



Tannery of the Year: Midori Hokuyo, Yamagata, Japan

The Midori Hokuyo tannery in Yamagata, is the only remaining automotive tannery in the home of automotive supply chain excellence. It aims to prove that many of the quality and continuous improvement initiatives to have come out of automotive manufacturing can work well in the production of leather.

Industrial group Midori Anzen is best known in Japan and overseas as a leading safety goods company, making helmets, workwear and safety footwear. It still makes some of its high-end shoes on home soil and, at first glance, it may look as though this is the reason why it continues to run its own tannery in Yamagata, a city 400 kilometres north-west of Tokyo. But it's not the case. The leather division, Midori Hokuyo, is a big operator in its own right (it accounts for around one-third of total group sales), with tanneries, cutting plants or sales offices in Brazil, China, Mexico and the US as well as Japan, and its specialism, at least for the last 35 years, has been automotive leather.

Midori Anzen bought the facility, already a functioning tannery, in 1968 but waited ten years before switching its production to automotive leather. Its customers are mainly Japanese automotive brands, including Toyota, Nissan, Honda, Mitsubishi, Subaru, Mazda, Suzuki, Daihatsu, Acura, Infiniti and Lexus. Of course, these are companies that run automotive plants in many parts of the world now, which is why Midori Hokuyo has the geographical spread it does. It has more than 2,200 employees in Guangzhou in China, for example, compared to the 420 in Japan (divided between the tannery in Yamagata and a design team and commercial office in Tokyo). The Brazilian and Mexican operations have, respectively, 865



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and 950 employees. But the facility in Yamagata is at the core of all this, with the tannery operating as the “mother” plant and the research and development team there carrying out investigations and examining new ideas on behalf of all.

The Midori Hokuyo tannery processes 7,500 hides per week, from which it produces 375,000 square-feet of finished leather. It works only with bovine hides, and only from wet blue or crust, having ceased operating its own beamhouse ten years ago. Currently, it brings in material from South America, the US, Australia, Europe, South Africa, Japan and other parts of Asia.

Japanese material comes as wet blue or wet white from a tannery in the west of the country. Its grade A material is very good, executive director and general manager, Toshikazu Suzuki, says, but he points out that, in general, Japanese cattle is better for meat than it is for leather. “It has a very thin grain and too much fat,” he says. “Japanese consumers like their beef to be tender, so it has a lot of fat. Unfortunately, that means the hides are fatty too.” Plus, the numbers are relatively small, with an annual slaughter rate of 1.2 million head of cattle (fish is the most important component of the national diet).

Managing director, Sho Sasaki, views the cost of raw materials as something over which Midori Hokuyo can have no control. “I can read the market,” he says, “and if I can, I like to buy ahead of time when the price is going up, without accumulating too much inventory. But we are part of a supply chain and we cannot interrupt the flow. We cannot allow a situation to develop in which we are preventing our customers from making their products and that’s more important than price. We would have to bring in wet blue by air rather than interrupt the supply chain. Too much inventory would be the second-worst thing that could happen because if the market goes down you lose money.”

Almost all the leather the Yamagata tannery produces, around 90%, goes into automotive seating and for steering wheels, with the other 10% being consumed by niche products in furniture and leathersgoods. One of these specialist products is a range of attractive, old-fashioned school satchels, a traditional gift that parents or grandparents give to children starting elementary school at the age of six or seven. They are expensive, costing up to \$600, but they mark something of a rite of passage for many Japanese families and,



The entire site is surrounded by trees. Many different species were originally planted to provide a sensitive diversity of trees at different heights and colours.

because they are well made, will typically last until the child goes to junior high school.

Japanese automotive mentality

The supply chain efficiency and effectiveness philosophy to have come out of the Japanese automotive industry, particularly Toyota, in the second half of the twentieth century has filtered into most manufacturing sectors. Supply chain and quality professionals in every part of the world drop into everyday conversation Japanese terms such as Kanban (signalling that more components are needed for the production line to keep flowing), Kaizen (continuous improvement) or Muda (waste). It’s no surprise that this mentality and the just-in-time principles it underpins are also part of Midori Hokuyo; Toshikazu Suzuki worked for a major automotive company for many years before turning his hand to leather. Another philosophical term he brought from the automotive industry is Mieruka. Perhaps less widely used, this one means using visual signals to communicate information along the production line.

