



A map of the US constructed from different samples of SB Foot leather.

FINALIST



Tannery of the Year: SB Foot Tanning Co, Red Wing, Minnesota, USA

SB Foot is determined to stay true to its roots and true to the people of the town of Red Wing, Minnesota, where it has been based for 140 years. However, it is also investing heavily in new technology to make the most of the raw material on its doorstep.

Within ten hours of "harvesting", which is what the people in the know in the US are now calling cattle slaughter, some of the country's best-quality cattle hides are going into processing at key wet blue plants within easy reach of SB Foot in Red Wing, Minnesota. SB Foot takes delivery of 2,000 hides (4,000 sides) a day and processes them through to finished leather, mostly for footwear applications. SB Foot is now owned by the town's famous Red Wing Shoe Corporation. The wet blue facilities in question, Twin City Tanning in South St Paul, 80 kilometres to the north, and Twin City Tanning in Waterloo, 250 kilometres to the south in the neighbouring state of Iowa, are partners rather than suppliers.

Twin City Tanning South St. Paul is managed by SB Foot and the tannery has a 50% share in its ownership. SB Foot's Technical

director, Andy Rhein, is enthusiastic about the arrangements the company has in place. "Leather is made in the beamhouse," he says. "Chrome tanning stabilises the protein, but it's in the beamhouse that you build the foundation, and the more control we have over that the better. We are like a gourmet restaurant: we want as much of a say as possible in the quality and preparation of our raw materials." He points out that the tannery is working hard to educate hide suppliers on the care and handling of raw material, but acknowledges the particular nature of this special supply chain relationship. "We can help with information in important areas such as green fleshing and what is required to chill the hides for transport to the tannery. But the hide supplier needs to get rid of the hides quickly, and if he can't he will have



to spend a few dollars per piece for curing. By using fresh hides, SB Foot saves the hide supplier time and money and reduces the amount of salt going into the effluent."

Harvesting is moving further north to the Midwest of the US, he continues, because of drought conditions in the south limiting food supply. Cattle have suffered in recent years and hides of inferior quality in terms of size, weight and insect damage have come into the supply chain. Weather hasn't been the only factor. Mr Rhein says that when the price of hides dropped dramatically in 2009, many feedlot owners stopped spraying animals to prevent insect damage in an effort to save money. "I have seen the entire surface of a side covered in insect bites," he adds. "They are making more money now that prices have gone up again, but they have not gone back to spraying the cattle. For us, it's becoming harder and harder to cover up all the defects on hides. We are beginning to have dialogue about this with our suppliers, but it's far from easy and we can't hope for too much help from the packers. If they had any influence over cattle feeders and livestock farmers, branding marks would have disappeared long ago." Although insect damage is not good news for tanners, the reduction of insecticides going into the ground water is a positive.

High hide prices

The hides SB Foot is buying now are heavy weight branded steers, sourced mostly from packers in the Midwest area. According to purchasing manager, Dennis Rindels, the packer's location is important to SB Foot; it can pick up fresh hides daily and get them into the wet blue process within a short period of time. The use of fresh hides versus cured is beneficial, as the packers do not have to use resources to cure the hides, which helps Foot's cost structure. Hides are a commodity and traded daily. Pricing is affected by a number of factors, including world demand, the number harvested, the placement of cattle in feedlots, reduction in beef consumption in the US, and current economic conditions on the world market. The current drought conditions, lack of grazing land and corn being made into ethanol for the biofuel market have all contributed to an increase in the cost of raising branded steers.

Hides prices at the middle-to-end of 2009 were in a range of \$35-\$55 dollars

per hide, and today's price is \$81-\$86 dollars. It's the same animal hide, but just more expensive to purchase. "We anticipate the hide price to remain firm for the balance of this year and possibly remain strong for the first half of fiscal 2013," Andy Rhein says.

As for purchasing leather chemicals, SB Foot uses suppliers with a strong sales and technical force that the tannery feels can assist with any necessary technical support. The biggest suppliers maintain safety stock available to be shipped at short notice. The company has a dedicated fleet of trucks to pick up chemicals weekly as needed, which allows easier control of inventory levels.

