
75	158.667	18.8386	239.016	78.2806	317.296
80	148.75	19.3546	279.554	54.012	333.566
90	350	70	350	0	350

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 24C

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS;
MODIFICATION - C; FABRIC - I; BREAK TYPE - UNSEAMED; PARAMETER 'A' - .94 ;
G - 5 CM; W - 5 CM; PEAK ANGLE - 35 DEGREES;
PEAK STRENGTH - 340 N; STRENGTH OF WARP - 580 N;
STRENGTH OF WEFT - 350 N; AT THE TESTING WIDTH OF 5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	580	116	580	0	580
10	204.852	18.8014	463.391	36.1023	499.493
15	222.312	19.8127	396.253	59.5366	455.789
20	243.148	21.2163	325.889	88.45	414.339
25	268.462	23.1172	254.436	125.114	379.55
30	299.893	25.6814	184.063	173.037	357.1
35	340	29.177	116.905	237.914	354.819
40	299.893	25.9873	55.0016	251.459	306.461
45	268.462	23.6756	.370217	268.035	268.405
50	243.148	21.9999	33.1463	203.879	237.025
55	222.312	20.8133	70.4676	155.562	226.029
60	204.852	20.0266	110.97	118.199	229.169
65	190.005	19.5901	153.425	88.5495	241.975
70	177.219	19.4847	196.543	64.467	261.01
75	166.091	19.7201	239.016	44.4802	283.496
80	156.314	20.3388	279.554	27.5481	307.102
90	350	70	350	0	350

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 24D

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS; MODIFICATION - D; FABRIC - I; BREAK TYPE - UNSEAMED; PARAMETER 'A' - 1 ; G - 5 CM; W - 5 CM; PEAK ANGLE - 35 DEGREES; PEAK STRENGTH - 340 N; STRENGTH OF WARP - 580 N; STRENGTH OF WEFT - 350 N; AT THE TESTING WIDTH OF 5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	580	116	580	0	580
10	198.333	18.2031	463.391	34.9534	498.344
15	216.364	19.2826	396.253	57.9437	454.196
20	238	20.7671	325.889	86.5772	412.466
25	264.444	22.7712	254.436	123.241	377.670
30	297.5	25.4765	184.063	171.656	355.719
35	340	29.177	116.905	237.914	354.819
40	297.5	25.78	55.0016	249.453	304.454
45	264.444	23.3212	.370217	264.023	264.394
50	238	21.5341	33.1463	199.562	232.708
55	216.364	20.2564	70.4676	151.4	221.867
60	198.333	19.3893	110.97	114.438	225.408
65	183.077	18.8758	153.425	85.3209	238.746
70	170	18.691	196.543	61.8409	258.384
75	158.667	18.8386	239.016	42.492	281.508
80	148.75	19.3546	279.554	26.2151	305.769
90	350	70	350	0	350

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

<u>Appendices 25 - 33</u> Calculated Breaking Strengths of Type II Breaks Using Modifications A,B,C,D to the Theoretical Model

APPENDIX 25A

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS; MODIFICATION - A; FABRIC - A; BREAK TYPE - II; PARAMETER 'A' - 1.99 ; G - 2.5 CM; W - 5 CM; PEAK ANGLE - 45 DEGREES; AND PEAK STRENGTH - 191 N; STRENGTH OF WARP - 191 N; STRENGTH OF WEFT - 191 N; AT THE TESTING WIDTH OF 5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	191	38.2	191	0	191
10	60.7823	5.24716	168.923	13.6605	182.583
15	69.1121	5.64342	154.354	21.8985	176.253
20	79.2832	6.18623	137.999	31.7218	169.721
25	91.8816	6.91453	120.354	43.8123	164.166
30	107.747	7.88819	108.396	53.8108	162.207
35	128.116	9.19945	101.356	63.9944	165.35
40	154.873	10.9934	97.0386	77.3685	174.407
45	191	13.5057	95.576	95.424	191
50	154.873	10.9926	97.0122	77.3794	174.392
55	128.116	9.19816	101.304	64.0135	165.317
60	107.747	7.88651	108.32	53.8373	162.157
65	91.8816	6.91253	120.264	43.8441	164.108
70	79.2832	6.18394	137.919	31.7533	169.672
75	69.1121	5.64082	154.288	21.9303	176.218
80	60.7823	5.24424	168.875	13.6934	182.569
90	191	38.2	191	0	191

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 25B

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS; MODIFICATION - B; FABRIC - A; BREAK TYPE - II; PARAMETER 'A' - 1.65 ; G - 2.5 CM; W - 5 CM; PEAK ANGLE - 45 DEGREES; AND PEAK STRENGTH - 191 N; STRENGTH OF WARP - 191 N; STRENGTH OF WEFT - 191 N; AT THE TESTING WIDTH OF 5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	191	38.2	191	0	191
10	73.9155	6.38091	168.923	16.6122	185.535
15	82.221	6.71383	154.354	26.0521	180.406
20	92.1345	7.18898	137.999	36.8637	174.863
25	104.118	7.8354	120.354	49.6472	170.001
30	118.819	8.69874	108.396	59.3401	167.736
35	137.163	9.84902	101.356	68.513	169.869
40	160.522	11.3943	97.0386	80.1903	177.229
45	191	13.5057	95.576	95.424	191
50	160.522	11.3935	97.0122	80.2016	177.214
55	137.163	9.84763	101.304	68.5334	169.837
60	118.819	8.69689	108.32	59.3693	167.689
65	104.118	7.83313	120.264	49.6832	169.947
70	92.1345	7.18631	137.919	36.9002	174.819
75	82.221	6.71075	154.288	26.0899	180.378
80	73.9155	6.37736	168.875	16.6522	185.528
90	191	38.2	191	0	191

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 25C

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS;
MODIFICATION - C; FABRIC - A; BREAK TYPE - II; PARAMETER 'A' - 1.99 ;
G - 2.5 CM; W - 5 CM; PEAK ANGLE - 45 DEGREES;
PEAK STRENGTH - 191 N; STRENGTH OF WARP - 191 N;
STRENGTH OF WEFT - 191 N; AT THE TESTING WIDTH OF 5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	191	38.2	191	0	191
10	60.7823	5.24716	168.923	5.35601	174.279
15	69.1121	5.64342	154.354	9.25436	163.608
20	79.2832	6.18623	137.999	14.4204	152.419
25	91.8816	6.91453	120.354	21.4102	141.764
30	107.747	7.88819	108.396	16.5352	124.931
35	128.116	9.19945	101.356	8.09797	109.454
40	154.873	10.9934	97.0386	2.25961	99.2982
45	191	13.5057	95.576	0	95.576
50	154.873	10.9926	97.0122	2.25961	99.2718
55	128.116	9.19816	101.304	8.09797	109.402
60	107.747	7.88651	108.32	16.5352	124.855
65	91.8816	6.91253	120.264	21.4102	141.674
70	79.2832	6.18394	137.919	14.4204	152.339
75	69.1121	5.64082	154.288	9.25436	163.543
80	60.7823	5.24424	168.875	5.35601	174.231
90	191	38.2	191	0	191

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 25D

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS;
MODIFICATION - D; FABRIC - A; BREAK TYPE - II; PARAMETER 'A' - 1.65 ;
G - 2.5 CM; W - 5 CM; PEAK ANGLE - 45 DEGREES;
PEAK STRENGTH - 191 N; STRENGTH OF WARP - 191 N;
STRENGTH OF WEFT - 191 N; AT THE TESTING WIDTH OF 5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	191	38.2	191	0	191
10	73.9155	6.38091	168.923	6.51328	175.436
15	82.221	6.71383	154.354	11.0097	165.364
20	92.1345	7.18898	137.999	16.7579	154.757
25	104.118	7.8354	120.354	24.2616	144.615
30	118.819	8.69874	108.396	18.2342	126.63
35	137.163	9.84902	101.356	8.66977	110.025
40	160.522	11.3943	97.0386	2.34202	99.3806
45	191	13.5057	95.576	0	95.576
50	160.522	11.3935	97.0122	2.34202	99.3542
55	137.163	9.84763	101.304	8.66777	109.973
60	118.819	8.69689	108.32	18.2342	126.554
65	104.118	7.83313	120.264	24.2616	144.526
70	92.1345	7.18631	137.919	16.7579	154.677
75	82.221	6.71075	154.288	11.0097	165.298
80	73.9155	6.37736	168.875	6.51328	175.387
90	191	38.2	191	0	191

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 26A

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS;
MODIFICATION - A; FABRIC - A; BREAK TYPE - II; PARAMETER 'A' - 1.99 ;
G - 5 CM; W - 5 CM; PEAK ANGLE - 45 DEGREES;
AND PEAK STRENGTH - 201 N; STRENGTH OF WARP - 206 N;
STRENGTH OF WEFT - 206 N; AT THE TESTING WIDTH OF 5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	206	41.2	206	0	206
10	63.9646	5.52188	164.584	19.1677	183.751
15	72.7306	5.93888	140.738	30.7267	171.465
20	83.4342	6.51012	115.747	44.5102	160.257
25	96.6922	7.27655	90.3687	61.4749	151.844
30	113.388	8.30119	65.3741	82.9737	148.348
35	134.824	9.6811	41.5215	111.008	152.529
40	162.982	11.5689	19.535	148.664	168.2
45	201	14.2128	.163978	200.84	201.004
50	162.982	11.5681	19.509	148.675	168.184
55	134.824	9.67974	41.4752	111.024	152.5
60	113.388	8.29942	65.314	82.9942	148.308
65	96.6922	7.27444	90.3016	61.4982	151.8
70	83.4342	6.5077	115.68	44.5359	160.216
75	72.7306	5.93615	140.678	30.755	171.433
80	63.9646	5.51881	164.537	19.1989	183.736
90	206	41.2	206	0	206

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 26B

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS; MODIFICATION - B; FABRIC - A; BREAK TYPE - II; PARAMETER 'A' - 1.65 ; G - 5 CM; W - 5 CM; PEAK ANGLE - 45 DEGREES; AND PEAK STRENGTH - 201 N; STRENGTH OF WARP - 206 N; STRENGTH OF WEFT - 206 N; AT THE TESTING WIDTH OF 5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	206	41.2	206	0	206
10	77.7854	6.71499	164.584	23.3092	187.893
15	86.5258	7.06534	140.738	36.5548	177.293
20	96.9583	7.56537	115.747	51.725	167.472
25	109.569	8.24563	90.3687	69.662	160.031
30	125.039	9.15418	65.3741	91.4997	156.874
35	144.344	10.3647	41.5215	118.846	160.368
40	168.926	11.9909	19.535	154.087	173.622
45	201	14.2128	.163978	200.84	201.004
50	168.926	11.99	19.509	154.097	173.606
55	144.344	10.3632	41.4752	118.864	160.339
60	125.039	9.15222	65.314	91.5222	156.836
65	109.569	8.24324	90.3016	69.6884	159.99
70	96.9583	7.56256	115.68	51.7549	167.435
75	86.5258	7.0621	140.678	36.5884	177.266
80	77.7854	6.71125	164.537	23.3472	187.885
90	206	41.2	206	0	206

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 26C

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS;
MODIFICATION - C; FABRIC - A; BREAK TYPE - II; PARAMETER 'A' - 1.99 ;
G - 5 CM; W - 5 CM; PEAK ANGLE - 45 DEGREES;
PEAK STRENGTH - 201 N; STRENGTH OF WARP - 206 N;
STRENGTH OF WEFT - 206 N; AT THE TESTING WIDTH OF 5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	206	41.2	206	0	206
10	63.9646	5.52188	164.584	11.2729	175.856
15	72.7306	5.93888	140.738	19.4778	160.216
20	83.4342	6.51012	115.747	30.3508	146.098
25	96.6922	7.27655	90.3687	45.0623	135.431
30	113.388	8.30119	65.3741	65.4246	130.799
35	134.824	9.6811	41.5215	94.3426	135.864
40	162.982	11.5689	19.535	136.66	156.195
45	201	14.2128	.163978	200.68	200.844
50	162.982	11.5681	19.509	136.66	156.169
55	134.824	9.67974	41.4752	94.3426	135.818
60	113.388	8.29942	65.314	65.4246	130.739
65	96.6922	7.27444	90.3016	45.0623	135.364
70	83.4342	6.5077	115.68	30.3508	146.031
75	72.7306	5.93615	140.678	19.4778	160.156
80	63.9646	5.51881	164.537	11.2729	175.81
90	206	41.2	206	0	206

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 26D

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM
THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS;
MODIFICATION - D; FABRIC - A; BREAK TYPE - II; PARAMETER 'A' - 2 ;
G - 5 CM; W - 5 CM; PEAK ANGLE - 45 DEGREES;
PEAK STRENGTH - 201 N; STRENGTH OF WARP - 206 N;
STRENGTH OF WEFT - 206 N; AT THE TESTING WIDTH OF 5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	206	41.2	206	0	206
10	63.5977	5.4902	164.584	11.2082	175.792
15	72.36	5.90862	140.738	19.3785	160.116
20	83.0663	6.48142	115.747	30.217	145.964
25	96.3373	7.24984	90.3687	44.8969	135.266
30	113.063	8.27734	65.3741	65.2367	130.611
35	134.554	9.66169	41.5215	94.1534	135.675
40	162.81	11.5567	19.535	136.516	156.051
45	201	14.2128	.163978	200.68	200.844
50	162.81	11.5559	19.509	136.516	156.025
55	134.554	9.66033	41.4752	94.1534	135.629
60	113.063	8.27557	65.314	65.2367	130.551
65	96.3373	7.24774	90.3016	44.8969	135.198
70	83.0663	6.47901	115.68	30.217	145.897
75	72.36	5.90591	140.678	19.3785	160.056
80	63.5977	5.48715	164.537	11.2082	175.746
90	206	41.2	206	0	206

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 27A

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS;
MODIFICATION - A; FABRIC - A; BREAK TYPE - II; PARAMETER 'A' - 1.99 ;
G - 7.5 CM; W - 5 CM; PEAK ANGLE - 45 DEGREES;
AND PEAK STRENGTH - 171 N; STRENGTH OF WARP - 194 N;
STRENGTH OF WEFT - 194 N; AT THE TESTING WIDTH OF 5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	194	38.8	194	0	194
10	54.4177	4.69772	138.416	20.3835	158.8
15	61.8753	5.05248	108.301	32.6758	140.977
20	70.9813	5.53846	77.8422	47.3336	125.176
25	82.2605	6.1905	47.9652	65.3744	113.34
30	96.4646	7.0622	19.5765	88.2369	107.813
35	114.701	8.23616	0	114.701	114.701
40	138.656	9.84222	0	138.656	138.656
45	171	12.0915	0	171	171
50	138.656	9.84153	0	138.656	138.656
55	114.701	8.235	0	114.701	114.701
60	96.4646	7.0607	19.5585	88.2425	107.801
65	82.2605	6.18871	47.9296	65.3856	113.315
70	70.9813	5.53641	77.7971	47.3492	125.146
75	61.8753	5.05016	108.255	32.6954	140.95
80	54.4177	4.69511	138.377	20.4073	158.785
90	194	38.8	194	0	194

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 27B

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS; MODIFICATION - B; FABRIC - A; BREAK TYPE - II; PARAMETER 'A' - 1.65 ; G - 7.5 CM; W - 5 CM; PEAK ANGLE - 45 DEGREES; AND PEAK STRENGTH - 171 N; STRENGTH OF WARP - 194 N; STRENGTH OF WEFT - 194 N; AT THE TESTING WIDTH OF 5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	194	38.8	194	0	194
10	66.1757	5.71276	138.416	24.7878	163.204
15	73.6115	6.01081	108.301	38.8736	147.174
20	82.4869	6.43621	77.8422	55.0061	132.848
25	93.2158	7.01494	47.9652	74.0809	122.046
30	106.377	7.78788	19.5765	97.3038	116.88
35	122.8	8.81771	0	122.8	122.8
40	143.713	10.2012	0	143.713	143.713
45	171	12.0915	0	171	171
50	143.713	10.2005	0	143.713	143.713
55	122.8	8.81647	0	122.8	122.8
60	106.377	7.78622	19.5585	97.3099	116.868
65	93.2158	7.01291	47.9296	74.0935	122.023
70	82.4869	6.43382	77.7971	55.0242	132.821
75	73.6115	6.00805	108.255	38.8969	147.151
80	66.1757	5.70957	138.377	24.8167	163.194
90	194	38.8	194	0	194

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 27C

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS;
MODIFICATION - C; FABRIC - A; BREAK TYPE - II; PARAMETER 'A' - 1.99 ;
G - 7.5 CM; W - 5 CM; PEAK ANGLE - 45 DEGREES;
PEAK STRENGTH - 171 N; STRENGTH OF WARP - 194 N;
STRENGTH OF WEFT - 194 N; AT THE TESTING WIDTH OF 5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	194	38.8	194	0	194
10	54.4177	4.69772	138.416	14.3855	152.802
15	61.8753	5.05248	108.301	24.8559	133.157
20	70.9813	5.53846	77.8422	38.7313	116.574
25	82.2605	6.1905	47.9652	57.5048	105.47
30	96.4646	7.0622	19.5765	83.4896	103.066
35	114.701	8.23616	0	114.701	114.701
40	138.656	9.84222	0	138.656	138.656
45	171	12.0915	0	171	171
50	138.656	9.84153	0	138.656	138.656
55	114.701	8.235	0	114.701	114.701
60	96.4646	7.0607	19.5585	83.4896	103.048
65	82.2605	6.18871	47.9296	57.5048	105.434
70	70.9813	5.53641	77.7971	38.7313	116.528
75	61.8753	5.05016	108.255	24.8559	133.11
80	54.4177	4.69511	138.377	14.3855	152.763
90	194	38.8	194	0	194

