Cesta Rebuild

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Introduction

If you like do-it-yourself projects and you play jai alai, you may be interested in the process described here to rebuild a battered cesta.

It doesn't matter how damaged the ribs are or how much of the reed has been broken. The main requirement is a sound frame. A rebuild takes up to 50 hours to complete and that time will be wasted if the frame is in poor shape.

The tools required are inexpensive and easily acquired. The necessary skills are easily learned and most of the materials are readily available, with the exception of synthetic reed.

I play at Matt DiDomizio's court, Connecticut Amateur Jai Alai, in Berlin Connecticut. Matt has been kind enough to give me enough reed to perfect the process, but as of yet I haven't discovered where the synthetic reed is manufactured, so it can be purchased in bulk.

My motive in offering this tutorial is mainly to help anyone interested in trying a rebuild, but I'm also hoping readers will share any information they might have regarding the purchase of synthetic reed.

What follows is a slide presentation that describes my rebuild process from start to finish in pictures and explanations.

Before attempting any work, browse the entire document, then read the whole section covering the work you're about to try. Unless otherwise noted, read the slides from left to right, not top to bottom.

You can email me with questions or comments at dougemg1@gmail.com .

Doug Miller

Tools

needle nose pliers

Craftsman 45661 5 ½" needle nose pliers or
Black Rhino 00299 6" extra long nose pliers
Note: grind down the tip, so they can be used both as pliers for crimping and as an awl

3/16" & 1/4" sockets – used to secure rib spacers

flashing strip – used to thread tape strips around ribs and around frame

large eye needle – from Joann Fabrics 1019884 Yarn Darners Hand Needles-Size 14/18, 7/Pkg

heavy duty shears – used to cut 1/16" plastic sheets

carving knives

SE 8106PK precision carving knife with 5 carving blades (1st knife) or
Proedge 40028 concave carving blade 5 pack (blade in 2nd knife)
General 75622 knife and blade set (3rd knife) used to thin synthetic reed at splice point

awl – Craftsman 41028 scratch awl

Dremel Rotary Tool (or the like)

with sanding drum and cutting wheel and optional flex shaft
used to cut ribs and thin ribs sections at splice points
other tools can be used to accomplish these functions

Online Tool Sites:

www.sears.com
www.amazon.com
www.all-spec.com
www.joann.com

Materials

polypropylene 1/16” sheet plastic
- item 42601 24” x 48” sheet
- used for rib replacements

waxed polycord thread .045”
- used at tip (black) and for glove (ecru)

aluminum flashing - used to reinforce weak ribs

nylon #4-40 3/8” machine screws & nuts

stainless #2-56 machine screws & nuts
- stainless #3-48 machine screws & nuts (not shown)
- used to maintain rib spacing for weaving
- homemade washers from a 1/32” polypropylene sheet (item 42600 24” x 48”)

synthetic reed

cotter pins
- used to hold split ribs together while weaving

two-sided 3/4” golf grip tape

3/4” masking tape & 2” masking tape

Scotch Extreme filament shipping tape

Online Material Sites:

- www.usplastic.com
- www.mainethread.com
- www.amazon.com (nylon screws & nuts)
- www.boltdepot.com
- www.golfsmith.com (two-sided tape)
- www.homedepot.com (flashing & tapes)

Process

Over the past two years I've rebuilt more than a dozen cestas. The process has been refined over that time. While my first attempts were acceptable, the current rebuilds are much better. They are lighter and less stiff and the labor time has been cut from 50 to 35 hours.

The first step is to select a cesta worthy of the rebuild effort. The frame must feel strong with no obvious weak spots. Once all the old reed has been removed, there's a good chance one or more minor splits will be found, where the frame is bent on the stretched side. These splits can be strengthened with filament tape, while the frame is exposed. It may be possible to apply wood glue before taping. This subject is explained further in the "Odds And Ends" section.

As far as the condition of the ribs is concerned, it doesn't really matter. Some of the cestas I've rebuilt have had whole sections of multiple ribs completely missing.

There are 13 ribs in every cesta, a center symmetrical rib (#7) and 6 pairs of mirror imaged ribs. The pairs are numbered from 1 to 6 from the frame to the center rib. Even if the center rib and the #6 pair seem to be in acceptable condition, they should be replaced with polypropylene (plastic) ribs. Those 3 ribs take most of the abuse and are almost always damaged to an extent that a good reweave is impossible, since they will deform when woven over. Once the cesta has been rebuilt, the plastic ribs will retain their shape and strength indefinitely, allowing future weave repairs to be done with ease.

The only requirement for the replaced ribs is that the center rib and one of the #6 ribs be in good enough condition to serve as templates for their replacements. Even a badly damaged center rib can be duplicated by approximating its original shape.

The next step after selection is to remove all the reed from the tip to just above the glove. This must be done carefully so as not to further damage any ribs. Three small sections of woven reed are kept in place temporarily to help hold the ribs in place for the reweave. The glove need not be removed and the weaving under the glove should not be disturbed.

Splits or breaks in the ribs should be repaired, as the old reed is removed. Repairs to the replaced ribs will allow them to be used to accurately trace their replacements. Repair to the other ribs will help produce the best reweave.

With the old reed removed, each of the ribs to be replaced must cut out one at a time, starting with center (#7) rib. The removed rib is then used to trace its outline over the plastic (polypropylene) sheet. Next the replacement rib is cut out and prepared for placement and then inserted back into its position with the other ribs.

With all the ribs back in place, weaving can begin. This process will be described in detail. It involves securing the ribs with spacers and tape and proceeding from a point 4-6 inches below the tip to the glove. Once all that is complete, which takes the bulk of the time, the small distance from the starting point to the tip is woven.

Weaving is very rough on the hands. Taped fingers and/or golf gloves will minimize blistering.

The last step is to sew waxed thread onto the tip.

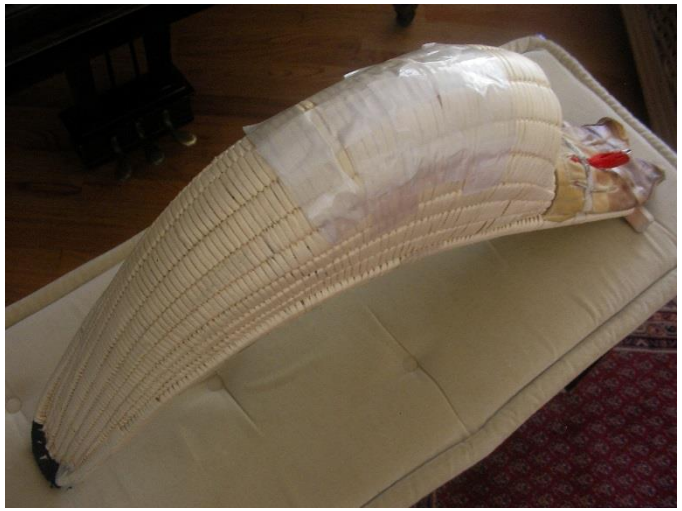
Of the many things I've learned about cesta construction, it's clear to me that I could never build a cesta from scratch. I have no alternative to a bent wood frame and it wouldn't be practical to replace all the ribs with plastic. The skill required to select the proper wood and bend the pieces into the necessary shapes is well beyond my capabilities.

The rebuilt cesta described here is very close to the real thing in the way it looks and performs. I've used them for the last two years, only changing cestas to test new rebuild techniques. I play 4-6 hours a week at Matt's court and luckily the frames have remained strong. None of the plastic ribs have cracked or broken and there's been little need to apply tape to the body. Replacing the occasional broken reed section has been simple and quick.

If you complete a rebuild, hopefully you will feel the same way about your finished product.

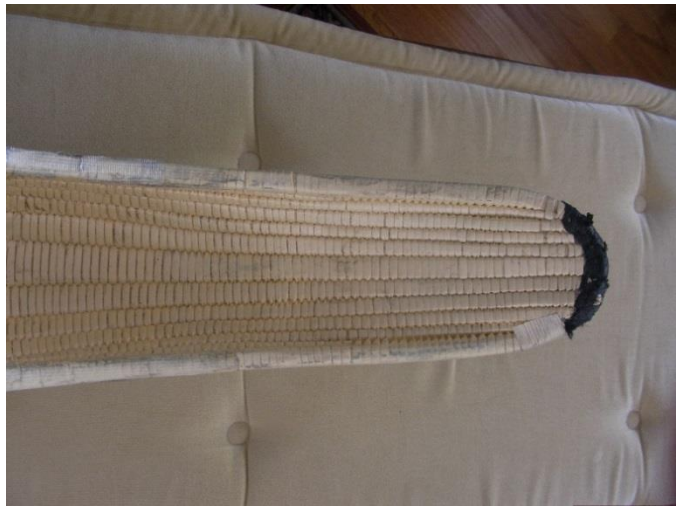
One last note, although I've never used a rebuilt cesta on a full sized pelota court with a real pelota, I think it would perform well. Matt's ball is slightly heavier than a pelota, which has bearing on the damage sustained. It would make for an interesting experiment.

Breakdown (1-6)



Here's the cesta before any work was performed. This cesta was originally woven with synthetic reed.

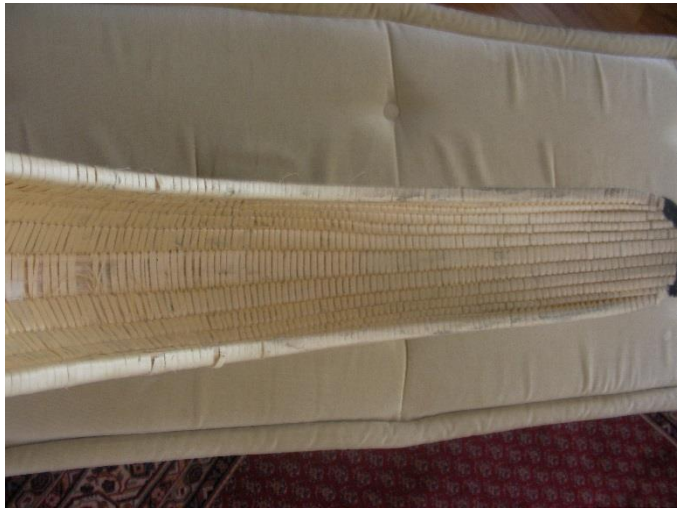
There's lots of tape on the cesta body to be removed.



As well as tape on the frame.

The outside tape has been removed.

The center rib is weak due to splits along its length.



The frame tape has been removed and reed damage has been exposed.

Cut thru the thread at top of the tip, but don't cut into frame.

Cut thru threads that are woven across the ribs.

Breakdown (7 - 9)

Peel back the cut thread.

Notice the cut has gone into the reed and ribs that overlap the frame, but not into the frame.

Use the needle nose pliers to remove sections of thread.

Rather than just grasping and pulling each thread section out, grasp and wrap the thread section around the plier jaws with a twirl. With this motion alone, the threads will start to come loose. Then a tug will free the thread section.

Repeat this process with more thread sections, until all the threads have been removed.

With the tip threads removed, begin the unweaving process working from the tip to the glove.

Later I'll show a quicker method to remove large areas of reed, but for now remove the reed by reversing the weave. This is slow and tedious, but it will give you a feel for what's involve in weaving a cesta.

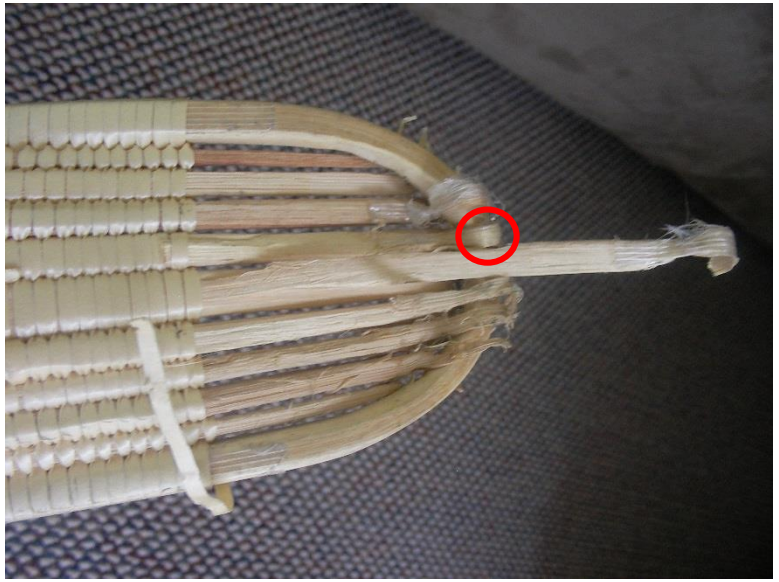
Eventually you'll come across a splice, where one length of reed has been joined with another. Take notice of what's involved with a splice, because you'll be splicing lengths of reed together during the reweave.

The awl is a great tool to assist in the reverse weave.

This particular cesta was originally woven with synthetic reed, which is much easier to remove than natural reed. Synthetic reed is soft and pliable, while natural reed is usually dry and brittle.

Natural reed will break into small pieces during removal. Wetting the reed with a spray bottle will make this task a little easier, but it's still a pain.

Breakdown (10 - 12)

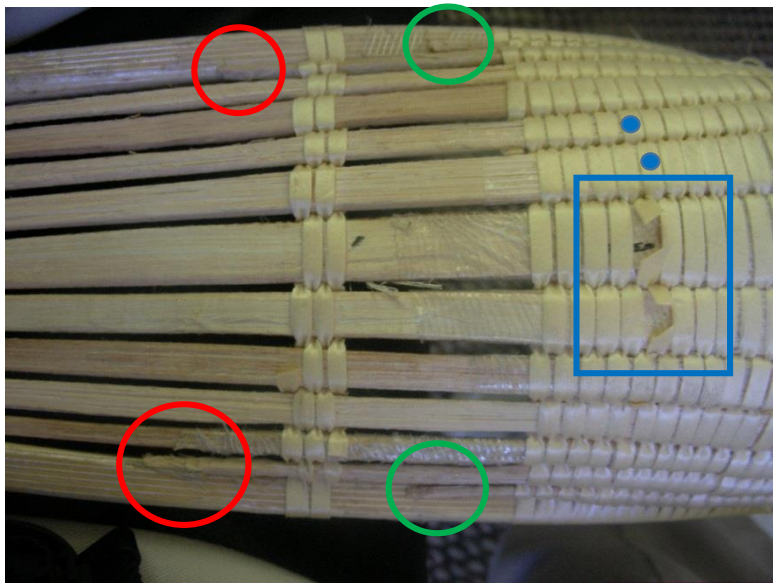


As the reverse weave proceeds, the parts of the ribs that are folded over the tip and frame are revealed. This part of ribs #4 - #7 must be removed.

If they are not already severed, cut the ribs at the back side of the tip, as noted in the red circle above. Leave enough of the rib, after the cut, so that it slightly protrudes beyond the tip on the front side. This will allow the tip to be reassembled later.

Once they are cut, these parts can be removed before their ends are completely revealed. Reverse weaving will be easier, after they are gone.

Notice rib pair #3 does not go over the frame at the tip like the rest of ribs (#4 - #7).



This shows the first of the 3 reed sections that will remain temporarily.

Rib pairs #1 and #2 (closest to the frame) do not go all the way to the tip. This small section of reed is positioned to hold rib pair #2 in place during the reweave. Notice that about ½" to 1" of both of the #2 ribs are exposed (see the red circles).

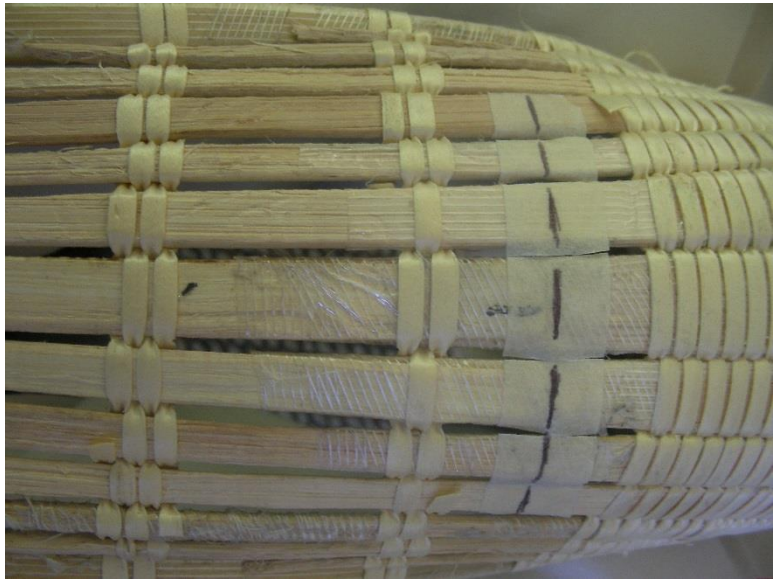
Leave a few reed rows in this section, then resume the reverse weave.

Stop removing reed when ½" to 1" of both #1 ribs are exposed (see the green circles).

Notice that both ribs of these pairs don't end at the same spot on either side of the frame. That's because both ribs of the same pair are often not the exact same length.

To start a new area to be unwoven, use the concave blade to cut a reed over rib #7 and a reed over a rib #6 on the next row (see the blue square). Squeeze the awl between the reed and rib at the blue circles. The awl is then used to pry the woven reed out.

The same technique for starting a new area can be used anywhere on the cesta.



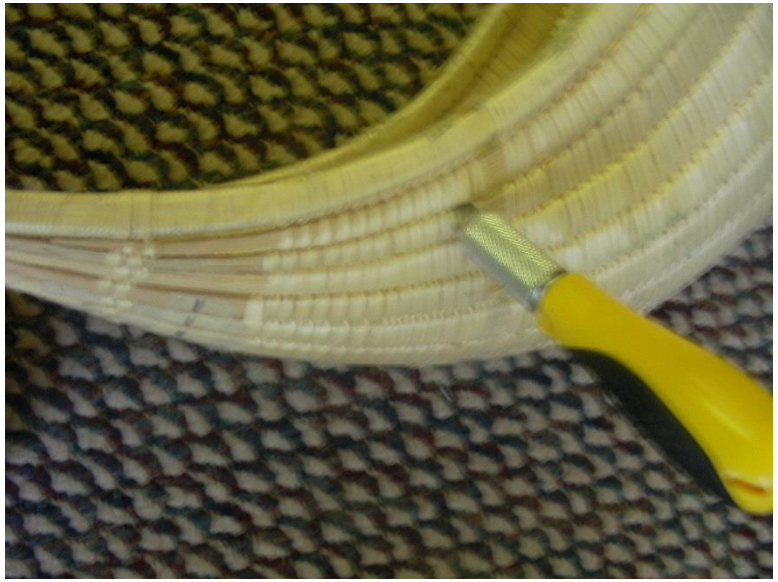
This shows the first 2 of the 3 reed sections that will remain temporarily to hold rib pairs #1 and #2, as well as to keep all the ribs in place for the reweave.

Place a strip of ¾" masking tape after the 2nd reed section and draw a line across the tape. Then use the concave blade to cut the tape between ribs.

The line across the #6 and #7 ribs will be transferred to their respective replacement ribs. This will allow the replacement ribs to be positioned accurately, relative to the ribs that are not replaced.

In the slides that follow a 2nd tape line is visible near the deepest area of the cesta. This extra alignment aid is not really necessary.

Breakdown (13 - 15)

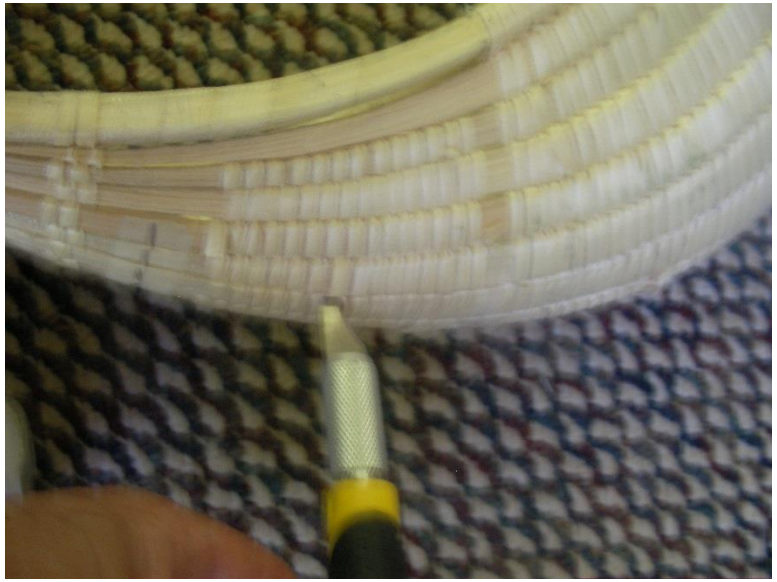


Reverse weaving is tedious. A quicker and easier way to get the remaining reed removed is to strip it off.

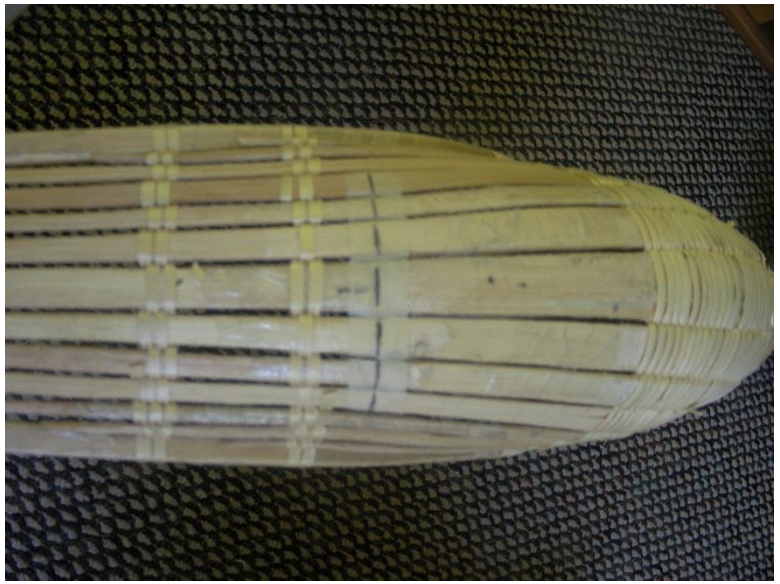
This involves running the carving blade between adjacent ribs over a 3 to 4 inch stretch. It's not necessary to slice between every two ribs. Between every 3rd or 4th rib is good enough.

Then by running the awl down the back of a rib and under the reed, many short reed lengths can be freed from the cesta quickly.

In a matter of a minute or two a large area can be stripped clean of reed.



Here a section of reed has been stripped consisting of the frame and rib #1. The carving blade is being run between the #5 and #6 ribs for the next strip.



Here the entire area has been stripped.

Breakdown (16 - 17)

As each area is stripped, the revealed ribs should be examined for damage and then repaired.

For rib #7 and the least damaged #6 rib, this is necessary so accurate clones can be created.

For the rest of the ribs (not being replaced) repair will yield a better reweave.

Ribs of a used cesta will show splits along the rib's length, following the wood grain.

The split will often travel to the edge of the rib, causing one part to come completely away from the other.

Strips of filament tape can be used to bring the pieces back together.

Filament tape is usually 2" wide. Narrower strips can be created using the following process. Cut a length of tape off the roll and lay it over the edge of a table, so that the desired strip width extends beyond the table's edge. Next, run the carving knife along the table's edge to create 2 pieces. As many as 5 or 6 narrow strips can be cut from one length of tape.

A strip of aluminum flashing can be used like a needle to help wrap the tape around a split.

Ribs that are completely broken across their width need to be patched. A filament tape strip is sufficient for ribs #6 and #7, since they will be replaced.

For the ribs #1 - #3, a more substantial patch is required. Once a 4" to 5" length of the rib is exposed with the break in the center, use a thick piece of paper or cardboard to trace that rib section. Cut out the drawn shape for use as a template. Make the template slightly narrower at both edges, but maintain the rib's curvature.

Cover a piece of aluminum flashing with wide masking tape, so that it can be written on, and then transfer the shape to the flashing. Cut out the shape, making sure it's slightly narrower than the rib section to be patched.

Cover the remaining shiny side of the patch with two-sided tape and use the carving blade to closely trim any excess tape from the patch. Remove the paper barrier to expose the 2nd sticky tape side and stick the patch on the outer side of the rib centered over the break. Keep the masking tape on the patch, so that the aluminum will not be visible.

The last step is to wrap a narrow strip of filament tape around the rib at each patch end, centering the strip over the end. This will keep the patch from being snagged during the reweave. Wrap a wider piece of filament tape around the rib at the center of the break for strength.

If either #4 or #5 rib is severely damaged with multiple cracks or breaks, it should be repaired by patching in a plastic rib section long enough to cover the whole pocket area.

The steps involved in making a plastic rib patch are discussed in the "Odds And Ends" section.

The next section covers how to make plastic ribs to replace the three center ribs. These replacements will require a single splice each (plastic to wood), near the heel or glove.

Note: the left slide is from a different cesta.

This slide shows the cesta completely stripped of reed, except for the two small areas previously described near the tip and the one shown here at the heel.

This 3rd area will help hold the replacement ribs in place, while the cesta is being prepared for the reweave and to assist in splicing the new plastic ribs to the wood rib stubs.

The original reed is still in place under the glove.

The reed removed near the glove should be carefully unwoven, rather than being stripped.

With the majority of the ribs being exposed, the markings used to aid the original cesta maker are visible.