To Texas and back

In the course of its 140-year history, SB Foot has, naturally, experienced a number of ups and downs. Daryl Mark, who is in charge of quality issues at the tannery, explains that a move to set up a facility in Texas in the 1980s was aimed at controlling raw material better by being closer to large sources of hides. The reverse happened, though. Hides were coming out of the tannery with drawn grain and poor tensile strength. By the middle of that decade, financial resources were drying up and the Foot family sold the tannery to neighbour and customer Red Wing Shoe, with SB Foot III, whom the industry knows as Buck,

remaining as president of the tanning operation. Mr Foot fulfilled that role until his retirement five years ago and did much to pave the way for the current mutual understanding between the tannery and the footwear company, encouraging Red Wing Shoe to use the research expertise in the tannery to develop leathers for its products. Mr Mark remembers going to the footwear factory once or twice a week to review quality issues concerning the leather SB Foot was supplying. "There was some resistance to change and it was difficult for the shoe factory to imagine going from several leather suppliers to basically one. But in time the shoemakers were able to recognise the value of our relationship and it is now difficult imagining going back to the way it was."

After Red Wing Shoe, SB Foot sells leather to several globally recognised branded footwear companies and a large portion of the leather also goes into the making of US military footwear. Total output from the tannery at the moment is around 20 million square-feet a year.

Demand for leather

Some synthetic material is making its way into the material mix for certain products in Red Wing Shoe's range, particularly where it's outdoor footwear sub-division, Vasque, is concerned. For the most part, though, Andy



Leather is made to last. Worn shoes "come home" to be repaired and revitalized instead of being discarded.



From a technical point of view

(1) Overview of operations

SB Foot is central to a highly integrated operation processing raw hides to the wet blue state, from the wet blue to finished leather, then to footwear mainly for a full range of safety and industrial applications.

The ownership of the wet blue plant (Twin City Tanning) is 50% SB Foot, 50% an independent partner. The plant processes 4,000–4,500 hides/day and is located at St Paul, Minnesota, being approximately 45 minutes by road from the SB Foot Tannery.

SB Foot tannery is located in Red Wing, Minnesota, consumes approximately 4,000 sides per day, employs 175 people, and is fully owned by Red Wing Shoes.

The Redwing Shoe factory is situated approximately one kilometre from SB Foot, produces 4,500 pairs of boots per day, and employs 500 people. There are two other Red Wing footwear plants in the group: Potosi, Missouri employing 300 people, and Danville, Kentucky, employing 80 people.

(2) Manufacture and processing

TWIN CITY TANNING

All of the hides processed as wet blue for supply to SB Foot are fresh/iced and received within a maximum of ten hours from time of harvesting. The tannery operates 24 hours per day and hides are received continuously throughout this period. The processing uses a 24-hour soaking and hair burn liming system and uses a double row of 22 hide processors set back-to-back with access via a central walkway. After unloading into containers placed in front of the processors, the limed hides are transferred to a chute that feeds an on-line chain conveyor system. These systems are used to link all of the operations – limed fleshing and splitting, trimming, and wet blue movements – throughout the plant.

Trimming of lime split hides takes place on curved tables with the hides still attached to the chain conveyor, then weighed and loaded into double rows of 12 Vallero International drums used for chrome tanning. After blue samming, 10 sides from each batch are checked to ensure that the substance is within tolerances required.

SB FOOT

The wet blue consumed by SB Foot is tanned under contract by Twin City Tanning. At times there is supply from Waterloo, Iowa (owned by the independent partner with 50% share of Twin City Tanning). Control of all wet blue manufacture for SB Foot is the responsibility of Andy Rhein.

All of the wet blue received is lime split. This provides advantages not only in terms of chemical saving in wet blue processing, but in improved uniformity of leathers after shaving and following retanning/dyeing/fatliquoring processes.

All of the wet blue is sorted into three grades, and stacked as left and right sides. Most of the leathers



Part of the back-to-back rows of hides processors used for soaking and liming. Each processor operates with an input weight of 14,500 lbs on a two day soaking/liming/unhairing cycle.



All the hides that are contract tanned for SB Foot are lime split. The grain splits are tanned in conventional Vallero International tanning drums, with the trimmed limed splits being sold for collagen manufacture.