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 27D

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS;
MODIFICATION - D; FABRIC - A; BREAK TYPE - II; PARAMETER 'A' - 1.65 ;
G - 7.5 CM; W - 5 CM; PEAK ANGLE - 45 DEGREES;
PEAK STRENGTH - 171 N; STRENGTH OF WARP - 194 N;
STRENGTH OF WEFT - 194 N; AT THE TESTING WIDTH OF 5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	194	38.8	194	0	194
10	66.1757	5.71276	138.416	17.4938	155.91
15	73.6115	6.01081	108.301	29.5705	137.871
20	82.4869	6.43621	77.8422	45.0094	122.852
25	93.2158	7.01494	47.9652	65.1632	113.128
30	106.377	7.78788	19.5765	92.0686	111.645
35	122.8	8.81771	0	122.8	122.8
40	143.713	10.2012	0	143.713	143.713
45	171	12.0915	0	171	171
50	143.713	10.2005	0	143.713	143.713
55	122.8	8.81647	0	122.8	122.8
60	106.377	7.78622	19.5585	92.0686	111.627
65	93.2158	7.01291	47.9296	65.1632	113.093
70	82.4869	6.43382	77.7971	45.0094	122.806
75	73.6115	6.00805	108.255	29.5705	137.825
80	66.1757	5.70957	138.377	17.4938	155.871
90	194	38.8	194	0	194

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 28A

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS; MODIFICATION - A; FABRIC - A; BREAK TYPE - II; PARAMETER 'A' - 1.99 ; G - 2.5 CM; W - 6.5 CM; PEAK ANGLE - 45 DEGREES; AND PEAK STRENGTH - 204 N; STRENGTH OF WARP - 205 N; STRENGTH OF WEFT - 205 N; AT THE TESTING WIDTH OF 6.5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	205	31.5385	205	0	205
10	64.9193	4.311	185.348	13.468	198.816
15	73.8161	4.63656	171.579	21.5098	193.169
20	84.6794	5.08253	155.713	31.2747	186.988
25	98.1354	5.68089	144.685	37.6909	182.376
30	115.081	6.48083	136.801	44.2102	181.011
35	136.836	7.55815	130.988	52.5769	183.565
40	165.414	9.03199	127.424	63.5649	190.989
45	204	11.0961	126.217	78.3991	204.616
50	165.414	9.03137	127.402	63.5739	190.976
55	136.836	7.55708	130.945	52.5926	183.538
60	115.081	6.47945	136.738	44.232	180.97
65	98.1354	5.67924	144.605	37.7194	182.324
70	84.6794	5.08064	155.623	31.31	186.933
75	73.8161	4.63443	171.505	21.625	193.13
80	64.9193	4.3086	185.296	13.5039	198.8
90	205	31.5385	205	0	205

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 28B

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM
THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS;
MODIFICATION - B; FABRIC - A; BREAK TYPE - II; PARAMETER 'A' - 1.65 ;
G - 2.5 CM; W - 6.5 CM; PEAK ANGLE - 45 DEGREES;
AND PEAK STRENGTH - 204 N; STRENGTH OF WARP - 205 N;
STRENGTH OF WEFT - 205 N; AT THE TESTING WIDTH OF 6.5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	205	31.5385	205	0	205
10	78.9464	5.24248	185.348	16.378	201.726
15	87.8172	5.516	171.579	25.6849	197.264
20	98.4054	5.90637	155.713	36.3441	192.057
25	111.205	6.43746	144.685	42.7105	187.396
30	126.906	7.14677	136.801	48.753	185.554
35	146.498	8.09182	130.988	56.2893	187.278
40	171.447	9.36141	127.424	65.8833	193.307
45	204	11.0961	126.217	78.3991	204.616
50	171.447	9.36076	127.402	65.8926	193.295
55	146.498	8.09069	130.945	56.3062	187.252
60	126.906	7.14525	136.738	48.7771	185.515
65	111.205	6.4356	144.605	42.7428	187.348
70	98.4054	5.90418	155.623	36.3851	172.008
75	87.8172	5.51346	171.505	25.7267	197.232
80	78.9464	5.23955	185.296	16.4217	201.717
90	205	31.5385	205	0	205

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 28C

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS;
MODIFICATION - C; FABRIC - A; BREAK TYPE - II; PARAMETER 'A' - 1.99 ;
G - 2.5 CM; W - 6.5 CM; PEAK ANGLE - 45 DEGREES;
PEAK STRENGTH - 204 N; STRENGTH OF WARP - 205 N;
STRENGTH OF WEFT - 205 N; AT THE TESTING WIDTH OF 6.5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	205	31.5385	205	0	205
10	64.9193	4.311	185.348	4.40043	189.748
15	73.8161	4.63656	171.579	7.60326	179.182
20	84.6794	5.08253	155.713	11.8476	167.561
25	98.1354	5.68089	144.685	.276636	144.962
30	115.081	6.48083	136.801	0	136.801
35	136.836	7.55815	130.988	0	130.988
40	165.414	9.03199	127.424	0	127.424
45	204	11.0961	126.217	0	126.217
50	165.414	9.03137	127.402	0	127.402
55	136.836	7.55708	130.945	0	130.945
60	115.081	6.47945	136.738	0	136.738
65	98.1354	5.67924	144.605	.276636	144.881
70	84.6794	5.08064	155.623	11.8476	167.47
75	73.8161	4.63443	171.505	7.60326	179.109
80	64.9193	4.3086	185.296	4.40043	189.696
90	205	31.5385	205	0	205

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 28D

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS;
MODIFICATION - D; FABRIC - A; BREAK TYPE - II; PARAMETER 'A' - 1.65 ;
G - 2.5 CM; W - 6.5 CM; PEAK ANGLE - 45 DEGREES;
PEAK STRENGTH - 204 N; STRENGTH OF WARP - 205 N;
STRENGTH OF WEFT - 205 N; AT THE TESTING WIDTH OF 6.5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	205	31.5385	205	0	205
10	78.9464	5.24248	185.348	5.35122	190.699
15	87.8172	5.516	171.579	9.04541	180.624
20	98.4054	5.90637	155.713	13.768	169.481
25	111.205	6.43746	144.685	.313478	144.999
30	126.906	7.14677	136.801	0	136.801
35	146.498	8.09182	130.988	0	130.988
40	171.447	9.36141	127.424	0	127.424
45	204	11.0961	126.217	0	126.217
50	171.447	9.36076	127.402	0	127.402
55	146.498	8.09069	130.945	0	130.945
60	126.906	7.14525	136.738	0	136.738
65	111.205	6.4356	144.605	.313478	144.918
70	98.4054	5.90418	155.623	13.768	169.391
75	87.8172	5.51346	171.505	9.04541	180.551
80	78.9464	5.23955	185.296	5.35122	190.647
90	205	31.5385	205	0	205

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 29A

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS; MODIFICATION - A; FABRIC - A; BREAK TYPE II; PARAMETER 'A' - 1.99 ; G - 5 CM; W - 6.5 CM; PEAK ANGLE - 45 DEGREES; AND PEAK STRENGTH - 206 N; STRENGTH OF WARP - 203 N; STRENGTH OF WEFT - 203 N; AT THE TESTING WIDTH OF 6.5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	203	31.2308	203	0	203
10	65.5558	4.35326	170.194	17.3778	187.572
15	74.5398	4.68201	150.395	27.8575	178.252
20	85.5096	5.13236	129.111	40.3539	169.465
25	99.0975	5.73658	106.989	55.7344	162.724
30	116.209	6.54437	84.7008	75.2257	159.926
35	138.178	7.63224	62.9224	100.642	163.564
40	167.036	9.12054	49.3619	128.376	177.738
45	206	11.2049	46.9705	158.335	205.306
50	167.036	9.11991	49.3188	128.394	177.713
55	138.178	7.63117	62.8522	100.668	163.52
60	116.209	6.54298	84.6229	75.2532	159.876
65	99.0975	5.73492	106.91	55.7631	162.673
70	85.5096	5.13045	129.036	40.3837	169.42
75	74.5398	4.67986	150.33	27.8889	178.219
80	65.5558	4.35084	170.146	17.4114	187.558
90	203	31.2308	203	0	203

WHERE
SKQ THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 BREAKING STRENGTH OF THE SECOND ZONE (N)
S TOTAL BREAKING STRENGTH (N)

APPENDIX 29B

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM
THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS:
MODIFICATION - B; FABRIC - A; BREAK TYPE - II; PARAMETER 'A' - 1.65 ;
G - 5 CM; W - 6.5 CM; PEAK ANGLE - 45 DEGREES;
AND PEAK STRENGTH - 206 N; STRENGTH OF WARP - 203 N;
STRENGTH OF WEFT - 203 N; AT THE TESTING WIDTH OF 6.5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	203	31.2308	203	0	203
10	79.7204	5.29387	170.194	21.1326	191.327
15	88.6782	5.57008	150.395	33.1413	183.536
20	99.3702	5.96428	129.111	46.895	176.006
25	112.295	6.50057	106.989	63.157	170.146
30	128.15	7.21684	84.7000	82.9555	167.656
35	147.934	8.17115	62.9224	107.748	170.671
40	173.128	9.45319	49.3619	133.058	182.42
45	206	11.2049	46.9705	158.335	205.306
50	173.128	9.45253	49.3188	133.077	182.396
55	147.934	8.17001	62.8522	107.776	170.629
60	128.15	7.2153	84.6229	82.9859	167.609
65	112.295	6.49869	106.91	63.1895	170.099
70	99.3702	5.96207	129.036	46.9296	175.966
75	88.6782	5.56752	150.33	33.1787	183.509
80	79.7204	5.29092	170.146	21.1735	191.32
90	203	31.2308	203	0	203

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^ 2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 29C

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS; MODIFICATION - C; FABRIC - A; BREAK TYPE - II; PARAMETER 'A' - 1.99 ; G - 5 CM; W - 6.5 CM; PEAK ANGLE - 45 DEGREES; PEAK STRENGTH - 206 N; STRENGTH OF WARP - 203 N; STRENGTH OF WEFT - 203 N; AT THE TESTING WIDTH OF 6.5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	203	31.2308	203	0	203
10	65.5558	4.35326	170.194	8.88713	179.081
15	74.5398	4.68201	150.395	15.3556	165.75
20	85.5096	5.13236	129.111	23.9276	153.038
25	99.0975	5.73658	106.989	35.5256	142.515
30	116.209	6.54437	84.7008	51.5785	136.279
35	138.178	7.63224	62.9224	74.3765	137.299
40	167.036	9.12054	49.3619	93.6917	143.054
45	206	11.2049	46.9705	110.671	157.641
50	167.036	9.11991	49.3188	93.6917	143.011
55	138.178	7.63117	62.8522	74.3765	137.229
60	116.209	6.54298	84.6229	51.5785	136.201
65	99.0975	5.73492	106.91	35.5256	142.435
70	85.5096	5.13045	129.036	23.9276	152.964
75	74.5398	4.67986	150.33	15.3556	165.686
80	65.5558	4.35084	170.146	8.88713	179.033
90	203	31.2308	203	0	203

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 29D

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS;
MODIFICATION - D; FABRIC - A; BREAK TYPE - II; PARAMETER 'A' - 1.65 ;
G - 5 CM; W - 6.5 CM; PEAK ANGLE - 45 DEGREES;
PEAK STRENGTH - 206 N; STRENGTH OF WARP - 203 N;
STRENGTH OF WEFT - 203 N; AT THE TESTING WIDTH OF 6.5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	203	31.2308	203	0	203
10	79.7204	5.29387	170.194	10.8074	181.001
15	88.6782	5.57008	150.395	18.2682	168.663
20	99.3702	5.96428	129.111	27.8061	156.917
25	112.295	6.50057	106.989	40.2568	147.246
30	128.15	7.21684	84.7008	56.8785	141.579
35	147.934	8.17115	62.9224	79.6281	142.55
40	173.128	9.45319	49.3619	97.1089	146.471
45	206	11.2049	46.9705	110.671	157.641
50	173.128	9.45253	49.3188	97.1089	146.428
55	147.934	8.17001	62.8522	79.6281	142.48
60	128.15	7.2153	84.6229	56.8785	141.501
65	112.295	6.49869	106.91	40.2568	147.166
70	99.3702	5.96207	129.036	27.8061	156.842
75	88.6782	5.56752	150.33	18.2682	168.598
80	79.7204	5.29092	170.146	10.8074	180.954
90	203	31.2308	203	0	203

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 30A

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS; MODIFICATION - A; FABRIC - A; BREAK TYPE - II; PARAMETER 'A' - 1.99 ; G - 7.5 CM; W - 6.5 CM; PEAK ANGLE - 45 DEGREES; AND PEAK STRENGTH - 203 N; STRENGTH OF WARP - 204 N; STRENGTH OF WEFT - 204 N; AT THE TESTING WIDTH OF 6.5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	204	31.3846	204	0	204
10	64.6011	4.28987	157.621	20.8475	178.469
15	73.4543	4.61383	131.529	33.4195	164.949
20	84.2643	5.05761	104.54	48.411	152.951
25	97.6543	5.65304	77.4748	66.8625	144.337
30	114.516	6.44906	51.1536	90.2454	141.399
35	136.166	7.5211	26.3750	120.736	147.112
40	164.603	8.98772	3.89341	161.693	165.587
45	203	11.0417	0	203	203
50	164.603	8.98709	3.88821	161.695	165.584
55	136.166	7.52004	26.3464	120.747	147.094
60	114.516	6.44769	51.1066	90.2617	141.368
65	97.6543	5.6514	77.4173	66.8828	144.3
70	84.2643	5.05574	104.48	48.4347	152.915
75	73.4543	4.61171	131.473	33.4465	164.919
80	64.6011	4.28748	157.577	20.878	178.455
90	204	31.3846	204	0	204

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 30B

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS; MODIFICATION - B; FABRIC - A; BREAK TYPE II; PARAMETER 'A' 1.65 ; G - 7.5 CM; W - 6.5 CM; PEAK ANGLE - 45 DEGREES; AND PEAK STRENGTH - 203 N; STRENGTH OF WARP - 204 N; STRENGTH OF WEFT - 204 N; AT THE TESTING WIDTH OF 6.5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	204	31.3846	204	0	204
10	78.5594	5.21678	157.621	25.352	182.973
15	87.3868	5.48896	131.529	39.7584	171.287
20	97.923	5.87742	104.54	56.2581	160.799
25	110.66	6.4059	77.4748	75.7671	153.242
30	126.284	7.11174	51.1536	99.5186	150.672
35	145.78	8.05216	26.3758	129.262	155.637
40	170.607	9.31552	3.89341	167.57	171.484
45	203	11.0417	0	203	203
50	170.607	9.31487	3.88821	167.593	171.481
55	145.78	8.05103	26.3464	129.273	155.619
60	126.284	7.11022	51.1066	99.5366	150.643
65	110.66	6.40405	77.4173	75.7902	153.207
70	97.923	5.87524	104.48	56.2857	160.766
75	87.3868	5.48644	131.473	39.7905	171.263
80	78.5594	5.21387	157.577	25.3891	182.966
90	204	31.3846	204	0	204

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 30C

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM
THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS;
MODIFICATION - C; FABRIC - A; BREAK TYPE - II; PARAMETER 'A' - 1.99 ;
G - 7.5 CM; W - 6.5 CM; PEAK ANGLE - 45 DEGREES;
PEAK STRENGTH - 203 N; STRENGTH OF WARP - 204 N;
STRENGTH OF WEFT - 204 N; AT THE TESTING WIDTH OF 6.5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	204	31.3846	204	0	204
10	64.6011	4.28987	157.621	13.1366	170.758
15	73.4543	4.61383	131.529	22.698	154.227
20	84.2643	5.05761	104.54	35.3686	139.909
25	97.6543	5.65304	77.4748	52.5123	129.987
30	114.516	6.44906	51.1536	76.2411	127.395
35	136.166	7.5211	26.3758	109.94	136.316
40	164.603	8.98772	3.89341	159.253	163.147
45	203	11.0417	0	203	203
50	164.603	8.98709	3.88821	159.253	163.141
55	136.166	7.52004	26.3464	109.94	136.286
60	114.516	6.44769	51.1066	76.2411	127.348
65	97.6543	5.6514	77.4173	52.5123	129.93
70	84.2643	5.05574	104.48	35.3686	139.849
75	73.4543	4.61171	131.473	22.698	154.171
80	64.6011	4.28748	157.577	13.1366	170.713
90	204	31.3846	204	0	204

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 30D

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM
THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS;
MODIFICATION - D; FABRIC - A; BREAK TYPE - II; PARAMETER 'A' - 1.65 ;
G - 7.5 CM; W - 6.5 CM; PEAK ANGLE - 45 DEGREES;
PEAK STRENGTH - 203 N; STRENGTH OF WARP - 204 N;
STRENGTH OF WEFT - 204 N; AT THE TESTING WIDTH OF 6.5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	204	31.3846	204	0	204
10	78.5594	5.21678	157.621	15.975	173.596
15	87.3868	5.48896	131.529	27.0032	158.532
20	97.923	5.87742	104.54	41.1017	145.642
25	110.66	6.4059	77.4748	59.5058	136.981
30	126.284	7.11174	51.1536	84.0752	135.229
35	145.78	8.05216	26.3758	117.703	144.079
40	170.607	9.31552	3.89341	165.061	168.955
45	203	11.0417	0	203	203
50	170.607	9.31487	3.88821	165.061	168.95
55	145.78	8.05103	26.3464	117.703	144.049
60	126.284	7.11022	51.1066	84.0752	135.182
65	110.66	6.40405	77.4173	59.5058	136.923
70	97.923	5.87524	104.48	41.1017	145.582
75	87.3868	5.48644	131.473	27.0032	158.476
80	78.5594	5.21387	157.577	15.975	173.552
90	204	31.3846	204	0	204

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 31A

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM
THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS;
MODIFICATION - A; FABRIC - D; BREAK TYPE - II; PARAMETER 'A' - 1.95 ;
G - 5 CM; W - 5 CM; PEAK ANGLE - 50 DEGREES;
AND PEAK STRENGTH - 410 N; STRENGTH OF WARP - 450 N;
STRENGTH OF WEFT - 400 N; AT THE TESTING WIDTH OF 5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	450	90	450	0	450
10	130.317	11.4404	359.527	37.5059	397.033
15	145.683	12.1818	307.437	59.5240	366.962
20	163.965	13.1844	252.845	85.135	337.98
25	185.754	14.5063	197.407	115.746	313.153
30	212.733	16.2342	142.807	153.253	296.06
35	245.807	18.4963	90.7023	200.305	291.007
40	287.33	21.4842	42.6736	260.742	303.415
45	340.462	25.4898	.33832	340.191	340.529
50	410	30.9714	37.8815	375.953	413.834
55	340.462	26.1519	80.5344	283.306	363.841
60	287.33	22.624	126.823	213.682	340.505
65	245.807	20.0082	175.343	159.762	335.105
70	212.733	18.0635	224.621	116.759	341.38
75	185.954	16.6341	273.161	81.4305	354.561
80	163.965	15.6213	319.49	51.3316	370.822
90	400	80	400	0	400