Replacement Ribs (1 - 3)

The #7 (center) rib is the first to be removed for cloning. Use the Dremel tool and the cutting wheel to cut the rib about 1 1/2” from the glove.

The #6 ribs will be cut at a greater distance from the glove, so that all the cut points will not be at the same position. This staggering of the cut points gives greater strength to the rebuilt cesta.

The guide line drawn on the rib can be seen just below the cutting wheel.

Use a thin scrap of wood to protect the adjacent ribs from being damaged. The wood piece is about 1/16” thick and was rip cut from a 1” pine board. This piece has another use, as will be shown later.

Here the #7 rib has been removed. It was carefully slid through the 3 woven sections remaining on the cesta.

The replacement rib will need to be slipped back through these reed sections. It’s important that the openings through which the old rib was slid remain intact to receive the new rib.

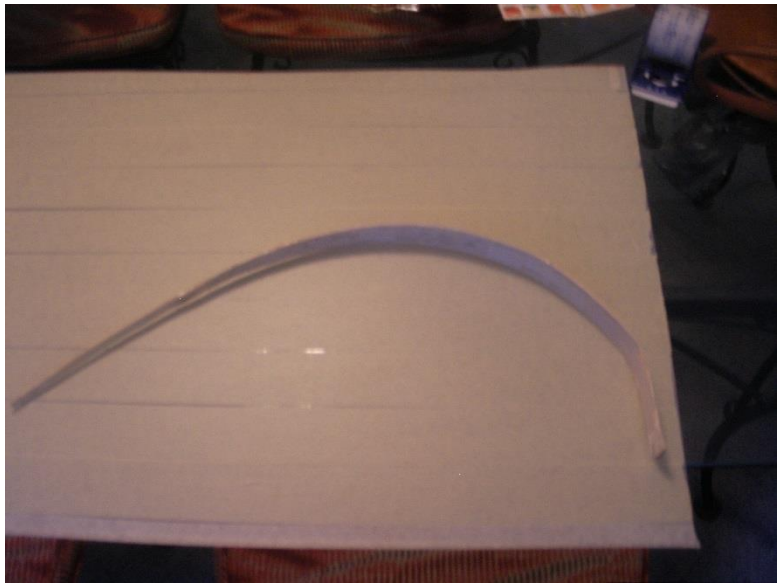
The new rib must be longer at the glove end than the rib it replaces. The extra length will allow it to be spliced with the remaining #7 wood rib.

In order to accurately produce this extra rib portion, slip a stiff piece of paper or cardboard under the cut rib and over the two adjacent #6 ribs, then trace the shape for the extra piece.

Draw a line across the extension corresponding to the cut line.

Replacement Ribs (4 - 6)

Place strips of two-sided tape on the inside surface of the rib to be copied. This is to hold the rib securely on the plastic sheet, while it is being traced.



The plastic sheet needs to be covered with the 2” masking tape (or contact paper), so trace lines can be drawn. Lines can’t be easily drawn directly on the plastic.

Remove the protective paper from the two-sided tape and stick the rib to the plastic sheet.

The sheet size I use i2 2’ by 4’, which is large enough for many ribs. The yield from a sheet can be maximized by placing ribs on the sheet to minimize waste.

In theory, the #7 rib should be symmetrical along its center line. However, due to sustained damage and the quirks of the owner’s catching and throwing style, this is seldom the case.

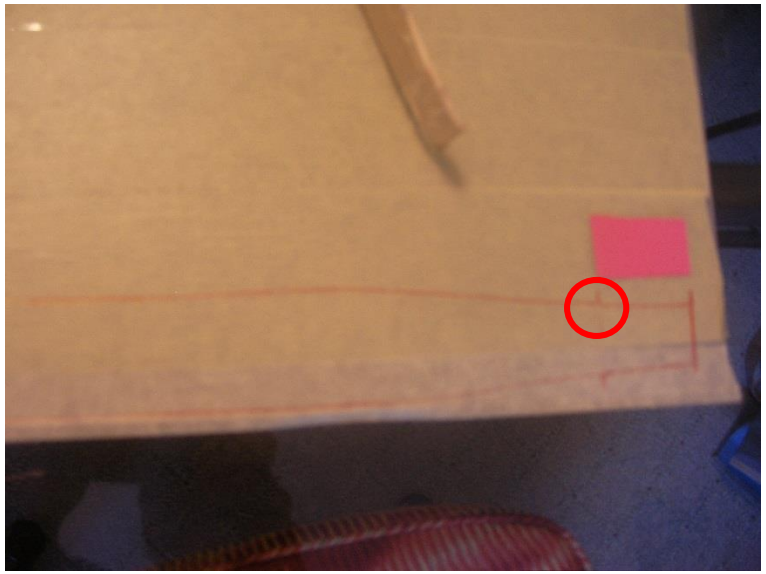
Cutting both #6 ribs from the same template, guarantees their symmetry with respect to each other.

With these factors in mind, it’s a good idea to alter the drawn #7 rib’s outline, if necessary, to improve its symmetry. Centering the rib on a straight line drawn on the plastic sheet will help highlight any center rib defects.

Drawing parallel lines outside the edges of the #7 rib will further highlight imperfections needing to be altered.

The paper template extension should be laid in position for tracing (see the red circle).

Replacement Ribs (7 - 9)



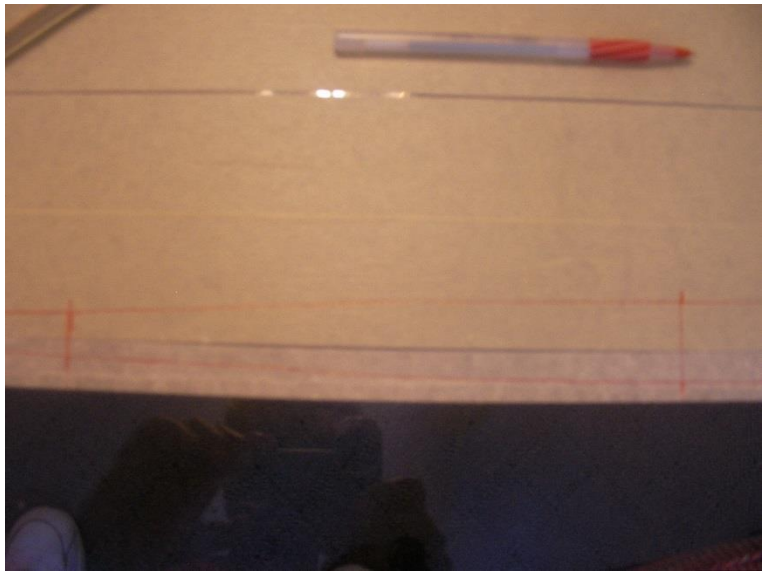
Here's the traced #7 rib. The extension for the splice has also been traced.

Draw the trace around the rib fixed in place by the two-sided tape. Lean the pen inward towards the rib, so that the outline is no larger than the original shape.

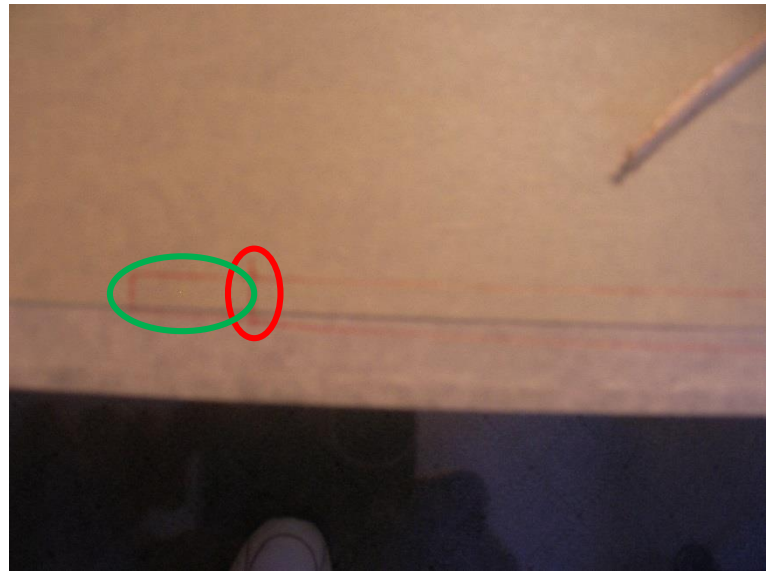
Position the extension with regard to its cut line and the rib's end. Draw around the extension which can be held in place by hand pressure.

Note the tick marks on either side of the trace on slides 7 and 8. Before cutting out the trace, connect these marks with a straight edge. The lines will identify the ends of the old cut rib and the reference line(s).

This particular center rib was reasonably symmetrical, so there was no need to alter the trace.



The 2 reference lines for rib alignment are shown here.



The line in the red oval marks the tip end of the old cut rib. The trace length should be extended with a straight edge maintaining the rib's taper.

This extra length (green oval) will allow the rib clone to extend beyond the frame at the tip. The rib clone length will be trimmed before the final tip processing is performed.

The 3 center-most replacement ribs described here are each a single plastic piece from near glove to tip.

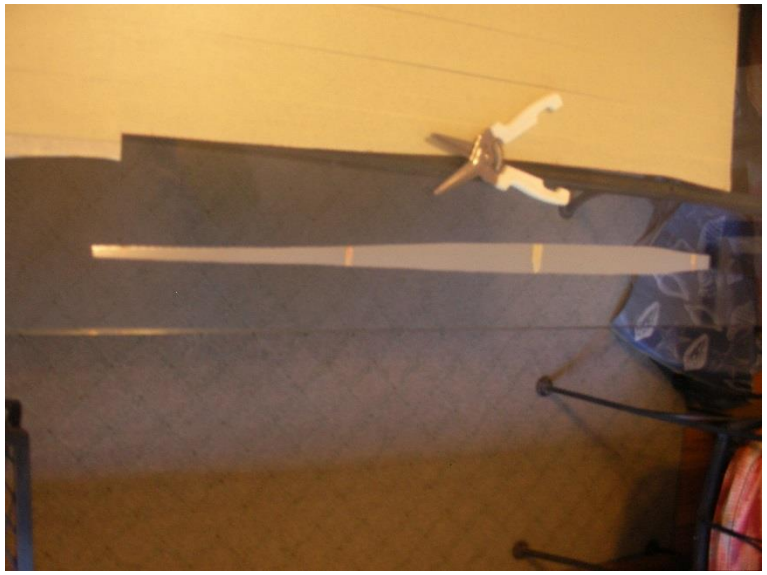
Recently I have been experimenting with a different technique, which involves plastic ribs that are spliced with the original wood ribs near the tip as well as near the glove. The result is 3 very large patches.

Plastic at the tip makes for a less rigid tip, which although it does plays well, is not as stiff as the original tip.

I've rebuilt 2 cestas with this new technique and have been pleased with the results.

This alternate technique is explained in the "Odds And Ends" section.

Replacement Ribs (10 - 12)



Here's the cut out center rib replacement.

Use heavy duty shears and cut from glove end to the tip and then return from the tip back to the glove. The 1/16" polypropylene cuts with some difficulty.

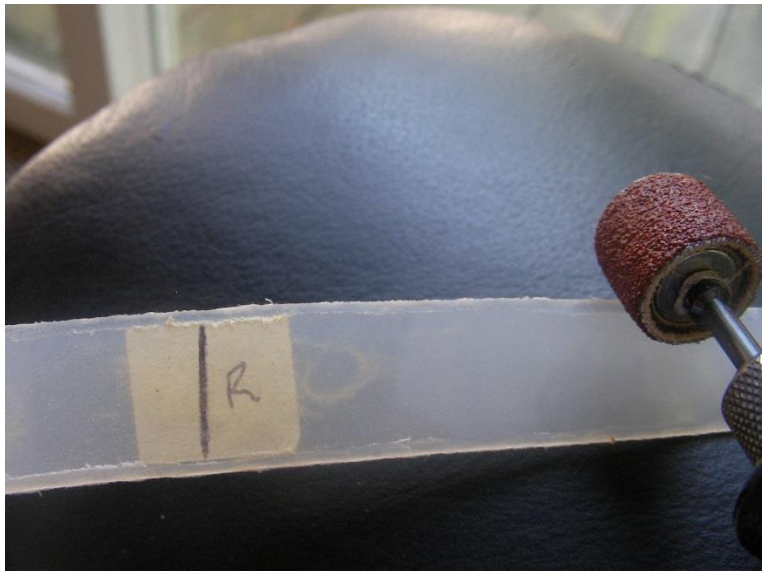
Use many short cut strokes as opposed to covering a long distance with a single cut stroke. This will allow small adjustments to be made in following the trace line.

When the clone has been completely cut out, the trace line should be on the scrap and not on the clone. The clone shape should be as close as possible to the original rib.

The glove extension should be under cut, making it smaller equally on both sides. This allows for a neat splice.

When cutting the #6 ribs, which are curved, some liberty can be taken in the cut to maintain a constant curve, especially where a flat spot has developed due to rib damage.

Remove all the masking tape from the clone, except for the tape under the reference and end lines.



Once the rib has been cut out, it needs to be beveled on both its edges. The beveling should be done on the outside surface, using the Dremel tool with the sanding drum.

The bevel makes for a neat weave in transitioning from one rib to another.

The sanding leaves rough debris on the rib. This must be scraped off with the carving blade, so the edge is clean and smooth. Be careful not to cut into the rib, changing its shape.

The rib shown here is actually one of the #6 ribs.

The last step to prepare the cloned rib, before it's repositioned back in the cesta, involves tapering the thickness of the extension section.

This should be done on the outside of the plastic rib.

The taper begins at the cut line with increasing taper to the end of the extension, where the rib should be paper thin.

The taper improves the transition from plastic to wood over the splice area.

Replacement Ribs (13 - 15)

Here the #7 cloned rib has been slid into position, through the 3 remaining reed sections.

Align the tip-most reference lines. For the time being don't worry about any other reference lines.

Cut out the best of the #6 ribs to be used as a template for both #6 clones.

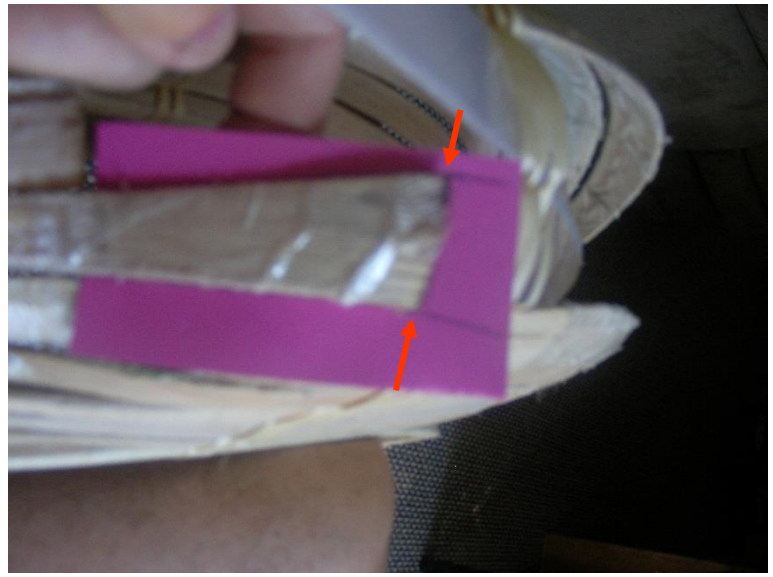
The cut point is 3"– 4" from the #7 cut point. The 3rd reed section should still hold the rib in place, after the cut.

The next slide shows the #6 extension template already drawn.

First draw the cut line, then trace the extension template, making sure the template covers 2" to 3" on the glove side and ½" to 1" on the other side (see the next slide).

A cut line must be drawn on both #6 ribs at the same spot. The green oval shows the spot where the other cut line will be drawn.

A major split is visible on the adjacent #5 rib. This problem (red oval) will be handled later with cotter pins. Since the rib is thick and quite curved at this point, filament tape will not hold the split pieces together.

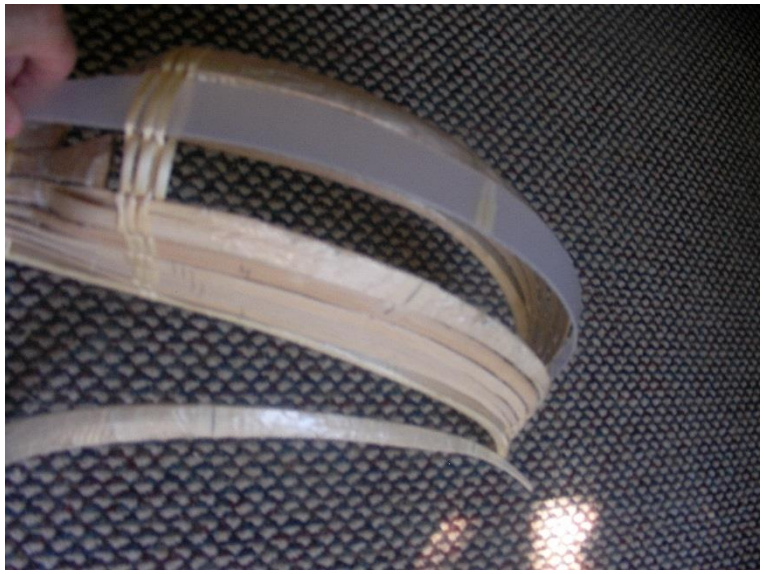


Here the cut has already been made and the #6 rib has been removed.

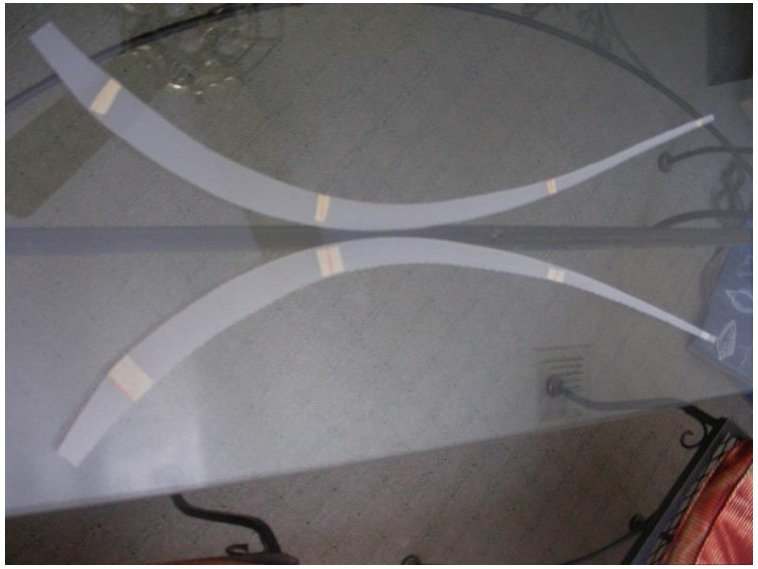
The extension template, as was mentioned previously, was drawn before the cut was made.

Make a tick mark on both sides of the extension template corresponding to the cut line (see the red arrows). Connect the tick marks with a line across the template. This will help align the extension with the rib for accurate tracing.

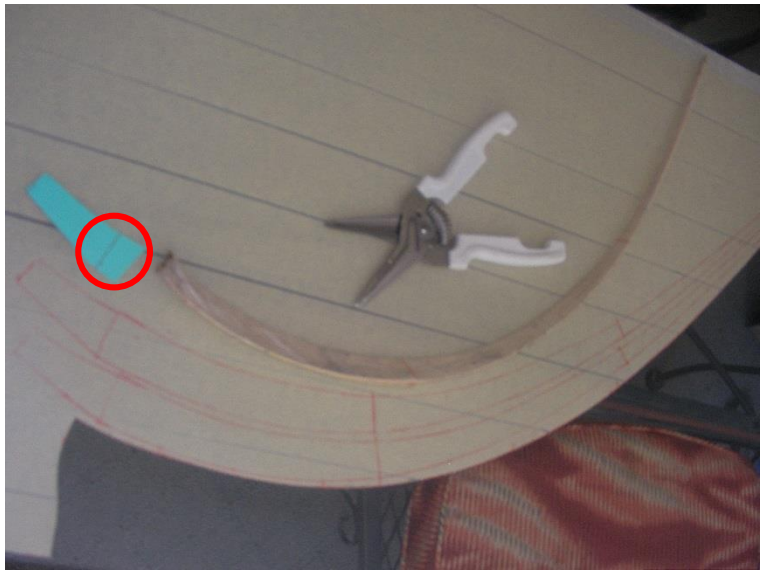
Replacement Ribs (16 - 19)



Here the #6 rib, which will be used as the template, has been removed.



Here the tape has been removed, prior to making the bevels and tapers.



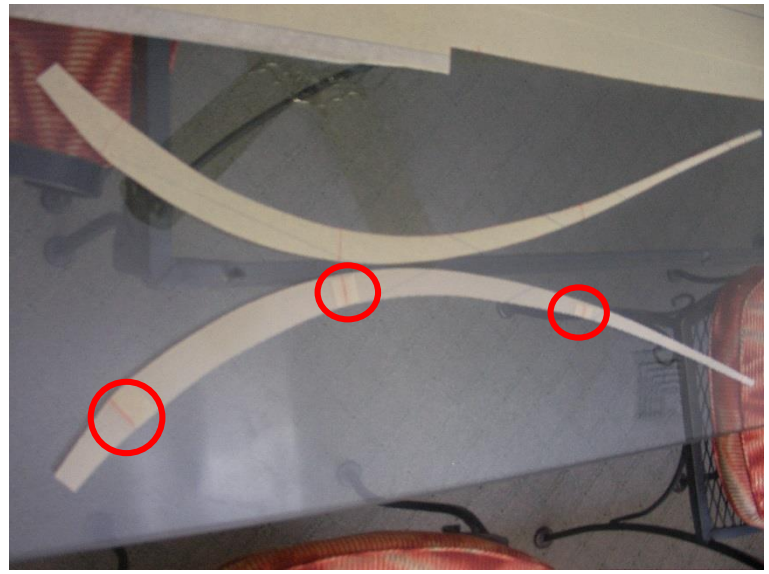
The removed #6 rib is used to make both #6 replacement ribs.

The two-sided tape was placed on the outside of the template this time, unlike with the #7 template. Either way will work.

The extension template was cut out and positioned with the rib template to produce each of the 2 traces.

The paper used for the extension has a different color on each side. Since the rib template was stuck to the plastic with the outside surface down, the extension template had to be flipped with its outside surface down.

The line referencing the cut line had to be accurately transferred to the other side of the extension.



Cut out both #6 ribs. Under cut the extension areas, making them narrower than the wood ribs, where the plastic and the wood will overlap to form the splice.

One of them will have to be flipped over and have its reference lines accurately drawn over small masking tape pieces on the other side of the plastic rib.

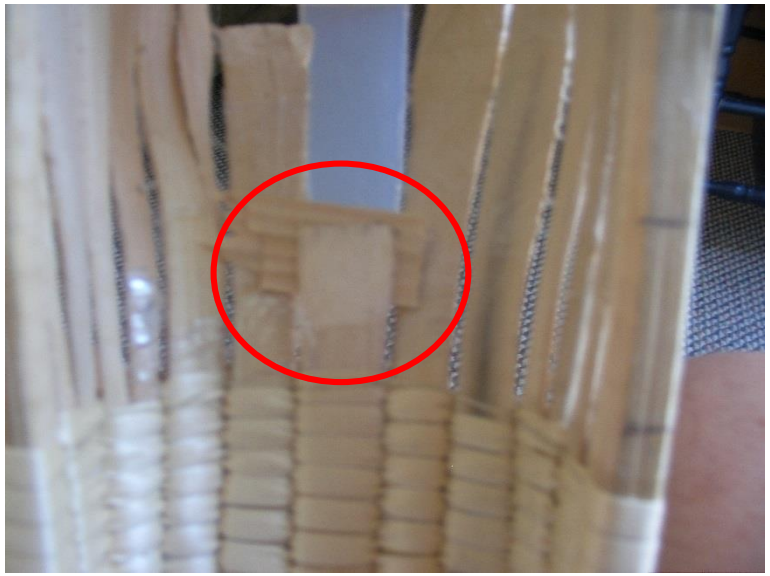
On the flipped rib remove all the masking tape, after transferring the reference lines.

On the rib that was not flipped remove all the masking tape, except for small sections of tape with the reference lines.

The remaining tape, besides containing the lines, also serves to identify the side of the rib that must be beveled and tapered.

Bevel and taper both #6 replacement ribs, as was done with the #7 rib replacement.

Replacement Ribs (20 - 22)



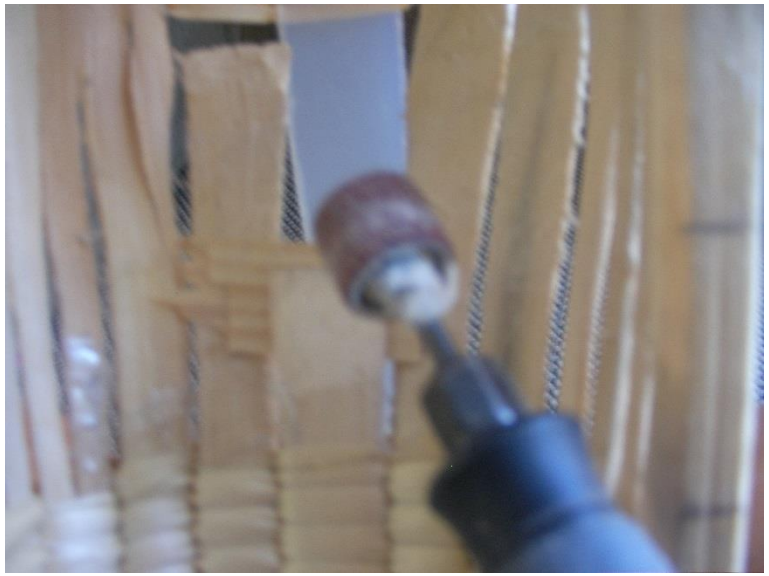
At this point all the replacement ribs have been beveled and tapered.