The tannery has its own quality control circles (QCCs) and everyone has the right to make Kaizen proposals. Chief standards officer, Goro Yamada, who chairs QCC activity, is currently fielding 200 Kaizen suggestions from the shop floor every

month. There is a monetary reward for any idea that goes into practice as, on average, 10% of these ideas do. One recent example was a suggested solution to the problem of a loss of yield resulting from having to print some of the embossing that cannot be sprayed on Midori Hokuyo leather. “If you don’t mind, I would rather not say what the answer is,” says managing director, Sho Sasaki. There are group-wide activities involving QCC experts in the 16 other Midori companies and a circle of 10 or so people from the different divisions of the leather division to encourage colleagues in all its plants to adopt good ideas from any individual factory.

He explains that one of the consequences of applying automotive supply chain principles to a tannery is safety. “If we can’t supply leather, we interrupt the whole supply chain,” he says, “and, today, the biggest risk to that is safety in the workplace: fire or other damage to people or equipment, and so on. So we have to pick up any sign of risk that could compromise safety. So, every month, every worker on the factory floor without exception, and there are 300 of them in Yamagata, has to come up with at least one proposal, no matter how small, on how to avoid risk.”

Another initiative to have come out of
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From a technical point of view

(1) Overview of operations

Midori Hokuyo Co. Ltd. comprises four tanneries located in Japan, Brazil, China and Mexico, with automotive leathers comprising the entire production (except in Japan). The mother plant is situated in Yamagata City and processes 7,500 hides per week from the wet blue to produce 375,000 sq.ft of finished leather. Around 90% of this production is for the major automotive manufacturers located in Japan for seats, dashboards, on steering wheels, gear shifts and trim. This supply is mainly as cut and packed components, with a capacity of 32,000 seat-sets per month. The 10% manufacturing balance is leather for furniture home and office use and for school bags.

It brings in materials from South America, the US, Australia, Europe, South Africa, Japan and other parts of Asia, mostly as wet blue, with some wet white and crust.

Established at Yamagata in 1946, the tannery and cutting plant are on the same site, employing 420 people, about 30% being women.

(2) Manufacture and processing

FINISHING

All of the wet blue leathers received are wet back in a row of six elevated drums of 3.5 x 3.5 m size. All of the goods are raised to the service mezzanine by elevator for rear loading. After soaking the leathers are dropped into stainless steel trucks and delivered to the samming machine where the individual hides are separated using manipulators and offered to the operation. All leathers supplied are slightly over substance, so after sorting and grading the leathers are re-split to substance. This ensures a very uniform substance from shaving. After shaving, the operative drops the pieces onto a circular table for opening out and trimming. These tables can be rotated to facilitate this operation.

Dyeing and retanning takes place in two sets of three drums of 2.5m diameter x 3.0 width, serviced by a common central mezzanine. There is an automatic water feed to these vessels,



This pilot plant is central to the development of new leathers for all of the four Midori Hoyuko manufacturing units.



These six drums are used for soaking back all of the wet blue leathers. A wide mezzanine runs along the back of these vessels enabling easy movement of batches of leather for loading purposes.



Three new polypropylene drums fitted with four deep shelves have recently been installed. These are used exclusively for automotive production.



Shaved pieces are dropped onto these circular tables for trimming. These can be rotated to ease the trimming operation for the operatives.



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and liquid chemicals are added automatically too, while powder chemical additions are done manually. The first set of drums are wooden, fitted with pegs and shelves and used for furniture and other leathers. The second set of drums was installed in 2011, made from polypropylene; these are slow rotating and fitted with four deep shelves set at an off-centre angle and are used for all of the automotive leathers. The benefit from these drums is that they can operate with twice the input load weight of the conventional drums without any increase in tangling or change in quality.

After discharging the load from the retanning/dyeing drums, the leathers are stacked in two piles within stainless steel trucks and floated with water before offer to the samm/setting operation. This is followed by wet stretching/staking and then dried in horizontal throughfeed drying cabinets. These comprise two drying units, both comparatively short in length and 4m high, custom built by Japanese manufacturers to suit the area available within the plant. A second wet stretching machine is situated between these two units to provide an intermediate staking of the part dried leather. Both wet stretching machines are Italian and the total time for the whole operation is 40 minutes. This production line was installed in 2011, and machine can be operated as a fully linked operation.

It is possible to separate leather after wet staking for vacuum drying as used in steering wheels and panels. This is normal, followed by airing off on a pole drying conveyor. Softening after conditioning is provided by feed-through vibration staking and four tumbling drums.