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 31B

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS: MODIFICATION - B; FABRIC - D; BREAK TYPE - II; PARAMETER 'A' 1.65 ; G - 5 CM; W - 5 CM; PEAK ANGLE - 50 DEGREES; AND PEAK STRENGTH - 410 N; STRENGTH OF WARP - 450 N; STRENGTH OF WEFT - 400 N; AT THE TESTING WIDTH OF 5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	450	90	450	0	450
10	155.448	13.6465	359.527	44.7385	404.266
15	170.822	14.2839	307.437	69.7964	377.234
20	188.793	15.1809	252.845	98.0266	350.872
25	210.007	16.3827	197.407	130.717	328.125
30	235.327	17.9585	142.807	169.53	312.337
35	265.936	20.011	90.7023	216.708	307.41
40	303.483	22.6921	42.6736	275.401	318.074
45	350.337	26.2292	.33832	350.058	350.396
50	410	30.9714	37.8815	375.953	413.834
55	350.337	26.9105	80.5344	291.524	372.058
60	303.483	23.8959	126.823	225.695	352.519
65	265.936	21.6467	175.343	172.845	348.188
70	235.327	19.982	224.621	12[illegible].161	353.701
75	210.007	18.7857	273.161	91.7274	365.09
80	188.793	17.9868	319.49	59.1046	378.595
90	400	80	400	0	400

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^ 2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 31C

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM
THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS;
MODIFICATION - C; FABRIC - D; BREAK TYPE - II; PARAMETER 'A' - 1.95 ;
G - 5 CM; W - 5 CM; PEAK ANGLE - 50 DEGREES;
PEAK STRENGTH - 410 N; STRENGTH OF WARP - 450 N;
STRENGTH OF WEFT - 400 N; AT THE TESTING WIDTH OF 5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	450	90	450	0	450
10	130.317	11.4404	359.527	22.9666	382.494
15	145.683	12.1818	307.437	39.0149	346.452
20	163.965	13.1844	252.845	59.6453	312.49
25	185.954	14.5063	197.407	86.6618	284.069
30	212.733	16.2342	142.807	122.746	265.553
35	245.807	18.4963	90.7023	173.003	262.705
40	287.33	21.4842	42.6736	240.725	283.599
45	340.462	25.4898	.33832	339.92	340.258
50	410	30.9714	37.8815	343.784	381.665
55	340.462	26.1519	80.5344	238.237	318.771
60	287.33	22.624	126.823	165.788	292.611
65	245.807	20.0082	175.343	114.556	289.898
70	212.733	18.0635	224.621	77.3057	302.096
75	185.954	16.6341	273.161	49.7998	322.961
80	163.965	15.6213	319.49	28.8964	348.386
90	400	80	400	0	400

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 31D

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS:
MODIFICATION – D; FABRIC – D; BREAK TYPE – II; PARAMETER 'A' – 1.65 ;
G – 5 CM; W – 5 CM; PEAK ANGLE – 50 DEGREES;
PEAK STRENGTH – 410 N; STRENGTH OF WARP – 450 N;
STRENGTH OF WEFT – 400 N; AT THE TESTING WIDTH OF 5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	450	90	450	0	450
10	155.448	13.6465	359.527	27.3954	386.923
15	170.822	14.2839	307.437	45.7472	353.185
20	188.793	15.1809	252.845	68.6772	321.522
25	210.007	16.3827	197.407	97.8712	295.279
30	235.327	17.9585	142.807	135.783	278.591
35	265.936	20.011	90.7023	186.088	276.79
40	303.483	22.6721	42.6736	254.47	297.143
45	350.337	26.2292	.33832	349.779	350.118
50	410	30.9714	37.8815	343.784	381.665
55	350.337	26.9105	80.5344	245.147	325.681
60	303.483	23.8959	126.823	175.109	301.932
65	265.936	21.6467	175.343	123.936	299.279
70	235.327	19.982	224.621	85.605	310.226
75	210.007	18.7857	273.161	56.2413	329.402
80	188.793	17.9868	319.49	33.2721	352.762
90	400	80	400	0	400

WHERE
SKQ – THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ – STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 – BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 – BREAKING STRENGTH OF THE SECOND ZONE (N)
S – TOTAL BREAKING STRENGTH (N)

APPENDIX 32A

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS;
MODIFICATION - A; FABRIC - H; BREAK TYPE - II; PARAMETER 'A' - 1.4 ;
G - 5 CM; W - 5 CM; PEAK ANGLE - 40 DEGREES;
AND PEAK STRENGTH - 410 N; STRENGTH OF WARP - 450 N;
STRENGTH OF WEFT - 470 N; AT THE TESTING WIDTH OF 5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	450	90	450	0	450
10	187.297	16.0618	359.527	56.9932	416.521
15	207.773	16.8081	307.437	88.8945	396.332
20	232.411	17.9219	252.845	125.256	378.101
25	262.519	19.4806	197.407	168.236	365.643
30	299.992	21.6111	142.807	220.812	363.619
35	347.672	24.5162	90.7023	287.361	378.063
40	410	28.5248	42.6736	374.699	417.373
45	347.672	24.0499	.366158	347.396	347.762
50	299.992	20.7906	44.5107	273.137	317.648
55	262.519	18.3677	94.6279	215.351	309.979
60	232.411	16.5452	149.017	169.126	318.143
65	207.773	15.1717	206.028	131.109	337.137
70	187.297	14.148	263.929	98.272	362.201
75	170.052	13.4096	320.264	71.716	391.98
80	155.361	12.9167	375.401	45.931	421.332
90	470	94	470	0	470

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 32B

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM
THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS;
MODIFICATION - B; FABRIC - H; BREAK TYPE - II; PARAMETER 'A' - 1.65 ;
G - 5 CM; W - 5 CM; PEAK ANGLE - 40 DEGREES;
AND PEAK STRENGTH - 410 N; STRENGTH OF WARP - 450 N;
STRENGTH OF WEFT - 470 N; AT THE TESTING WIDTH OF 5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	450	90	450	0	450
10	162.844	13.9648	359.527	49.5523	407.08
15	184.025	14.8869	307.437	78.7339	386.171
20	210.007	16.1942	252.845	113.182	366.027
25	242.429	17.9898	197.407	155.361	352.769
30	283.715	20.4385	142.807	208.831	351.638
35	337.584	23.8048	90.7023	279.023	369.725
40	410	28.5248	42.6736	374.699	417.373
45	337.584	23.3521	.366158	337.316	337.682
50	283.715	19.6626	44.5107	258.317	302.028
55	242.429	16.9621	94.6279	198.871	293.497
60	210.007	14.9503	149.017	152.822	301.84
65	184.025	13.4376	206.028	116.123	322.151
70	162.844	12.3009	263.929	86.0504	349.98
75	145.322	11.4595	320.964	60.6884	301.652
80	130.642	10.8616	375.401	38.6232	414.024
90	470	94	470	0	470

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 32C

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS;
MODIFICATION - C; FABRIC - H; BREAK TYPE - II; PARAMETER 'A' 1.4 ;
G - 5 CM; W - 5 CM; PEAK ANGLE - 40 DEGREES;
PEAK STRENGTH - 410 N; STRENGTH OF WARP - 450 N;
STRENGTH OF WEFT - 470 N; AT THE TESTING WIDTH OF 5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	450	90	450	0	450
10	187.297	16.0618	359.527	33.0004	392.536
15	207.773	16.8081	307.437	55.6431	363.08
20	232.411	17.9219	252.845	84.544	337.389
25	262.519	19.4806	197.407	122.344	319.751
30	299.992	21.6111	142.807	173.094	315.902
35	347.672	24.5162	90.7023	243.282	333.985
40	410	28.5248	42.6736	343.784	386.457
45	347.672	24.0499	.366158	347.119	347.485
50	299.992	20.7906	44.5107	251.542	296.053
55	262.519	18.3677	94.6279	183.696	278.324
60	232.411	16.5452	149.017	134.1	283.117
65	207.773	15.1717	206.028	96.8302	302.858
70	187.297	14.148	263.929	68.133	332.062
75	170.052	13.4096	320.964	45.5411	366.505
80	155.361	12.9167	375.401	27.3802	402.781
90	470	94	470	0	470

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^ 2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 32D

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM
THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS;
MODIFICATION - D; FABRIC - H; BREAK TYPE - II; PARAMETER 'A' - 1.65 ;
G - 5 CM; W - 5 CM; PEAK ANGLE - 40 DEGREES;
PEAK STRENGTH - 410 N; STRENGTH OF WARP - 450 N;
STRENGTH OF WEFT - 470 N; AT THE TESTING WIDTH OF 5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	450	90	450	0	450
10	162.844	13.9648	359.527	28.6989	388.226
15	184.025	14.8869	307.437	49.2831	356.72
20	210.007	16.1942	252.845	76.3941	329.239
25	242.429	17.9898	197.407	112.981	310.389
30	283.715	20.4385	142.807	163.703	306.51
35	337.584	23.8048	90.7023	236.223	326.926
40	410	28.5248	42.6736	343.784	386.457
45	337.584	23.3521	.366158	337.047	337.413
50	283.715	19.6626	44.5107	237.894	282.405
55	242.429	16.9621	94.6279	169.639	264.267
60	210.007	14.9503	149.017	121.173	270.19
65	184.025	13.4376	206.028	85.7625	291.79
70	162.844	12.3009	263.929	59.2376	323.167
75	145.302	11.4595	320.964	38.9183	359.882
80	130.642	10.8616	375.401	23.0239	398.425
90	470	94	470	0	470

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*.0^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 33A

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS; MODIFICATION - A; FABRIC - I; BREAK TYPE - II; PARAMETER 'A' - 1.5 ; G - 5 CM; W - 5 CM; PEAK ANGLE - 45 DEGREES; AND PEAK STRENGTH - 280 N; STRENGTH OF WARP - 510 N; STRENGTH OF WEFT - 265 N; AT THE TESTING WIDTH OF 5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	510	102	510	0	510
10	118.125	10.9883	407.464	28.7311	436.445
15	130.132	11.8261	348.429	46.4896	394.719
20	144.321	12.916	286.558	67.0965	353.654
25	161.29	14.3255	223.728	91.9567	315.685
30	181.865	16.1537	161.848	122.68	284.529
35	207.221	18.5477	102.796	161.592	264.388
40	239.068	21.7309	48.3635	212.175	260.538
45	280	26.0547	.308531	279.777	280.086
50	239.068	22.9648	25.0965	224.311	249.407
55	207.221	20.7331	53.3541	180.733	234.087
60	181.865	19.1374	84.0204	145.449	229.469
65	161.29	18.0426	116.165	115.933	232.097
70	144.321	17.3721	148.811	90.3663	239.178
75	130.132	17.094	180.969	67.3247	248.294
80	118.125	17.2195	211.662	45.5484	257.21
90	265	53	265	0	265

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S TOTAL BREAKING STRENGTH (N)

APPENDIX 33B

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM
THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS;
MODIFICATION - B; FABRIC - I; BREAK TYPE - II; PARAMETER 'A' - 1.65 ;
G - 5 CM; W - 5 CM; PEAK ANGLE - 45 DEGREES;
AND PEAK STRENGTH - 280 N; STRENGTH OF WARP - 510 N;
STRENGTH OF WEFT - 265 N; AT THE TESTING WIDTH OF 5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	510	102	510	0	510
10	108.358	10.0797	407.464	26.5848	434.049
15	120.533	10.9538	348.429	43.0604	371.489
20	135.066	12.0877	286.558	62.7938	349.351
25	152.634	13.5567	223.728	87.0218	310.75
30	174.184	15.4715	161.848	117.499	279.347
35	201.076	17.9977	102.796	156.8	259.596
40	235.32	21.3902	48.3635	208.848	257.212
45	280	26.0547	.308531	279.777	280.086
50	235.32	22.6047	25.0965	220.794	245.89
55	201.076	20.1183	53.3541	175.374	228.728
60	174.184	18.3291	84.0204	139.306	223.326
65	152.634	17.0744	116.165	109.711	225.876
70	135.066	16.2581	148.811	84.5714	233.383
75	120.533	15.8331	180.969	62.3587	243.328
80	108.358	15.7957	211.662	41.7822	253.444
90	265	53	265	0	265

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE=10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 33C

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS; MODIFICATION - C; FABRIC - I; BREAK TYPE - II; PARAMETER 'A' 1.5 ; G - 5 CM; W - 5 CM; PEAK ANGLE - 45 DEGREES; PEAK STRENGTH - 280 N; STRENGTH OF WARP - 510 N; STRENGTH OF WEFT - 265 N; AT THE TESTING WIDTH OF 5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	510	102	510	0	510
10	118.125	10.9883	407.464	20.8178	428.282
15	130.132	11.8261	348.429	34.8503	383.279
20	144.321	12.916	286.558	52.4997	339.057
25	161.29	14.3255	223.728	75.1672	298.896
30	181.865	16.1537	161.848	104.936	266.784
35	207.221	18.5477	102.796	145.002	247.798
40	239.068	21.7309	48.3635	200.458	248.821
45	280	26.0547	.308531	277.554	279.863
50	239.068	22.9648	25.0965	200.458	225.554
55	207.221	20.7331	53.3541	145.002	198.356
60	181.865	19.1374	84.0204	104.936	188.956
65	161.29	18.0426	116.165	75.1672	191.332
70	144.321	17.3721	148.811	52.4997	201.311
75	130.132	17.094	180.969	34.8503	215.819
80	118.125	17.2195	211.662	20.8178	232.48
90	265	53	265	0	265

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 33D

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM
THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS;
MODIFICATION - D; FABRIC - I; BREAK TYPE - II; PARAMETER 'A' - 1.65 ;
G - 5 CM; W - 5 CM; PEAK ANGLE - 45 DEGREES;
PEAK STRENGTH - 280 N; STRENGTH OF WARP - 510 N;
STRENGTH OF WEFT - 265 N; AT THE TESTING WIDTH OF 5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	510	102	510	0	510
10	108.358	10.0797	407.464	19.0965	426.561
15	120.533	10.9538	348.429	32.2797	380.709
20	135.066	12.0877	286.558	49.133	335.691
25	152.634	13.5567	223.728	71.1334	294.862
30	174.184	15.4715	161.848	100.504	262.352
35	201.076	17.9977	102.776	140.702	243.498
40	235.32	21.3902	48.3635	197.315	245.678
45	280	26.0547	.308531	279.554	279.863
50	235.32	22.6047	25.0965	197.315	222.411
55	201.076	20.1183	53.3541	140.702	194.056
60	174.184	18.3291	84.0204	100.504	184.524
65	152.634	17.0744	116.165	71.1334	187.298
70	135.066	16.2581	148.811	49.133	197.944
75	120.533	15.8331	180.969	32.2797	213.249
80	108.358	15.7757	211.662	19.0965	230.759
90	265	53	265	0	265

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

Appendices 34 - 50 Calculated Breaking Strengths of Type I Breaks Using Modifications A,B,C,D to the Theoretical Model

APPENDIX 34A

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS; MODIFICATION - A; FABRIC - A; BREAK TYPE - I; PARAMETER 'A' - 2.5 ; G - 2.5 CM; W - 3.5 CM; PEAK ANGLE - 45 DEGREES; AND PEAK STRENGTH - 79 N; STRENGTH OF WARP - 99 N; STRENGTH OF WEFT - 99 N; AT THE TESTING WIDTH OF 3.5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	99	28.2857	99	0	99
10	18.7471	2.31197	83.9308	4.81522	88.746
15	22.0295	2.56977	74.7044	7.97732	82.6817
20	26.1766	2.91783	64.7129	11.9697	76.6826
25	31.5047	3.38697	54.2597	17.1686	71.4283
30	38.484	4.02489	43.662	24.1383	67.8002
35	47.8356	4.90694	33.2415	33.7591	67.0006
40	60.7062	6.15587	29.425	43.3235	72.7485
45	79	7.98021	28.342	56.3837	84.7257
50	60.7062	6.15544	29.4055	43.3296	72.7351
55	47.8356	4.90625	33.2044	33.769	66.9734
60	38.484	4.02403	43.6218	24.1479	67.7697
65	31.5047	3.38599	54.2194	17.1781	71.3974
70	26.1766	2.91675	64.6754	11.9791	76.6544
75	22.0295	2.56859	74.6725	7.98678	82.6593
80	18.7471	2.31069	83.9072	4.82494	88.7321
90	99	28.2857	99	0	99

WHERE

SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)

KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)

S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)

S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)

S - TOTAL BREAKING STRENGTH (N)

APPENDIX 34B

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS; MODIFICATION - B; FABRIC - A; BREAK TYPE - I; PARAMETER 'A' - 2 ; G - 2.5 CM; W - 3.5 CM; PEAK ANGLE - 45 DEGREES; AND PEAK STRENGTH - 79 N; STRENGTH OF WARP - 99 N; STRENGTH OF WEFT - 99 N; AT THE TESTING WIDTH OF 3.5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	99	28.2857	99	0	99
10	24.9961	3.08263	83.9308	6.4203	90.3511
15	28.44	3.31756	74.7044	10.2987	85.0031
20	32.648	3.63918	64.7129	14.9288	79.6417
25	37.8639	4.07063	54.2597	20.6341	74.8937
30	44.4375	4.64755	43.662	27.8725	71.5344
35	52.8843	5.42483	33.2415	37.3221	70.5636
40	63.99	6.48886	29.425	45.667	75.092
45	79	7.98021	28.342	56.3837	84.7257
50	63.99	6.48841	29.4055	45.6734	75.0789
55	52.8843	5.42407	33.2044	37.333	70.5374
60	44.4375	4.64656	43.6218	27.8836	71.5054
65	37.8639	4.06945	54.2194	20.6455	74.8648
70	32.648	3.63783	64.6754	14.9405	79.6159
75	28.44	3.31604	74.6725	10.3109	84.9834
80	24.9961	3.08091	83.9072	6.43325	90.3404
90	99	28.2857	99	0	99