Now the portions of the #7 and #6 ribs still on the cesta must be tapered slightly at the cut point. This will ensure a neat splice.

From the inside of the cesta, taper the #7 rib, gradually reducing its thickness from the glove end to the cut point over about a 1/2” length.

At the cut point the wood should be tapered to a fine point.

Use a thin scrap of wood to protect the adjacent ribs.



The Dremel tool with the sanding drum is used to create the taper.

Taper the cut #6 rib in a similar manner.

The scrap wood piece is used in this slide to push the remaining #6 rib towards the outside even though the sanding is done from the inside.

The #6 tapers need only cover a 1/4” to 3/8”.

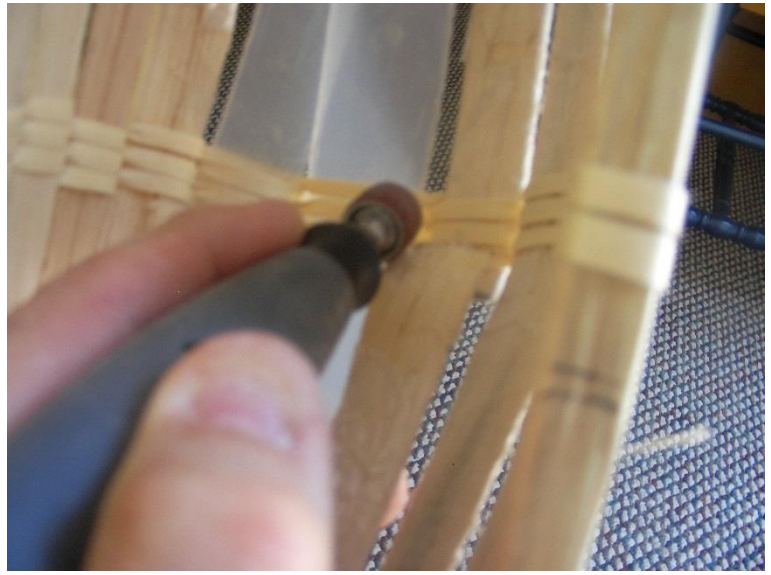
Paper thin tapers at the cut point make weaving over that part of the splice smooth and easy.

Bevel the outside edges of the #6 rib as was done with the #7 rib.

Replacement Ribs (23 - 27)

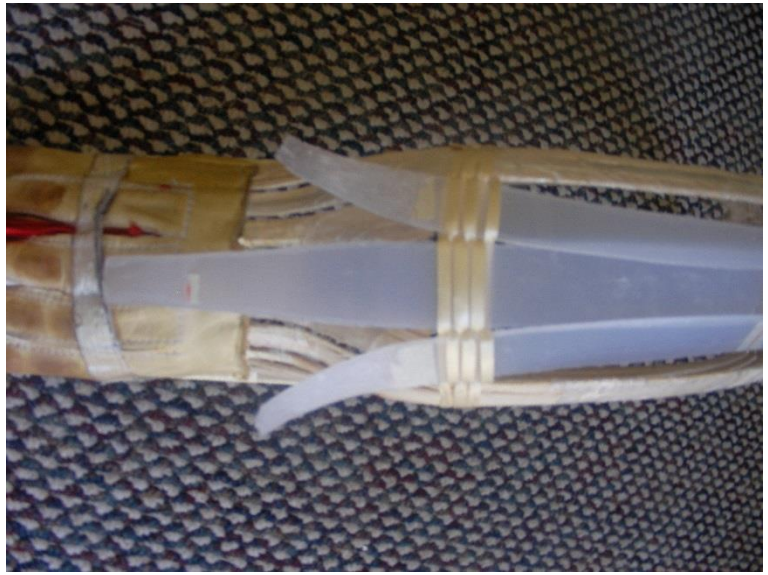
Place the #6 beveled and tapered clone in the cesta through the 3 reed sections. The reference lines must be on the outside.

Cut the other #6 rib.



Taper the just cut #6 wood rib on the inside.

Another method to expose a #6 rib for sanding is to push it inwards with a finger from the outside.



Place the 2nd #6 clone in the cesta, after it has been beveled and tapered.

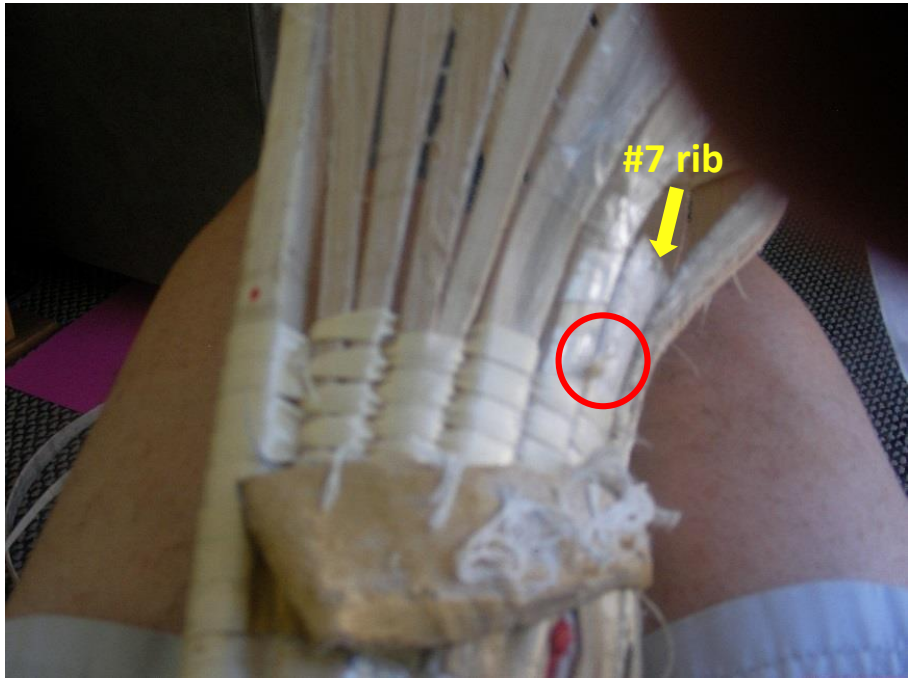
Here the reference lines haven't been completely aligned yet.

If replacement sections must be built for either #5 rib due to excessive damage, it is best to replace the same section of both #5 ribs.

These replacements, should they be necessary, must be beveled on both edges and tapered at both ends. The remaining #5 rib wood pieces must also be tapered at both splice points. This will form patches, which are discussed in detail in the "Odds And Ends" section.

This front court cesta did not require the #5 ribs to be patched.

Reweave (1 - 2)



The reweave will start near the tip and proceed to the glove.

The old reed end (red circle) will be part of the final splice between the last new reed length and the old reed. The old reed in this slide has come from the right and weaves to the left.

Without some planning, there's a only a 50% chance of starting the first reweave row near the tip such that a successful final splice near the glove will be guaranteed.

Looking at the cesta from the outside, note whether the last reed row goes over odd or even ribs. Here the last row goes over even ribs. Make sure the first row of new reed near the tip, again looking from the outside, goes over similar ribs. For this cesta, the first new row should go over the even ribs.

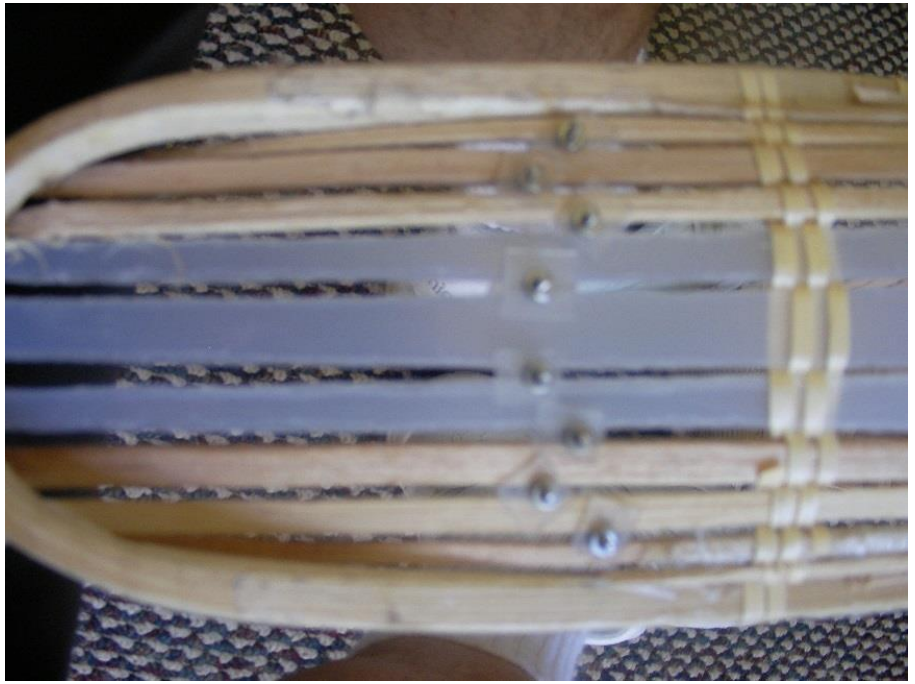
The direction of the weave right to left, in this case with the tip up and the glove down, must also be maintained for the first row of new reed at the tip.

If the last old reed row is very close to the glove, pulling the glove back will make it easier to make the final reed splice. It's easy to unstitch this section of the glove and restitch it after the reweave has been completed (see the first 12 slides of "Glove Replacement" section).

Use #2 screws with plastic washers on both sides as spacers to hold the ribs together evenly for weaving at the tip. These small screws will help keep the tip weave tight.

The stiffness of the cesta is a very important issue. It is determined by 3 factors: the spacing between the ribs; the tightness of the weave (how close the rows are to one another); and the amount of slack in the reed across the ribs.

The tip needs to be very stiff and the pocket area should be much looser by comparison.



My first rebuilds were too stiff across the whole weave. Back then I would weave from glove to tip with a very tight weave and the ribs were too close together in the pocket area. As a result, it was hard to control a ball that was not caught near the tip.

I made three changes that had a positive effect on playability. Weaving from tip to glove increased the slack. Ribs get wider from tip to glove, so weaving from the glove end and pushing back on a woven row to get the weave tight also reduced the slack, making the cesta stiffer. Conversely, pushing rows back towards the tip slightly increases the slack.

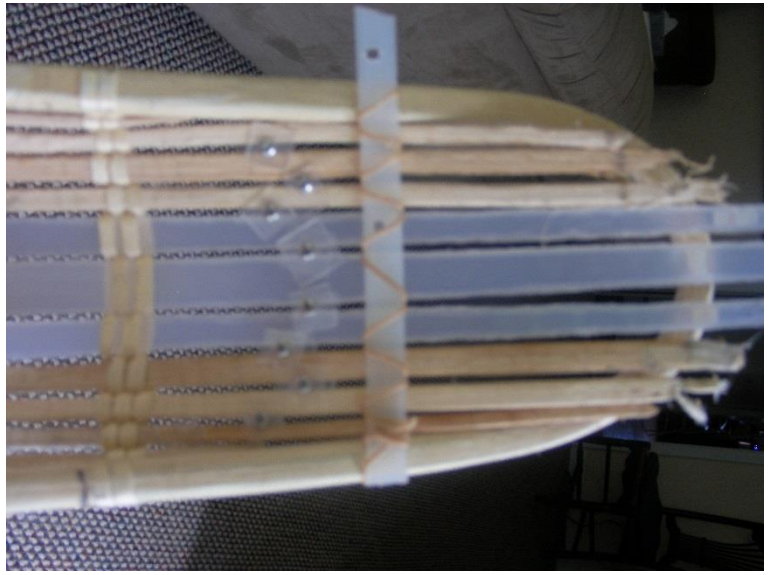
I consider the tip area to be 10" to 12" long. Beyond that the pocket starts to take shape, as the cesta gets deeper. Using large (#4) screws as spacers in the pocket reduces stiffness in that area.

The last change was to weave the rows a little farther apart in the pocket than at the tip, where the weave should be very tight.

A cesta gets less stiff naturally with play, since the reed gets more pliable. I'll show a method to soften the synthetic reeds, breaking them in before they're woven onto the cesta.

In the slide above, the rib spacing at the tip near the frame is erratic. This will be corrected when that area is woven, as one of the final steps.

Reweave (3 - 5)

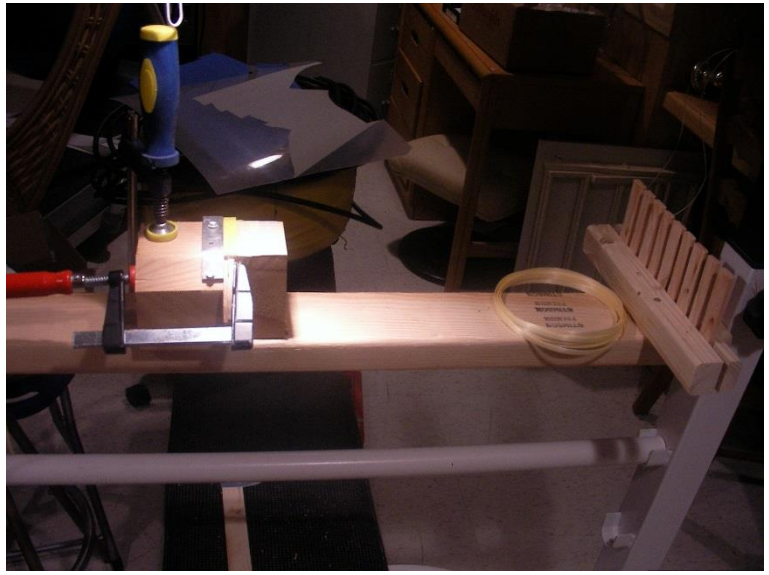


Here's another aid to keep the ribs in their proper position during the reweave.

The ribs transition from the underside of the frame over most of the cesta's length to on top of the frame at the tip.

A strip of plastic is held in place by weaving thread around the plastic strip, the ribs and the frame. This thick plastic strip is positioned where the #3 ribs are just about at the same level as the top side of the frame.

The strip also promotes the proper curvature across the ribs at this spot.



The synthetic reed that I've used from Mexico comes in 500' rolls and is about ¼" wide with some variation from roll to roll.

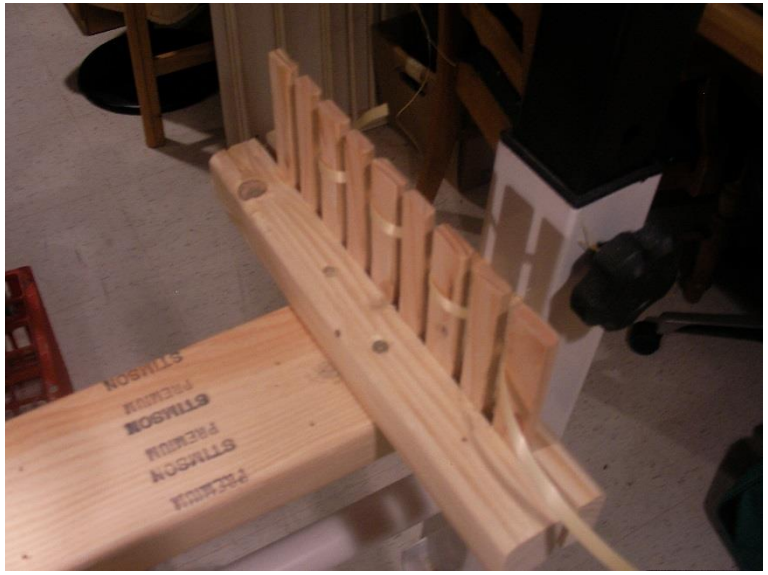
At ¼" this reed is too wide for weaving except under the glove.

I split the reed to narrow it to 2 different widths, one at .17" for the tip area and the other at .2" for the remainder of the reweave.

The homemade device shown in this slide allows the synthetic reed to be split to any desired width.

It's cut from a 4" x 4" block of wood with a common utility knife blade clamped in place at the desired distance from metal guide.

Slides on the next page further illustrate the jig's design.



The synthetic reed from Mexico is coiled on a roll and is stiff.

I noticed that the reed becomes less stiff or softer after being pulled through the ribs as part of the weaving process, so I built this jig to simulate this process.

I run a length of reed through the tines of the jig twice, first from one end of the length and then from the other. As a result, the coiling is greatly reduced or removed and the reed is softer and more pliable.

Both of these improved attributes help to make weaving easier.

Reweave (6- 8)

My splitting jig was made from a 4” x 4” post with 2 sections cut out.

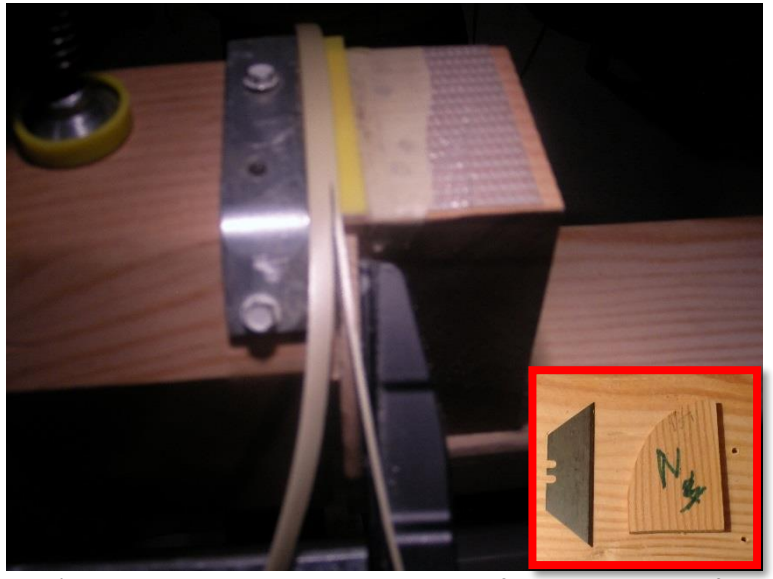
A bevel cut on the top front supports the metal guide. The other cut on the right front allows a utility blade sandwiched between 2 thin pieces of wood (shown in the red circle) to be clamped against the block.

The thickness of the first thin wood piece, closest to the block, determines the finished reed width. The other piece serves to spread the holding force of the clamp across a larger area of the blade.

The aluminum guide is 1/8” thick as is bent over the bevel and is held in place by 2 screws.

The reed is pulled past the blade as it slides across the yellow plastic piece, which is secured by two-sided tape over a filament tape strip.

The jig could also be built with two 2” x 4” pieces, with one shorter than the other. The shorter piece gets the bevel. The 2 parts would then be screwed together.



Here’s another look at the jig in the process of splitting a length of reed.

The reed part on the right is waste.

The inset shows the utility blade and one of the spacers. The spacer is marked with an “N” indicating the narrow spacer, used for tip reed.

The mounted spacer is used is for the wide reed.

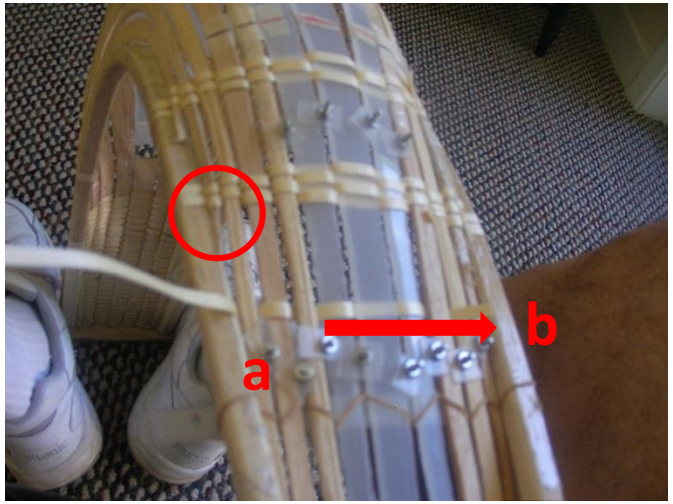
My preferred reed length is 10’, which I first cut from the roll, then run through the softening jig twice. The last step is to split the 10’ length.

As the reed is pulled through the splitter, it’s held in place with finger pressure on top of the reed.

The pull is started by grabbing the reed between the guide and the blade with needle nose pliers. Once the split has been started, the rest of the reed can be pulled through by hand without the pliers.

Pulling the reed generates heat from friction, so it’s advisable to wear a glove on the hand that holds the reed down.

After the reed has been split, take care not to cut the hold down finger. Keep it away from the blade.



The first row of new reed starts between the end of the #2 ribs and the spacer screws. The end of one #2 rib appears in the red circle.

I weave with 10’ reed lengths, but the length is arbitrary. Longer lengths require fewer splices. On the downside, it takes more work to pull longer lengths across the ribs.

It’s easier to weave from point “a” to point “b” to start, since a short length of reed will be pulled across the ribs. Weaving the next row towards the glove will involve pulling a long length of reed.

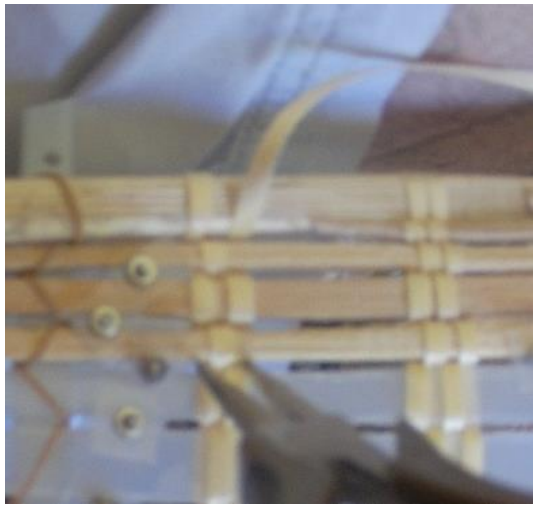
The row goes over even ribs (#4, #6, #6 and #4), since the last row near the glove also goes over even ribs and the weave direction has been maintained. In this slide the tip is down, so the direction is left to right.

Splices between reed lengths involve 2 adjacent ribs. The set of ribs should be either #2 & #3 or #3 & #4, except near the tip where the set should involve either the #3 & #4 or the #4 & #5 ribs. The idea is definitely keep each splice off the center-most ribs and to try and stay away from the ribs nearest the frame.

The spacers near the tip are slightly staggered due to the width of the ribs near the tip and the size of the plastic washers.

A 2nd row of spacers has been placed between the two sections of old reed.

Reweave (9 - 11)



At this point 3 rows have been woven across the ribs.

In order to control weave tightness, use the needle nose pliers to draw the rows close together. One jaw grasps the tip-most edge of the previous row at the space between ribs and the other jaw grasps the glove-most edge of the row just woven. A firm squeeze of the pliers will draw the rows together, producing a permanent crimp.

This process is repeated at every gap between ribs and even the gap between rib and frame.

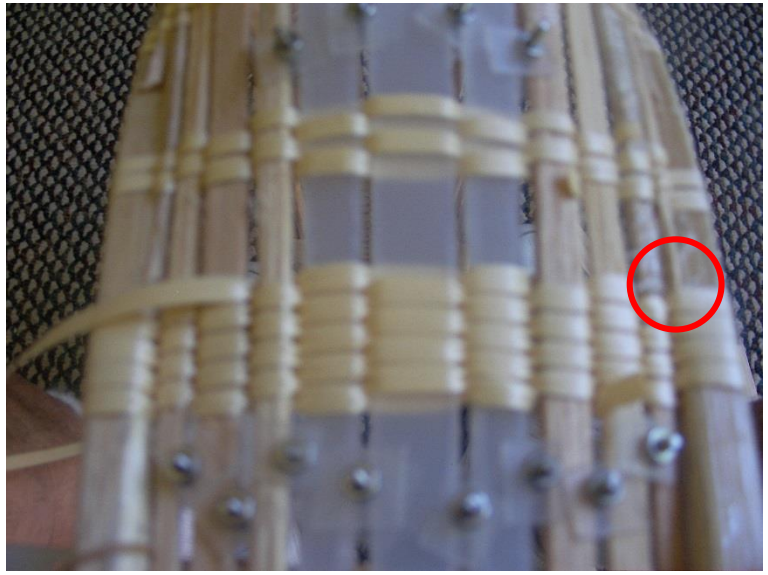
Natural reed unlike synthetic reed has a shiny and a dull side. The shiny side must always be kept on the outside, which requires the reed to be twisted at the frame. This is an unnecessary step with synthetic reed, so I never twist.

Weave in and out of two ribs at a time, except in tight places near the frame. The edge of the reed can act as a knife and cut the reed of the previous row, so be careful.

Use a finger to make a large loop under the first rib to make pulling the reed easier from the outside.

The slack created by the loop must be removed by one final pull.

The reed should be snug against the ribs.