Cuttings are taken and dried from each pack of leather at the end of dyeing/retan/fatliquoring. Placed on top of cuttings from previous packs in the control office, this presents a detailed colour profile of production and, by comparison to other packs and master samples, is central to basic colour management.



produced are at 2.0-2.2 mm, but the wet blue is subdivided into three substance ranges with only 0.2 mm difference in thickness. This is part of ensuring consistency from shaving operations.

Retanning/dyeing takes place in 17 drums. Seven of these are Vortex drums manufactured by Vallero International, and are replacing the conventional drums at two per year. These drums are fitted with three deep shelves and are slow revolving. Over and above energy and water savings, the “dragon teeth” shelf arrangement fitted within the drums helps prevent the sides from tangling within process; this separation also makes stacking the sides easier for the workforce, causing less strain and employee fatigue.

All of the chemical additions are made manually. Chemicals and dyes are first weighed and placed on a movable platform. These weights are checked by the department manager before moving to the drum being serviced, then a third time by the drum operative before offering to process.

This system has replaced a fully computer managed chemical dosing system. The operations are now managed using process sheets where actions are checked and verified, and continuous monitoring of temperature, pH, and time throughout processing. This change has resulted in operatives looking and touching the leather during processing, and is considered essential by the company.

Within this system eight basic leather types in 85 colours are manufactured, dependent on end use: waterproof and non-waterproof for heavy duty workwear, a softer tumbled version in both waterproof and non-waterproof, aniline leather for casual wear in waterproof and non-waterproof, lightweight lining leather and a heavy vegetable retanned leather used for mechanical purposes. As part of colour control, a single cutting is taken at the end of process and placed with an accumulation of dried leather cuttings from previous dyeings of that colour to highlight any variations. No leathers are adjusted to shade during the retanning process as the variation using this system has proved to be within acceptable limits. With improved consistency of both product and dyeing outcome brought about by these changes, the rejection rate has been almost eliminated.

All of the leathers after samm/setting are extended and softened by wet stretching/staking, before drying on two six plate Cartigliano vacuum drying units, each coupled with carefully controlled suspension drying. One line serves non-waterproof leathers, the other dedicated to waterproof production as this requires different drying techniques during the suspension drying operation.

Two features of manufacture are the fast and easy movement of goods between operations, and an emphasis on allowing time for the leathers to lie after each stage of processing. Specific times are allocated for goods to lay wrapped in polythene between operations; the processing time could be shortened, but a little extra time is considered important for uniformity.



The weights of all chemicals are checked three times. First at the time of weighing, second by the department manager, finally by the operative when the chemicals are offered to the dyeing drum.



All of the leathers offered to the vacuum drying plates have been wet stretched/staked after samm setting. These sides are well extended, and can be simply placed on the plates without the need for any hand setting.



Leather is curtain coated on the grain and flesh sides with specially blended oils as the first stage of finishing. The curtain coating machine is suspended on rubber mountings to eliminate disruption of the curtain due to any vibration.



These sides are cut in two to customer specification. These leathers are impregnated with resin, then dried, and are used in mechanical applications in ultra-cold conditions experienced in Canada, Russia and Alaska.



Leathers for delivery to Red Wing Shoe are individually rolled and placed on racking suited for direct use within the shoe factory.



Both clicking operations and stitching depend entirely on eye and hand coordination.

Although part of the production is buffed, assisted or embossed, the majority of the production is for plain aniline leathers for working boots for multi-industrial applications. Out of approximately 150 customers, the main consumer is Red Wing Shoe Company, using mainly waterproof leathers.

Almost all of these leathers are oiled or waxed. This commences with a curtain coating application of specially blended oil that has fully replaced oils/waxes where solvents are required. Once coated on the flesh side, the pack is stacked, and then re-coated on the grain side.

In the main finishing operation a variety of oil and wax blends are applied by roller coater, followed by infrared drying cells to warm the blends as appropriate for penetration. A spraying line is also used, and although all of the production is as side leather, this is a whole hide spraying unit as the spray pattern is improved. There are four spray units in this assembly, each followed by infrared drying cells to dry the individual finish coats.