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 34C

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS; MODIFICATION - C; FABRIC - A; BREAK TYPE - I; PARAMETER 'A' - 2.5 ; G - 2.5 CM; W - 3.5 CM; PEAK ANGLE - 45 DEGREES; PEAK STRENGTH - 79 N; STRENGTH OF WARP - 99 N; STRENGTH OF WEFT - 99 N; AT THE TESTING WIDTH OF 3.5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	99	28.2857	99	0	99
10	18.7471	2.31197	83.9308	2.35993	86.2907
15	22.0295	2.56977	74.7044	4.21404	78.9184
20	26.1766	2.91783	64.7129	6.80161	71.5145
25	31.5047	3.38697	54.2597	10.4874	64.7471
30	38.484	4.02489	43.662	15.8608	59.5228
35	47.8356	4.90694	33.2415	23.9091	57.1506
40	60.7062	6.15587	29.425	27.2823	56.7072
45	79	7.98021	28.342	33.7673	62.1093
50	60.7062	6.15544	29.4055	27.2823	56.6877
55	47.8356	4.90625	33.2044	23.9091	57.1135
60	38.484	4.02403	43.6218	15.8608	59.4826
65	31.5047	3.38599	54.2194	10.4874	64.7068
70	26.1766	2.91675	64.6754	6.80161	71.477
75	22.0295	2.56859	74.6725	4.21404	78.8865
80	18.7471	2.31069	83.9072	2.35993	86.2671
90	99	28.2857	99	0	99

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 34D

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS; MODIFICATION - D; FABRIC - A; BREAK TYPE - I; PARAMETER 'A' - 2 ; G - 2.5 CM; W - 3.5 CM; PEAK ANGLE - 45 DEGREES; PEAK STRENGTH - 79 N; STRENGTH OF WARP - 99 N; STRENGTH OF WEFT - 99 N; AT THE TESTING WIDTH OF 3.5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	99	28.2857	99	0	99
10	24.9961	3.08263	83.9308	3.14658	87.0774
15	28.44	3.31756	74.7044	5.44031	80.1447
20	32.648	3.63918	64.7129	8.4831	73.196
25	37.8639	4.07063	54.2597	12.6043	66.864
30	44.4375	4.64755	43.662	18.3145	61.9764
35	52.8843	5.42483	33.2415	26.4326	59.674
40	63.99	6.48886	29.425	28.758	58.183
45	79	7.98021	28.342	33.7673	62.1093
50	63.99	6.48841	29.4055	28.758	58.1635
55	52.8843	5.42407	33.2044	26.4326	59.637
60	44.4375	4.64656	43.6218	18.3145	61.9363
65	37.8639	4.06945	54.2194	12.6043	66.8237
70	32.648	3.63783	64.6754	8.4831	73.1585
75	28.44	3.31604	74.6725	5.44031	80.1128
80	24.9961	3.08091	83.9072	3.14658	87.0538
90	99	28.2857	99	0	99

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 35A

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS;
MODIFICATION - A; FABRIC - A; BREAK TYPE - I; PARAMETER 'A' - 2.5 ;
G - 5 CM; W - 3.5 CM; PEAK ANGLE - 45 DEGREES;
AND PEAK STRENGTH - 94 N; STRENGTH OF WARP - 115 N;
STRENGTH OF WEFT - 115 N; AT THE TESTING WIDTH OF 3.5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	115	32.8571	115	0	115
10	22.3066	2.75096	83.455	8.1168	91.5718
15	26.2124	3.05771	66.2515	13.447	79.6986
20	31.1468	3.47185	48.7825	20.1767	68.9592
25	37.4866	4.03006	31.5781	28.9403	60.5184
30	45.7911	4.78911	15.1604	40.6887	55.8492
35	56.9184	5.83864	2.79991E-2	56.9062	56.9342
40	72.2327	7.32471	0	72.2327	72.2327
45	94	9.49543	0	94	94
50	72.2327	7.3242	0	72.2327	72.2327
55	56.9184	5.83782	2.79679E-2	56.9062	56.9342
60	45.7911	4.78809	15.1465	40.6922	55.8387
65	37.4866	4.0289	31.5546	28.9459	60.5005
70	31.1468	3.47056	48.7542	20.184	68.9382
75	26.2124	3.0563	66.2232	13.4556	79.6788
80	22.3066	2.74942	83.4315	8.1267	91.5582
90	115	32.8571	115	0	115

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 35B

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS;
MODIFICATION - B; FABRIC - A; BREAK TYPE - I; PARAMETER 'A' - 2 ;
G - 5 CM; W - 3.5 CM; PEAK ANGLE - 45 DEGREES;
AND PEAK STRENGTH - 94 N; STRENGTH OF WARP - 115 N;
STRENGTH OF WEFT - 115 N; AT THE TESTING WIDTH OF 3.5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	115	32.8571	115	0	115
10	29.7422	3.66794	83.455	10.8224	94.2773
15	33.84	3.94748	66.2515	17.36	83.6116
20	38.8469	4.33016	48.7825	25.1648	73.9473
25	45.0533	4.84353	31.5781	34.7819	66.36
30	52.875	5.52999	15.1604	46.9833	62.1438
35	62.9256	6.45486	2.79991E-2	62.9122	62.9402
40	76.14	7.72092	0	76.14	76.14
45	94	9.49543	0	94	94
50	76.14	7.72038	0	76.14	76.14
55	62.9256	6.45395	2.79679E-2	62.9122	62.9402
60	52.875	5.52881	15.1465	46.9873	62.1338
65	45.0533	4.84213	31.5546	34.7887	66.3433
70	38.8469	4.32855	48.7542	25.1738	73.928
75	33.84	3.94567	66.2232	17.3711	83.5943
80	29.7422	3.6659	83.4315	10.8356	94.2671
90	115	32.8571	115	0	115

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 35C

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM
THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS;
MODIFICATION - C; FABRIC - A; BREAK TYPE - I; PARAMETER 'A' - 2.5 ;
G - 5 CM; W - 3.5 CM; PEAK ANGLE - 45 DEGREES;
PEAK STRENGTH - 94 N; STRENGTH OF WARP - 115 N;
STRENGTH OF WEFT - 115 N; AT THE TESTING WIDTH OF 3.5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	115	32.8571	115	0	115
10	22.3066	2.75096	83.455	5.61604	89.071
15	26.2124	3.05771	66.2515	10.0284	76.2799
20	31.1468	3.47185	48.7825	16.1861	64.9686
25	37.4866	4.03006	31.5781	24.9574	56.5355
30	45.7911	4.78911	15.1604	37.7447	52.9052
35	56.9184	5.83864	2.79991E-2	56.8977	56.9257
40	72.2327	7.32471	0	72.2327	72.2327
45	94	9.49543	0	94	94
50	72.2327	7.3242	0	72.2327	72.2327
55	56.9184	5.83782	2.79679E-2	56.8977	56.9257
60	45.7911	4.78809	15.1465	37.7447	52.8912
65	37.4866	4.0289	31.5546	24.9574	56.512
70	31.1468	3.47056	48.7542	16.1861	64.9403
75	26.2124	3.0563	66.2232	10.0284	76.2516
80	22.3066	2.74942	83.4315	5.61604	89.0475
90	115	32.8571	115	0	115

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 35D

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS;
MODIFICATION - D; FABRIC - A; BREAK TYPE - I; PARAMETER 'A' - 2 ;
G - 5 CM; W - 3.5 CM; PEAK ANGLE - 45 DEGREES;
PEAK STRENGTH - 94 N; STRENGTH OF WARP - 115 N;
STRENGTH OF WEFT - 115 N; AT THE TESTING WIDTH OF 3.5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	115	32.8571	115	0	115
10	29.7422	3.66794	83.455	7.48805	90.943
15	33.84	3.94748	66.2515	12.9466	79.1981
20	38.8469	4.33016	48.7825	20.1876	68.9701
25	45.0533	4.84353	31.5781	29.9951	61.5731
30	52.875	5.52999	15.1604	43.5838	58.7443
35	62.9256	6.45486	2.79991E-2	62.9028	62.9308
40	76.14	7.72092	0	76.14	76.14
45	94	9.49543	0	94	94
50	76.14	7.72038	0	76.14	76.14
55	62.9256	6.45395	2.79679E-2	62.9028	62.9308
60	52.875	5.52881	15.1465	43.5838	58.7303
65	45.0533	4.84213	31.5546	29.9951	61.5497
70	38.8469	4.32855	48.7542	20.1876	68.9418
75	33.84	3.94567	66.2232	12.9466	79.1698
80	29.7422	3.6659	83.4315	7.48805	90.9195
90	115	32.8571	115	0	115

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 36A

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS; MODIFICATION - A; FABRIC - A; BREAK TYPE - I; PARAMETER 'A' - 2.5 ; G - 10 CM; W - 3.5 CM; PEAK ANGLE - 45 DEGREES; AND PEAK STRENGTH - 93 N; STRENGTH OF WARP - 94 N; STRENGTH OF WEFT - 94 N; AT THE TESTING WIDTH OF 3.5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	94	26.8571	94	0	94
10	22.0693	2.72169	45.2623	12.7542	58.0166
15	25.9335	3.02518	20.5974	21.1298	41.7273
20	30.8155	3.43492	0	30.8155	30.8155
25	37.0878	3.98719	0	37.0878	37.0878
30	45.304	4.73817	0	45.304	45.304
35	56.3129	5.77653	0	56.3129	56.3129
40	71.4643	7.24679	0	71.4643	71.4643
45	93	9.39442	0	93	93
50	71.4643	7.24628	0	71.4643	71.4643
55	56.3129	5.77572	0	56.3129	56.3129
60	45.304	4.73715	0	45.304	45.304
65	37.0878	3.98604	0	37.0878	37.0878
70	30.8155	3.43364	0	30.8155	30.8155
75	25.9335	3.02379	20.5886	21.133	41.7217
80	22.0693	2.72017	45.2496	12.7607	58.0103
90	94	26.8571	94	0	94

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 36B

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS; MODIFICATION - B; FABRIC - A; BREAK TYPE - I; PARAMETER 'A' - 2 ; G - 10 CM; W - 3.5 CM; PEAK ANGLE - 45 DEGREES; AND PEAK STRENGTH - 93 N; STRENGTH OF WARP - 94 N; STRENGTH OF WEFT - 94 N; AT THE TESTING WIDTH OF 3.5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	94	26.8571	94	0	94
10	29.4258	3.62892	45.2623	17.0057	62.268
15	33.48	3.90549	20.5974	27.2785	47.8759
20	38.4337	4.28409	0	38.4337	38.4337
25	44.574	4.79201	0	44.574	44.574
30	52.3125	5.47116	0	52.3125	52.3125
35	62.2562	6.38619	0	62.2562	62.2562
40	75.33	7.63878	0	75.33	75.33
45	93	9.39442	0	93	93
50	75.33	7.63825	0	75.33	75.33
55	62.2562	6.38529	0	62.2562	62.2562
60	52.3125	5.47	0	52.3125	52.3125
65	44.574	4.79062	0	44.574	44.574
70	38.4337	4.2825	0	38.4337	38.4337
75	33.48	3.90369	20.5886	27.2826	47.8713
80	29.4258	3.6269	45.2496	17.0143	62.2639
90	94	26.8571	94	0	94

WHERE

SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)

KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)

S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)

S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)

S - TOTAL BREAKING STRENGTH (N)

APPENDIX 36C

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS;
MODIFICATION - C; FABRIC - A; BREAK TYPE - I; PARAMETER 'A' - 2.5 ;
G - 10 CM; W - 3.5 CM; PEAK ANGLE - 45 DEGREES;
PEAK STRENGTH - 93 N; STRENGTH OF WARP - 94 N;
STRENGTH OF WEFT - 94 N; AT THE TESTING WIDTH OF 3.5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	94	26.8571	94	0	94
10	22.0693	2.72169	45.2623	11.1126	56.3749
15	25.9335	3.02518	20.5974	19.8433	40.4408
20	30.8155	3.43492	0	30.8155	30.8155
25	37.0878	3.98719	0	37.0878	37.0878
30	45.304	4.73817	0	45.304	45.304
35	56.3129	5.77653	0	56.3129	56.3129
40	71.4643	7.24679	0	71.4643	71.4643
45	93	9.39442	0	93	93
50	71.4643	7.24628	0	71.4643	71.4643
55	56.3129	5.77572	0	56.3129	56.3129
60	45.304	4.73715	0	45.304	45.304
65	37.0878	3.98604	0	37.0878	37.0878
70	30.8155	3.43364	0	30.8155	30.8155
75	25.9335	3.02379	20.5886	19.8433	40.432
80	22.0693	2.72017	45.2496	11.1126	56.3622
90	94	26.8571	94	0	94

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 36D

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS;
MODIFICATION - D; FABRIC - A; BREAK TYPE - I; PARAMETER 'A' - 2 ;
G - 10 CM; W - 3.5 CM; PEAK ANGLE - 45 DEGREES;
PEAK STRENGTH - 93 N; STRENGTH OF WARP - 94 N;
STRENGTH OF WEFT - 94 N; AT THE TESTING WIDTH OF 3.5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	94	26.8571	94	0	94
10	29.4258	3.62892	45.2623	14.8168	60.0791
15	33.48	3.90549	20.5974	25.6176	46.2151
20	38.4337	4.28409	0	38.4337	38.4337
25	44.574	4.79201	0	44.574	44.574
30	52.3125	5.47116	0	52.3125	52.3125
35	62.2562	6.38619	0	62.2562	62.2562
40	75.33	7.63878	0	75.33	75.33
45	93	9.39442	0	93	93
50	75.33	7.63825	0	75.33	75.33
55	62.2562	6.38529	0	62.2562	62.2562
60	52.3125	5.47	0	52.3125	52.3125
65	44.574	4.79062	0	44.574	44.574
70	38.4337	4.2825	0	38.4337	38.4337
75	33.48	3.90369	20.5886	25.6176	46.2063
80	29.4258	3.6269	45.2496	14.8168	60.0664
90	94	26.8571	94	0	94

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 37A

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS; MODIFICATION - A; FABRIC - A; BREAK TYPE - I; PARAMETER 'A' - 2.5 ; G - 2.5 CM; W - 5 CM; PEAK ANGLE - 45 DEGREES; AND PEAK STRENGTH - 116 N; STRENGTH OF WARP - 153 N; STRENGTH OF WEFT - 153 N; AT THE TESTING WIDTH OF 5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	153	30.6	153	0	153
10	27.5273	2.37636	135.315	6.18665	141.502
15	32.3472	2.64134	123.645	10.2493	133.894
20	38.4365	2.99909	110.544	15.3788	125.922
25	46.26	3.48129	96.4089	22.0584	118.467
30	56.5082	4.13698	86.8302	28.2212	115.051
35	70.2397	5.04359	81.1906	35.0849	116.275
40	89.1383	6.3273	77.7325	44.53	122.262
45	116	8.20244	76.5609	57.9538	134.515
50	89.1383	6.32686	77.7114	44.5363	122.248
55	70.2397	5.04288	81.149	35.0953	116.244
60	56.5082	4.1361	86.7694	28.2351	115.004
65	46.26	3.48028	96.3372	22.0744	118.412
70	38.4365	2.99798	110.479	15.394	125.873
75	32.3472	2.64012	123.592	10.2642	133.856
80	27.5273	2.37503	135.277	6.20153	141.479
90	153	30.6	153	0	153

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 37B

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS; MODIFICATION - B; FABRIC - A; BREAK TYPE - I; PARAMETER 'A' - 2 ; G - 2.5 CM; W - 5 CM; PEAK ANGLE - 45 DEGREES; AND PEAK STRENGTH - 116 N; STRENGTH OF WARP - 153 N; STRENGTH OF WEFT - 153 N; AT THE TESTING WIDTH OF 5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	153	30.6	153	0	153
10	36.7031	3.16848	135.315	8.24886	143.564
15	41.76	3.40995	123.645	13.2318	136.877
20	47.9388	3.74052	110.544	19.1807	129.724
25	55.5976	4.18399	96.4089	26.5109	122.92
30	65.25	4.77697	86.8302	32.587	119.417
35	77.6529	5.5759	81.1906	38.7078	119.978
40	93.96	6.66956	77.7325	46.9387	124.671
45	116	8.20244	76.5609	57.9538	134.515
50	93.96	6.6691	77.7114	46.9453	124.657
55	77.6529	5.57512	81.149	38.7994	119.948
60	65.25	4.77595	86.7694	32.603	119.372
65	55.5976	4.18278	96.3372	26.5301	122.867
70	47.9388	3.73913	110.479	19.1997	129.679
75	41.76	3.40838	123.592	13.251	136.843
80	36.7031	3.16671	135.277	8.26871	143.546
90	153	30.6	153	0	153

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 37C

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS; MODIFICATION - C; FABRIC - A; BREAK TYPE - I; PARAMETER 'A' - 2.5 ; G - 2.5 CM; W - 5 CM; PEAK ANGLE - 45 DEGREES; PEAK STRENGTH - 116 N; STRENGTH OF WARP - 153 N; STRENGTH OF WEFT - 153 N; AT THE TESTING WIDTH OF 5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	153	30.6	153	0	153
10	27.5273	2.37636	135.315	2.42565	137.741
15	32.3472	2.64134	123.645	4.3314	127.976
20	38.4365	2.99909	110.544	6.99103	117.535
25	46.26	3.48129	96.4089	10.7795	107.188
30	56.5082	4.13698	86.8302	8.6719	95.5021
35	70.2397	5.04359	81.1906	4.43971	85.6303
40	89.1383	6.3273	77.7325	1.30053	79.033
45	116	8.20244	76.5609	0	76.5609
50	89.1383	6.32686	77.7114	1.30053	79.0119
55	70.2397	5.04288	81.149	4.43971	85.5887
60	56.5082	4.1361	86.7694	8.6719	95.4413
65	46.26	3.48028	96.3372	10.7795	107.117
70	38.4365	2.99798	110.479	6.99103	117.47
75	32.3472	2.64012	123.592	4.3314	127.923
80	27.5273	2.37503	135.277	2.42565	137.703
90	153	30.6	153	0	153