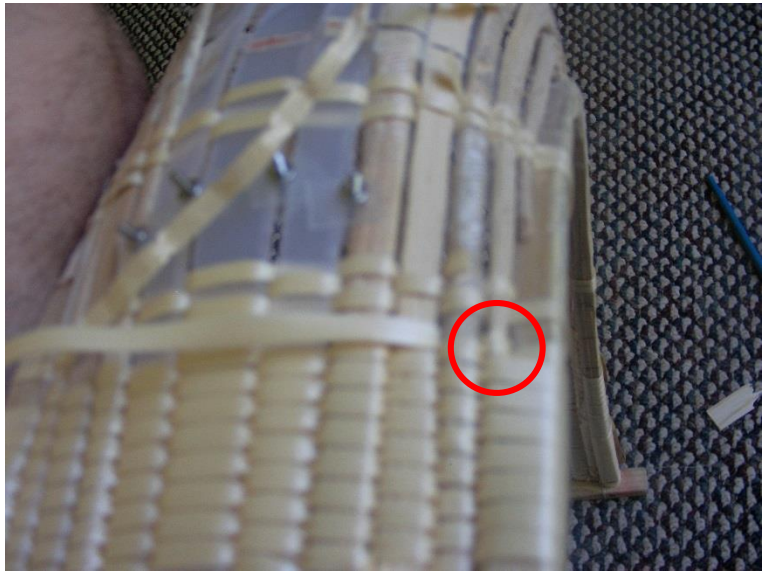


Weaving has proceeded to the point that the end of the #2 rib has been woven tightly against the frame and is locked in place (see the red circle).

After several more rows have been woven in this manner, the reed will be woven between the #2 rib and the frame.

Since both #2 ribs are often not the exact same length, this point in the weave may be reached at different rows for each #2 rib.

Wraps around the frame should be tight.



Three or four more rows have been woven and now the #2 rib is woven around, like the rest of the ribs, as shown in the red circle.

Be sure to weave between the #2 rib and the frame on the way to the frame (left to right in this slide), as well as after looping around the frame. Otherwise, the #2 rib will only be half woven and the weave will be out of kilter.

The first section of old reed is removed, row by row, as weaving proceeds to make room for new reed.

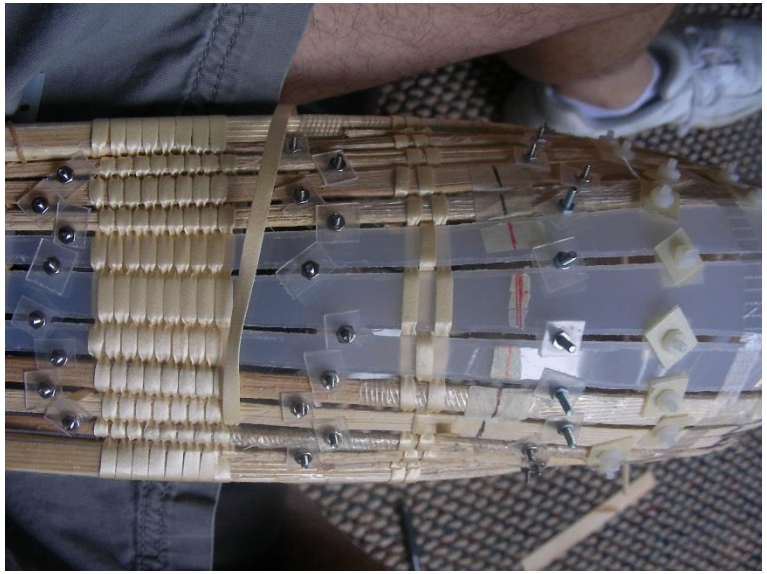
This old section can be completely removed, once both #2 ribs have been bound to the frame.

Near the tip a 10’ reed length will weave about 3 to 4 inches of the cesta, so this is still the first length of new reed.

A 10’ length will cover less and less area as weaving proceeds towards the glove and the cesta’s pocket gets deeper.

The same steps should be followed to bind the #1 ribs to the frame as has been shown for the #2 ribs.

Reweave (12 - 14)



Weaving is at the same stage here, as in the previous slide.

The first section of old reed has been completely removed.

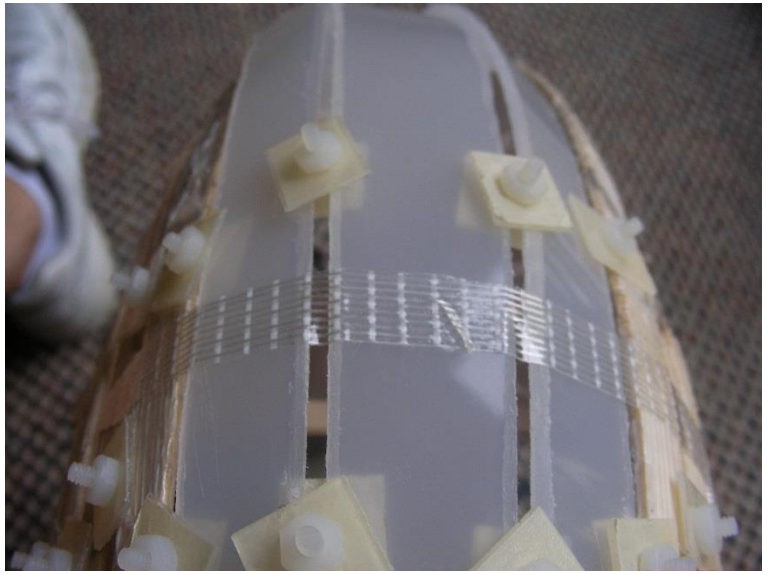
More spacing screws have been set in place. The first two rows of spacers use #2-56 stainless screws, which are the smallest. The slightly larger #3-48 screws are used in the next row of spacers.

From that point on, only the largest #4-40 nylon screws are used to set the best rib spacing for the pocket area. Not all of those screws have been placed yet.

The #3-48 screws are not really necessary. I got them as an experiment. #2-56 screws can be used instead.

The screws can be moved around easily by loosening the nuts with a 3/8" socket for the #2 and #3 nuts and a 1/4" socket for the #4 nuts. Use the pliers or awl to slide the loosened screws into the desired position, then retighten.

Rows of screws are removed as weaving proceeds and the repositioned rows of screws get too close to one another. Add new rows of spacers further down the cesta, towards the glove end.

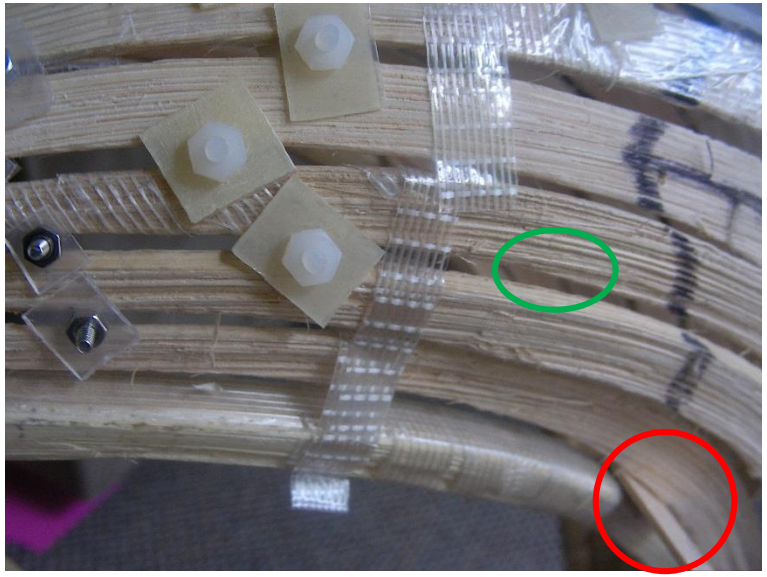


Use narrow strips of filament tape to adjust the spacing between rows of screws and to hold all the ribs together.

With the screws loosened the tape can be pulled tight enough across the ribs to keep proper and even spacing, as well as maintain smooth rib curvature. Once the tape has been set in place, the screws should be retightened to hold the spacing.

Adjust the tape over 2 ribs first and then adjust those 2 ribs to the next rib.

The tape can run from one frame side to the other, although shorter lengths of tape over fewer ribs are usually sufficient.



There's a lot going on in this slide.

The cesta's craftsman made the marks on the ribs. He wrapped the frame and the #5 - #7 ribs with filament tape. The tape around the #3 rib was also applied when the cesta was built to repair a split.

Plastic ribs don't crack, split or break, so precautionary taping is not required on those ribs.

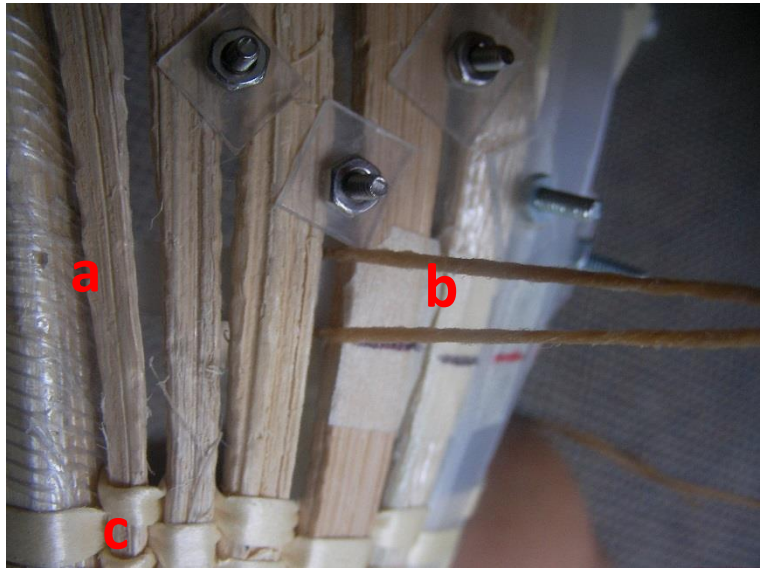
If necessary, a scrap wood strip (red circle) is used to keep proper spacing between the frame and the #1 ribs. The spacer extends through to the frame and #1 rib on the opposite side. If ribs or the rib and frame are too close to each other, the shape will deform and buckle during the weave.

The tape strips across multiple ribs and the frame show another method of coaxing the wood members to be properly spaced.

Spacing doesn't have to be perfect, so don't be too fussy.

As a last resort, the wooden ribs can be narrowed with the carving knife to increase spacing. Care must be taken to not run the knife against the grain. If the rib in the green oval were to be narrowed, the knife would have to move from right to left. Otherwise, the knife would dig into the rib.

Reweave (15 - 17)



I like to get the ribs next to the frame aligned with the frame's outer edge. As a consequence of weaving, one side ends up more aligned in this manner than the other side.

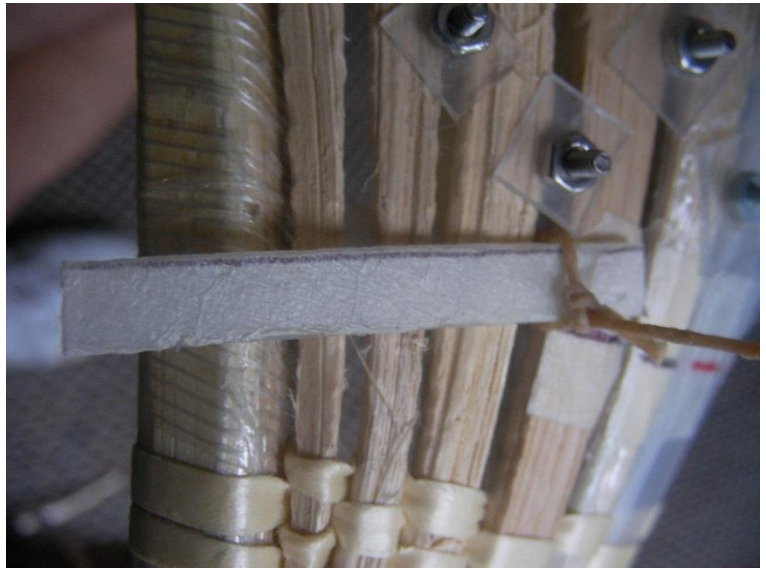
In order for the ribs to rest on the frame at the tip, the #2 ribs must move across the underside of the frame from the outside edge to the inside. The aid about to be described must not be used before the #1 ribs are involved in the weave.

A pair of 1/16" polypropylene plastic strips about 1/4" wide are used to coax the #1 rib towards the outer frame edge.

Cut a thread length of about 15" and make an adjustable noose at one end. Insert a noose between ribs #3 and #4.

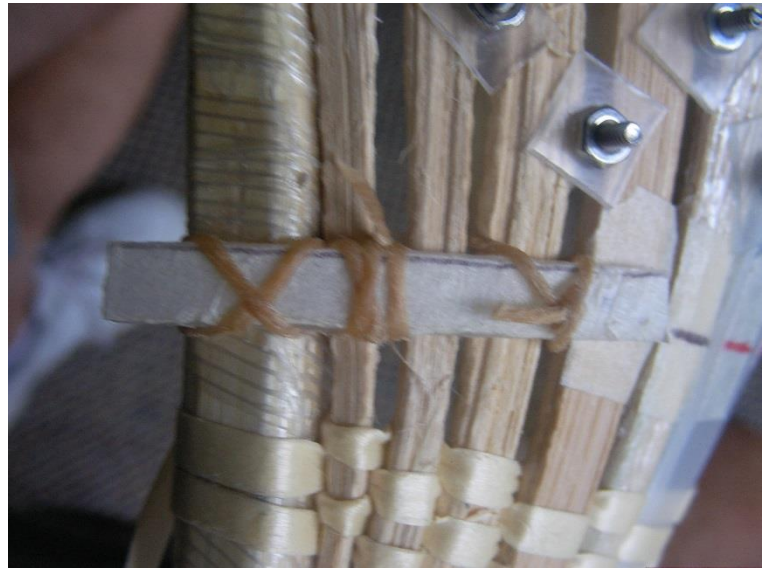
Place a plastic strip under the ribs running from the frame at point "a" to point "b", through the noose.

The cesta side most in need of this aid is the side where the reed comes from the inside to wrap around the frame, as weaving proceeds from the tip to the glove (see "c" above).



A second, but longer, plastic strip is slid through the noose before it is pulled tight.

Note that the outside strip extends beyond the frame.



Weave the thread around the plastic strips, ribs and frame. The thread is tied off between ribs #1 and #2 (or between the #2 and #3 ribs).

This aid will help rib #1 on this side to resist its tendency to remain near the inside frame edge.

This tendency is much less on the opposite side of the cesta. However, a similar aid may be useful on the other side, as well.

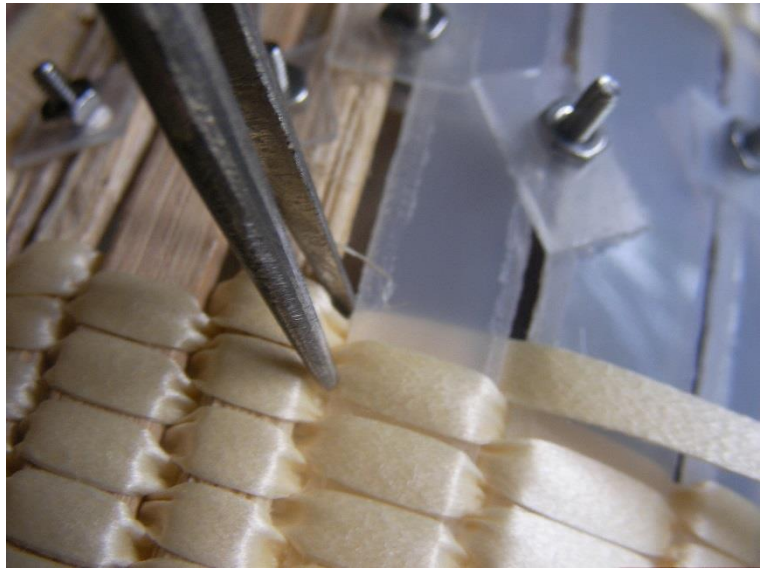
Once setup the pair of woven plastic strips can be slid as a unit up to several inches towards the glove as weaving proceeds.

Because the ribs keep getting wider, there's only so far the aid can be slid before it fails. When this happens, remove the assembly by cutting the thread with the carving knife and reset it further on down.

Slightly longer plastic strips and thread will be needed as the aid is placed closer to the glove.

When the glove is within 4" to 6", along the frame, the aid is no longer needed, since the ribs should eventually be aligned with the inside of the frame in that area.

Reweave (18 - 20)



Here's a closer look at how a crimp is made.

One plier jaw grasps the tip-most edge of the next to last reed row at the space between two ribs. The other jaw grasps the glove-most edge of the last row. A firm squeeze of the pliers draws the rows together and a permanent crimp is produced.

With the jaws closed, the pliers can be used as an awl to push the woven rows closer together or push them further apart to adjust weave tightness.

The woven rows should be pushed together tightly in the tip area, which I consider to be 10" to 12" down from the tip.

There should be no slack in the reed as it is wrapped around the frame. In the tip area, the reed should also be pulled snug across all the ribs. After that, as the pocket area approaches, the weave should be loosened slightly over ribs #4 to #7, otherwise the shape will get distorted.

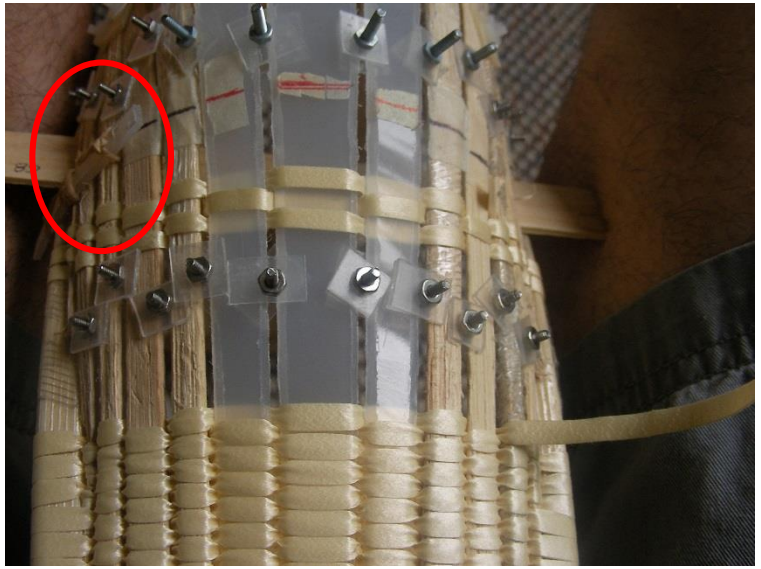
Over the long pocket area the separation between rows should be increased gradually to as much as a dime's width across rib #7.

The last several inches, before the new reed is spliced to the old reed near the glove, the weave should again be very tight.

Here the first 10' length of synthetic reed has been completely woven.

Only a small bit at the end remains and that is too small to go over the frame again to start a new row.

In the pocket area, where the rows should be less tight against one another, the crimping motion does not always need to involve two rows. Instead crimp a single row over the #6 and #7 ribs and then adjust the row spacing.



This is about the same slide, except here the spacer screws between the new and old reeds have been slid back towards the old reed to allow for more new rows.

The scrap wood spacer separating the frame from the #1 ribs is visible.

The plastic strips woven to the frame and the next few ribs can also be seen in the top left of this slide, near the wood spacer.

The next issue to be dealt with is the splicing of a new length of synthetic reed with the last piece already woven.

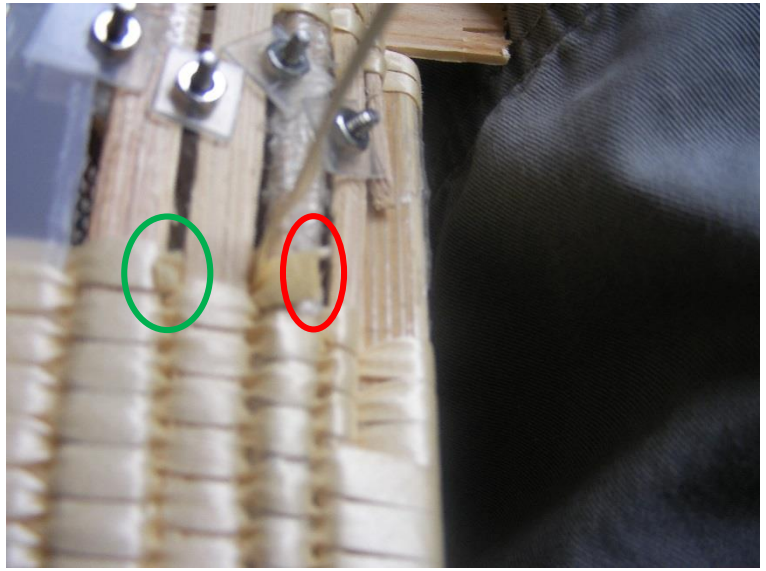
Reweave (21 - 23)

A splice requires that 2 reeds be layered, doubling the reed thickness over several ribs.

The thickness of 2 reeds makes a slight bump. In the pocket area, this is of no consequence, since a splice there does not involve the 5 center-most ribs, over which the ball rolls.

Splices near the tip do involve ribs that the ball will roll over.

To minimize the thickness for tip area splices, use a flat blade to shave some material off the end of the new reed length.



The splices I use involve just 2 ribs.

During the breakdown, you most likely noticed that the cesta maker's splices go over a 4 rib span, which certainly make them stronger. However, I've yet to see a 2 rib splice fail, even after many months of play.

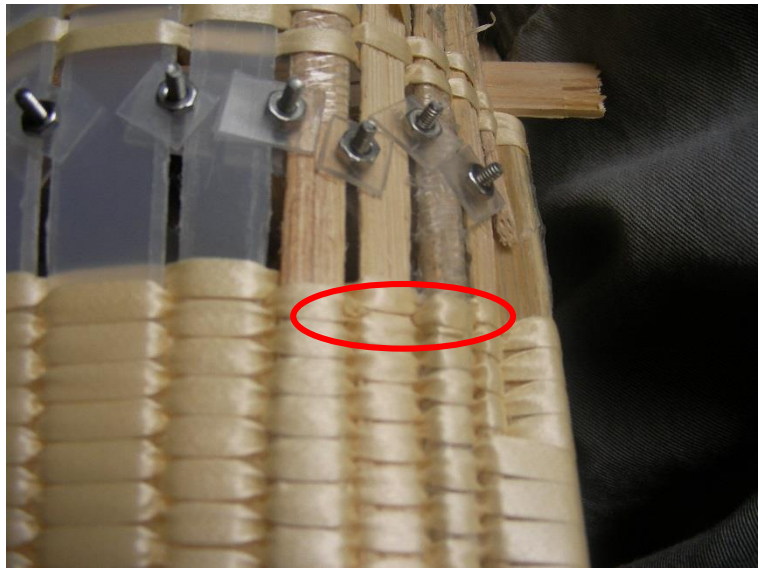
Here the already woven reed has been cut back, so that its trailing end just extends over the 2nd rib of the splice (see the red oval).

The thinned end of the new reed is slid between the old reed and the 1st rib of the splice.

The starting end of the new reed should be positioned so it just protrudes into the space before the 1st rib (see the green oval).

As a result, the reed thickness over the 1st rib on the inside is minimized, while the thickness over the 2nd rib on the outside is fully doubled.

The new reed has not been reverse woven, as it should be, on this slide so the splice can be better seen.



Here's the finished splice, after the next row has been woven with new reed.

After the splice has been formed, the doubled reed still needs to crimped. It's easier to make the crimp without grasping the previous row in the plier jaws. As a separate step, draw the rows close, using the pliers as an awl.

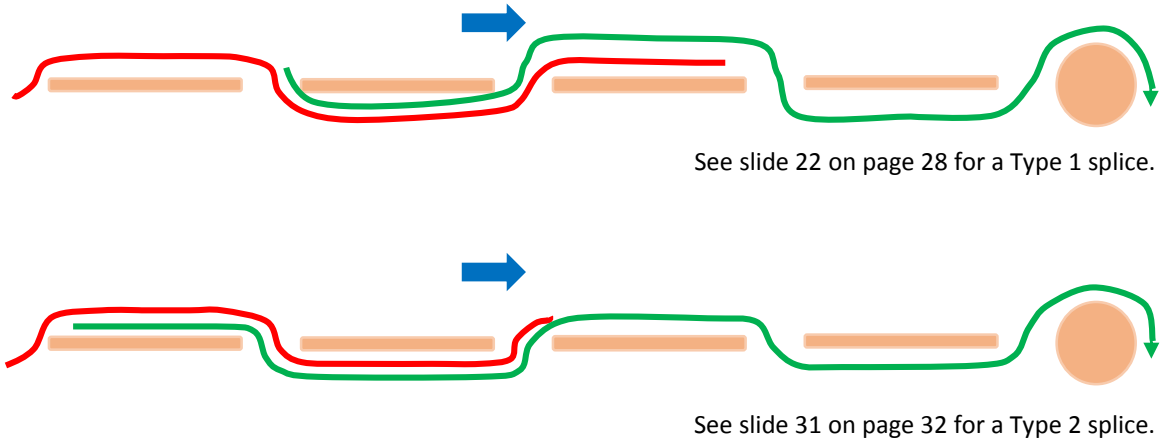
When the first row of a new length is reverse woven, leave some slack across the ribs for ease of maneuvering the reed into place and remove the slack after the splice has been completed.

Backwards weaving the 1st row of new reed allows a short reed length to be pulled through the ribs, rather than the full reed length.

There are actually 4 types of splices and they are described in the diagrams on the next page.