At final inspection, there are seven sorters who inspect and record details of each batch produced by the tannery. Four of these sorters are designated to specific customers, with the remaining three sorters working on Red Wing Shoe leathers only, where there is an additional assessment for cutting coefficients. Following inspection these leathers are individually rolled and placed in racks for direct use in footwear manufacture. Because of the level of coordination with Red Wing Shoes, these leathers are not viewed as the end product from leather manufacture, but part of a supply chain where the process is finalised as a complete working boot.

RED WING SHOE COMPANY

Around 70% of the footwear manufactured by Red Wing Shoe Company is for industrial footwear, and almost all of the leather is provided by SB Foot. Before dispatch from SB Foot, each batch is sorted, graded and assessed using a SATRA system to determine cutting coefficients. Deliveries take place three times per day, and the leather moves directly into footwear construction. This ensures instant feedback to SB Foot as leather received, but also as finished footwear as the manufacturing cycle at Red Wing Shoe is only 24 hours. There is continuous liaison between these two manufacturing units.

Both cutting of boot components and all assembly work relies on hand and eye coordination, and there are three main types of footwear construction being used. These form three production lines based on attaching soles to the uppers: welted with single or dual density polyurethane, cement and direct attach construction.

These boots are made to last with exceptional fit and comfort, and owners do not like to throw them away. Within the plant there is a unit employing eight people who provide a complete repair service for Red Wing boot customers. Soles are replaced, seams are stitched and the leather is reconditioned before returning to the faithful customers.



The largest boot in the world. 60 volunteers constructed this boot using 80 hides over a one-year period to celebrate Red Wing Shoe's centennial in 2005. It is an exact replica of the 877 style, which is now built in 77 different combinations of size.

Rhein says it is clear that for this customer leather is king. "It's a company that doesn't just want to sell you shoes," he says. "It wants to supply a service. It wants to measure your feet properly and, although you can buy online, you have to go to a store to make sure the shoes you have bought fit properly. It has a repair department and customers send shoes back to Red Wing to be rebuilt. The team there talks about the shoes coming home. Leather is made to last and people do not readily throw away their Red Wing shoes; the brand has a fan club rather than a customer base."

He recounts the experience of an electrical worker in Maryland in May 2012 using a jackhammer on an abandoned duct bank without realising that part of the electrical duct bank was live. A loud explosion followed and the man was thrown backwards and injured. On his release from hospital, his employers carried out an investigation into what had happened and found that he had hit a live, unmarked electric line with 15,000 volts running through it. The line's copper shield was blown away, but the Red Wing boots saved their wearer's life.

Return on technology investment

One of the benefits of using Vortex retanning drums is one that the manufacturer itself, Italian tanning

technology provider Vallero International, appears not to push. There are 17 of these drums at SB Foot and the company has found that Vallero International is true to its word with its promise of savings in energy and water-use (60% and 40%, respectively). Turning at four revolutions per minute and with the dragon's teeth-style shelves inside, the drums produce sides that tannery workers can lift out easily. There is no tangling up. And because they are ergonomically easier to lift out at the end of the process, there is the opportunity for reduction in stress and strain injuries. At this stage, each side will weigh around 10 kilos, but in one load, a worker could easily be lifting that weight 25 or 30 times. Snagging can bring the lifting movement to an abrupt halt and the jarring this causes can lead to a muscle injury.

"When we first put the Vortex system in, alongside traditional drums, the guys in the tannery didn't comment," Andy Rhein recalls. "But I noticed that they were soon fighting to see who got to unload the Vortex drums. That told us everything we needed to know. We don't want injuries. Retanning time includes 16 hours turning slowly in the Vortex drums, followed by four hours' resting time before going into samm-setting, just to allow the chemical reactions to come to completion. Plastic

covers go over them during the rest period to keep moisture in and dust out.

Another technological breakthrough has come slightly further down the line. Another Italian tanning machinery manufacturer, Cartigliano, has communicated consistently about the benefits of its wet-staking technology. When it launched its Staktreking wet-staking machine in 2007, it explained that it was based on medium-high vibration frequency, which would give improvements in layout, thickness and uniformity. Mr Rhein says the company has gained significantly in yield. "The loads on the carts are as flat as a deck of cards," he points out. Efforts are being made to carry this idea into staking at wet blue stage, prior to shaving, to control the amount of wet blue shavings the operation produces.