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 37D

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS; MODIFICATION - D; FABRIC - A; BREAK TYPE - I; PARAMETER 'A' - 2 ; G - 2.5 CM; W - 5 CM; PEAK ANGLE - 45 DEGREES; PEAK STRENGTH - 116 N; STRENGTH OF WARP - 153 N; STRENGTH OF WEFT - 153 N; AT THE TESTING WIDTH OF 5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	153	30.6	153	0	153
10	36.7031	3.16848	135.315	3.2342	138.549
15	41.76	3.40995	123.645	5.59181	129.237
20	47.9388	3.74052	110.544	8.71934	119.263
25	55.5976	4.18399	96.4089	12.9553	109.364
30	65.25	4.77697	86.8302	10.0134	96.8437
35	77.6529	5.5759	81.1906	4.90828	86.0989
40	93.96	6.66956	77.7325	1.37088	79.1034
45	116	8.20244	76.5609	0	76.5609
50	93.96	6.6691	77.7114	1.37088	79.0822
55	77.6529	5.57512	81.149	4.90828	86.0572
60	65.25	4.77595	86.7694	10.0134	96.7828
65	55.5976	4.18278	96.3372	12.9553	109.293
70	47.9388	3.73913	110.479	8.71934	119.199
75	41.76	3.40838	123.592	5.59181	129.184
80	36.7031	3.16671	135.277	3.2342	138.511
90	153	30.6	153	0	153

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 38A

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS; MODIFICATION - A; FABRIC - A; BREAK TYPE - I; PARAMETER 'A' - 2.5 ; G - 5 CM; W - 5 CM; PEAK ANGLE - 45 DEGREES; AND PEAK STRENGTH - 125 N; STRENGTH OF WARP - 147 N; STRENGTH OF WEFT - 147 N; AT THE TESTING WIDTH OF 5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	147	29.4	147	0	147
10	29.6631	2.56073	117.446	8.88886	126.334
15	34.8569	2.84627	100.43	14.7261	115.156
20	41.4187	3.23178	82.596	22.0959	104.692
25	49.8492	3.75139	64.4864	31.6931	96.1795
30	60.8924	4.45795	46.6504	44.559	91.2095
35	75.6893	5.4349	29.6294	62.3191	91.9485
40	96.0542	6.81821	13.9401	87.6163	101.556
45	125	8.83884	.117013	124.9	125.018
50	96.0542	6.81774	13.9214	87.6225	101.544
55	75.6893	5.43414	29.5964	62.3284	91.9248
60	60.8924	4.457	46.6075	44.57	91.1776
65	49.8492	3.7503	64.4385	31.7051	96.1436
70	41.4187	3.23058	82.5481	22.1087	104.657
75	34.8569	2.84496	100.387	14.7396	115.126
80	29.6631	2.5593	117.413	8.90335	126.316
90	147	29.4	147	0	147

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 38B

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS; MODIFICATION - B; FABRIC - A; BREAK TYPE - I; PARAMETER 'A' - 2 ; G - 5 CM; W - 5 CM; PEAK ANGLE - 45 DEGREES; AND PEAK STRENGTH - 125 N; STRENGTH OF WARP - 147 N; STRENGTH OF WEFT - 147 N; AT THE TESTING WIDTH OF 5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	147	29.4	147	0	147
10	39.5508	3.41431	117.446	11.8518	129.297
15	45	3.67452	100.43	19.0113	119.441
20	51.6582	4.03073	82.596	27.5584	110.154
25	59.9112	4.50861	64.4864	38.0903	102.577
30	70.3125	5.1476	46.6504	51.4523	98.1028
35	83.6777	6.00851	29.6294	68.8963	98.5258
40	101.25	7.18703	13.9401	92.3557	106.296
45	125	8.83884	.117013	124.9	125.018
50	101.25	7.18653	13.9214	92.3622	106.284
55	83.6777	6.00767	29.5964	68.9066	98.503
60	70.3125	5.1465	46.6075	51.465	98.0726
65	59.9112	4.5073	64.4385	38.1047	102.543
70	51.6582	4.02924	82.5481	27.5744	110.122
75	45	3.67283	100.387	19.0288	119.415
80	39.5508	3.4124	117.413	11.8711	129.284
90	147	29.4	147	0	147

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 38C

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS; MODIFICATION - C; FABRIC - A; BREAK TYPE - I; PARAMETER 'A' - 2.5 ; G - 5 CM; W - 5 CM; PEAK ANGLE - 45 DEGREES; PEAK STRENGTH - 125 N; STRENGTH OF WARP - 147 N; STRENGTH OF WEFT - 147 N; AT THE TESTING WIDTH OF 5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	147	29.4	147	0	147
10	29.6631	2.56073	117.446	5.2277	122.673
15	34.8569	2.84627	100.43	9.33491	109.764
20	41.4187	3.23178	82.596	15.0669	97.6629
25	49.8492	3.75139	64.4864	23.2316	87.7181
30	60.8924	4.45795	46.6504	35.1347	81.7851
35	75.6893	5.4349	29.6294	52.9633	82.5927
40	96.0542	6.81821	13.9401	80.5411	94.4812
45	125	8.83884	.117013	124.801	124.918
50	96.0542	6.81774	13.9214	80.5411	94.4626
55	75.6893	5.43414	29.5964	52.9633	82.5597
60	60.8924	4.457	46.6075	35.1347	81.7423
65	49.8492	3.7503	64.4385	23.2316	87.6702
70	41.4187	3.23058	82.5481	15.0669	97.615
75	34.8569	2.84496	100.387	9.33491	109.722
80	29.6631	2.5593	117.413	5.2277	122.64
90	147	29.4	147	0	147

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 37D

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS; MODIFICATION - D; FABRIC - A; BREAK TYPE - I; PARAMETER 'A' - 2 ; G - 5 CM; W - 5 CM; PEAK ANGLE - 45 DEGREES; PEAK STRENGTH - 125 N; STRENGTH OF WARP - 147 N; STRENGTH OF WEFT - 147 N; AT THE TESTING WIDTH OF 5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	147	29.4	147	0	147
10	39.5508	3.41431	117.446	6.97026	124.416
15	45	3.67452	100.43	12.0513	112.481
20	51.6582	4.03073	82.596	18.7917	101.388
25	59.9112	4.50861	64.4864	27.9209	92.4074
30	70.3125	5.1476	46.6504	40.5701	87.2205
35	83.6777	6.00851	29.6294	58.5531	88.1826
40	101.25	7.18703	13.9401	84.8978	98.8378
45	125	8.83884	.117013	124.801	124.918
50	101.25	7.18653	13.9214	84.8978	98.8192
55	83.6777	6.00767	29.5964	58.5531	88.1495
60	70.3125	5.1465	46.6075	40.5701	87.1776
65	59.9112	4.5073	64.4385	27.9209	92.3595
70	51.6582	4.02924	82.5481	18.7917	101.34
75	45	3.67283	100.387	12.0513	112.438
80	39.5508	3.4124	117.413	6.97026	124.383
90	147	29.4	147	0	147

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 39A

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS; MODIFICATION - A; FABRIC - A; BREAK TYPE - I; PARAMETER 'A' - 2.5 ; G - 10 CM; W - 5 CM; PEAK ANGLE - 45 DEGREES; AND PEAK STRENGTH - 125 N; STRENGTH OF WARP - 147 N; STRENGTH OF WEFT - 147 N; AT THE TESTING WIDTH OF 5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	147	29.4	147	0	147
10	29.6631	2.56073	92.3193	13.3333	105.653
15	34.8569	2.84627	63.6964	22.0891	85.7855
20	41.4187	3.23178	35.3711	33.1439	68.5149
25	49.8492	3.75139	8.20307	47.5396	55.7427
30	60.8924	4.45795	0	60.8924	60.8924
35	75.6893	5.4349	0	75.6893	75.6893
40	96.0542	6.81821	0	96.0542	96.0542
45	125	8.83884	0	125	125
50	96.0542	6.81774	0	96.0542	96.0542
55	75.6893	5.43414	0	75.6893	75.6893
60	60.8924	4.457	0	60.8924	60.8924
65	49.8492	3.7503	8.19698	47.5411	55.7381
70	41.4187	3.23058	35.3506	33.1493	68.4999
75	34.8569	2.84496	63.6692	22.0977	85.7669
80	29.6631	2.5593	92.2934	13.3447	105.638
90	147	29.4	147	0	147

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 39B

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS:
MODIFICATION - B; FABRIC - A; BREAK TYPE - I; PARAMETER 'A' - 2 ;
G - 10 CM; W - 5 CM; PEAK ANGLE - 45 DEGREES;
AND PEAK STRENGTH - 132 N; STRENGTH OF WARP - 140 N;
STRENGTH OF WEFT - 140 N; AT THE TESTING WIDTH OF 5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	140	28	140	0	140
10	41.7656	3.60551	87.9232	18.7733	106.696
15	47.52	3.88029	60.6633	30.1139	90.7771
20	54.551	4.25645	33.6867	43.6526	77.3393
25	63.2663	4.76109	7.81245	60.3351	68.1475
30	74.25	5.43586	0	74.25	74.25
35	88.3636	6.34499	0	88.3636	88.3636
40	106.92	7.5895	0	106.92	106.92
45	132	9.33381	0	132	132
50	106.92	7.58897	0	106.92	106.92
55	88.3636	6.3441	0	88.3636	88.3636
60	74.25	5.4347	0	74.25	74.25
65	63.2663	4.75971	7.80665	60.337	68.1437
70	54.551	4.25488	33.6672	43.6598	77.327
75	47.52	3.87851	60.6373	30.1256	90.7629
80	41.7656	3.6035	87.8984	18.7893	106.688
90	140	28	140	0	140

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 39C

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS; MODIFICATION - C; FABRIC - A; BREAK TYPE - I; PARAMETER 'A' - 2.5 ; G - 10 CM; W - 5 CM; PEAK ANGLE - 45 DEGREES; PEAK STRENGTH - 132 N; STRENGTH OF WARP - 140 N; STRENGTH OF WEFT - 140 N; AT THE TESTING WIDTH OF 5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	140	28	140	0	140
10	31.3242	2.70413	87.9232	11.0409	98.9641
15	36.8088	3.00566	60.6633	19.7153	80.3786
20	43.7381	3.41276	33.6867	31.8212	65.5079
25	52.6407	3.96147	7.81245	49.0652	56.8776
30	64.3024	4.7076	0	64.3024	64.3024
35	79.9279	5.73926	0	79.9279	79.9279
40	101.433	7.20003	0	101.433	101.433
45	132	9.33381	0	132	132
50	101.433	7.19953	0	101.433	101.433
55	79.9279	5.73845	0	79.9279	79.9279
60	64.3024	4.70659	0	64.3024	64.3024
65	52.6407	3.96032	7.80665	49.0652	56.8718
70	43.7381	3.41149	33.6672	31.8212	65.4884
75	36.8088	3.00428	60.6373	19.7153	80.3527
80	31.3242	2.70262	87.8984	11.0409	98.9393
90	140	28	140	0	140

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 39D

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS;
MODIFICATION - D; FABRIC - A; BREAK TYPE - I; PARAMETER 'A' - 2 ;
G - 10 CM; W - 5 CM; PEAK ANGLE - 45 DEGREES;
PEAK STRENGTH - 132 N; STRENGTH OF WARP - 140 N;
STRENGTH OF WEFT - 140 N; AT THE TESTING WIDTH OF 5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	140	28	140	0	140
10	41.7656	3.60551	87.9232	14.7212	102.644
15	47.52	3.88029	60.6633	25.4524	86.1156
20	54.551	4.25645	33.6867	39.688	73.3748
25	63.2663	4.76109	7.81245	58.969	66.7815
30	74.25	5.43586	0	74.25	74.25
35	88.3636	6.34499	0	88.3636	88.3636
40	106.92	7.5895	0	106.92	106.92
45	132	9.33381	0	132	132
50	106.92	7.58897	0	106.92	106.92
55	88.3636	6.3441	0	88.3636	88.3636
60	74.25	5.4347	0	74.25	74.25
65	63.2663	4.75971	7.80665	58.969	66.7757
70	54.551	4.25488	33.6672	39.688	73.3552
75	47.52	3.87851	60.6373	25.4524	86.0897
80	41.7656	3.6035	87.8984	14.7212	102.62
90	140	28	140	0	140

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 40A

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS;
MODIFICATION - A; FABRIC - A; BREAK TYPE - I; PARAMETER 'A' - 2.5 ;
G - 2.5 CM; W - 6.5 CM; PEAK ANGLE - 45 DEGREES;
AND PEAK STRENGTH - 163 N; STRENGTH OF WARP - 155 N;
STRENGTH OF WEFT - 155 N; AT THE TESTING WIDTH OF 6.5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	155	23.8462	155	0	155
10	38.6807	2.56861	140.141	8.02459	148.166
15	45.4533	2.85503	129.73	13.2942	143.025
20	54.01	3.24172	117.734	19.9475	137.682
25	65.0033	3.76293	109.396	24.9659	134.362
30	79.4037	4.47167	103.435	30.5043	133.939
35	98.6989	5.45163	99.0399	37.9233	136.963
40	125.255	6.83919	96.3451	48.1325	144.478
45	163	8.86603	95.4321	62.6424	158.074
50	125.255	6.83872	96.3286	48.1393	144.468
55	98.6989	5.45086	99.0075	37.9346	136.942
60	79.4037	4.47071	103.387	30.5193	133.907
65	65.0033	3.76184	109.335	24.9847	134.32
70	54.01	3.24052	117.666	19.97	137.636
75	45.4533	2.85371	129.675	13.3159	142.991
80	38.6807	2.56718	140.102	8.04597	148.148
90	155	23.8462	155	0	155

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 40B

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS;
MODIFICATION - B; FABRIC - A; BREAK TYPE - I; PARAMETER 'A' - 2 ;
G - 2.5 CM; W - 6.5 CM; PEAK ANGLE - 45 DEGREES;
AND PEAK STRENGTH - 163 N; STRENGTH OF WARP - 155 N;
STRENGTH OF WEFT - 155 N; AT THE TESTING WIDTH OF 6.5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	155	23.8462	155	0	155
10	51.5742	3.42481	140.141	10.6994	150.84
15	58.68	3.68582	129.73	17.1620	146.893
20	67.3622	4.04314	117.734	24.8789	142.613
25	78.1243	4.52248	109.396	30.0052	139.402
30	91.6875	5.16344	103.435	35.2233	138.658
35	109.116	6.027	99.0399	41.9258	140.966
40	132.03	7.20914	96.3451	50.7361	147.081
45	163	8.86603	95.4321	62.6424	158.074
50	132.03	7.20864	96.3286	50.7433	147.072
55	109.116	6.02615	99.0075	41.9383	140.946
60	91.6875	5.16234	103.387	35.2407	138.628
65	78.1243	4.52117	109.335	30.0279	139.363
70	67.3622	4.04164	117.666	24.907	142.573
75	58.68	3.68413	129.675	17.1907	146.866
80	51.5742	3.4229	140.102	10.728	150.83
90	155	23.8462	155	0	155

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 4OC

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS;
MODIFICATION - C; FABRIC - A; BREAK TYPE - I; PARAMETER 'A' - 2.5 ;
G - 2.5 CM; W - 6.5 CM; PEAK ANGLE - 45 DEGREES;
PEAK STRENGTH - 163 N; STRENGTH OF WARP - 155 N;
STRENGTH OF WEFT - 155 N; AT THE TESTING WIDTH OF 6.5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	155	23.8462	155	0	155
10	38.6807	2.56861	140.141	2.62189	142.763
15	45.4533	2.85503	129.73	4.68181	134.412
20	54.01	3.24172	117.734	7.55661	125.291
25	65.0033	3.76293	109.396	.183239	109.58
30	79.4037	4.47167	103.435	0	103.435
35	98.6989	5.45163	99.0399	0	99.0399
40	125.255	6.83919	96.3451	0	96.3451
45	163	8.86603	95.4321	0	95.4321
50	125.255	6.83872	96.3286	0	96.3286
55	98.6989	5.45086	99.0075	0	99.0075
60	79.4037	4.47071	103.387	0	103.387
65	65.0033	3.76184	109.335	.183239	109.519
70	54.01	3.24052	117.666	7.55661	125.222
75	45.4533	2.85371	129.675	4.68181	134.357
80	38.6807	2.56718	140.102	2.62189	142.723
90	155	23.8462	155	0	155

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 4OD

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS; MODIFICATION - D; FABRIC - A; BREAK TYPE - I; PARAMETER 'A' - 2 ; G - 2.5 CM; W - 6.5 CM; PEAK ANGLE - 45 DEGREES; PEAK STRENGTH - 163 N; STRENGTH OF WARP - 155 N; STRENGTH OF WEFT - 155 N; AT THE TESTING WIDTH OF 6.5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	155	23.8462	155	0	155
10	51.5742	3.42481	140.141	3.49585	143.637
15	58.68	3.68582	129.73	6.0442	135.774
20	67.3622	4.04314	117.734	9.42475	127.159
25	78.1243	4.52248	109.396	.220226	109.617
30	91.6875	5.16344	103.435	0	103.435
35	109.116	6.027	99.0399	0	99.0399
40	132.03	7.20914	96.3451	0	96.3451
45	163	8.86603	95.4321	0	95.4321
50	132.03	7.20864	96.3286	0	96.3286
55	109.116	6.02615	99.0075	0	99.0075
60	91.6875	5.16234	103.387	0	103.387
65	78.1243	4.52117	109.335	.220226	109.556
70	67.3622	4.04164	117.666	9.42475	127.091
75	58.68	3.68413	129.675	6.0442	135.719
80	51.5742	3.4229	140.102	3.49585	143.597
90	155	23.8462	155	0	155