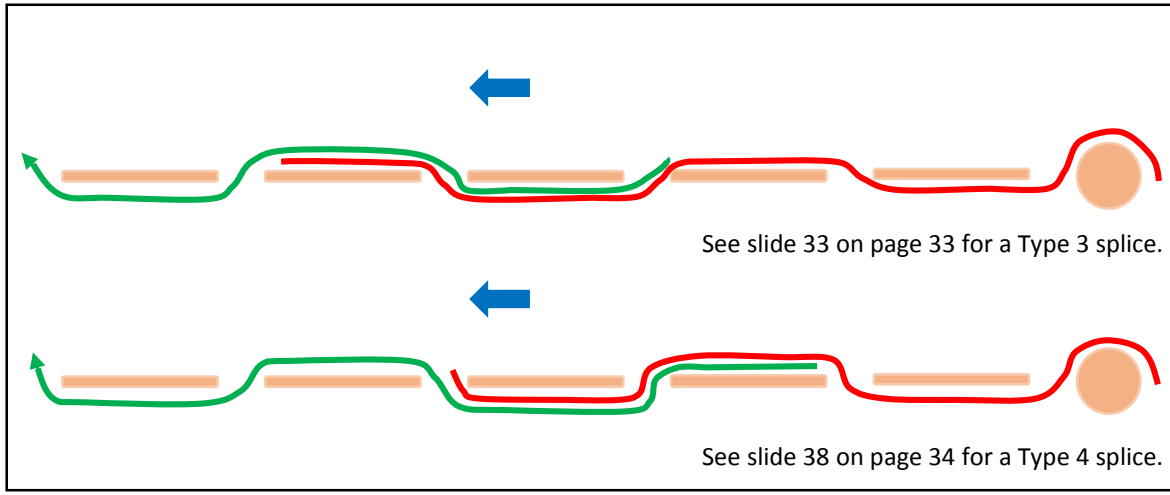
Reweave - the 4 splice types

For all the diagrams below, the last woven reed is red and the next reed to be woven is green. The blue arrows show the weave direction. The circles represent the frame and the upper side of each of the 4 diagrams (with the blue arrows) corresponds to the outside of the cesta.



See slide 22 on page 28 for a Type 1 splice.

See slide 31 on page 32 for a Type 2 splice.



See slide 33 on page 33 for a Type 3 splice.

See slide 38 on page 34 for a Type 4 splice.

The diagrams are in pairs. In the first pair the last reed (red) has passed the center rib on the way to the frame, but the remaining length is not long enough to wrap around the frame. In the second pair of diagrams, the last reed can wrap around the frame, but it's not long enough to weave past the center rib.

What distinguishes each diagram in the pair from the other is which reed has its end exposed in the splice. In the top diagram of each pair the next (green) reed's end is exposed and for the lower diagrams it's the last (red) reed.

All of theses splice possibilities are equally useful. General rule of thumb is to choose the splice that wastes the least reed.

The upper splices of each pair are slightly easier to form.

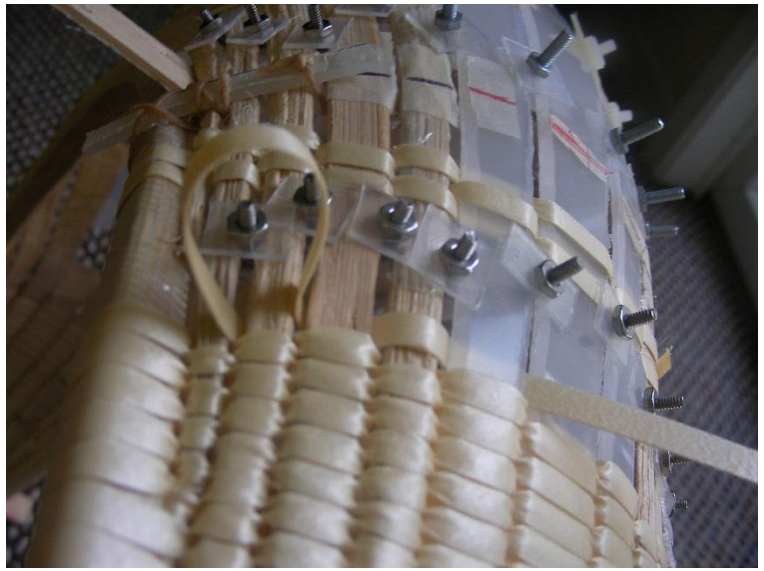
The second pair allows for a longer backwards weave of the next reed, which is a good thing.

For the 2 ribs involved in a splice, never use the rib next to the frame and never use ribs #5, #6 or #7.

If the exposed end of reed in a splice needs to be cut, use the carving knife or nail clippers. Make the cut close to the splice to expose as little of the end as possible.

It takes around 220' to reweave a cesta from tip to glove, a little more for a back court cesta and a little less for a front court cesta. Using 10' synthetic reed lengths, there will be about 22 splices.

Reweave (24 - 26)



Weaving is very repetitive work, but there are 5 issues/areas that require special handling.

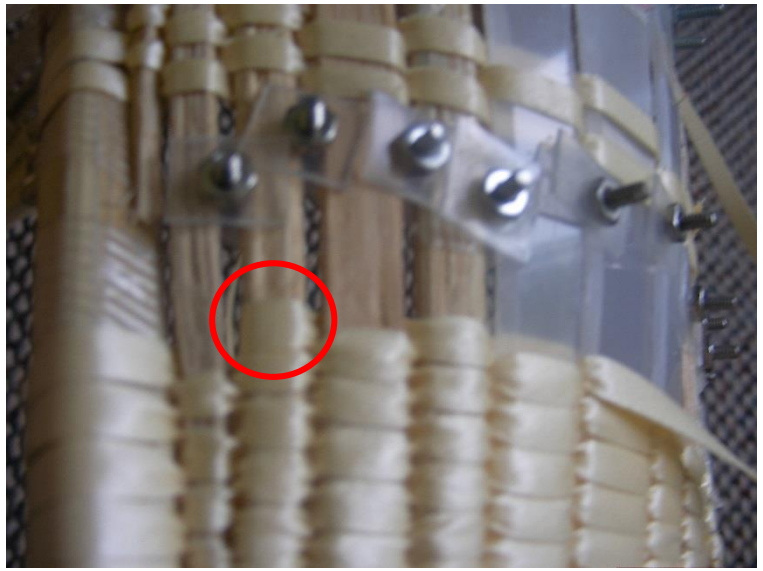
Two of these issues have already been discussed, the splice and the handling of #2 and #1 ribs, that don't reach the tip and need to be bound to the frame.

To understand the next issue, check the length of the center (#7) rib from the glove end to where the reweaving began near the tip. Compare that to the frame distance from the glove end to the reweave start. The difference, which allows the pocket to be formed, is about 6".

If all woven rows crossing the #7 rib also wrapped around the frame, the frame would be completely covered long before the center rib.

In order to keep the weaving balanced, extra rows must be woven that do not wrap the frame.

My term for this maneuver is "switchback", where the weave direction is reversed on a rib rather than on the frame.



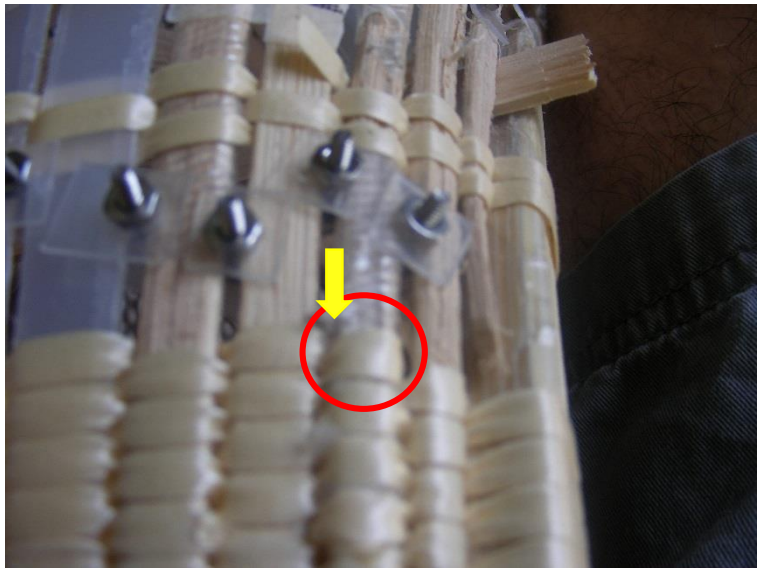
You may have noticed switchbacks as you removed the old reed. The reed was probably twisted at the change of direction similar to the wraps around the frame. With the synthetic reed this twist is also not necessary.

Switchbacks occur in pairs on the same rib number on either side of the center rib. The 1st switchback should be on the 2nd rib from the frame (#3 above). After making this switchback, the next one is made on the other #3 rib. Each switchback of a pair will start the next new row.

The very first switchback pair is made in the last half of the 2nd 10' length of new reed. No other switchbacks are required on the 2nd length.

For every additional 10' length there should be 2 switchback pairs except for where the frame parallels the center rib in the deep pocket area. Here either one or no switchbacks are required.

The goal is to have the woven rows appear to radiate from the frame.



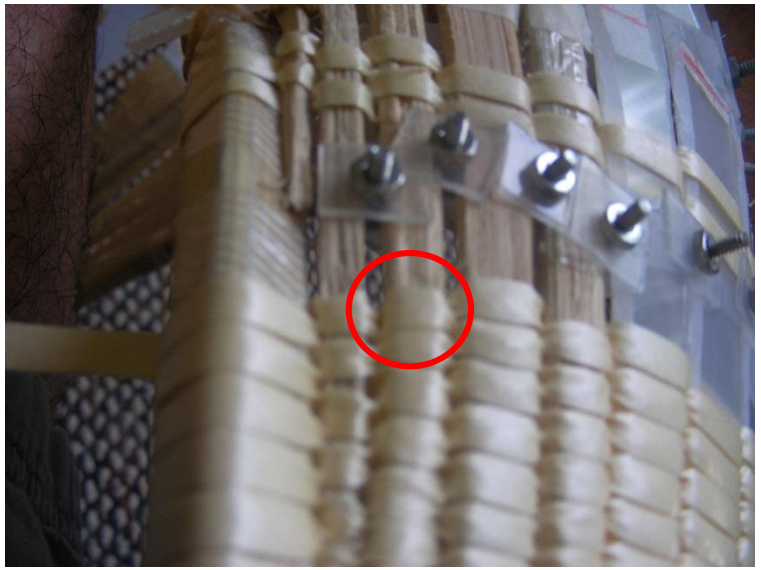
As weaving proceeds to the glove, switchback pairs should alternate between the #3 and #4 ribs to spread them out. Otherwise, the single chosen switchback rib gets cluttered.

The #5 rib may be used at the heel, where the ribs change direction the most over a very short distance.

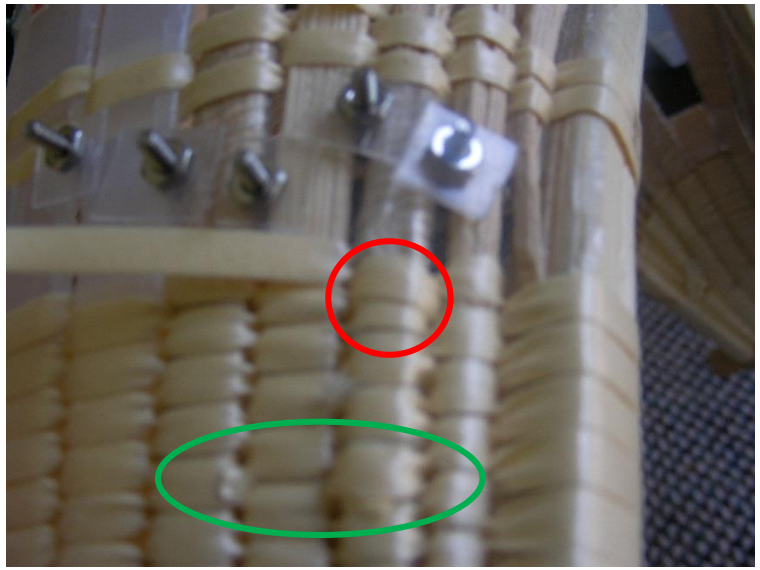
Do not crimp the reed where it goes over the rib to change direction. However, a crimp should be made on the other side of that rib (see the yellow arrow).

Each pair of switchbacks make 2 additional rows.

Reweave (27 - 29)



This switchback was formed with the reed wrapping the switchback rib (#3) from inside to outside. The next row to wrap the frame is doubled up with the switchback.



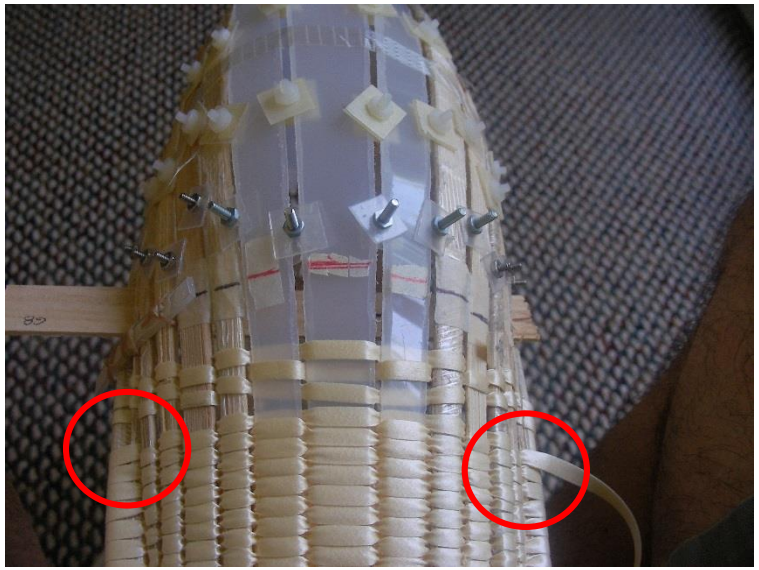
The opposite switchback of the pair is formed the opposite way with the switchback (the opposite #3) rib wrapped from outside to inside. This switchback has been doubled up with the previous row.

A “vee” is formed by 2 rows at this point. In the previous slide, a “vee” is formed but it can only be seen on the inside of the cesta.

This opposite but equal relationship between the 2 switchbacks of a pair results from the same rib number being used for both switchbacks of the pair.

Because of the double reed aspect of switchbacks and splices, they should be spaced so they are not on adjacent rows.

The 1st splice is in the green oval.



At this point more simple rows (no splices or switchbacks) have been woven and the #1 ribs have been bound to the frame.

Reweave (30 - 32)

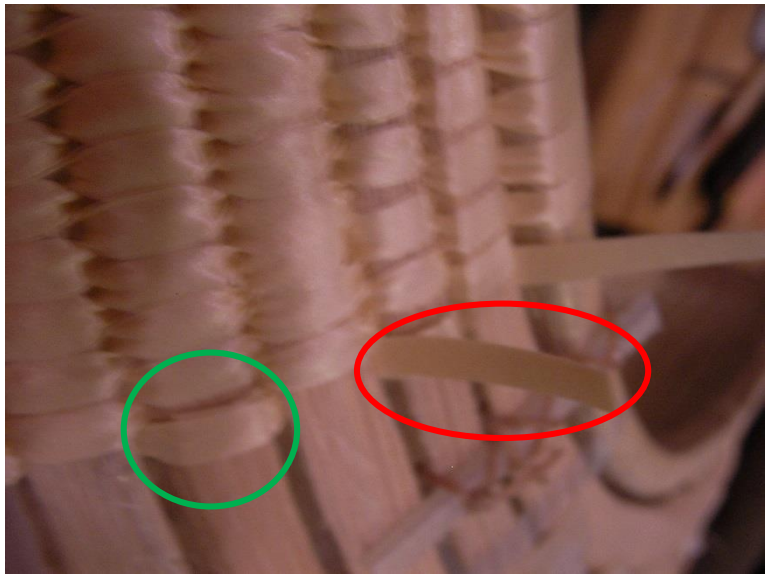
Now the 2nd row of old reed has been removed.

Remember that 2 different widths of synthetic reed are used for the reweave, narrow reed near the tip and wider reed every where else.

The first two reed lengths used were narrow and when the tip area is finished, 2 more narrow lengths will be used. That makes about 40' of narrow reed.

The next splice will join a narrow length to the first wide length.

All reference tape should be removed before they are covered with new reed.



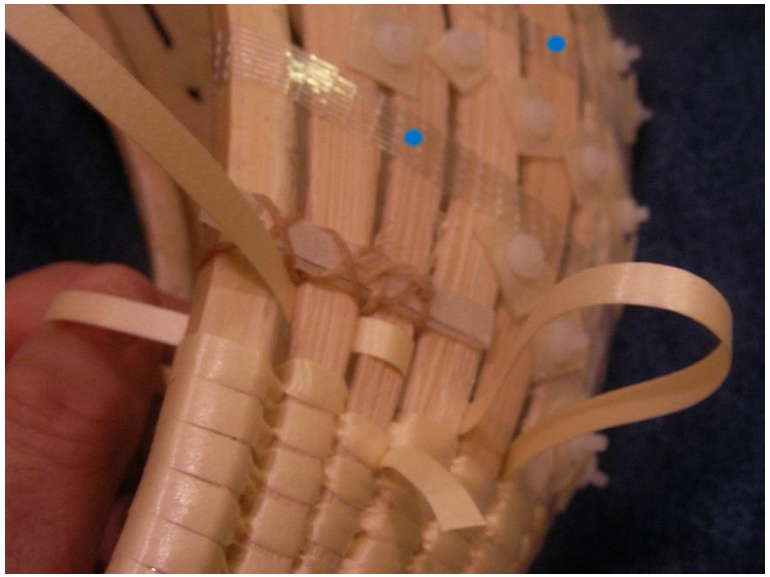
In this slide weaving has proceeded much further towards the glove, as can be determined by the width of the #1 rib.

The wide reed is in use.

This slide has the reverse orientation from the other slides in that the tip rather than the glove is at the top.

The splice shown is the 2nd type. See the 2nd diagram from the top on page 28. The end of the last reed is exposed (see the red circle).

The leading end of the next reed is tucked under the last reed in the green circle.



At this point several more rows have been woven.

The end of the last reed in the splice shown on the last slide has not been cut yet. In fact, it doesn't have to be cut until the rebuild is finished. It's your choice.

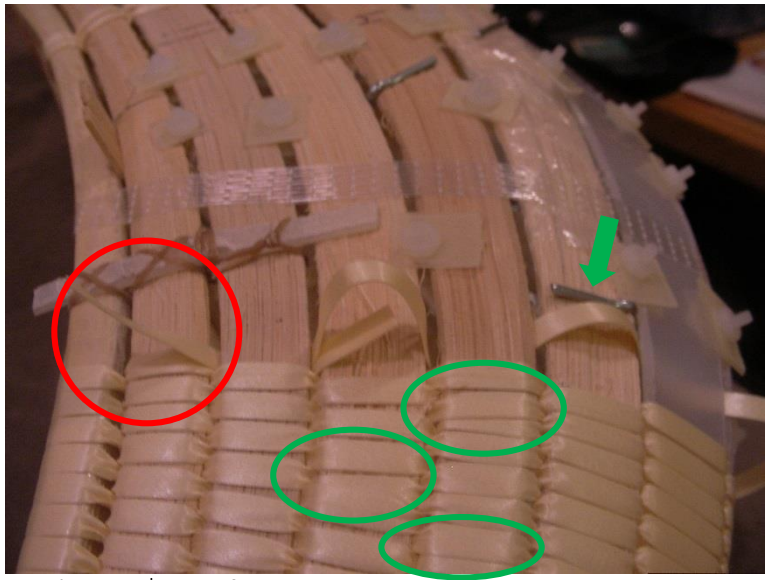
Notice that only the large #4 nylon spacer screws are in use now.

The loop of reed caught by my thumb is actually from under rib #3. The loop helps minimize the resistance and friction in pulling the reed past ribs #1 through #4.

The plastic strips used to force #1 rib towards the outside of the frame have been slid down towards the glove several inches to allow more rows to be woven. Soon they will be removed and reset in a new position.

Notice the strips of filament tape between the rows of nylon screws. These help maintain proper rib spacing (see the blue dots).

Reweave (33 - 35)



Here's the 3rd type of splice, where the last reed has just wrapped around the frame, but isn't long enough to make it past rib #7.

The new reed has been woven backwards from the frame on the opposite side and its leading end is exposed and will need to be cut (red circle).

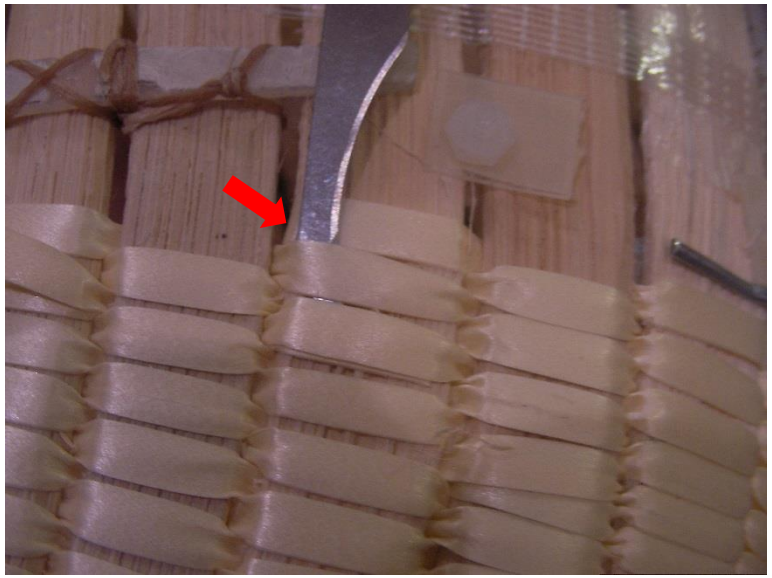
The cotter pin on rib #5 (green arrow), which is split along its length, is used to keep the 2 parts of the rib together (in the same plane) during the weave. The other cotter pins serve the same purpose.

Tape is usually not strong enough to keep the split parts aligned, but a cotter pin gets the job done, as long as its separation width is adjusted for a tight fit.

The pin has been cut with a hacksaw so that its length (distance from the eye to the tip) has been reduced to about 3/4".

Cotter pins can be slid into position by hand and removed with the needle nose pliers.

The green ovals highlight the switchbacks that alternate between ribs #4 and #3. The same switchback pattern is on the other side of the cesta on the adjacent woven rows. The switchback pairs are separated from one another by one or more rows.

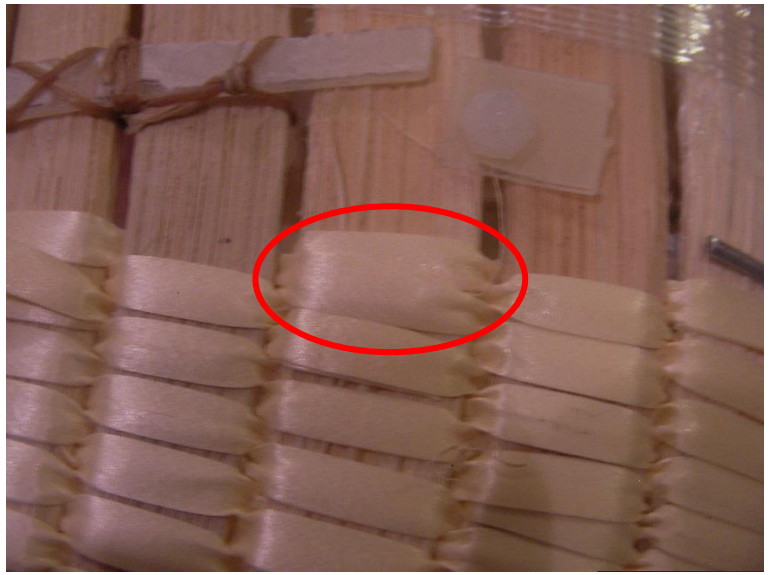


The next switchback alternates back to the #3 rib.

As was said previously, a switchback doubles up with either the last or the next woven row.

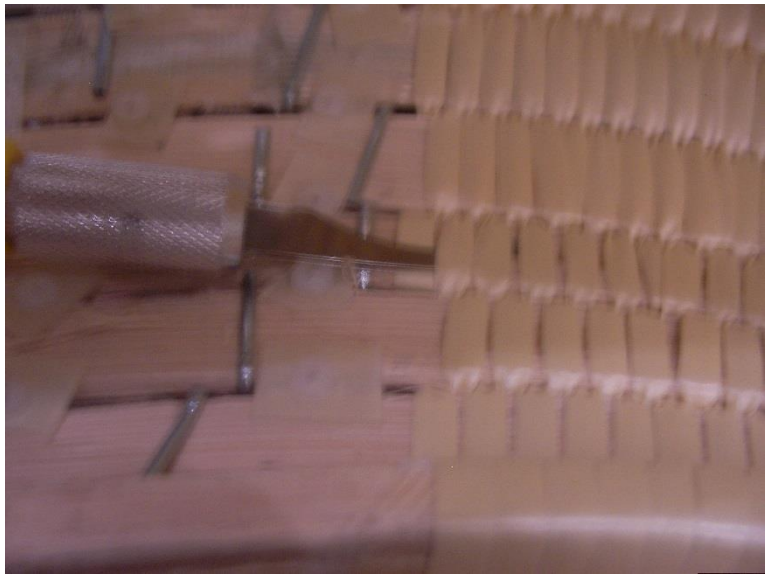
Here the carving blade is slid under the last row, so the switchback can be nudged under that row with the pliers. Another option is to not nudge this row under the previous row, but weave the next row so that it comes from under rib #3 at the point marked by the red arrow.

Either method works, but I've gotten used to the former (with the blade).



After the nudge, the switchback has been tucked neatly under the previous row of weaving and the "vee" has been formed.