Waste not want not

While the company is doing everything it can to reduce waste, it wants to keep shaving at wet blue stage. Andy Rhein says: "If you shave, you open up the fibres and make sure that the chemicals you use penetrate fully. [There are] claims from suppliers that they can eliminate wet blue shaving, but if you do that, the chemicals won't penetrate, because the chemicals go in from the flesh side."

There is a landfill site 50 kilometres from SB Foot to which the shavings go at the moment, and it has the capacity to keep taking material from the tannery and manage it correctly. It is clay-lined and handles only industrial waste, almost, the company says, at a level of hazardous substances (a category the tannery waste does not fall into). Other ideas over the years have failed to take off. At one time in the 1990s, there was interest in using the shavings as bedding for horses. SB Foot said no. "You need to control what you do with your waste," Andy Rhein says, "and we prefer not to take any risk."

Waste management is a constant challenge, of course, and the Red Wing Shoe group takes a collective approach to many aspects of it. Internal lean events have yielded interesting results. John Smith, now director of enterprise risk management for the Red Wing Shoe group, was environmental director of the tannery until April 2011. He recalls an exercise examining water consumption in detail. It showed that SB Foot was consuming 16 litres of water a minute even over the weekend when it was



After closing, the upper is lasted and a welt sewn in using the Goodyear welt process ready for the soles to be attached.

(3) Solid waste management

- Limed splits (trimmed) are further processed on site, and then chilled before transport to customers for various collagen end products.
- Raw and limed trimmings are sold for gelatine and dog-chew manufacture.
- Solids after sulfide removal are settled, and are then used directly in agriculture as a source of nutrient.
- Dyed leather trimmings are used for sandal straps, tags, shoes, bags, accessories.
- Blue shavings are deposited in landfill, but pilot studies are taking place to produce hydrolysate and potentially chrome recovery.
- General wastewater screenings, limed fleshings, chrome precipitates, and compressed buffing dust are all deposited in landfill.
- All of the solids designated for landfill are subjected to secure landfill. This category requires a clay lining of 90 centimetres in depth at the landfill site. The landfill has a double liner system which includes dual synthetic liners plus an impermeable clay liner, and two leachate collection systems. An extensive network of groundwater monitoring wells is regularly sampled to test up and down gradient water quality.

(4) Water and environmental management

[a] RAW WATER

All of the water used in leather processing at SB Foot comes from wells on the property. Municipal water is used for sprinkler systems and office buildings.

[b] EFFLUENT TREATMENT

Twin City Tanning: All of the chrome containing wastewaters is separated, and the chrome precipitated using lime addition. After settling, the supernatant is used for washing purposes within the tannery.

The other wastewater streams are screened to remove gross solids, then mixed together, oxidized to remove sulfide, then discharged to the main sewer for subsequent treatment by the St Paul municipality.



35% of the energy used by SB Foot is generated from incinerating domestic refuse. This plant is managed by the Red Wing municipality and is situated next to the tannery.



Primary clarifiers operate in parallel for settling of suspended solids after screening to remove gross solids.

SB Foot: All of the effluent is screened to remove gross solids, then mixed together and settled in two primary clarifiers that operate in parallel. The effluent is discharged for treatment by the Red Wing municipality.

Both of the municipality treatment plants operate to a discharge standard of 25mg/l BOD, 30mg/l Suspended Solids. However, these are relatively new plants and practice end-of-pipe discharges of 5mg/l BOD, 5mg/l Suspended Solids. Charges are made by the municipalities based on effluent volume and strength.