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 41A

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS; MODIFICATION - A; FABRIC - A; BREAK TYPE - I; PARAMETER 'A' - 2.5 ; G - 5 CM; W - 6.5 CM; PEAK ANGLE - 45 DEGREES; AND PEAK STRENGTH - 165 N; STRENGTH OF WARP - 166 N; STRENGTH OF WEFT - 166 N; AT THE TESTING WIDTH OF 6.5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	166	25.5385	166	0	166
10	39.1553	2.60013	139.173	10.3795	149.553
15	46.011	2.89006	122.983	17.1955	140.178
20	54.6727	3.2815	105.578	25.8012	131.38
25	65.8009	3.8091	87.4887	37.0077	124.496
30	80.378	4.52653	69.2627	52.0312	121.294
35	99.9099	5.51852	51.4538	72.7695	124.223
40	126.792	6.92311	40.3649	97.4462	137.811
45	165	8.97482	38.4093	126.822	165.231
50	126.792	6.92263	40.3297	97.46	137.79
55	99.9099	5.51774	51.3964	72.7884	124.185
60	80.378	4.52557	67.199	52.0503	121.249
65	65.8009	3.808	87.4237	37.0268	124.45
70	54.6727	3.28028	105.517	25.8203	131.337
75	46.011	2.88873	122.93	17.2149	140.145
80	39.1553	2.59868	139.134	10.3995	149.534
90	166	25.5385	166	0	166

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 41B

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS; MODIFICATION - B; FABRIC - A; BREAK TYPE - I; PARAMETER 'A' - 2 ; G - 5 CM; W - 6.5 CM; PEAK ANGLE - 45 DEGREES; AND PEAK STRENGTH - 165 N; STRENGTH OF WARP - 166 N; STRENGTH OF WEFT - 166 N; AT THE TESTING WIDTH OF 6.5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	166	25.5385	166	0	166
10	52.207	3.46683	139.173	13.8393	153.013
15	59.4	3.73105	122.983	22.1993	145.182
20	68.1888	4.09274	105.578	32.1798	137.758
25	79.0828	4.57797	87.4887	44.4778	131.966
30	92.8125	5.22679	69.2627	60.0805	129.343
35	110.455	6.10095	51.4538	80.4497	131.903
40	133.65	7.2976	40.3649	102.717	143.082
45	165	8.97482	38.4093	126.822	165.231
50	133.65	7.29709	40.3297	102.732	143.062
55	110.455	6.10009	51.3964	80.4707	131.867
60	92.8125	5.22568	69.199	60.1025	129.302
65	79.0828	4.57665	87.4237	44.5007	131.924
70	68.1888	4.09123	105.517	32.2036	137.721
75	59.4	3.72933	122.93	22.2243	145.155
80	52.207	3.4649	139.134	13.866	153
90	166	25.5385	166	0	166

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 41C

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS; MODIFICATION - C; FABRIC - A; BREAK TYPE - I; PARAMETER 'A' - 2.5 ; G - 5 CM; W - 6.5 CM; PEAK ANGLE - 45 DEGREES; PEAK STRENGTH - 165 N; STRENGTH OF WARP - 166 N; STRENGTH OF WEFT - 166 N; AT THE TESTING WIDTH OF 6.5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	166	25.5385	166	0	166
10	39.1553	2.60013	139.173	5.30812	144.482
15	46.011	2.89006	122.983	9.47852	132.461
20	54.6727	3.2815	105.578	15.2987	120.877
25	65.8009	3.8091	87.4887	23.589	111.078
30	80.378	4.52653	69.2627	35.6752	104.938
35	99.9099	5.51852	51.4538	53.7781	105.232
40	126.792	6.92311	40.3649	71.1184	111.483
45	165	8.97482	38.4093	88.6441	127.053
50	126.792	6.92263	40.3297	71.1184	111.448
55	99.9099	5.51774	51.3964	53.7781	105.175
60	80.378	4.52557	69.199	35.6752	104.874
65	65.8009	3.808	87.4237	23.589	111.013
70	54.6727	3.28028	105.517	15.2987	120.816
75	46.011	2.88873	122.93	9.47852	132.409
80	39.1553	2.59868	139.134	5.30812	144.442
90	166	25.5385	166	0	166

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 41D

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS;
MODIFICATION - D; FABRIC - A; BREAK TYPE - I; PARAMETER 'A' - 2 ;
G - 5 CM; W - 6.5 CM; PEAK ANGLE - 45 DEGREES;
PEAK STRENGTH - 165 N; STRENGTH OF WARP - 166 N;
STRENGTH OF WEFT - 166 N; AT THE TESTING WIDTH OF 6.5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	166	25.5385	166	0	166
10	52.207	3.46683	139.173	7.0775	146.251
15	59.4	3.73105	122.983	12.2367	135.219
20	68.1888	4.09274	105.578	19.0808	124.659
25	79.0828	4.57797	87.4887	28.3505	115.839
30	92.8125	5.22679	69.2627	41.1942	110.457
35	110.455	6.10095	51.4538	59.454	110.908
40	133.65	7.2976	40.3649	74.9653	115.33
45	165	8.97482	38.4093	88.6441	127.053
50	133.65	7.29709	40.3297	74.9653	115.295
55	110.455	6.10009	51.3964	59.454	110.85
60	92.8125	5.22568	69.199	41.1942	110.393
65	79.0828	4.57665	87.4237	28.3505	115.774
70	68.1888	4.09123	105.517	19.0808	124.598
75	59.4	3.72933	122.93	12.2367	135.167
80	52.207	3.4649	139.134	7.0775	146.212
90	166	25.5385	166	0	166

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 42A

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS; MODIFICATION - A; FABRIC - A; BREAK TYPE - I; PARAMETER 'A' - 2.5 ; G - 10 CM; W - 6.5 CM; PEAK ANGLE - 45 DEGREES; AND PEAK STRENGTH - 151 N; STRENGTH OF WARP - 172 N; STRENGTH OF WEFT - 172 N; AT THE TESTING WIDTH OF 6.5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	172	26.4615	172	0	172
10	35.833	2.37951	121.589	13.6287	135.218
15	42.1071	2.64484	94.3662	22.5785	116.945
20	50.0338	3.00307	66.8895	33.8781	100.768
25	60.2178	3.48591	39.9929	48.5928	88.5857
30	73.558	4.14247	14.4928	68.3193	82.8121
35	91.4327	5.05028	0	91.4327	91.4327
40	116.033	6.33569	0	116.033	116.033
45	151	8.21332	0	151	151
50	116.033	6.33525	0	116.033	116.033
55	91.4327	5.04957	0	91.4327	91.4327
60	73.558	4.14158	14.4795	68.3228	82.8023
65	60.2178	3.4849	39.9632	48.6005	88.5637
70	50.0338	3.00195	66.8507	33.8888	100.74
75	42.1071	2.64362	94.3259	22.5916	116.917
80	35.833	2.37818	121.555	13.6442	135.199
90	172	26.4615	172	0	172

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 42B

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS; MODIFICATION - B; FABRIC - A; BREAK TYPE - I; PARAMETER 'A' - 2 ; G - 10 CM; W - 6.5 CM; PEAK ANGLE - 45 DEGREES; AND PEAK STRENGTH - 151 N; STRENGTH OF WARP - 172 N; STRENGTH OF WEFT - 172 N; AT THE TESTING WIDTH OF 6.5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	172	26.4615	172	0	172
10	47.7773	3.17268	121.589	18.1716	139.76
15	54.36	3.41447	94.3662	29.1487	123.515
20	62.4031	3.74548	66.8895	42.2534	109.143
25	72.3728	4.18954	39.9929	58.4013	98.3942
30	84.9375	4.78331	14.4928	78.8883	93.3811
35	101.083	5.58329	0	101.083	101.083
40	122.31	6.67841	0	122.31	122.31
45	151	8.21332	0	151	151
50	122.31	6.67794	0	122.31	122.31
55	101.083	5.58251	0	101.083	101.083
60	84.9375	4.78229	14.4795	78.8923	93.3719
65	72.3728	4.18832	39.9632	58.4105	98.3737
70	62.4031	3.74409	66.8507	42.2668	109.117
75	54.36	3.41291	94.3259	29.1656	123.491
80	47.7773	3.17091	121.555	18.1922	139.747
90	172	26.4615	172	0	172

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 42C

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS;
MODIFICATION - C; FABRIC - A; BREAK TYPE - I; PARAMETER 'A' - 2.5 ;
G - 10 CM; W - 6.5 CM; PEAK ANGLE - 45 DEGREES;
PEAK STRENGTH - 151 N; STRENGTH OF WARP - 172 N;
STRENGTH OF WEFT - 172 N; AT THE TESTING WIDTH OF 6.5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	172	26.4615	172	0	172
10	35.833	2.37951	121.589	9.71547	131.304
15	42.1071	2.64484	94.3662	17.3486	111.715
20	50.0338	3.00307	66.8895	28.0012	94.8907
25	60.2178	3.48591	39.9929	43.1751	83.168
30	73.558	4.14247	14.4928	65.2965	79.7893
35	91.4327	5.05028	0	91.4327	91.4327
40	116.033	6.33569	0	116.033	116.033
45	151	8.21332	0	151	151
50	116.033	6.33525	0	116.033	116.033
55	91.4327	5.04957	0	91.4327	91.4327
60	73.558	4.14158	14.4795	65.2965	79.776
65	60.2178	3.4849	39.9632	43.1751	83.1383
70	50.0338	3.00195	66.8507	28.0012	94.8519
75	42.1071	2.64362	94.3259	17.3486	111.674
80	35.833	2.37818	121.555	9.71547	131.27
90	172	26.4615	172	0	172

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 42D

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS; MODIFICATION - D; FABRIC - A; BREAK TYPE - I; PARAMETER 'A' - 2 ; G - 10 CM; W - 6.5 CM; PEAK ANGLE - 45 DEGREES; PEAK STRENGTH - 151 N; STRENGTH OF WARP - 172 N; STRENGTH OF WEFT - 172 N; AT THE TESTING WIDTH OF 6.5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	172	26.4615	172	0	172
10	47.7773	3.17268	121.589	12.954	134.543
15	54.36	3.41447	94.3662	22.3969	116.763
20	62.4031	3.74548	66.8895	34.9236	101.813
25	72.3728	4.18954	39.9929	51.89	91.8829
30	84.9375	4.78331	14.4928	75.3979	89.8907
35	101.083	5.58329	0	101.083	101.083
40	122.31	6.67841	0	122.31	122.31
45	151	8.21332	0	151	151
50	122.31	6.67794	0	122.31	122.31
55	101.083	5.58251	0	101.083	101.083
60	84.9375	4.78229	14.4795	75.3979	89.8774
65	72.3728	4.18832	39.9632	51.89	91.8532
70	62.4031	3.74409	66.8507	34.9236	101.774
75	54.36	3.41291	94.3259	22.3969	116.723
80	47.7773	3.17091	121.555	12.954	134.509
90	172	26.4615	172	0	172

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 43A

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS; MODIFICATION - A; FABRIC - B; BREAK TYPE - I; PARAMETER 'A' - 2.5 ; G - 5 CM; W - 5 CM; PEAK ANGLE - 50 DEGREES; AND PEAK STRENGTH - 97 N; STRENGTH OF WARP - 149 N; STRENGTH OF WEFT - 143 N; AT THE TESTING WIDTH OF 5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	149	29.8	149	0	149
10	22.3147	1.93805	119.043	6.59197	125.635
15	25.7424	2.12005	101.796	10.7479	112.544
20	29.9552	2.36269	83.7198	15.8287	99.5484
25	35.2001	2.68332	65.3638	22.2132	87.577
30	41.8265	3.10792	47.2851	30.4395	77.7246
35	50.34	3.67562	30.0326	41.2977	71.3303
40	61.492	4.44655	14.1297	55.9892	70.1189
45	76.4346	5.51575	.116219	76.3738	76.49
50	97	7.03893	13.5426	88.6453	102.188
55	76.4346	5.62072	28.7911	63.1715	91.9625
60	61.492	4.61875	45.3393	45.2584	90.5977
65	50.34	3.89412	62.6851	32.2588	94.9439
70	41.8265	3.36158	80.3019	22.5426	102.845
75	35.2001	2.96715	97.655	15.0637	112.719
80	29.9552	2.67605	114.218	9.1225	123.34
90	143	28.6	143	0	143

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 43B

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS; MODIFICATION - B; FABRIC - B; BREAK TYPE - I; PARAMETER 'A' - 2 ; G - 5 CM; W - 5 CM; PEAK ANGLE - 50 DEGREES; AND PEAK STRENGTH - 97 N; STRENGTH OF WARP - 149 N; STRENGTH OF WEFT - 143 N; AT THE TESTING WIDTH OF 5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	149	29.8	149	0	149
10	29.9383	2.60017	119.043	8.84405	127.888
15	33.564	2.76421	101.796	14.0136	115.809
20	37.8906	2.98859	83.7198	20.0218	103.742
25	43.1111	3.28639	65.3638	27.2055	92.5693
30	49.4898	3.67734	47.2851	36.0165	83.3016
35	57.3964	4.19085	30.0326	47.0867	77.1192
40	67.3611	4.87095	14.1297	61.333	75.4628
45	80.1653	5.78497	.116219	80.1015	80.2177
50	97	7.03893	13.5426	88.6453	102.188
55	80.1653	5.89506	28.7911	66.2548	95.0458
60	67.3611	5.05958	45.3393	49.5781	94.9174
65	57.3964	4.43998	62.6851	36.7807	99.4658
70	49.4898	3.97748	80.3019	26.6728	106.975
75	43.1111	3.63401	97.655	18.4492	116.104
80	37.8906	3.38497	114.218	11.5392	125.757
90	143	28.6	143	0	143

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 43C

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS;
MODIFICATION - C; FABRIC - B; BREAK TYPE - I; PARAMETER 'A' - 2 ;
G - 5 CM; W - 5 CM; PEAK ANGLE - 50 DEGREES;
PEAK STRENGTH - 97 N; STRENGTH OF WARP - 149 N;
STRENGTH OF WEFT - 143 N; AT THE TESTING WIDTH OF 5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	149	29.8	149	0	149
10	29.9383	2.60017	119.043	5.27619	124.32
15	33.564	2.76421	101.796	8.98868	110.785
20	37.8906	2.98859	83.7198	13.7835	97.5032
25	43.1111	3.28639	65.3638	20.0914	85.4552
30	49.4898	3.67734	47.2851	28.5554	75.8406
35	57.3964	4.19085	30.0326	40.1629	70.1955
40	67.3611	4.87095	14.1297	56.4821	70.6118
45	80.1653	5.78497	.116219	80.0377	80.1539
50	97	7.03893	13.5426	81.3342	94.8768
55	80.1653	5.89506	28.7911	56.0954	84.8864
60	67.3611	5.05958	45.3393	38.8671	84.2064
65	57.3964	4.43998	62.6851	26.7489	89.4341
70	49.4898	3.97748	80.3019	18.0029	98.3048
75	43.1111	3.63401	97.655	11.5455	109.2
80	37.8906	3.38497	114.218	6.67768	120.895
90	143	28.6	143	0	143

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 43D

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS;
MODIFICATION - D; FABRIC - B; BREAK TYPE - I; PARAMETER 'A' - 2 ;
G - 5 CM; W - 5 CM; PEAK ANGLE - 50 DEGREES;
PEAK STRENGTH - 97 N; STRENGTH OF WARP - 149 N;
STRENGTH OF WEFT - 143 N; AT THE TESTING WIDTH OF 5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	149	29.8	149	0	149
10	29.9383	2.60017	119.043	5.27619	124.32
15	33.564	2.76421	101.796	8.98868	110.785
20	37.8906	2.98859	83.7198	13.7835	97.5032
25	43.1111	3.28639	65.3638	20.0914	85.4552
30	49.4898	3.67734	47.2851	28.5554	75.8406
35	57.3964	4.19085	30.0326	40.1629	70.1955
40	67.3611	4.87095	14.1297	56.4821	70.6118
45	80.1653	5.78497	.116219	80.0377	80.1539
50	97	7.03893	13.5426	81.3342	94.8768
55	80.1653	5.89506	28.7911	56.0954	84.8864
60	67.3611	5.05958	45.3393	38.8671	84.2064
65	57.3964	4.43998	62.6851	26.7489	89.4341
70	49.4898	3.97748	80.3019	18.0029	98.3048
75	43.1111	3.63401	97.655	11.5455	109.2
80	37.8906	3.38497	114.218	6.67768	120.895
90	143	28.6	143	0	143

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 44A

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS;
MODIFICATION - A; FABRIC - C; BREAK TYPE - I; PARAMETER 'A' - 1.43 ;
G - 5 CM; W - 5 CM; PEAK ANGLE - 47 DEGREES;
AND PEAK STRENGTH - 107 N; STRENGTH OF WARP - 132 N;
STRENGTH OF WEFT - 137 N; AT THE TESTING WIDTH OF 5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	132	26.4	132	0	132
10	46.6406	4.00363	105.461	14.1607	119.622
15	50.9187	4.12481	90.1816	21.7452	111.927
20	55.9091	4.31878	74.1679	30.0871	104.255
25	61.7916	4.59479	57.9062	39.5536	97.4598
30	68.8092	4.96868	41.8902	50.6045	92.4947
35	77.2975	5.46516	26.606	63.8528	90.4588
40	87.7325	6.12176	12.5176	80.1565	92.6741
45	100.81	6.99589	.107062	100.73	100.837
50	97.9392	6.8113	12.9744	89.1964	102.171
55	85.4604	6.002	27.583	70.1443	97.7274
60	75.4618	5.39393	43.437	54.96	98.3969
65	67.3004	4.93577	60.055	42.5164	102.571
70	60.5332	4.59396	76.9326	32.0338	108.966
75	54.8461	4.34667	93.5576	22.9458	116.503
80	50.0109	4.18037	109.425	14.8175	124.243
90	137	27.4	137	0	137