Reweave (36 - 38)

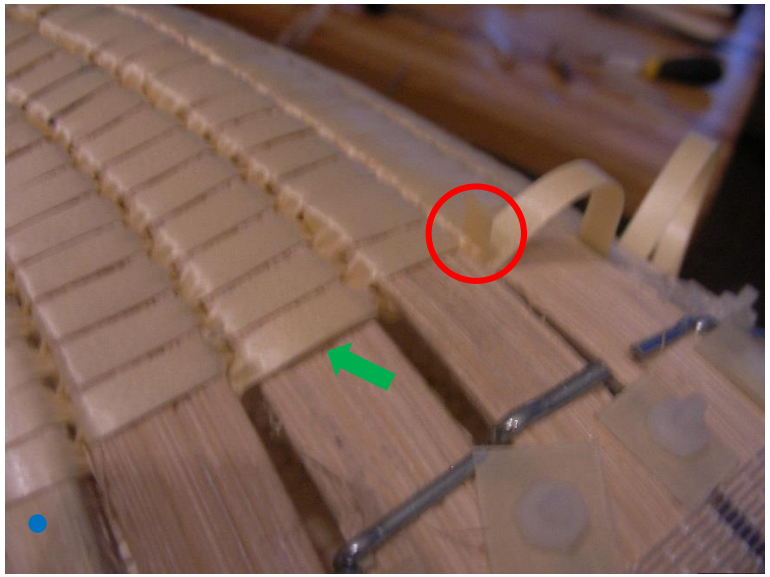


The #3 rib switchback paired with the one on the last slide is shown here from the inside of the cesta.

If the nudge-under method (tucking this switchback under the last row) is used, it must be done from inside, since its paired switchback was performed from the outside.

Here's the finished switchback from the outside.

Another way to get the 2 rows oriented as shown above, can be done from the outside. It involves pulling the reed so that it's trapped between the last row (green dot) and the rib with the blue dot.



Here's the 4th type of splice, where the last reed has just wrapped around the frame, but isn't long enough to make it past rib #7. The frame is on the left (blue dot).

The trailing end of the last reed is exposed (red circle).

The new reed has been woven backwards from the frame on the opposite side.

The leading end of the new reed has been tucked under the last reed length at the #2 rib (see the green arrow).

Note that the slides on this page all show many cotter pins. Some of the split ribs require several cotter pins to hold the split pieces in the same plane. The weaving has progressed well into the pocket area, where split ribs are most likely.

A split rib only slightly compromises strength. The real problem with a split rib is that the parts of the split tend to overlap one another, as the weave progresses over the split. This causes a noticeable bump that can extend many inches along the rib.

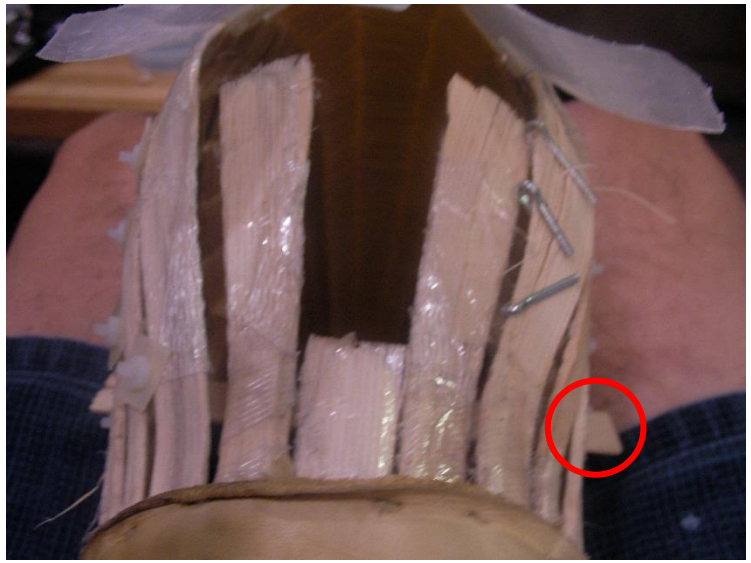
Reweave (39 - 41)

The 3rd and last section of old reed has just about been reached.

The plastic strip aid can be moved rather than reset in this area, because the width of the ribs near the frame doesn't change much.

Here where the pocket is the deepest, a 10' section of reed will only cover about 1" of frame.

In this area, the number of switchbacks per 10' length of reed is down to one or none, because every inch of frame corresponds to about an inch of center rib.



Weaving has proceeded very close to the last old reed section, which has been completely removed in this slide.

The process to form the #6 and #7 rib splices can now be performed.

The scrap wood is in use here to keep the #1 ribs spaced from the frame. It is only necessary where the frame and rib are almost touching and that can be anywhere along the frame. It's different for every cesta.

Note the cotter pins on the #5 rib on the right. The split on that rib is so severe that many cotter pins are needed to hold it together as it's woven over.

Splice a #6 rib first.

The plastic and wood rib ends have already been tapered to help form a smooth splice.

Two-sided tape is used to bond plastic to wood. The tape can first be applied to either. In the next slide, the tape has been stuck to the wood, which was covered with tape by the cesta maker.

The two-sided tape won't stick well to wood, so the wood in the splice area should be either wrapped with tape or covered with a lacquer, before forming the splice.

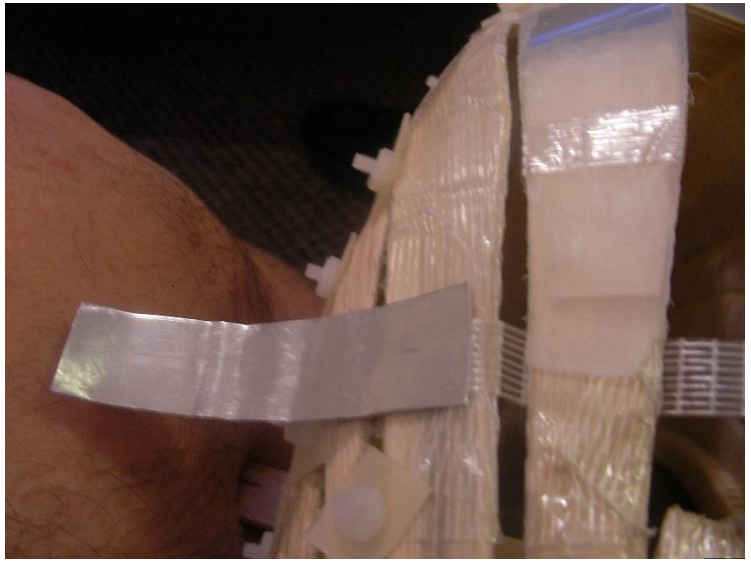
If there is old tape and it isn't neat or if it isn't securely bonded to the rib, it should be removed and replaced with new 2" wide filament tape. Lay the new tape centered on the outside of the rib so that the entire splice area is covered, then wrap the tape around the rib. The tape may need to be trimmed so that it won't wrap back around to the outside. On curved ribs (#6 and #5) the tape should be notched in several spots on both sides, so the curve can be neatly wrapped.

Peel off the protective paper.

Narrow filament tape strips will be wrapped around the formed splice at its ends and its center. The center strip will help strengthen the splice (It can be seen above).

The wrap at each splice end serves two purposes, one to better bond the splice and also to keep the splice ends from being caught by new reed woven over the splice.

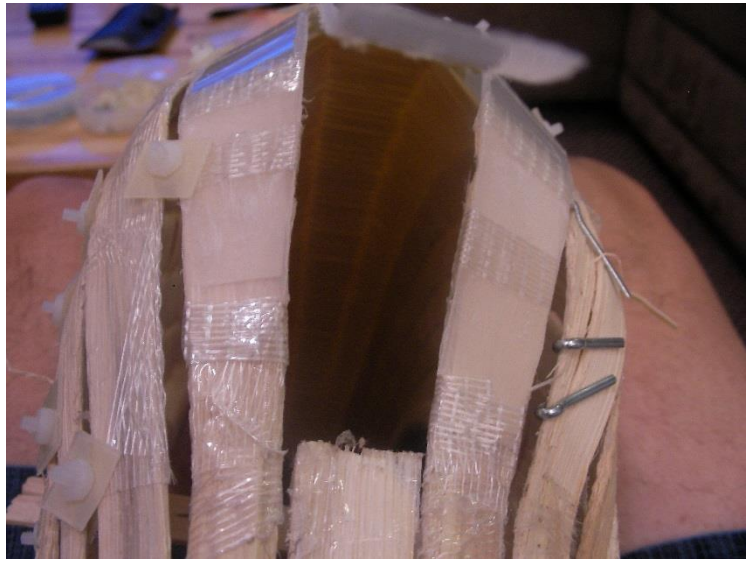
Reweave (42 - 44)



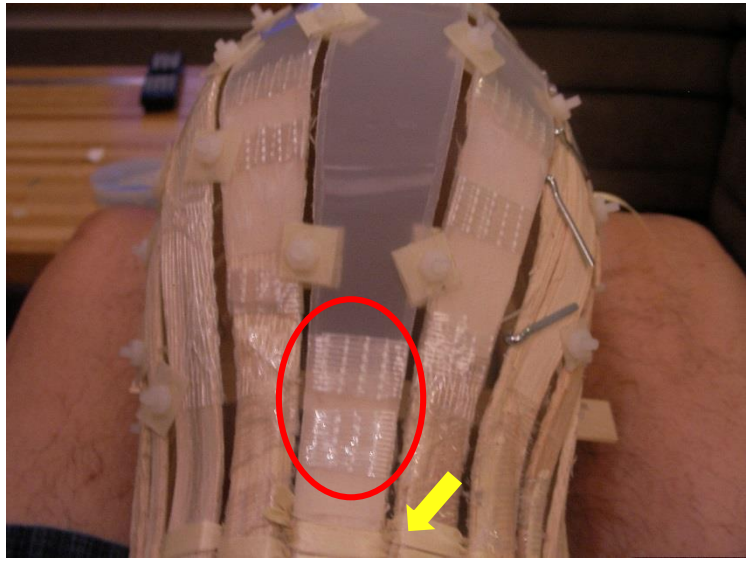
Before connecting the 2 splice pieces, the #6 plastic ribs should be twisted to conform to the necessary shape. In this slide the plastic end of the left #6 rib should be twisted clockwise. The right #6 plastic rib end must be twisted in the other direction.

Stick the plastic rib to the two-sided tape, making sure the two pieces align as well as possible. Sometimes it's necessary to trim a little off the plastic or off the wood (at the cut) to make a smooth transition from plastic to wood.

Wrap the splice with filament tape at the center and ends. A strip of aluminum flashing can be use as a needle to assist in this process.



Next, splice the other #6 rib.



Now splice the #7 rib.

The #7 rib should also be twisted before its 2 pieces are bonded together. The twist is in an "S" shape to help make the 2 curves required, one at the pocket and the other reverse curve near the glove.

Make the "S" curve with your hands and hold it for a couple minutes so that the plastic remembers the shape.

The #7 splice is short, so only 2 filament tape strips are needed to wrap the splice, as is shown in the previous slide (see the red oval).

Additional nylon screws have been inserted for proper spacing and filament tape strips can be used across the ribs to help hold them together.

Unfortunately I don't have any slides showing how to weave past the pocket and over the spices, but what follows is a description that should be helpful.

Because the shape changes dramatically over a short distance forming the #7 rib "S" curve, many switchbacks will be required to keep the woven rows aligned with the frame. These switchbacks can be formed over the #5 ribs, as well as the #4 and #3 ribs.

The ribs narrow as they near the glove. This causes the woven rows to separate more than is desired. To keep the rows properly spaced they must be continually pushed together with the awl or pliers.

Short and narrow strips of filament tape can help keep the rows together. Lay the tape across 5 to 10 rows, starting with the last woven row, backwards along a rib. Do this on the #7 - #5 ribs. New pieces should be laid over the old pieces to hold new rows as they are woven. This process is repeated until the ribs stop narrowing nearer the glove and the rows stop slipping out of position.

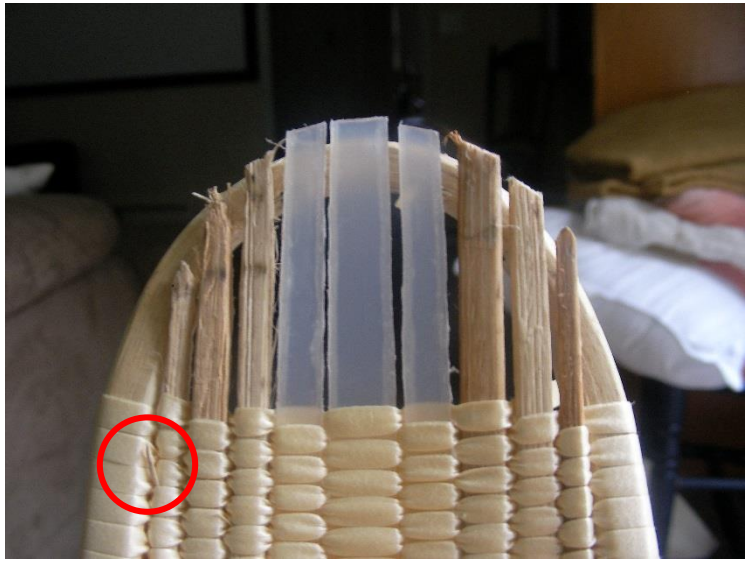
The final splice, joining the new reed to the old reed presents a challenge, since there is so little room to maneuver. The last 5 or so rows before the splice should temporarily be forced very close together to make room for the splice. They should be spread evenly with the awl. after the final reed splice has been made.

As the splice point nears, the leading end of the new reed should be cut to point to make threading the reed easier in this confined area.

In the slide on the left, the end of the old reed is too small for a proper splice, so It needs to be cut back to the point shown with the yellow arrow.

The slides that follow will show how to finish the tip.

Reweave (45 - 47)



Finishing the reweave requires about 20', or two 10' lengths, to be woven from where the reweave started many pages ago.

That 20' should be with narrow reed. All together there will be about 40' of narrow reed at the tip end of the cesta.

Here the 1st of these 10' lengths has already been woven.

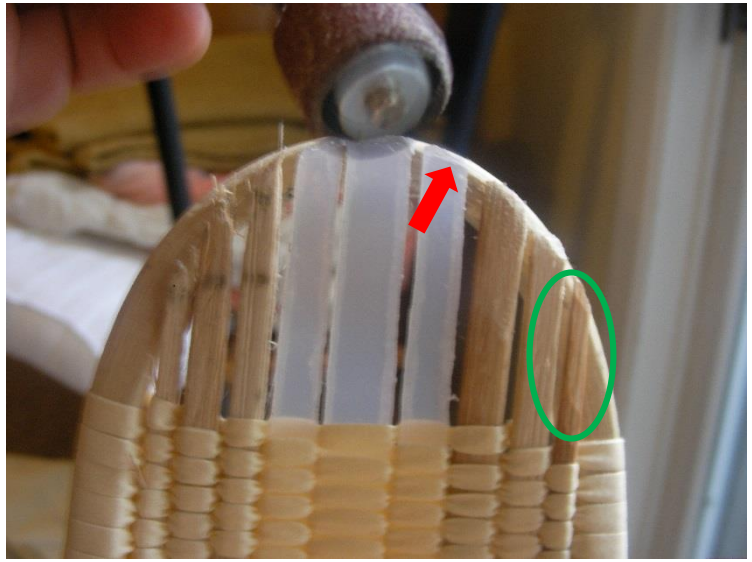
There's nothing remarkable about weaving the 1st 10' length, since there are no switchbacks and the #3 ribs are not bound to the frame, until later.

Don't forget to thin the splice end of these 2 lengths, so a neat splice can be formed.

I find it easiest to weave the tip area with the taco (wood bar connecting the glove ends of the frame) on the floor and the tip pointing away from me. I use my feet to hold the taco to the floor and my knees to hold the cesta in place.

All the plastic ribs have been trimmed with shears, so they only slightly protrude beyond the frame at the tip.

There's a small sliver of rib (shown in the red circle), that got caught outside the weave. This small piece will be cut off later.



Use the Dremel tool with the sanding drum to further reduce the ribs and apply a bevel. As a result, the ribs should be even with the outside edge of the frame.

In this slide it looks like the sanding drum is between the frame and the back side of rib #7. This may be an optical illusion, because the sanding must be done on the front of the ribs, where the ball makes contact.

The red arrow points to the bevel, which must be created on all the ribs that are long enough to make it to the outside frame edge.

Don't worry if the #3 ribs are too short, since they will be bound to the frame, as will be shown later.

If either of the #3 ribs are thick at their end, they should be sanded or whittled down so they don't protrude too much from the frame (see the green oval). This will make for a neater tip.

Next wrap the frame with a long strip (12 inches or more) of filament tape.

Use a narrow strip of aluminum flashing, as a needle, to make it easier to thread the tape around the frame.

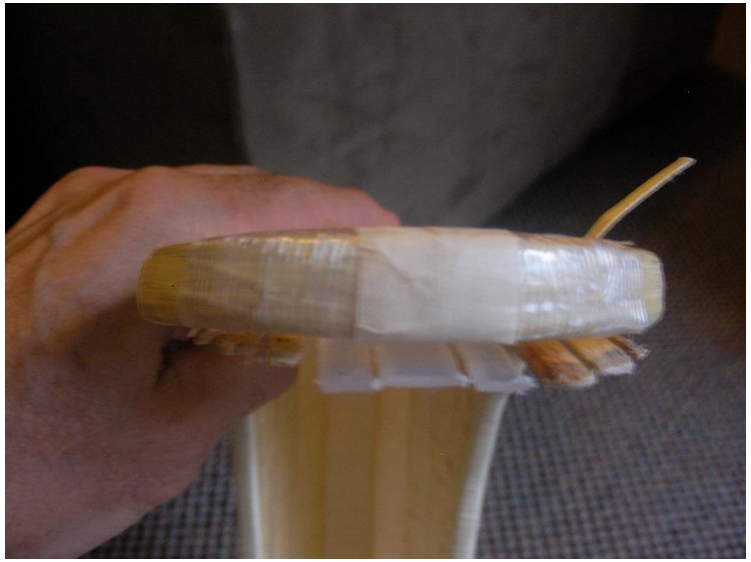
The wrap only needs to cover the frame from one #5 rib to the other.

The tape serves to strengthen the frame, which often is split at the tip due to the sharp bend radius.

More importantly, the tape allows two-sided tape to stick securely to the frame.

If the frame is split at the tip, use some wood glue and clamps to close the spilt, before applying the filament tape wrap.

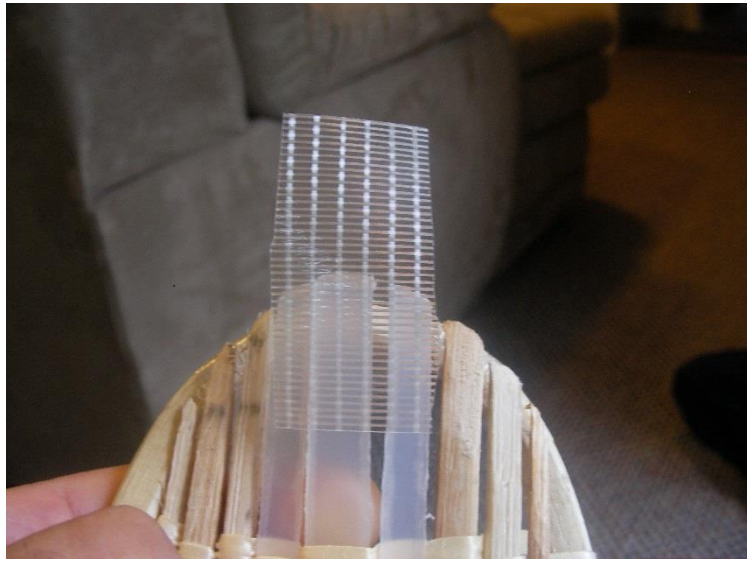
Reweave (48 - 50)



Now that there is a good base, apply a strip of two-sided tape over the tip behind the #7 rib.

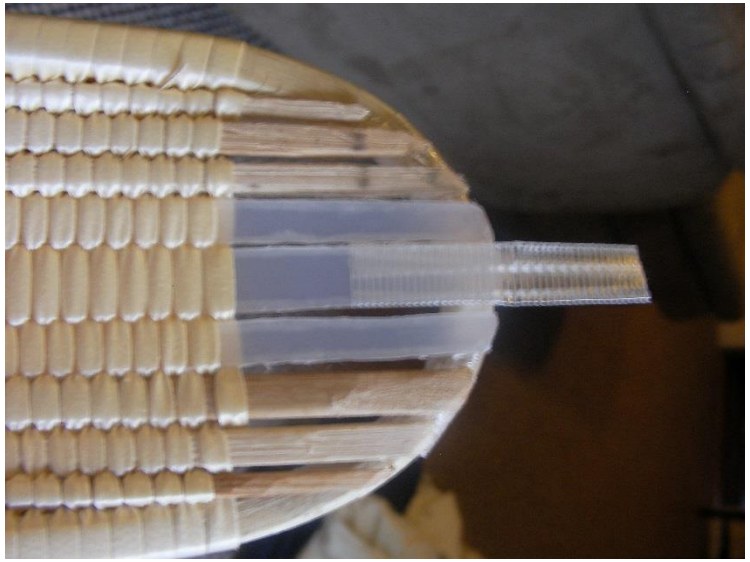
The strip should be long enough to almost wrap around the frame. Make sure some tape is between the #7 rib and the frame.

Don't peel the protective paper off the tape yet.



Cut a piece of filament tape across the roll's width that is slightly narrower than 3 times the #7 rib's width at the tip (about an inch).

Position the tape on the #7 rib as shown above. Don't let the tape stick to either of the #6 ribs.



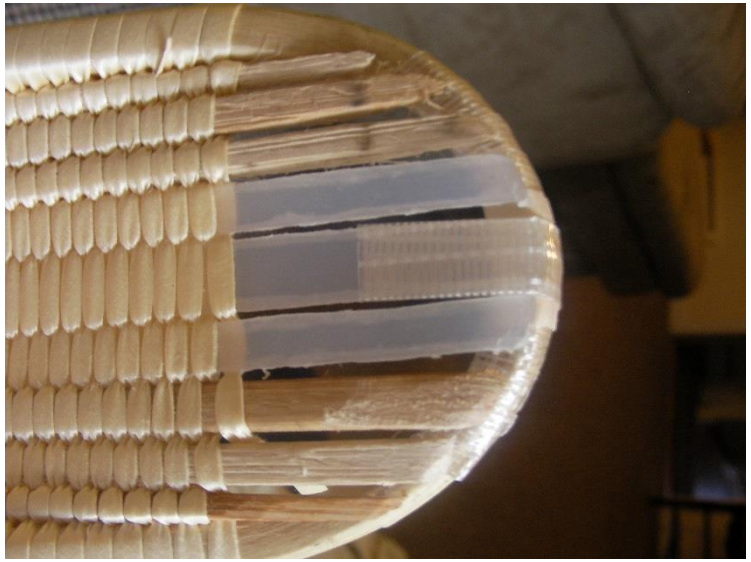
Fold the tape over, first on one side so it wraps around the rib tightly and sticks to the back side.

Where the tape extends beyond the tip of the rib, fold it over also, so it sticks to itself.

Now wrap the tape around the other side of the rib.

The tape strip should be wide enough so that one side of the tape overlaps the other on the back side, but not so wide that a double course of tape is formed on the front.

Reweave (51 - 53)

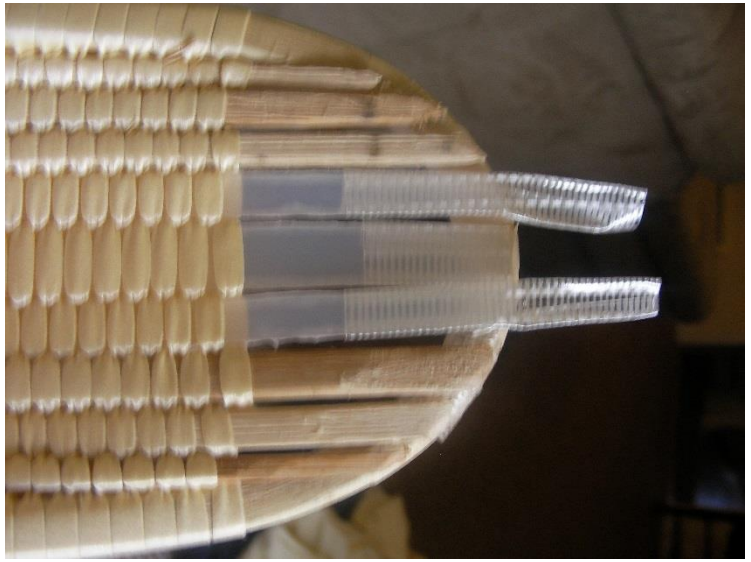


Remove the protective paper from the two-sided tape and fold the filament tape extending from the #7 rib over the frame.

Wrap the filament tape around the frame, but first be sure it is centered on the frame. This will allow for proper and equal spacing of all the ribs once they are all stuck in place.

If the two-sided tape was positioned on the frame, as described, the back of the rib should be stuck to the tape, as well as all the filament tape wound around the frame.

You may find it easier to wrap all the ribs with filament tape before applying any two-sided tape to the tip.