In addition to the main production area there is a separate department for development. This comprise six small and three larger sized stainless steel Dose drums capable of processing between five and 25 sides. This is a particularly important department as all of the development work for the group is performed and evaluated at this site before the technology is transferred to any other tanneries. In total 50 people are employed in wet-end and finishing research and development, with a further 30 people committed to quality control.



After samm/setting and vibration staking, the leather is dried using two throughfeed drying tunnels. These are separated by a second wet stretching machine to soften and extend the part dried leathers.



These stainless steel milling drums are set next to the finishing department and were manufactured in Japan.



Leathers throughout the finishing department are carefully managed to avoid contamination. This shows the moveable holding racks that are loaded at the end of spraying operations, where the leathers are protected by plastic curtaining.



Final leather inspection. This leather is for the first class departments within a Japanese Super Train. These trains are run by different companies and each has its own livery – ivory, white, blue and black.



This shows leather placed onto cast finish films that are still attached to backing paper. After heat lamination, the paper is peeled from the finish to reveal the slightly embossed grain surface.



In the cutting departments, once defects have been identified on the grain, patterns are placed onto the leather and the section marked. Cutting dies are placed exactly on these areas before cutting.



Very intricate stitching is required to create patterns and details on many automotive components. This computer managed system was installed in 2009.

FINISHING OPERATIONS

The finishing department is fitted with three roller coating machines. These are being used for 'moss-backed' applications as required, for sealing the flesh side of the leather to prevent loose fibres and dust, and within a new roller coating/spraying line that is currently being installed. Finishing at the present is mainly by spraying machines followed by infrared drying units.

When leathers are removed from the end of these lines they are lifted from the conveyor using wooden poles, which are then placed in moveable racks to cool. This may be followed by loading onto a line-conveyor system fitted with poles for airing off.

There are two hydraulic embossing presses, and three throughfeed embossing machines with 12 embossing rollers to create grain effects as required. Management within finishing uses a newly installed system where four touch sensitive monitor screens are set within the departments so that the location and status of any batch can be determined.

All of the finishes are dispensed from a central finishing department. All of the pigments are dispensed automatically and are colour matched by computer. The resins are stored above the department and fed by gravity into the preparation area. Once the blends are made up, test samples are finished, then colour checked by computer and visually under different light conditions. These are then colour coded for use.

The department also includes buffing machines, a row of eight Japanese manufactured stainless steel tumbling drums, and a vibration staking machine with return feed. All are in dedicated areas and are sealed to prevent dust contamination within the main finishing area. In addition, both feed and take-off areas for the spraying machines are enclosed to avoid contamination, and the drying racks are fully enclosed/curtained to avoid dust and soiling. Everything is protected and clean.

In a separate department leathers are laminated for school satchels. The operation first spreads resin onto a roll of embossed paper to cast a finish film, with the final finished surface lightly adhering to the paper. This film is then dried to form a finish, and leather that has been pre-treated with an adhesive placed onto the film. The leather and film are then heat laminated and the embossed paper peeled away to reveal the surface layer.

CUTTING DEPARTMENTS

All of the automotive leathers produced are for cut components for the Japanese automobile sector, the rest being rolled and delivered to other cutting companies. The cutting operations are managed in two units that are next to the main tannery. In the first unit where components are cut for seats and steering wheels, the sequence of events is that the approved leathers are first inspected and graded. In this operation any defects are identified manually and the leather marked. Transparent templates for the various components are then placed on the skin to optimise the cutting values, and the leather marked for cutting. Cutting dies are then hand-placed precisely onto the identified areas as appropriate and the components cut out by press. Some of the component are perforated and stitched as required, then



the sets of components are brought together as kits for manufacture into components for seats and steering wheels.

The sequence is similar in the second department, but after identifying defects the leather is automatically scanned for those defects, then cut under computer control. Stitching is also performed on the components in this department using state of the art stitching equipment.

3] Solids management

- Wet blue splits and shavings: these are residual from re-splitting hides that were lime split. They are very irregular and of low tensile strength. Together with compressed shaving blocks and compressed buffing dust these are collected by a specialist company for hydrolysis, then use as fertilisers.
- Packaging and containers are washed and sold for reuse.
- Tannery sludge is deposited to licenced landfill.

4] Water and environmental management

RAW WATER

A fresh water supply is obtained directly from the municipal supply but also from bore holes.

EFFLUENT TREATMENT

Effluent treatment is comprehensive, and comprises balancing of the effluent, then pH adjustment and chemical dosing using aluminium sulphate for precipitation, followed by primary settling. The supernatant from primary treatment is then offered to secondary biological treatment as the activated sludge treatment method taking place in a series of seven holding tanks, followed by secondary clarification.