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 45B

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS; MODIFICATION - B; FABRIC - C; BREAK TYPE - I; PARAMETER 'A' - 2 ; G - 5 CM; W - 5 CM; PEAK ANGLE - 47 DEGREES; AND PEAK STRENGTH - 107 N; STRENGTH OF WARP - 132 N; STRENGTH OF WEFT - 137 N; AT THE TESTING WIDTH OF 5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	132	26.4	132	0	132
10	33.4982	2.87548	105.461	10.1705	115.632
15	37.8726	3.06798	90.1816	16.1738	106.355
20	43.1634	3.33423	74.1679	23.2281	97.396
25	49.6457	3.69162	57.9062	31.7788	89.685
30	57.7058	4.16691	41.8902	42.4388	84.3289
35	67.9009	4.80079	26.606	56.0706	82.6966
40	81.0573	5.65598	12.5176	74.0577	86.5753
45	98.4436	6.83168	.107062	98.3652	98.4723
50	94.5452	6.57526	12.9744	86.1054	99.0798
55	78.1365	5.48763	27.583	64.133	91.7161
60	65.6564	4.69305	43.437	47.8185	91.2555
65	55.9439	4.10289	60.055	35.3421	95.397
70	48.2373	3.66081	76.9326	25.5269	102.46
75	42.0201	3.33018	93.5576	17.5798	111.137
80	36.9317	3.08709	109.425	10.9423	120.368
90	137	27.4	137	0	137

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 45C

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS;
MODIFICATION - C; FABRIC - C; BREAK TYPE - I; PARAMETER 'A' - 1.43 ;
G - 5 CM; W - 5 CM; PEAK ANGLE - 47 DEGREES;
PEAK STRENGTH - 107 N; STRENGTH OF WARP - 132 N;
STRENGTH OF WEFT - 137 N; AT THE TESTING WIDTH OF 5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	132	26.4	132	0	132
10	46.6406	4.00363	105.461	8.21975	113.681
15	50.9187	4.12481	90.1816	13.6364	103.818
20	55.9091	4.31878	74.1679	20.338	94.5059
25	61.7916	4.59479	57.9062	28.7973	86.7034
30	68.8092	4.96868	41.8902	39.7026	81.5928
35	77.2975	5.46516	26.606	54.0886	80.6946
40	87.7325	6.12176	12.5176	73.5634	86.081
45	100.81	6.99589	.107062	100.649	100.757
50	97.9392	6.8113	12.9744	82.1217	95.0961
55	85.4604	6.002	27.583	59.8006	87.3836
60	75.4618	5.39393	43.437	43.5412	86.9782
65	67.3004	4.93577	60.055	31.3646	91.4195
70	60.5332	4.59396	76.9326	22.0201	98.9528
75	54.8461	4.34667	93.5576	14.6882	108.246
80	50.0109	4.18037	109.425	8.81372	118.239
90	137	27.4	137	0	137

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 45D

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS;
MODIFICATION - D; FABRIC - C; BREAK TYPE - I; PARAMETER 'A' - 2 ;
G - 5 CM; W - 5 CM; PEAK ANGLE - 47 DEGREES;
PEAK STRENGTH - 107 N; STRENGTH OF WARP - 132 N;
STRENGTH OF WEFT - 137 N; AT THE TESTING WIDTH OF 5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	132	26.4	132	0	132
10	33.4982	2.87548	105.461	5.90357	111.365
15	37.8726	3.06798	90.1816	10.1425	100.324
20	43.1634	3.33423	74.1679	15.7016	89.8694
25	49.6457	3.69162	57.9062	23.1368	81.043
30	57.7058	4.16691	41.8902	33.296	75.1862
35	67.9009	4.80079	26.606	47.5134	74.1194
40	81.0573	5.65598	12.5176	67.9663	80.4839
45	98.4436	6.83168	.107062	98.2868	98.3939
50	94.5452	6.57526	12.9744	79.2758	92.2502
55	78.1365	5.48763	27.583	54.6757	82.2588
60	65.6564	4.69305	43.437	37.8835	81.3205
65	55.9439	4.10289	60.055	26.072	86.127
70	48.2373	3.66081	76.9326	17.5473	94.4799
75	42.0201	3.33018	93.5576	11.2533	104.811
80	36.9317	3.08709	109.425	6.50869	115.934
90	137	27.4	137	0	137

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 45A

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS; MODIFICATION - A; FABRIC - D; BREAK TYPE - I; PARAMETER 'A' - 2.22 ; G - 5 CM; W - 5 CM; PEAK ANGLE - 50 DEGREES;
AND PEAK STRENGTH - 265 N; STRENGTH OF WARP - 300 N; STRENGTH OF WEFT - 280 N; AT THE TESTING WIDTH OF 5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	300	60	300	0	300
10	71.8689	6.26683	239.685	21.0284	260.713
15	81.5923	6.75766	204.958	33.7975	238.756
20	93.3468	7.41544	168.563	49.0099	217.573
25	107.727	8.28248	131.605	67.6409	199.246
30	125.557	9.4219	95.205	91.0365	186.241
35	148.01	10.9279	60.4682	121.127	181.595
40	176.792	12.9428	28.4491	160.775	189.224
45	214.464	15.6876	.230849	214.293	214.524
50	265	19.5164	26.517	242.473	268.99
55	214.464	16.0256	56.3741	177.689	234.063
60	176.792	13.511	88.7763	130.611	219.387
65	148.01	11.6654	122.74	95.3352	218.075
70	125.557	10.2962	157.235	68.117	225.351
75	107.727	9.28014	191.213	46.4799	237.692
80	93.3468	8.53742	223.643	28.7124	252.355
90	280	56	280	0	280

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-3)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 45B

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS; MODIFICATION - B; FABRIC - D; BREAK TYPE - I; PARAMETER 'A' - 2 ; G - 5 CM; W - 5 CM; PEAK ANGLE - 50 DEGREES; AND PEAK STRENGTH - 265 N; STRENGTH OF WARP - 300 N; STRENGTH OF WEFT - 280 N; AT THE TESTING WIDTH OF 5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	300	60	300	0	300
10	81.7901	7.13195	239.685	23.9313	263.616
15	91.6955	7.59443	204.958	37.9824	242.941
20	103.516	8.22325	168.563	54.3489	222.912
25	117.778	9.05525	131.605	73.9519	205.557
30	135.204	10.1458	95.205	98.0311	193.236
35	156.805	11.5772	60.4682	128.324	188.792
40	184.028	13.4725	28.4491	167.355	195.804
45	219.008	16.02	.230849	218.834	219.065
50	265	19.5164	26.517	242.473	268.99
55	219.008	16.3652	56.3741	181.454	237.828
60	184.028	14.064	88.7763	135.956	224.733
65	156.805	12.3585	122.74	101	223.74
70	135.204	11.0873	157.235	73.3506	230.585
75	117.778	10.146	191.213	50.8165	242.029
80	103.516	9.46745	223.643	31.8402	255.483
90	280	56	280	0	280

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 45C

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS; MODIFICATION - C; FABRIC - D; BREAK TYPE - I; PARAMETER 'A' - 2.22 ; G - 5 CM; W - 5 CM; PEAK ANGLE - 50 DEGREES; PEAK STRENGTH - 265 N; STRENGTH OF WARP - 300 N; STRENGTH OF WEFT - 280 N; AT THE TESTING WIDTH OF 5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	300	60	300	0	300
10	71.8689	6.26683	239.685	12.6659	252.351
15	81.5923	6.75766	204.958	21.851	226.809
20	93.3468	7.41544	168.563	33.9568	202.52
25	107.727	8.28248	131.605	50.2048	181.81
30	125.557	9.4219	95.205	72.4461	167.651
35	148.01	10.9279	60.4682	103.57	164.038
40	176.792	12.9428	28.4491	148.24	176.689
45	214.464	15.6876	.230849	214.122	214.353
50	265	19.5164	26.517	222.202	248.719
55	214.464	16.0256	56.3741	150.07	206.444
60	176.792	13.511	88.7763	102.009	190.785
65	148.01	11.6654	122.74	68.9784	191.719
70	125.557	10.2962	157.235	45.6739	202.908
75	107.727	9.28014	191.213	28.85	220.063
80	93.3468	8.53742	223.643	16.451	240.094
90	280	56	280	0	280

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 45D

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS:
MODIFICATION - D; FABRIC - D; BREAK TYPE - I; PARAMETER 'A' - 2 ;
G - 5 CM; W - 5 CM; PEAK ANGLE - 50 DEGREES;
PEAK STRENGTH - 265 N; STRENGTH OF WARP - 300 N;
STRENGTH OF WEFT - 280 N; AT THE TESTING WIDTH OF 5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	300	60	300	0	300
10	81.7901	7.13195	239.685	14.4143	254.099
15	91.6955	7.59443	204.958	24.5567	229.515
20	103.516	8.22325	168.563	37.6559	206.219
25	117.778	9.05525	131.605	54.889	186.494
30	135.204	10.1458	95.205	78.0123	173.217
35	156.805	11.5772	60.4682	109.724	170.192
40	184.028	13.4725	28.4491	154.307	182.756
45	219.008	16.02	.230849	218.66	218.89
50	265	19.5164	26.517	222.202	248.719
55	219.008	16.3652	56.3741	153.25	209.624
60	184.028	14.064	88.7763	106.183	194.96
65	156.805	12.3585	122.74	73.077	195.817
70	135.204	11.0873	157.235	49.1832	206.418
75	117.778	10.146	191.213	31.5417	222.754
80	103.516	9.46745	223.643	18.2432	241.886
90	280	56	280	0	280

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 46A

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS;
MODIFICATION - A; FABRIC - E; BREAK TYPE - I; PARAMETER 'A' - 2.68 ;
G - 5 CM; W - 5 CM; PEAK ANGLE - 40 DEGREES;
AND PEAK STRENGTH - 410 N; STRENGTH OF WARP - 460 N;
STRENGTH OF WEFT - 375 N; AT THE TESTING WIDTH OF 5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	460	92	460	0	460
10	91.5044	8.12424	367.517	25.5955	393.112
15	111.608	9.48366	314.269	44.5334	358.803
20	138.312	11.3516	258.464	70.4409	328.905
25	174.636	13.9623	201.794	107.06	308.855
30	225.458	17.7027	145.981	160.597	306.578
35	299.016	23.2388	92.7179	241.847	334.565
40	410	31.7814	43.6219	370.669	414.291
45	299.016	23.2951	.332361	298.778	299.111
50	225.458	17.7892	35.5139	207.523	243.036
55	174.636	14.0661	75.501	146.442	221.943
60	138.312	11.4663	118.897	104.079	222.976
65	111.608	9.60668	164.384	73.7191	238.103
70	91.5044	8.25492	210.582	51.2801	261.862
75	76.0572	7.26597	256.088	34.1722	290.26
80	63.9769	6.54779	299.522	20.6792	320.201
90	375	75	375	0	375

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 46B

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS; MODIFICATION - B; FABRIC - E; BREAK TYPE - I; PARAMETER 'A' - 2 ; G - 5 CM; W - 5 CM; PEAK ANGLE - 40 DEGREES; AND PEAK STRENGTH - 410 N; STRENGTH OF WARP - 460 N; STRENGTH OF WEFT - 375 N; AT THE TESTING WIDTH OF 5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	460	92	460	0	460
10	133.878	11.8864	367.517	37.4481	404.965
15	155.266	13.1934	314.269	61.9535	376.223
20	182.222	14.9554	258.464	92.804	351.268
25	216.86	17.3382	201.794	132.946	334.74
30	262.4	20.6033	145.981	186.912	332.893
35	323.951	25.1766	92.7179	262.014	354.732
40	410	31.7814	43.6219	370.669	414.291
45	323.951	25.2376	.332361	323.693	324.025
50	262.4	20.704	35.5139	241.526	277.04
55	216.86	17.4671	75.501	181.849	257.35
60	182.222	15.1066	118.897	137.122	256.018
65	155.266	13.3645	164.304	102.556	266.74
70	133.878	12.0775	210.582	75.0265	285.608
75	116.622	11.1413	256.088	52.3978	308.486
80	102.5	10.4905	299.522	33.1305	332.652
90	375	75 .	375	0	375

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 46C

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS; MODIFICATION - C; FABRIC - E; BREAK TYPE - I; PARAMETER 'A' - 2.68 ; G - 5 CM; W - 5 CM; PEAK ANGLE - 40 DEGREES; PEAK STRENGTH - 410 N; STRENGTH OF WARP - 460 N; STRENGTH OF WEFT - 375 N; AT THE TESTING WIDTH OF 5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	460	92	460	0	460
10	91.5044	8.12424	367.517	16.1263	383.643
15	111.608	9.48366	314.269	29.8895	344.159
20	138.312	11.3516	258.464	50.3137	308.777
25	174.636	13.9623	201.794	81.3869	283.181
30	225.458	17.7027	145.981	130.088	276.069
35	299.016	23.2388	92.7179	209.236	301.954
40	410	31.7814	43.6219	343.784	387.406
45	299.016	23.2951	.332361	298.54	298.873
50	225.458	17.7892	35.5139	189.046	224.559
55	174.636	14.0661	75.501	122.201	197.702
60	138.312	11.4663	118.897	79.8054	198.702
65	111.608	9.60668	164.384	52.0138	216.398
70	91.5044	8.25492	210.582	33.2865	243.868
75	76.0572	7.26597	256.088	20.3687	276.457
80	63.9769	6.54779	299.522	11.275	310.797
90	375	75	375	0	375

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 46D

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS; MODIFICATION - D; FABRIC - E; BREAK TYPE - I; PARAMETER 'A' - 2 ; G - 5 CM; W - 5 CM; PEAK ANGLE - 40 DEGREES; PEAK STRENGTH - 410 N; STRENGTH OF WARP - 460 N; STRENGTH OF WEFT - 375 N; AT THE TESTING WIDTH OF 5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	460	92	460	0	460
10	133.878	11.8864	367.517	23.594	391.111
15	155.266	13.1934	314.269	41.5814	355.851
20	182.222	14.9554	258.464	66.2869	324.751
25	216.86	17.3382	201.794	101.065	302.859
30	262.4	20.6033	145.981	151.404	297.385
35	323.951	25.1766	92.7179	226.683	319.401
40	410	31.7814	43.6219	343.784	387.406
45	323.951	25.2376	.332361	323.435	323.767
50	262.4	20.704	35.5139	220.022	255.535
55	216.86	17.4671	75.501	151.747	227.248
60	182.222	15.1066	118.897	105.142	224.038
65	155.266	13.3645	164.384	72.36	236.744
70	133.878	12.0775	210.582	48.7006	259.283
75	116.622	11.1413	256.088	31.2322	287.321
80	102.5	10.4905	299.522	18.0642	317.586
90	375	75	375	0	375

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 47A

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS; MODIFICATION - A; FABRIC - F; BREAK TYPE - I; PARAMETER 'A' - 2.63 ; G - 5 CM; W - 5 CM; PEAK ANGLE - 50 DEGREES; AND PEAK STRENGTH - 410 N; STRENGTH OF WARP - 455 N; STRENGTH OF WEFT - 450 N; AT THE TESTING WIDTH OF 5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	455	91	455	0	455
10	87.381	7.5558	363.522	26.0837	389.606
15	101.555	8.3119	310.853	42.7679	353.621
20	119.11	9.32112	255.654	63.3791	319.033
25	141.144	10.659	199.601	89.5565	289.157
30	169.226	12.4391	144.394	123.651	268.045
35	205.642	14.8334	91.7101	169.151	260.862
40	253.827	18.1081	43.1478	231.417	274.565
45	319.096	22.6881	.360196	318.842	319.202
50	410	29.2759	42.6166	374.192	416.808
55	319.096	23.0586	90.6012	263.025	353.626
60	253.827	18.709	142.676	186.063	328.74
65	205.642	15.5879	197.261	131.057	328.317
70	169.226	13.3065	252.698	90.5639	343.262
75	141.144	11.6206	307.306	59.8758	367.182
80	119.11	10.3735	359.426	35.8899	395.316
90	450	90	450	0	450

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 47B

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS; MODIFICATION - B; FABRIC - F; BREAK TYPE - I; PARAMETER 'A' - 2 ; G - 5 CM; W - 5 CM; PEAK ANGLE - 50 DEGREES; AND PEAK STRENGTH - 410 N; STRENGTH OF WARP - 455 N; STRENGTH OF WEFT - 450 N; AT THE TESTING WIDTH OF 5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	455	91	455	0	455
10	126.543	10.9421	363.522	37.7739	401.296
15	141.869	11.6114	310.853	59.7449	370.598
20	160.156	12.5333	255.654	85.22	340.874
25	182.222	13.7612	199.601	115.62	315.221
30	209.184	15.3762	144.394	152.847	297.241
35	242.604	17.4994	91.7101	199.554	291.264
40	284.722	20.3122	43.1478	259.585	302.733
45	338.843	24.0921	.360196	338.573	338.933
50	410	29.2759	42.6166	374.192	416.808
55	338.843	24.4855	90.6012	279.302	369.903
60	284.722	20.9863	142.676	208.711	351.387
65	242.604	18.3895	197.261	154.612	351.873
70	209.184	16.4484	252.698	111.948	364.646
75	182.222	15.0026	307.306	77.3016	384.608
80	160.156	13.9484	359.426	48.2578	407.684
90	450	90	450	0	450

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 47C

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS:
MODIFICATION - C; FABRIC - F; BREAK TYPE - I; PARAMETER 'A' - 2.63 ;
G - 5 CM; W - 5 CM; PEAK ANGLE - 50 DEGREES;
PEAK STRENGTH - 410 N; STRENGTH OF WARP - 455 N;
STRENGTH OF WEFT - 450 N; AT THE TESTING WIDTH OF 5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	455	91	455	0	455
10	87.381	7.5558	363.522	15.3997	378.922
15	101.555	8.3119	310.853	27.1973	338.051
20	119.11	9.32112	255.654	43.3286	298.983
25	141.144	10.659	199.601	65.7787	265.38
30	169.226	12.4391	144.394	97.6428	242.037
35	205.642	14.8334	91.7101	143.898	235.608
40	253.827	18.1081	43.1478	212.833	255.981
45	319.096	22.6881	.360196	318.588	318.948
50	410	29.2759	42.6166	343.784	386.4
55	319.096	23.0586	90.6012	223.286	313.887
60	253.827	18.709	142.676	146.457	289.133
65	205.642	15.5879	197.261	95.8373	293.098
70	169.226	13.3065	252.698	61.5593	314.258
75	141.144	11.6206	307.306	37.7995	345.105
80	119.11	10.3735	359.426	20.9914	380.418
90	450	90	450	0	450