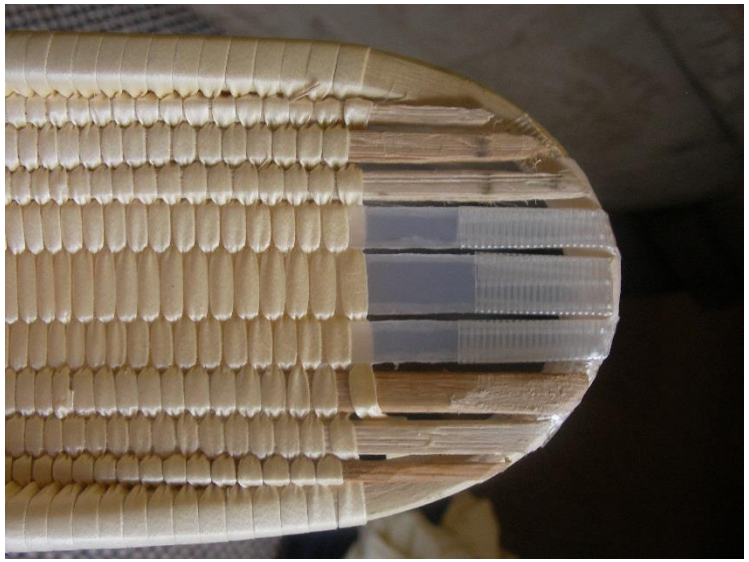
Wrap filament tape around the #6 ribs.

Wrap a strip of two-sided tape around the frame in back of each of the #6 ribs. Because the filament tape extensions will wrap towards the center of the cesta, the strips should be positioned to slightly overlap the #7 rib's filament tape extension.

Remove the protective tape from one of the #6 rib's two-sided tape strip and fold that rib's extension over the frame.

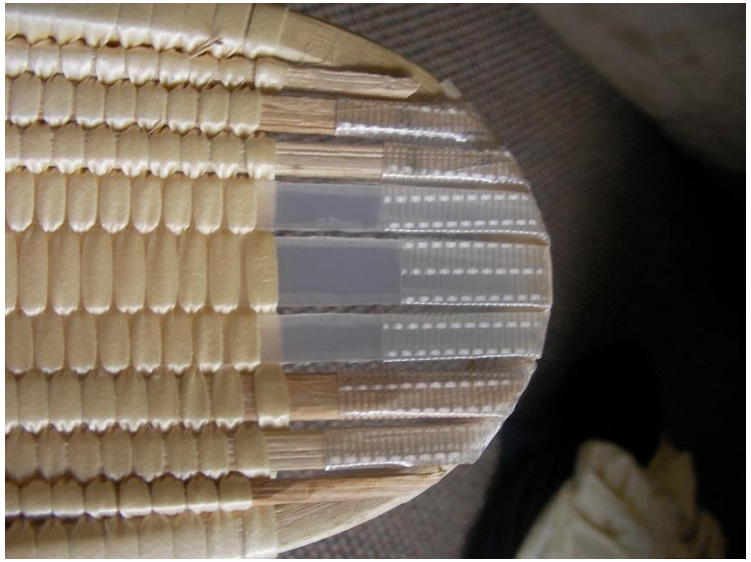
The rib can be moved left or right slightly to achieve equal spacing.

Repeat the process for the other #6 rib.



Here's what the 3 plastic ribs look like when they have been stuck in place.

Reweave (54 - 56)



The #5 and #4 ribs are processed in the same manner even though they are wood.

Wood is porous and the filament tape does not bind well to it. To achieve a better bond coat the wood where the tape will be applied with a fast drying lacquer. Clear nail polish or polyurethane can be used. Make sure the coating has dried before applying the filament tape.

The #3 ribs do not need this treatment, since they will be bound to the frame before the tip weaving has been completed.

The filament tape extensions fold towards the center of the tip, so the two-sided tape strips should be applied accordingly.

Further secure all the attached ribs with waxed thread sewn in an "X'" pattern across them.

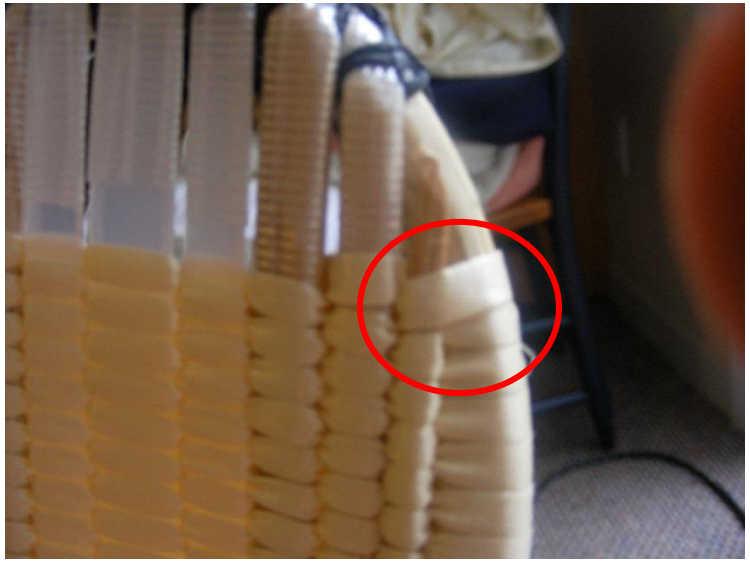
Be careful not to pull the thread so tight that the spacing is disturbed, as can be seen with the top #5 rib above. This problem was corrected with a spacer screw, before the weave was completed.

For this cesta the thread used is black, since the tip will be finished in black.

Actuallly any color can be used. I've used royal blue thread for the cestas I've rebuilt for myself. The size thread I use is .045".

A complimentary wax polycord size and color chart can be requested at www.mainethread.com.

The standard spool size at Maine Thread is 70 yards, but it's more economical to purchase thread by the pound or half pound. You have to call (207 784-7770) and ask for that option.



Weaving has resumed to the point that the #3 rib can no longer be woven around, so it has to be bound to the frame.

Several rows binding each #3 rib to the frame can be woven in this manner.

A full bind involves trapping the rib against the frame in both weave directions. Don't weave between the rib and frame in one direction and not on the return (a half bind). That will really mess up your weave.

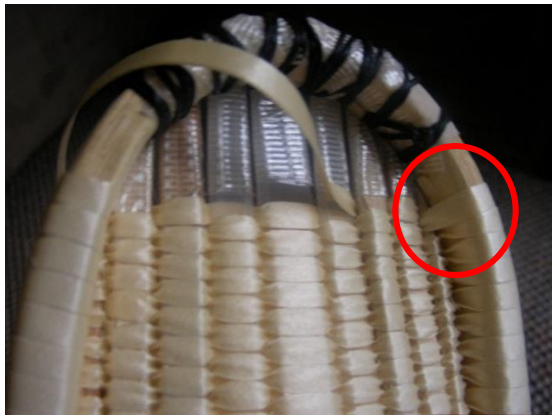
Weaving the last 10' reed length is difficult because the tip-most area is very cramped. It's easier if 5' lengths are used, even though an extra splice is required.

If more than 10' of reed is needed to complete the weave, it's best done with 2 lengths (6' & 5' or 6' & 6').

Note the distance covered by the lengths of reed woven near the tip and you will be able to accurately judge the length for the last piece.

The last piece should not be shorter than 3' or the last splice will be too close to the tip to be made easily.

Reweave (57 - 60)



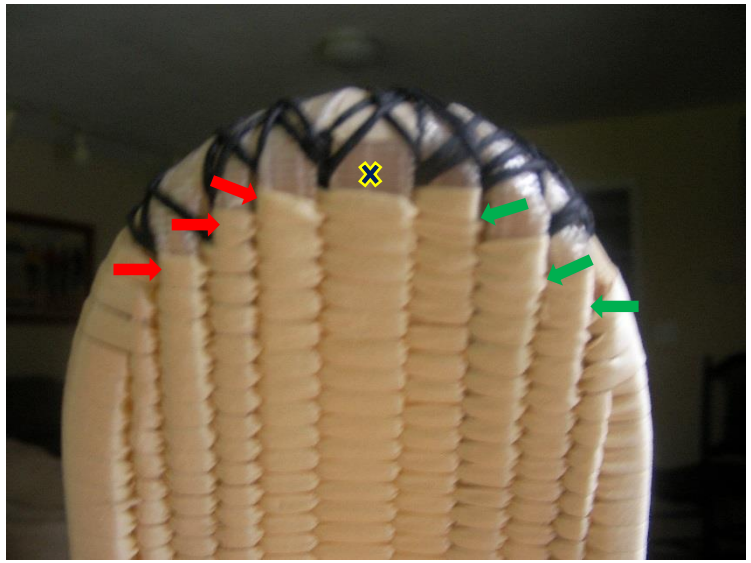
The first bind weave from the back is shown here.

As the tip nears it gets more difficult to weave between the #3 ribs and the frame. Even so, there should be no more than 3 bind rows on either side of the frame.

Use the carving blade to separate the #3 ribs from the frame so the reed can be slipped between the #3 rib and the frame. This will allow extra regular (non-bind) rows to be woven.

Try to balance the bind rows. When the first bind has been woven, put one on the other side.

Note that the #3 ribs are of different lengths, which often happens.



The tip weave is almost complete.

There are 3 binds on the right and 2 on the left, since the left side #3 rib is shorter than the right.

Some switchbacks are necessary as the tip nears, where the frame rounds over.

Unlike earlier switchbacks, these are solely to cover the ribs completely and not to account for the difference between rib and frame lengths.

The arrows point to the switchbacks, with green arrows high lighting 2 consecutive switchbacks over the same rib.

Consecutive switchbacks are needed when there's no room for a regular weave over the frame.

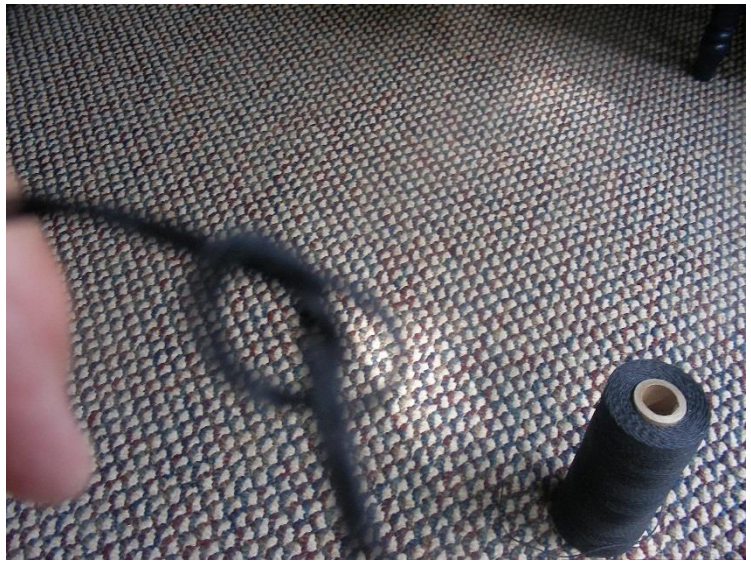
Professional cesta makers, working with wood ribs that wrap around the frame at the tip, weave the natural reed around the tip as well. This isn't easy with the way the ribs are attached at the tip in the rebuilt cesta.

Fortunately the rebuilt tip finished in this manner is just as strong and looks almost as good.

The final row end can be seen in the red circle, protruding out the back side. On the opposite side, it covers the "X" in the previous slide.

The last woven rows will be locked in by the waxed thread that will be sewn over the tip in the next section.

Tip Completion (1 - 3)



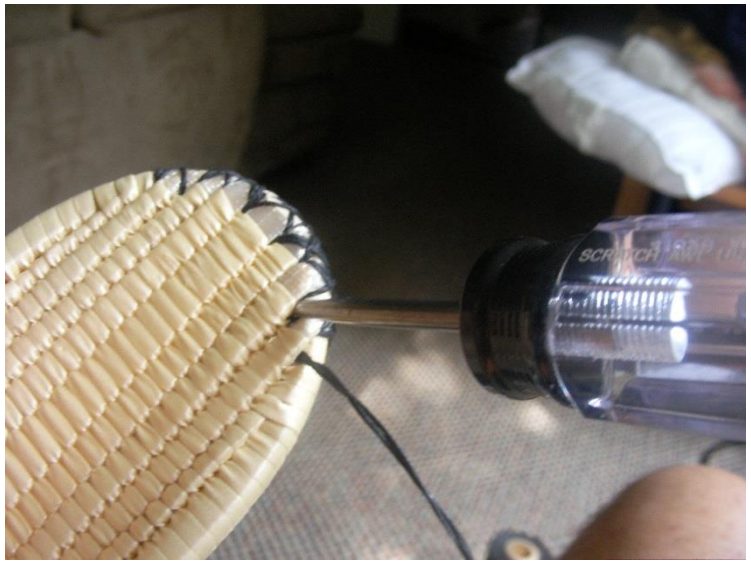
It's desirable to cover the tip with a single length of waxed thread, so cut about a 22' length of thread. Thread it through a large needle and make a simple knot with the two ends.

Position the needle in the middle of the length. The resulting 11' length of double thread will halve the work required to cover the entire tip.

After the tip threading has been finished, the frame at the tip should be completely covered.

Push the needle from the back through the space between a #4 rib and the adjacent #3 rib at the frame.

Pull the thread all the way through so the knot is snug against the back side.



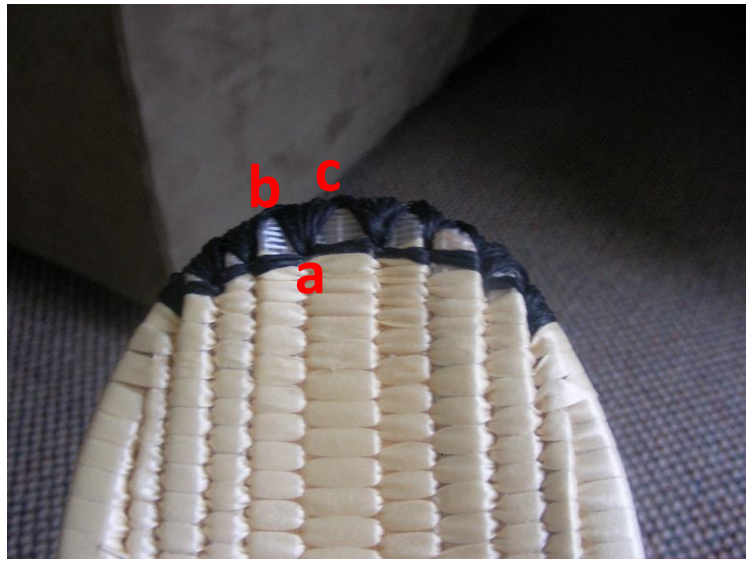
The next step is to weave the thread between the ribs, just like weaving with reed.

If necessary, use the awl to enlarge the space between ribs. This will make it easier to get the needle through.

Tip Completion (4 - 8)

Here the first row of thread has been completed.

Weave the thread around the opposite #4 rib and back to the other side. The needle last goes between the #5 and #4 ribs and ends up on the back side.



It's much easier to wrap the tip in thread if the needle is inserted between the ribs on the front side.

For each loop the awl can be used to widen the space between the ribs where the needle will be inserted.

The thread should form triangles over the frame.

Points "a", "b" and "c" above define the triangle that covers half of ribs #7 and #6. Point "a" is where the needle is inserted for each loop that makes up that triangle.

In this slide the threading was worked from right to left.

Every tenth loop or so, knot the thread by passing the needle through the loop on the back side, before pulling the thread tight.

The final loop wrapped around the frame must be knotted in this fashion to hold the thread tight and keep it from unraveling.

If the thread length is not long enough to complete the tip job, cut another length of double thread. Insert the needle from the back and pull the thread so the knot is firmly against the back side. Weave the thread across the rib closest to the unfinished side, so the needle can be inserted from the front for all the remaining loops.

Here's what it looks like from the back side.

Tap with a hammer or weight to squash the threads against one another.

Glove Replacement (1 - 8)

To expose the reed under the glove or to remove the glove for replacement, start by cutting the thread stitched over a #6 rib with the carving blade.

Then cut the thread stitched over the #7 rib.

If the glove is stitched through the ribs, rather than between them, cut 2 consecutive stitches at the top center of the glove.

Set the awl between the glove and the thread for an adjacent stitch.

Pull up with the awl to undo the stitch.

Repeat this process to undo the next stitch on the opposite side.

Keep repeating this process, alternating sides, until all the stitches at the top of the glove are undone.

As each stitch is undone, a longer length of thread is exposed.

Next start unstitching down the sides of the frame.

If the goal is to release the top of the glove, then stop after one or two stitches down the sides have been undone. The last stitch undone from each side should be pulled with the awl from the underside.

Knot (red circle) each of the 4 thread pieces close to the cesta. The knots will be used to connect new threads, when the glove section is reattached.

Here the glove has been pulled back to reveal more woven rows.

The last reed splice of the rebuild may be easier to make with this area exposed.

The next 5 slides deal with reattaching this section, after that a glove replacement will be described.

To resew the glove, cut an 18” length of brown thread.

Knot one end, then tie it to one of the previously knotted thread lengths.

With a needle on the other end of the new length, start stitching through the glove holes, following the path of the old thread.

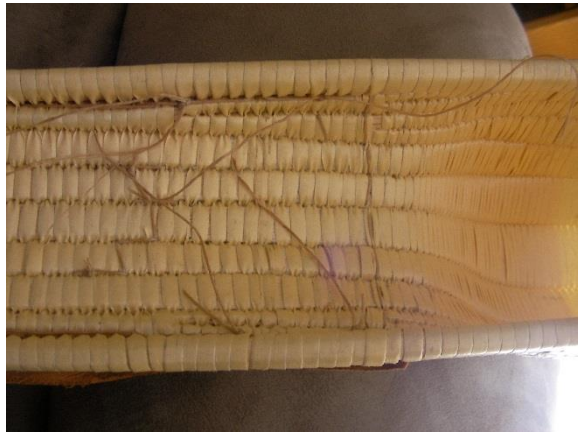
Glove Replacement (9 - 15)

Stitch until the old corresponding knotted thread is reached on the other side and tie it off there.

The stitching is a lot like weaving in that every other stitch shows on the outside.

Repeat this process with the two remaining knotted threads holding the glove in place.

Now the glove is completely restitched.



All that remains is cut off the scrap pieces from the knotted joins of old and new threads.

It's easier to sew between the ribs across the top, rather than through the ribs. The glove is held just as securely either way.

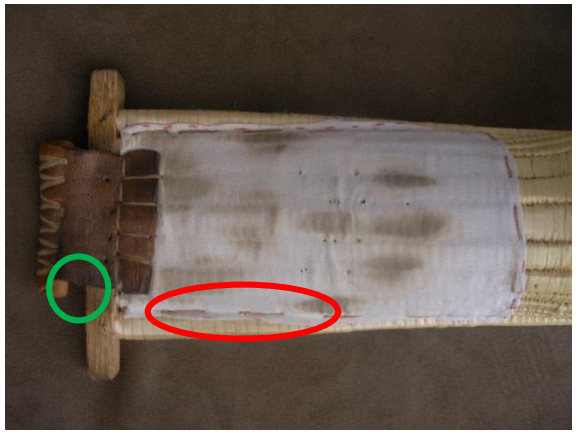
To completely remove the glove, continue unstitching with the awl, until the taco is reached.

The glove is either secured to the taco with tacks or with thread, so either remove the tacks or cut the threads with the carving blade.

Lift the glove to expose the threads between the fingers and cut them.

Remove the glove and the thread pieces remaining between the fingers and on the cesta.

Separate the cinta cinch (tie loop) from the glove.



The only glove remnants left on the cesta are the leather tongue and the cloth pad.

If the pad is a mess, it can be replaced, but the tongue must be removed first.

Use the old pad as a template for a new pad.

The pad is held in place with a single row of stitching (red oval) since the glove stitching will also secure it.

The tongue also holds the pad in place and is stitched with the same thread length used for the pad.

Knot an end of a 4' length of brown thread and pass the other end through the needle. Insert the needle in the corner where the taco meets the frame under the palm on the little finger side. The knot will keep the thread from pulling through.

Stitch up the frame, then across the top and down the other side and continue with the tongue stitching.

Follow the old thread pattern for the tongue and be sure to leave enough space between tongue roll and the taco for several cinta wraps (green circle).

When the tongue stitching is complete, tie the thread off on an underside stitch under the tongue.

Glove Replacement (16 - 23)

To stitch the glove back onto the cesta, start with a 7’ length of brown waxed thread.

Triple knot one end and thread it through from the taco/frame corner on the thumb side.

Pull it tight against taco/frame corner.

On the glove side, pass the needle through the leather about a half inch from the glove’s end.

An old glove will already have a hole in this spot.

For a new glove, use the awl to make a large hole.

Wrap the thread around the glove and the taco so the thread rests against the frame’s end.

Pull the thread tight and pass the needle from the underside back through the same glove hole.

Repeat this process until there are 3 thread loops wrapped around the taco.

Then start stitching down the frame.

Every other stitch will cover the glove side.

The “missing” stitches will be sewn on the return.

The thread seen between the thumb and index finger is scrap and should have already been removed.

Before stitching across the top, be sure the glove is positioned so that the end of the glove at the taco will be even on both the left and right sides.

Ribs pairs #1 & #2 and #3 & #4 are all too narrow to stitch between at the top of the glove, so the pairs should be treated as a single rib.

Stitch down the other frame side.

When the taco is reached, wrap the thread around the taco 3 times, as was done on the thumb side.

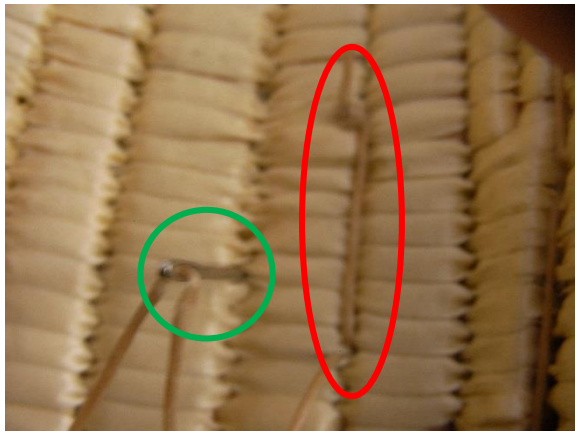
Then stitch back to the starting point down the frame, over the top and back down to the taco.

After all the stitching has been completed, tie the thread off on the underside with an existing stitch.

Use the awl to lift an existing stitch away from the cesta enough to slip the thread though so the knot can be made.

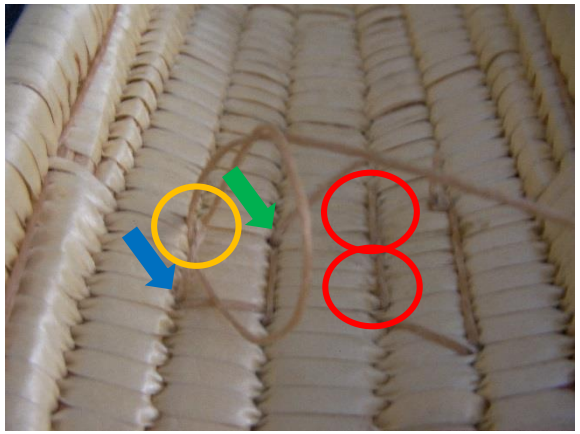
Glove Replacement (24 - 29)

To sew the finger webbing, double knot a 2’ length of brown thread. Pass the threaded needle through the underside of the cesta, between the #6 and #5 ribs on the thumb side, so the needle pierces the webbing on the crease line.



Pass the needle back through the webbing on the crease line to create about a 1” stitch.

Double up the same stitch so a single stitch can be seen on the underside (red oval).



Adjust the tightness by placing your hand in the glove. If it’s too loose, pull on the thread. If its too tight, wiggle your hand to make more room.

Insert the needle between the #7 and #6 ribs (green circle on the previous slide), so it pierces the webbing between the index and middle fingers.

Before making a stitch, pass the needle through the cinta cinch (red oval on the next slide).

Make a ½” stitch by passing the needle back through the cinch and glove webbing on the center crease.

The cinch must be secured with 2 double stitches (red circles), since the cinta will be pulling on it.

After each of these stitches are made, adjust the tightness with your hand in the glove.

Continue to the next finger (green arrow) and make one double stitch and test the tightness before going on to the last finger (blue arrow).

Make a double stitch on the baby finge.

Tie off the thread as shown in the orange circle. Use the awl to lift the tie off stitch away from the cesta so the knot can be made more easily.

Here’s the completed job from the glove side.

Here’s the stitch pattern from the underside.

If the glove needs to be tighter, loop a length of thread between the thumb stitch and the stitch between the middle and ring fingers as shown above.

Tighten the loop to get the desired glove tightness.

Another loop can be made between the baby finger stitch and one of the stitches holding the cinch.

Finished Product (1 - 3)

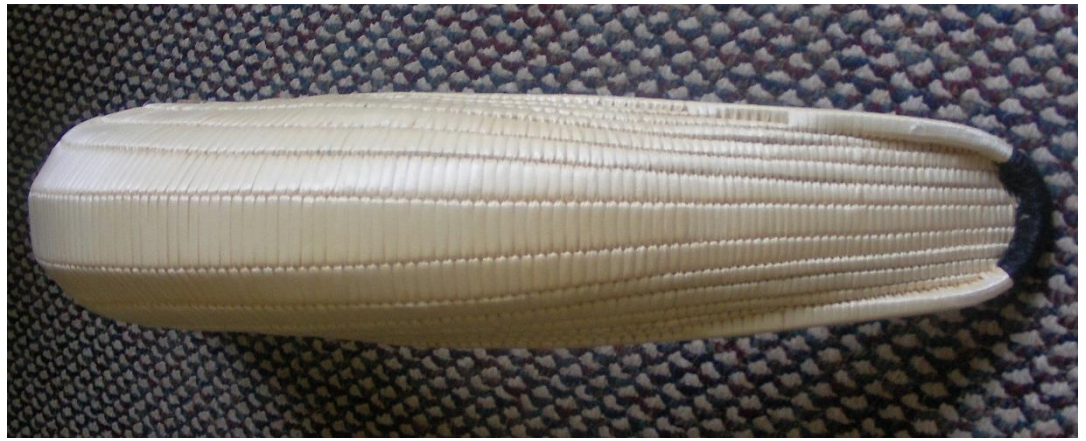
The finished cesta is shown on these slides and the one on the next page.