The in-feed of the effluent can be summarised as volume 1,200 m³/day, BOD 800 mg/l, suspended solids 750 mg/l,



This photo shows part of the activated sludge treatment system. This comprises seven separate sections and this treatment follows chemical dosing with aluminium salts. The finally treated effluent is of a sufficiently high standard that it is discharged to the nearby canal.

and Cr 40 mg/l. After treatment the effluent must comply with discharge standards of pH 5.8-6.8, BOD 70 mg/l, suspended solids 50 mg/l, Cr 1 mg/l. Analysis is performed daily, and the operational values for discharge is well below these limits. The discharge is directly to an adjacent canal where there is considerable dilution.

The sludges from settling are blended then dewatered using a screw press to create solids of approximately 50% moisture content. ☺

this is 5S. You achieve safety (in truth, the sixth S, and the objective of the exercise), if you have on the shop floor Seiketsu (good hygiene), Seiri (orderliness), Seiton (tidiness), Seiso (keeping work areas clean) and Shitsuke (good manners and good discipline).

As all other suppliers to automotive companies know, another consequence of specialising in this market is that the customer expects additional efficiency and lower costs every year. And, meanwhile, the suppliers themselves have to find a way to keep paying the bills and, if possible, keep growing. "We could have taken everything outside Japan," Mr Sasaki muses, "for cost reasons. But we don't want to give up production in our homeland. The knowledge and continuity are very precious, and once they are gone, you can't get them back."

State of the Japanese car industry

As mentioned above, Japanese car brands have plants all over the world now, to save

logistical costs and have finished vehicles ready at the various points of consumption that they believe can deliver good growth. They also have concerns about what fluctuating and unpredictable currency values can do to their results. But Japan is still a big market too and Toyota has committed publicly to keeping the production of a minimum of three million vehicles a year in its home country. Nissan has made a similar commitment on one million vehicles.

Across all brands, Japan is producing around ten million cars a year on home soil at the moment. These companies still carry out much of their research and development at home, so it's often the case that they carry out initial production of new models in their domestic plants. And for all these reasons, Midori Hokuyo, as the last automotive tanner Japan has left, feels it will have a role to play for years to come.

"Having the tannery here means our customers can have a quick response and a

quick delivery and this gives us a small advantage," Mr Sasaki explains. "Our design team in Tokyo focuses on colour, on perforations and on stitching and aims to show the brands what a seat can look like. We give each company a presentation once every year to make these design ideas available to them and to offer value-add that it's not so easy for our competitors to imitate. But our labour costs are high (and we know because we have real data from our plants in China, Brazil and Mexico) so we need always to be competitive. We have to keep improving or we will lose business. They're not going to keep doing business with us just because we're Japanese."

He says that anywhere you have mass production you have room for continuous improvement. Investment in the right technology can help reduce labour costs and save time. If you save time you save inventory and if you save inventory you save money. One recent example at Midori Hokuyo is a new drying system initiated in



Display of traditional wood and leather furniture.



Display of small part of the range of seats designed in cooperation with major Japanese automotive manufacturers.

May 2011. It's not as easy as it sounds, though. Apart from the cost of investing in new technology, automotive customers insist on giving their approval. Uniformity is important to them and they want to know for certain that articles they have assessed and commissioned will continue to come out looking, feeling, smelling and measuring the same as before.

Chemical and machinery suppliers

Most of the big leather chemicals manufacturers do business with Midori Hokuyo and the company intends to keep the supplier list long. Toshikazu Suzuki says some chemical suppliers have worked closely with automotive manufacturers to work out exactly what is required to make the leather the car companies want for the

upholstery for each model. Then the chemical manufacturers seek to sell to tanners an entire "system" for particular models. Midori Hokuyo says it prefers to work out for itself the best way to meet customer requirements. "We view having our own recipes as a key to our competitiveness," says Mr Suzuki. "We don't want the chemicals companies to tell us how to make our leather."

For machinery, too, he wants to keep "buying from everybody". And he wants to continue to invest if the technology will genuinely give the tannery better results, better quality leather, soft, but with no loose grain, and as big a yield as possible. So performance-against-cost is the discussion he will always try to have with the machinery manufacturers. If they can help him achieve what he wants to achieve, he says he will buy. When it replaces machines, the company seeks to sell the old ones. If it can't find a buyer, it separates out the components for recycling.