[c] EMISSIONS AND ENERGY

35% of the energy requirements for SB Foot are provided by combustion of domestic waste. Located next to the tannery, this was a joint project in 1996 with 50:50 funding between the municipality and tannery. All of the solid waste from Red Wing and the surrounding area is delivered to this site, shredded, and then used as fuel to generate steam. The facility is run by the municipality, and the tannery is the sole customer. ☺



producing no leather. "We waited for the next weekend and went through the tannery," he explains, "and we could hear the water running into the drain. It was the Bause samm-setting machine. It's water-cooled, so if the machine is left on, it keeps consuming water. Now we make sure we turn it off at the end of the working week." Mr Smith has served on state-level task forces on issues such as water quality. "The state people have a job to do, just like we do," he comments. "We generally see eye to eye." The treated effluent from the tannery goes into the Mississippi, the river that runs through Red Wing all the way to the Gulf of Mexico. The tannery is located 50 metres from a much smaller body of water, known as the Hay Creek, a carefully controlled trout stream. Prior to 2002, the wastewater was discharged into the Hay Creek after being treated at the wastewater facility next to the tannery. Today, that facility acts as a pre-treatment plant before discharging to a larger municipal treatment plant for final treatment and discharge to the Mississippi.

A long way from Wall Street

A lot has happened during the 140 years in which the SB Foot tannery has been active, and as well as being a continuous and important source of jobs (it stayed open even during the depression of the 1930s and employs 175 people today), its contributions include helping to fund the public library, which has an SB Foot room. It's creating jobs that excites owner, Bill Sweasy. Red Wing Shoe has been Mr Sweasy's family business since 1905. "We looked at buying the tannery for two reasons," he says now. "We saw that it was going to close. We still had shoe factories in the US, so we thought about making leather ourselves. The tannery was there, the resource was there, the people were there." And the people were the second reason. Red Wing is a small town, Mr Sweasy says, a place where it doesn't matter what you drive or what you wear because everyone knows who you are anyway. In a big city, what you wear says something about you, but it doesn't in Red Wing. What matters there are actions. He wants to be able to look the townspeople of Red Wing in the eye and be sure that he is doing his best to create jobs and keep local families prosperous. Bill Sweasy says he feels immense pride that the town still

makes high-quality leather and high-quality shoes and that it is shipping those shoes all over the world, including China, from where the US is currently importing so many consumer goods. "We have strived to look at our own value chain, from raw hide to finished shoe as a holistic system," he continues. "We know that it's just as important for the retailers who stock our shoes to make money as it is for us. We want to be profitable; we want our dealers to be profitable. But in ten years I have never asked our company president and chief operating officer, Dave Murphy, what the bottom line is. Never. That's not the way to achieve success, in my opinion."

Instead, his focus is on making quality products that discerning consumers will pay for, and he makes it clear he regards being a privately owned company as a distinct advantage in this; there is "no Wall Street looking over our shoulder".

Red Wing is a long way from Wall Street. He knows there are famous fashion and accessories brands, companies that owe much of their success to consumers' love of leathers, that are now

compromising on quality and starting to use synthetic substitute materials, at least in their entry-level products. He asks: "But how many of them are privately owned? How many of them are thinking about keeping things going for the generation that is coming after them? And how many of them are just thinking about the next quarterly report?"

Quick response

An emphasis on the workforce, their families and the wider communities is one of the main reasons SB Foot is still in business, according to operations director Andy Rhein, who is originally from Europe but regards himself as a Minnesotan now. He talks in glowing terms about the commitment to the tannery from Red Wing Shoe and from Bill Sweasy in particular. In the last six years, the parent company has invested an estimated \$12 million in new technology and, on the back of that, he says the tannery has performed well. "The end result is that we are able to provide employment, including health insurance for our workers and for their families," he says. ☺

Control and accreditation



LABORATORY SERVICES

SB Foot takes pride in the quality of their products and great effort is put forth to assure that all performance requirements are met. Atomic absorption is used for checking the chrome content of all batches of wet blue received and leaving SB Foot. The test procedures are extensive, with a very high focus on Maeser testing for waterproofness. Other services that are provided that are associated with footwear manufacture, including destructive tests on completed boots and field testing. With emphasis on safety aspects of footwear under extreme conditions, of special interest are flame tests and the test for high voltage resistance footwear to 18,000 volts.

AWARDS

- ISO 9001/1 2008 Certification for Red Wing Shoe Company incorporating SB Foot (Effective 2012-2015)
- LWG Gold Award Twin City Tanning
- Laboratory: Qualified listed laboratory certified by Department of Defence, US Military.