I like to tape the frame with short pieces of ½" wide filament tape.

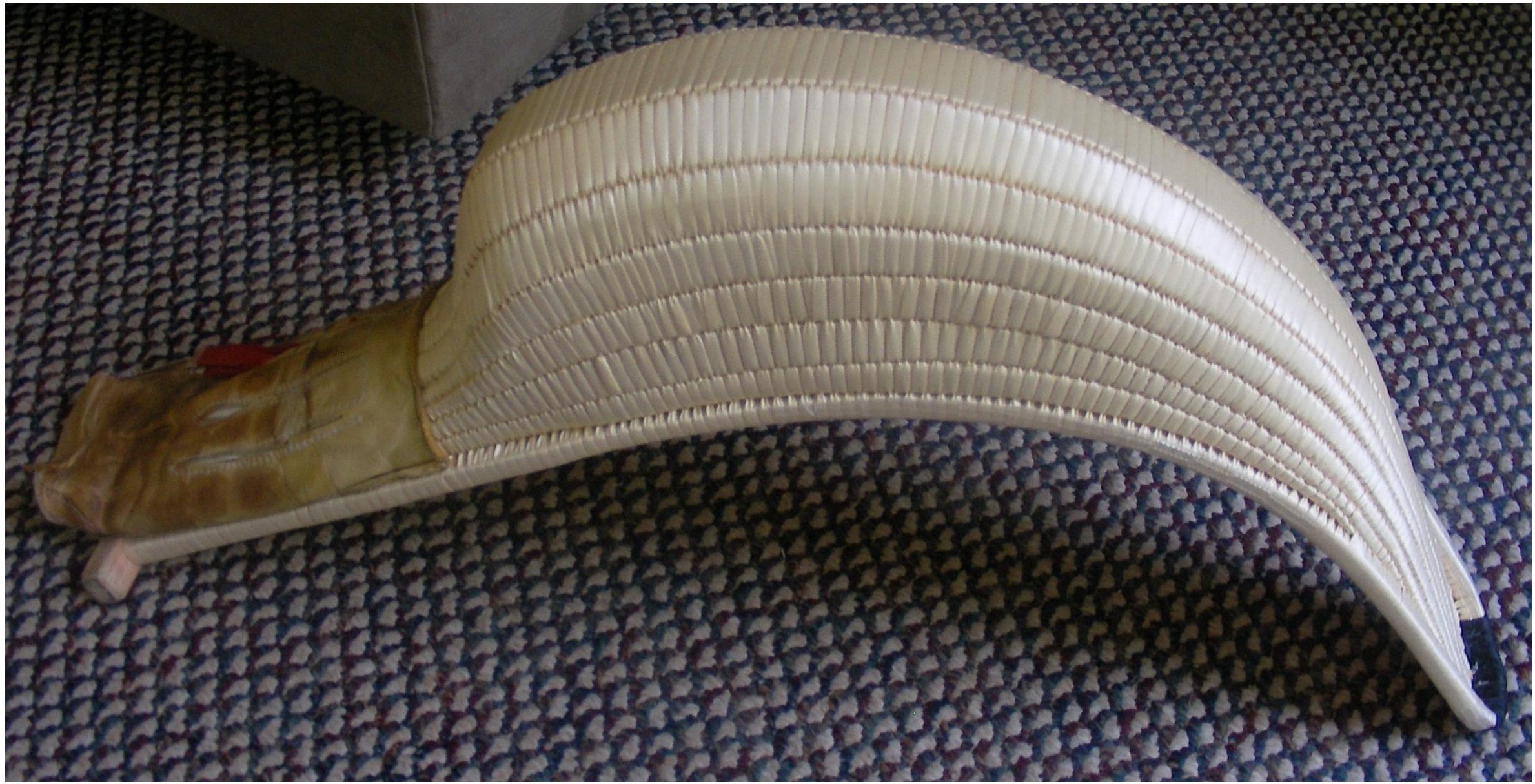
The coverage area is between the 2 red arrows below, on both sides and near the tip between the 2 green arrows, again on both sides.

At the tip, rubbing against the side wall can cut the reed and the ball will eventually break through the reed in the area between the red arrows.

I apply the tape from the inside to the outside of the frame and cut it at before the first rib.



Finished Product (4)



Finished Product (5 - 7)

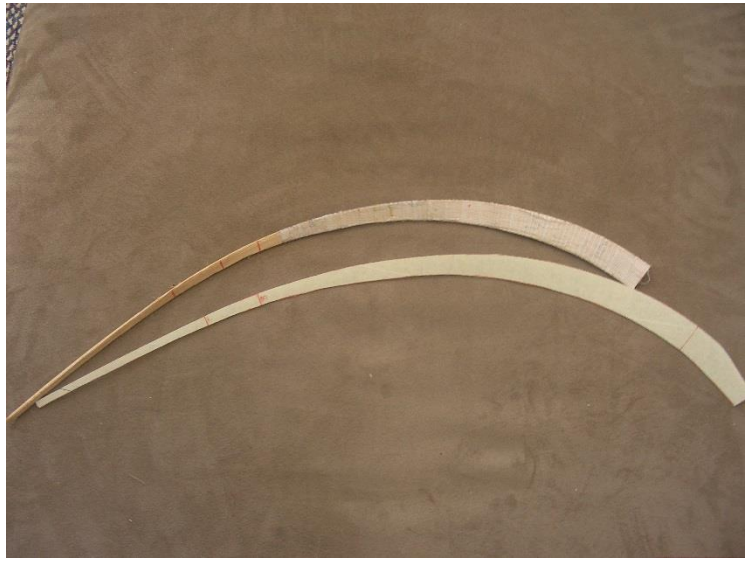
Here are 2 other cestas I've worked on.

The top one in each slide is the cesta I have been using for the last 3 months. Note the blue thread at the tip.

I rebuilt the other cesta for a friend. It was originally woven with natural reed, having been made over thirty years ago. The old reed is definitely showing its age.

Other than being a little too slow and a little too heavy for my friend's liking, it played quite well.

Odds And Ends – Alternate Rib Replacement Technique (1 - 3)



Plastic ribs that go all the way to the tip create a softer tip, compared to wood ribs. This is due to two factors. The plastic (1/16" polypropylene) is more pliable and it's a constant thickness. Wood ribs get thicker, to more than 1/8" near the tip.

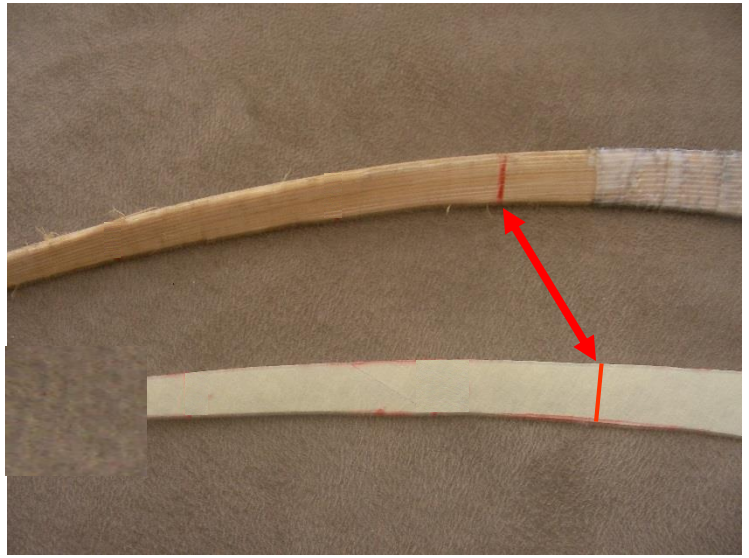
One way to maintain the same tip stiffness as the original cesta is to make hybrid replacement ribs formed from both the original wood at the tip and plastic in the pocket area. As an additional advantage, this technique uses less plastic, so more ribs can be cut from a sheet.

The plastic rib shown above is full length, which is longer than necessary to make a hybrid replacement. It only needs to be long enough to cover the splices between wood and plastic at both ends.

Splices for adjacent ribs should be staggered at the tip as well as near the glove to maximize overall strength.

Each tip splice should be formed with wood on the outside and plastic on the inside. This will result in a smoother splice on the inside, where the ball will roll.

The wood portion of the hybrid ribs at the tip should be 9" to 12".



The finished hybrid ribs should be long enough to reach the outer edge of the frame at the tip. Because the wood ribs were originally wrapped around the frame, the breakdown process often leaves them a little too short. The length of the finished hybrid rib can be easily adjusted by sliding the 2 pieces at the splice further apart, up to ¼".

These slides show a wood rib that has been removed from the cesta for cloning. The hybrid replacement will be formed from wood and plastic and then slid back into place with the other ribs. Reference lines will be used to align the ribs properly..

Before beginning the breakdown process, examine the tip area carefully. If the tip threading is in tact and the woven reed at the tip is good shape, many hours of work can be avoided by forming the hybrids while the rib wood tip sections remain on the cesta. These rib sections must be stripped of reed so the splice areas are fully exposed.

Hybrids made this alternate way involve creating very large plastic patches.

Plastic patches are discussed on page 54 later in this section.

Remove any tape from the wood rib covering the tip splice area.

Draw the cut line on the wood.

After tracing the wood rib over the plastic and transferring the tip cut line to the plastic, the wood rib can be cut, as shown above.

The previous slide shows the tip cut line transferred to the plastic.

The splice area should cover at least 2 ½".

Beveled the outside plastic edges , but only up to the point where the plastic will be covered by wood.

The tapering of the plastic at the tip splice must be done on the inside surface. This will leave a smooth surface to bond plastic to wood.

Odds And Ends – Alternate Rib Replacement Technique (4 - 8)

Before the splice is made, taper the outside surface of the wood at the cut to a fine point,. The rest of the wood over the splice area can be tapered after the splice is formed.

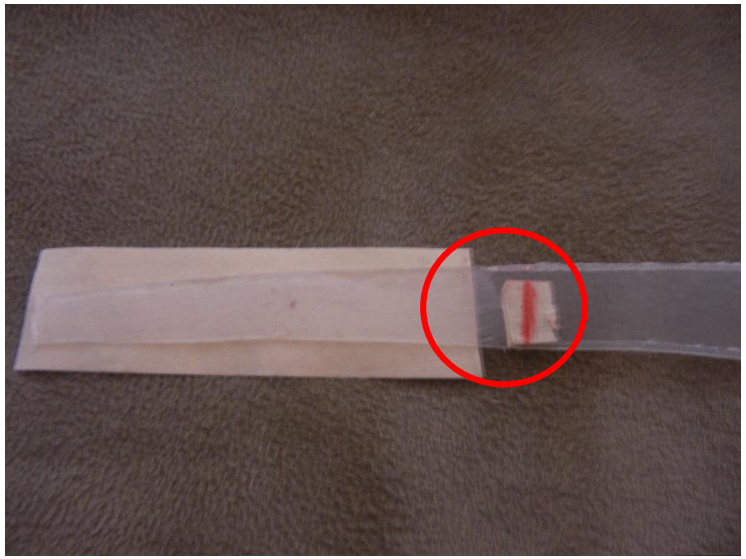
Using the carving knife, trim off any excess tape at the edges.

Cover the inside wood surface over the splice area with lacquer. Here I'm using clear nail polish because it comes with a handy brush and it dries fast.

If the inside wood surface is bumpy or uneven, smooth it out with the sandpaper or the Dremel sanding drum and be sure to wide off any sawdust before applying the lacquer.

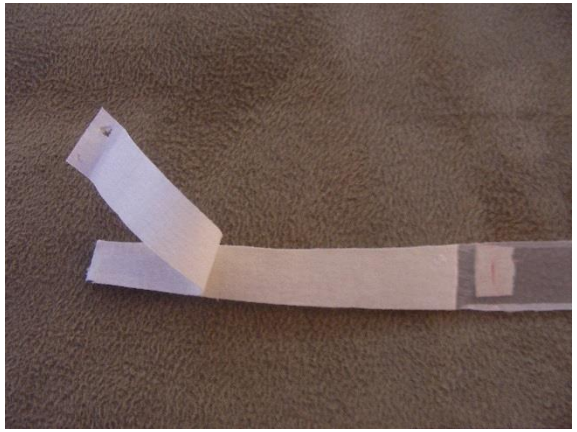
The lacquer must be dry before forming the splice.

Remove all the masking tape from the plastic rib, except for the cut line and any reference lines.



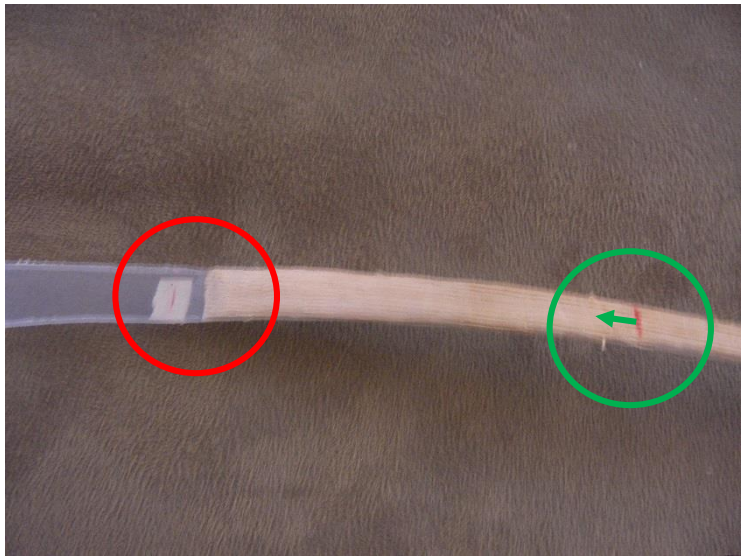
Apply two-sided tape to the smooth outside plastic surface over the entire splice area. Remember the plastic taper was done to the inside surface. If the finished rib does not need to be larger than the replaced rib, start the tape at the cut line.

This rib will be enlarged by the difference between the red cut mark and the two-sided tape edge (see the red circle).



Peel off the protective paper.

Odds And Ends – Alternate Rib Replacement Technique (9 - 12)



Here the wood and plastic have been joined.

The smooth curvature of the hybrid matches the original rib.

This new rib is slightly longer than the original rib, as can be seen by the gap between the cut reference line and the cut edge of the wood (see the red circle).

If the hybrid rib has been lengthened, the alignment reference line must be moved accordingly to compensate for the change in length (see the green circle).

Wrap the tip-most end of the splice with filament tape to keep rows woven over the splice from being caught between the wood and the plastic.

At this point the wood over the splice can be further tapered to smooth the transition over the splice area and minimize the resultant bump. Don't taper too much or else strength might be sacrificed for looks.

The end of the wood portion was tapered to a fine point, before the splice was formed. That way the plastic thickness is not compromised by the tapering.

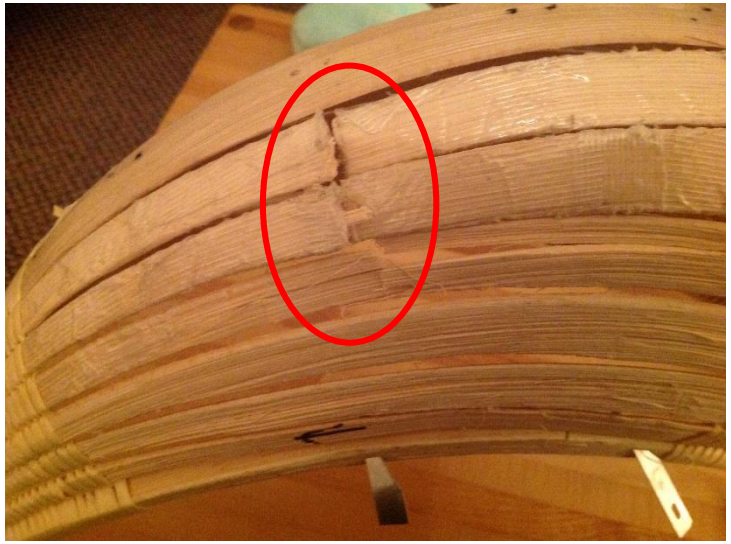
Wrap filament tape over the other end of the splice, again to assist in the weaving process.

Here's the hybrid rib with the finished tip end splice.

The glove end splice is handled in the same way as for the full plastic replacement rib. This is described on slide 12 on page 16 (tapering) and slides 40-44 (splicing) on pages 35 and 36.

Once the hybrid ribs are set in place on the cesta, weaving proceeds the same as with full plastic replacements. The glove end splices are not formed until most of the cesta has been rewoven.

Odds And Ends – Plastic Rib Patch (1 - 2)



A friend asked me to look into rebuilding this cesta. We both guessed that it wasn't a good candidate, not so much because the #4, #5 and #6 ribs, shown above, were completely severed, but because the frame also seemed very weak.

I removed enough old reed to reveal the extent of the frame damage, as well as the broken ribs.

I decided not to try a full rebuild, because after all the hours of work, the chances of the cesta becoming unusable were too high. The alternative was to fix the ribs and frame and weave over the exposed area.

On this page I'll describe the patching of the 3 broken ribs. In the next section I'll describe how I repaired the frame.

About 90' of reed was removed, which was enough to expose most of the frame damage. This also uncovered a significant portion of each broken rib on either side of the break.

The next slide shows the removed rib portions. Note that each rib section had its two pieces taped together, so it could be used to trace an accurate patch.

The rib templates are of different lengths so that the splices for the ribs would be staggered.

The actual patches must be larger than the removed sections to accommodate a splice at either end.

For multiple patches, cut each rib so the cuts are staggered by at least 1" to maximize overall strength. Each splice area should be no less than 2". The patches should also fill most of the exposed area, since plastic is better for strength and weaving. If necessary, unweave additional reed to accommodate these factors.

Extensions covering both ends of each rib corresponding to the splice areas must be created and used to draw each patch (see pages 17 and 18).

The templates with extensions are traced over a 1/16" plastic sheet the same as for full or hybrid replacement ribs (see the description under slide 7 on page 15).

Reference lines corresponding to the cut lines should be transferred to the patches before they are cut out.

The next step is to decide how each splice should be made, because that will determine how each patch is prepared. The splice will be thicker on the wood side because its more difficult to evenly taper the wood. With this in mind, it's better to put the plastic on the inside for the tip end splice so the ball will roll smoothly over it. The bump created on the outside will not be too noticeable. The glove end splice can be made with either the plastic or wood on the inside. If the glove end splice is fairly close to the heel, where the ribs slope down to the glove, put the wood on the inside, since the ball roll isn't a consideration there. Otherwise, put the wood on the outside for the glove end splice.

The patches should then be prepared for splicing by beveling the outer edges of each patch (see slide 11 on page 16). If the plastic will be on the inside of the splice, the bevel should not extend into the splice area.

Both the wood and plastic need to be tapered through the splice area. For the wood, first remove any tape covering the splice area. If the wood will be on the outside, taper the outside surface to fine point at the cut with the sanding drum and then the taper the area over the splice as best you can. If the wood will be on the inside and the splice is near the heel, it's sufficient to only taper the inside surface to a fine point at the cut (see slide 25 on page 20).

Once the tip and glove ends of the wood have been tapered, clean off any dust. Apply lacquer or a fresh filament tape wrap to cover the splice area on the surface that will contact the two-sided tape. Lacquer is best on the tip end and tape on the glove end, where the rib is wider. Make sure the ends of a tape wrap overlapping each other are on the side not to be covered by two-sided tape.

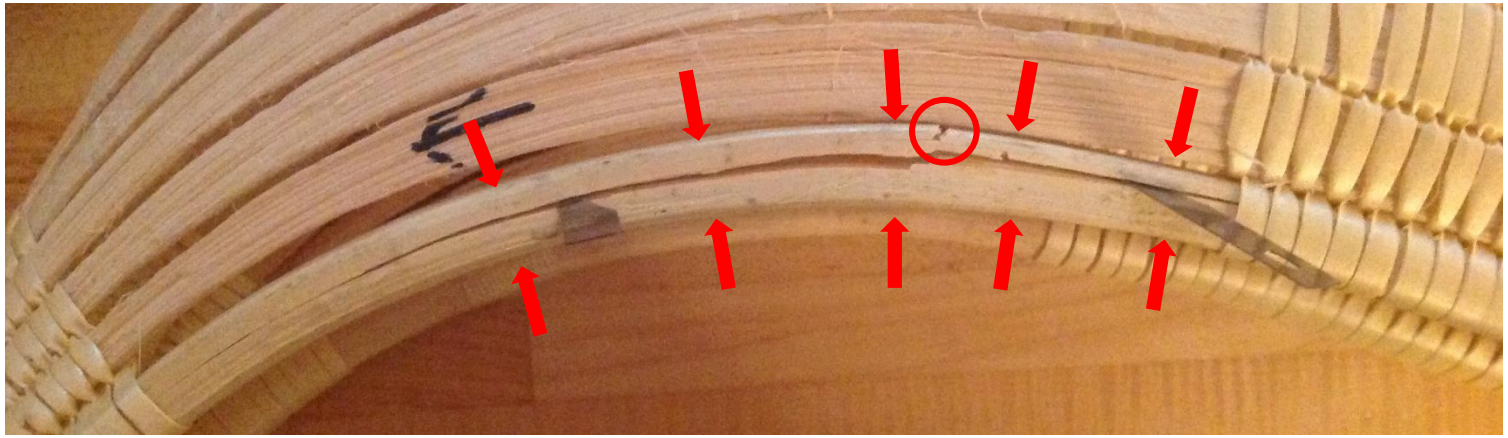
Plastic is easier to taper gradually over the splice area with a minimal thickness at the end, because its not part of the cesta yet (see slide 12 on page 16). Taper the inside surface if the plastic will be on the inside and the outside surface if the plastic will be on the outside. This will leave a smooth surface for the application of the two-sided tape.

With both ends of the plastic patch and the wood rib ends prepared, the tip-most splice can be formed. Remove all patch masking tape, except for the tip cut reference line. If necessary, transfer that reference line to the opposite side, so it won't be inside the splice. Cover the splice area of the plastic with two-sided tape. This will be on the smooth (non-tapered) side. Trim the tape and remove the protective paper, then align the plastic and the wood so rib curvature is maintained and the plastic reference line is over the wood cut line. With the 2 pieces stuck together, remove the masking tape with the reference line and wrap filament tape around both ends of the splice to keep woven reed rows from getting into the splice.

The glove end splice will be made after weaving has proceeded to within several inches of that splice area. The cut reference line is not needed for this splice and can be removed any time after the plastic has been tapered. Doing the steps in this order eliminates possible defects in the cesta's shape.

Weaving can begin once all patches and spacer screws have been set in place.

Odds And Ends – Frame Repair (1 - 2)



This is the same cesta with the 3 broken ribs discussed on the previous page.

Enough reed has been removed to expose the broken frame and ribs.

This frame is damaged in two ways. There is a partial break across the frame shown in the red circle. The frame is also split along its length in both directions away from the break.

A cesta with a completely (or more than half) broken frame across its width isn't worth saving.

The extent of the splits weren't visible until knife blades were inserted into the cracks. This was done very carefully, so as not to cause further damage.

Here are the steps involved in completing the repair:

Lay the cesta down on a table with the outside surface of the damage on top and place some paper or cloth inside the cesta under the damaged frame area.

Lay a bead of (Elmer's) wood glue on the outside frame surface over the widened splits and the partial crack.

Wait several minutes to allow the glue time to seep into the opened wounds. The paper or cloth will keep any glue from dripping inside the cesta. Use a cloth or paper towel to remove any excess glue from both sides of the frame.

Remove the blades and clamp the frame in multiple places to tightly close the splits and the break. The arrows show the 5 spots where I clamped this frame. Push the #1 rib out of the way to allow the clamps to be set. Clean off any glue forced out of the wounds, as a result of tightening the clamps.

Allow the glue to set overnight. Remove the clamps and scrape off any excess hardened glue.

Spiral wrap the frame with a long strip of filament tape about 3/8" wide. The wrap must be as tight as possible. The spiral angle should be such that each successive loop around the frame half covers the previous loop. If the strip isn't long enough to wrap the entire exposed frame, cut another piece of tape and continue the wrap. Wrap the break area (red circle) with a 5/8" wide piece of tape over the spiral wrap. See the top of page 12 for a description of how to cut narrow strips from 2" wide filament tape.

After this cesta was rewoven with the reed wrapped tightly around the frame, the once weak frame was restored to a very strong condition. Hopefully, it will last a long time.

Here are some clamps I have used.

The best clamp is the bar clamp on the top, which can be set with one hand. It costs about $6 at Home Depot or Lowe's. Harbor Freight has a knockoff model for $2.

I use these clamps to repair tip frame splits, as well as the type of frame damage shown on the previous slide.

The spring clamps are useful and they are inexpensive. The large spring clamp costs $1 at Home Depot and the small clamps are less than 50 cents.