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 47D

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS; MODIFICATION - D; FABRIC - F; BREAK TYPE - I; PARAMETER 'A' - 2 ; G - 5 CM; W - 5 CM; PEAK ANGLE - 50 DEGREES; PEAK STRENGTH - 410 N; STRENGTH OF WARP - 455 N; STRENGTH OF WEFT - 450 N; AT THE TESTING WIDTH OF 5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	455	91	455	0	455
10	126.543	10.9421	363.522	22.3014	385.824
15	141.869	11.6114	310.853	37.9934	348.847
20	160.156	12.5333	255.654	58.26	313.914
25	182.222	13.7612	199.601	84.9226	284.523
30	209.184	15.3762	144.394	120.698	265.092
35	242.604	17.4994	91.7101	169.761	261.471
40	284.722	20.3122	43.1478	238.739	281.886
45	338.843	24.0921	.360196	338.304	338.664
50	410	29.2759	42.6166	343.784	386.4
55	338.843	24.4855	90.6012	237.104	327.705
60	284.722	20.9863	142.676	164.284	306.96
65	242.604	18.3895	197.261	113.063	310.323
70	209.184	16.4484	252.698	76.0947	328.793
75	182.222	15.0026	307.306	48.8004	356.106
80	160.156	13.9484	359.426	28.2253	387.651
90	450	90	450	0	450

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 48A

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS; MODIFICATION - A; FABRIC - G; BREAK TYPE - I; PARAMETER 'A' - 1.75 ; G - 5 CM; W - 5 CM; PEAK ANGLE - 45 DEGREES; AND PEAK STRENGTH - 385 N; STRENGTH OF WARP - 400 N; STRENGTH OF WEFT - 423 N; AT THE TESTING WIDTH OF 5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	400	80	400	0	400
10	140.661	12.0392	319.58	42.9221	362.572
15	157.48	12.7049	273.278	67.6224	340.9
20	177.689	13.6551	224.751	96.0453	320.796
25	202.295	14.9504	175.473	129.937	305.411
30	232.712	16.6858	126.94	171.577	298.517
35	270.987	19.0084	80.6243	224.225	304.849
40	320.173	22.1461	37.9321	292.766	330.698
45	385	26.4631	.327551	384.694	385.021
50	320.173	22.0366	40.0596	291.353	331.413
55	270.987	18.8194	85.1651	222.055	307.22
60	232.712	16.4344	134.116	169.065	303.18
65	202.295	14.6452	185.425	127.366	312.792
70	177.689	13.2991	237.536	93.6265	331.163
75	157.48	12.296	288.868	65.5335	354.401
80	140.661	11.5709	337.861	41.4076	379.268
90	423	84.6	423	0	423

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 47B

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS; MODIFICATION - B; FABRIC - G; BREAK TYPE - I; PARAMETER 'A' - 2 ; G - 5 CM; W - 5 CM; PEAK ANGLE - 45 DEGREES; AND PEAK STRENGTH - 385 N; STRENGTH OF WARP - 400 N; STRENGTH OF WEFT - 423 N; AT THE TESTING WIDTH OF 5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	400	80	400	0	400
10	121.816	10.4262	319.58	37.2323	356.812
15	138.6	11.1817	273.278	59.5153	332.793
20	159.107	12.2271	224.751	86.0012	310.752
25	184.527	13.6372	175.473	118.525	293.998
30	216.563	15.5279	126.94	159.67	286.61
35	257.727	18.0783	80.6243	213.253	293.878
40	311.85	21.5704	37.9321	285.155	323.088
45	385	26.4631	.327551	384.694	385.021
50	311.85	21.4637	40.0596	283.779	323.839
55	257.727	17.8986	85.1651	211.19	296.355
60	216.563	15.294	134.116	157.333	291.448
65	184.527	13.3589	185.425	116.18	301.605
70	159.107	11.9083	237.536	83.8354	321.372
75	138.6	10.8218	288.868	57.6768	346.544
80	121.816	10.0207	337.861	35.8601	373.721
90	423	84.6	423	0	423

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 48C

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS:
MODIFICATION - C; FABRIC - G; BREAK TYPE - I; PARAMETER 'A' - 1.75 ;
G - 5 CM; W - 5 CM; PEAK ANGLE - 45 DEGREES;
PEAK STRENGTH - 385 N; STRENGTH OF WARP - 400 N;
STRENGTH OF WEFT - 423 N; AT THE TESTING WIDTH OF 5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	400	80	400	0	400
10	140.661	12.0392	319.58	24.7896	344.369
15	157.48	12.7049	273.278	42.1742	315.452
20	177.689	13.6551	224.751	64.638	289.389
25	202.295	14.9504	175.473	94.277	269.75
30	232.712	16.6858	126.94	134.274	261.214
35	270.987	19.0084	80.6243	189.622	270.246
40	320.173	22.1461	37.9321	268.464	306.396
45	385	26.4631	.327551	384.387	384.715
50	320.173	22.0366	40.0596	268.464	308.524
55	270.987	18.8194	85.1651	189.622	274.787
60	232.712	16.4344	134.116	134.274	268.389
65	202.295	14.6452	185.425	94.277	279.702
70	177.689	13.2991	237.536	64.638	302.174
75	157.48	12.296	288.868	42.1742	331.042
80	140.661	11.5709	337.861	24.7896	362.65
90	423	84.6	423	0	423

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 48D

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS;
MODIFICATION - D; FABRIC - G; BREAK TYPE - I; PARAMETER 'A' - 2 ;
G - 5 CM; W - 5 CM; PEAK ANGLE - 45 DEGREES;
PEAK STRENGTH - 385 N; STRENGTH OF WARP - 400 N;
STRENGTH OF WEFT - 423 N; AT THE TESTING WIDTH OF 5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	400	80	400	0	400
10	121.816	10.4262	319.58	21.4684	341.048
15	138.6	11.1817	273.278	37.118	310.396
20	159.107	12.2271	224.751	57.8784	282.629
25	184.527	13.6372	175.473	85.9965	261.47
30	216.563	15.5279	126.94	124.956	251.896
35	257.727	18.0783	80.6243	180.344	260.968
40	311.85	21.5704	37.9321	261.485	299.417
45	385	26.4631	.327551	384.387	384.715
50	311.85	21.4637	40.0596	261.485	301.545
55	257.727	17.8986	85.1651	180.344	265.509
60	216.563	15.294	134.116	124.956	259.071
65	184.527	13.3589	185.425	85.9965	271.422
70	159.107	11.9083	237.536	57.8784	295.415
75	138.6	10.8218	288.868	37.118	325.986
80	121.816	10.0207	337.861	21.4684	359.329
90	423	84.6	423	0	423

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 49A

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS; MODIFICATION - A; FABRIC - H; BREAK TYPE - I; PARAMETER 'A' - 1.18 ; G - 5 CM; W - 5 CM; PEAK ANGLE - 40 DEGREES; AND PEAK STRENGTH - 250 N; STRENGTH OF WARP - 340 N; STRENGTH OF WEFT - 315 N; AT THE TESTING WIDTH OF 5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	340	68	340	0	340
10	129.168	11.2749	271.643	37.6989	309.342
15	140.972	11.6928	232.286	58.2724	290.558
20	154.936	12.331	191.038	81.2087	272.247
25	171.689	13.2297	149.152	107.66	256.812
30	192.126	14.4545	107.899	139.167	247.066
35	217.56	16.1097	68.5307	177.93	246.46
40	250	18.3615	32.2423	227.277	259.519
45	217.56	15.9708	.260701	217.387	217.648
50	192.126	14.2044	29.8317	175.851	205.682
55	171.689	12.8834	63.4209	142.342	205.763
60	154.936	11.8947	99.8733	114.578	214.452
65	140.972	11.1654	138.083	90.9255	229.090
70	129.168	10.6486	176.889	70.1986	247.097
75	119.069	10.3161	215.114	51.4855	266.6
80	110.338	10.1542	251.598	34.0288	295.627
90	315	63	315	0	315

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^ 2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 49B

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS; MODIFICATION - B; FABRIC - H; BREAK TYPE - I; PARAMETER 'A' - 2 ; G - 5 CM; W - 5 CM; PEAK ANGLE - 40 DEGREES; AND PEAK STRENGTH - 250 N; STRENGTH OF WARP - 340 N; STRENGTH OF WEFT - 315 N; AT THE TESTING WIDTH OF 5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	340	68	340	0	340
10	81.6327	7.12562	271.643	23.8252	295.468
15	94.6746	7.85271	232.286	39.1348	271.421
20	111.111	8.84311	191.038	58.2382	249.277
25	132.231	10.1892	149.152	82.9173	232.07
30	160	12.0375	107.899	115.896	223.795
35	197.531	14.6265	68.5307	161.549	230.079
40	250	18.3615	32.2423	227.277	259.519
45	197.531	14.5004	.260701	197.374	197.634
50	160	11.8292	29.8317	146.446	176.278
55	132.231	9.92254	63.4209	109.629	173.05
60	111.111	8.53021	99.8733	82.1608	182.042
65	94.6746	7.49849	138.083	61.0641	199.147
70	81.6327	6.7298	176.809	44.3647	221.254
75	71.1111	6.16106	215.114	30.7405	245.863
80	62.5	5.75175	251.598	19.2754	270.874
90	315	63	315	0	315

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 49C

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS;
MODIFICATION - C; FABRIC --Ø; BREAK TYPE - I; PARAMETER 'A' - 1.18 ;
G - 5 CM; W - 5 CM; PEAK ANGLE - 40 DEGREES;
PEAK STRENGTH - 250 N; STRENGTH OF WARP - 340 N;
STRENGTH OF WEFT - 315 N; AT THE TESTING WIDTH OF 5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	340	68	340	0	340
10	129.168	11.2749	271.643	22.764	294.407
15	140.972	11.6928	232.286	37.7533	270.039
20	154.936	12.331	191.038	56.361	247.399
25	171.689	13.2297	149.152	80.0137	229.166
30	192.126	14.4545	107.899	110.856	218.755
35	217.56	16.1097	68.5307	152.237	220.768
40	250	18.3615	32.2423	209.624	241.866
45	217.56	15.9708	.260701	217.214	217.475
50	192.126	14.2044	29.8317	161.097	190.929
55	171.689	12.8834	63.4209	120.139	183.56
60	154.936	11.8947	99.8733	89.3975	189.271
65	140.972	11.1654	138.083	65.6984	203.781
70	129.168	10.6486	176.889	46.9874	223.876
75	119.069	10.3161	215.114	31.8875	247.002
80	110.338	10.1542	251.598	19.4455	271.044
90	315	63	315	0	315

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 49D

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS; MODIFICATION - D; FABRIC - H; BREAK TYPE - I; PARAMETER 'A' - 2 ; G - 5 CM; W - 5 CM; PEAK ANGLE - 40 DEGREES; PEAK STRENGTH - 250 N; STRENGTH OF WARP - 340 N; STRENGTH OF WEFT - 315 N; AT THE TESTING WIDTH OF 5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	340	68	340	0	340
10	81.6327	7.12562	271.643	14.3866	286.029
15	94.6746	7.85271	232.286	25.3545	257.64
20	111.111	8.84311	191.038	40.4189	231.457
25	132.231	10.1892	149.152	61.6249	210.777
30	160	12.0375	107.899	92.3194	200.218
35	197.531	14.6265	68.5307	138.221	206.752
40	250	18.3615	32.2423	209.624	241.866
45	197.531	14.5004	.260701	197.216	197.477
50	160	11.8292	29.8317	134.159	163.991
55	132.231	9.92254	63.4209	92.5284	155.949
60	111.111	8.53021	99.8733	64.1107	163.984
65	94.6746	7.49849	138.083	44.122	182.205
70	81.6327	6.7298	176.809	29.6955	206.504
75	71.1111	6.16106	215.114	19.044	234.158
80	62.5	5.75175	251.598	11.0147	262.613
90	315	63	315	0	315

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 50A

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS; MODIFICATION - A; FABRIC - I; BREAK TYPE - I; PARAMETER 'A' - 2.2 ; G - 5 CM; W - 5 CM; PEAK ANGLE - 45 DEGREES; AND PEAK STRENGTH - 250 N; STRENGTH OF WARP - 280 N; STRENGTH OF WEFT - 260 N; AT THE TESTING WIDTH OF 5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	280	56	280	0	280
10	70.5033	6.15219	223.706	20.5929	244.299
15	81.2592	6.73695	171.294	53.6109	224.905
20	94.5784	7.523	157.326	49.5984	206.924
25	111.326	8.5725	122.831	69.8369	192.668
30	132.762	9.9804	88.858	96.1953	185.053
35	160.772	11.894	56.437	131.512	187.949
40	198.278	14.5483	26.5525	180.273	206.826
45	250	18.3321	.214929	249.801	250.016
50	198.278	14.6418	24.623	181.463	206.086
55	160.772	12.0486	52.3474	133.264	185.611
60	132.762	10.1782	82.4351	98.1502	180.585
65	111.326	8.80409	113.973	71.7744	185.747
70	94.5784	7.78438	146.003	51.3727	197.376
75	81.2592	7.02794	177.555	35.1131	212.668
80	70.5033	6.47595	207.668	21.7259	229.394
90	260	52	260	0	260

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE+10^ 2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 50B

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS; MODIFICATION - B; FABRIC - I; BREAK TYPE - I; PARAMETER 'A' - 2 ; G - 5 CM; W - 5 CM; PEAK ANGLE - 45 DEGREES; AND PEAK STRENGTH - 250 N; STRENGTH OF WARP - 280 N; STRENGTH OF WEFT - 260 N; AT THE TESTING WIDTH OF 5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	280	56	280	0	280
10	79.1016	6.90248	223.706	23.1043	246.81
15	90	7.46162	191.294	37.2263	228.521
20	103.316	8.21804	157.326	54.1807	211.506
25	119.822	9.22672	122.831	75.1667	197.998
30	140.625	10.5715	88.858	101.892	190.75
35	167.355	12.3811	56.437	136.897	193.334
40	202.5	14.8581	26.5525	184.112	210.665
45	250	18.3321	.214929	249.801	250.016
50	202.5	14.9536	24.623	185.327	209.95
55	167.355	12.542	52.3474	138.721	191.068
60	140.625	10.781	82.4351	103.963	186.398
65	119.822	9.47599	113.973	77.252	191.225
70	103.316	8.50356	146.003	56.1189	202.122
75	90	7.78391	177.555	38.8901	216.445
80	79.1016	7.26572	207.668	24.3755	232.044
90	260	52	260	0	260

WHERE

SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)

KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)

S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)

S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)

S - TOTAL BREAKING STRENGTH (N)

APPENDIX 5OC

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS: MODIFICATION - C; FABRIC - I; BREAK TYPE - I; PARAMETER 'A' - 2.2 ; G - 5 CM; W - 5 CM; PEAK ANGLE - 45 DEGREES; PEAK STRENGTH - 250 N; STRENGTH OF WARP - 280 N; STRENGTH OF WEFT - 260 N; AT THE TESTING WIDTH OF 5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	280	56	280	0	280
10	70.5033	6.15219	223.706	12.4252	236.131
15	81.2592	6.73695	191.294	21.7618	213.056
20	94.5784	7.523	157.326	34.4048	191.731
25	111.326	8.5725	122.831	51.8824	174.714
30	132.762	9.9804	88.858	76.6034	165.461
35	160.772	11.894	56.437	112.499	168.936
40	198.278	14.5483	26.5525	166.255	192.808
45	250	18.3321	.214929	249.602	249.817
50	198.278	14.6418	24.623	166.255	190.878
55	160.772	12.0486	52.3474	112.499	164.847
60	132.762	10.1782	82.4351	76.6034	159.038
65	111.326	8.80409	113.973	51.8824	165.855
70	94.5784	7.78438	146.003	34.4048	180.408
75	81.2592	7.02794	177.555	21.7618	199.316
80	70.5033	6.47595	207.668	12.4252	220.094
90	260	52	260	0	260

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)

APPENDIX 50D

THE BREAKDOWN OF THE CALCULATED BREAKING STRENGTHS FROM THE MATHEMATICAL MODEL WITH THE PARAMETERS AS FOLLOWS;
MODIFICATION - D; FABRIC - I; BREAK TYPE - I; PARAMETER 'A' - 2 ;
G - 5 CM; W - 5 CM; PEAK ANGLE - 45 DEGREES;
PEAK STRENGTH - 250 N; STRENGTH OF WARP - 280 N;
STRENGTH OF WEFT - 260 N; AT THE TESTING WIDTH OF 5 CM.

ANGLE	SKQ	KQ	S1	S2	S
0	280	56	280	0	280
10	79.1016	6.90248	223.706	13.9405	237.646
15	90	7.46162	191.294	24.1026	215.397
20	103.316	8.21804	157.326	37.5834	194.909
25	119.822	9.22672	122.831	55.8419	178.673
30	140.625	10.5715	88.858	81.1401	169.998
35	167.355	12.3811	56.437	117.106	173.543
40	202.5	14.8581	26.5525	169.796	196.348
45	250	18.3321	.214929	249.602	249.817
50	202.5	14.9536	24.623	169.796	194.419
55	167.355	12.542	52.3474	117.106	169.454
60	140.625	10.781	82.4351	81.1401	163.575
65	119.822	9.47599	113.973	55.8419	169.815
70	103.316	8.50356	146.003	37.5834	183.587
75	90	7.78391	177.555	24.1026	201.657
80	79.1016	7.26572	207.668	13.9405	221.609
90	260	52	260	0	260

WHERE
SKQ - THE CALCULATED STRENGTH OF THE SECOND ZONE (N)
KQ - STRENGTH PER UNIT LENGTH AT DIFFERENT ANGLES (N/(METRE*10^-2)
S1 - BREAKING STRENGTH OF THE FIRST ZONE (N)
S2 - BREAKING STRENGTH OF THE SECOND ZONE (N)
S - TOTAL BREAKING STRENGTH (N)