Environmental concerns on the doorstep

Midori Hokuyo's location is interesting. The tannery is on the outskirts of Yamagata City and is surrounded by farmland where, mostly, vegetables and rice grow. But the surrounding high mountains are easily visible with the naked eye from the building. These include Mount Zao, the most active volcano in the region, but a popular area with visitors from all over Japan and from overseas for winter sports. It's more than 1,800 metres high. Mount Gassan, on the other side of the tannery is even higher (by a few metres) and also attracts skiers and snowboarders in spring (it usually has too much snow in winter to be accessible) and hikers in the summer. Knowledge of these mountains and of the national park areas around them is high inside the company: chief standards officer, Goro Yamada, is an official mountain guide, taking tourists up Mount Gassan in his spare time. In 2012, he organised a trip up the mountain for workers in the tannery and 20 people joined the party. The fauna and flora, as well as the views, are worth the effort he feels. Antelope are a common sight and he has found himself no more than 20 metres from bears on occasion.

The Sakasa River runs right beside the tannery, with a small dam used for irrigation of the agricultural fields that surround the



site. There is a mix of trees planted along the perimeter of the tannery with a seemingly random, but entirely deliberate, distribution of species so that no two trees of the same type are beside one another. The company's policy is that this is nature's own defence because problems of disease or infestations of insects are far less likely to spread from one species to another. It's proud of having chosen this way to mark its boundaries, rather than use a fence or a wall.

Once a year, local farmers and other representatives of the community attend a meeting at Midori Hokuyo. They watch a presentation of what the company has been doing, with results of effluent analysis and so on, and have the chance to raise any concerns they have. "Rice fields are very sensitive," Toshikazu Suzuki says. "No pollution would be tolerated." Managing director, Sho Sasaki, points once again at the mountains that form the backdrop to this area, and says: "We simply cannot mess up this environment."

Yamagata is in the same region, Tohoku, as Fukushima, where cooling systems at nuclear power plants failed after the earthquake and tsunami of 2011, which had a confirmed death toll of almost 16,000 people and caused damage to an estimated 130,000 buildings.

Saving energy, a continuous activity at the tannery and at most companies in Japan, has become even more important since the 2011 earthquake. Power-generation from most of the country's nuclear power stations has still to get back under way, so the country is having to import more oil and gas (it has none of its own) than before the disaster. Inevitably, this is having an impact at Midori Hokuyo. One simple example is in the drying department. A few years ago, it ran five infrared drying compartments all the time. Now it tries to use only what it really needs and has found that three of the five compartments are enough in summer and four in winter.

Local people are keenly aware of the vulnerability of the earth. Like many local businesses, Midori Hokuyo was a donor to survivors affected by the devastation. And it acts locally too. Once a year, the workforce goes out into the surrounding countryside to pick up litter and clear clogged up ditches. It sponsors a local semi-professional soccer team.

In terms of sports participation, being part of a bigger group means there are

tournaments in which different Midori companies compete against one another. Volleyball is popular, so are snowball competitions in winter. Once a year, in summer, all employees and their families are invited to attend a company picnic.

More competitive

Sho Sasaki's opinion, formed by hearing group president, Fujio Matsumura, repeat the message frequently and forcefully, is that what makes Midori Hokuyo stand out is that its closeness to the Kaizen culture of the big Japanese automotive firms has enabled it to make their commitment to quality and constant improvement part of his company's way of working. "We are

trying, through small individual Kaizen activities and our QCC initiatives, to be the best cost-performing tanner in the automotive sector," he says. "Having the workers think about this so deeply, and the ideas they come up with as a result, is helping to make us a better company. We know that if we are not as competitive as we can be, we will not have a future. Quality is very important, but we have to be thinking all of the time of ways to become more competitive. This is the culture of the automotive industry and is, therefore, our culture, and as long as the Japanese automotive companies continue to make cars in Japan, we will keep this going." 🌐

Control and Accreditations



LABORATORY SERVICES

Over and above inspection, a full range of tests are performed at the onsite laboratories that include heat tests, light fastness, various rubbing and abrasion tests, and fogging tests. Specialised equipment includes FT-IR and SEM microscopes. A full range of environmental analysis is also performed to support control within effluent treatment.

ACCREDITATION AND AWARDS

- Quality: ISO9001, 2006 (Bureau Veritas)
- Environmental: ISO14001, 2002 (Lloyd's Register Quality Assurance Ltd)
- Safety and Health: OSHMS (Japan Industrial Safety and Health Association)