

Tracing the origin of hides

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The September-October issue of *World Footwear* featured an article on counterfeiting and traceability which included a reference to developments by French research organisation CTC. As the use of leather continues to be under so much scrutiny, a fuller explanation of these developments should be of interest to readers as a simple, reliable and financially viable traceability system. It would provide tanners and footwear manufacturers with an essential tool for supply chain security, enabling them to respond appropriately to increasing societal concerns. After ten years of research, CTC now has a complete solution that allows players in the industry to face this major challenge.

In a world in which hides with few defects are rare, it is important to improve the quality of leather through sustainable corrective actions, from the birth of the animal to the tannery, including transport, flaying and conservation. The comprehensive solution that CTC has developed and is currently industrialising and implementing has benefits that include reliable knowledge of the origin of finished leather, securing supply sources through partnerships and access to information pertaining to animal welfare. The system can be broken down into four separate phases.

PHASE 1 Securing the transfer of meat traceability to hides

Ideally, the system relies on the meat traceability requirements that are enforced in most industrialised countries. Where there are none, slaughterhouses can generate a unit identification code. The CTC solution's first phase therefore consists in transferring this unitary identification number from the animal to the hide. This phase must take place on the slaughter line before the flaying station, so as to reliably keep the traceability chain continuous (*Title image and Figure 1*).



There are two options. The animal's ear tag is instantly and autonomously flashed. A label is then printed in real time, which the operator attaches to the hide's flank, thus allowing it to be tracked until the next phase of the process. Alternatively, the printer is directly connected to the slaughterhouse's digital management system, which will initiate the order by issuing a label with the unit identification number of the hide so that it is present at the pre-flaying application station. The cost of this equipment is relatively low (less than €4,000) and the cost of consumables is very low at around seven cents per printed label. This first phase allows small slaughterhouses to transfer meat traceability on to hides so as to provide reliable traceability for clients at an economically viable cost. It also allows large slaughterhouses to ensure the continuity of traceability between the slaughter lines and the salting workshop where hides can be marked at their core.



Figure 1: Industrial use of labeller in a slaughterhouse.



Figure 2: Laser marking on an automatic industrial line.

PHASE 2

Securing the transfer of traceability by marking the at hide at its core

It was quickly noticed that no label or matter added onto the hide could resist or survive the tannery process, which means the unit mark must be copied into the core of the material. CTC has therefore opted to transfer it there by means of an innovative technology that fits right into our industry: laser marking (Figure 2).

A high-power CO₂ laser marking system has been developed. Transferring a 14-character code to the core of the hide by marking on the hair side takes only a few seconds, making it possible to fully automate the operation and complete it at some point during the process of salting or sorting raw hides. After several studies, it was agreed that the best area for marking was on the shoulder, 15 cm to the left of the back line and 10 cm below the hide's edge. The cost of the industrial system deployed in several French slaughterhouses and tanneries ranges from €100,000 to €150,000 depending on the level of automation and integration chosen.

The marking process has proved itself on bovine leather (ranging from calf to bull) and exotic hides and skins (alligator, snake, etc). Tests are also currently under way on lambskins. This operation can be carried out at all stages from the extraction of the hide on the slaughter line to tannery entry if

the hide bears a label as described under Phase 1. Another crucial point in the success of this solution is the form and nature of the marked code, which must respect a strict typology defined in terms of size and type, marking power according to animal species and code structure (number and length of each line and information carried by each line). All these settings are crucial to achieving very high automatic reading rates in the next phase.

PHASE 3

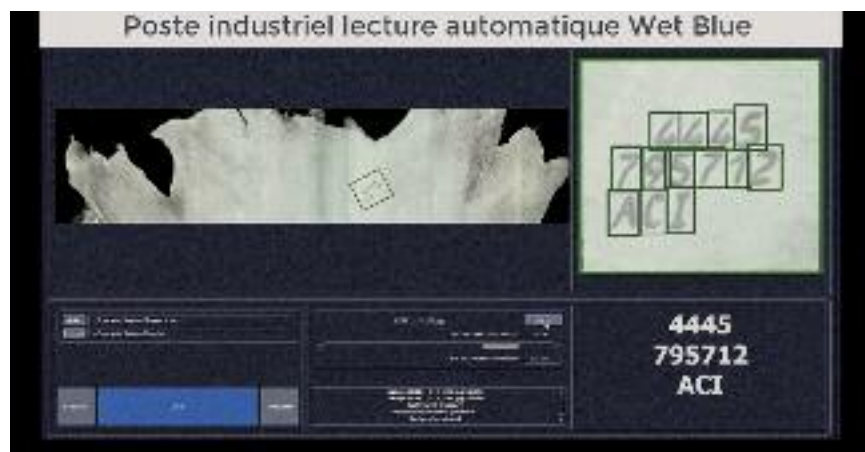
Automatic reading of the mark from the tanned stage onwards

After tanning, each hide or skin is inspected. During the feasibility study, it was possible for an operator to read and copy the hide's unit code and note down any defects along with it. This process cannot realistically be exported

to an industrial operation, as it would take too long and lack reliability. CTC has therefore developed automatic mark reading stations for use during the sorting operation, first at the tanning stage (wet blue or wet white) and then at later stages of the process. For this purpose, various leather image acquisition stations have been developed to suit the different configurations of sorting stations at each tannery. To date, there are three types of acquisition station, all of which use algorithms based on artificial intelligence (specifically neutral networks). More common OCR-type image processing algorithms could have been used but the results would not have met expectations.

The solution developed by CTC makes it possible to recognise alphanumeric characters set in the hide, even when they were only partially marked or were warped during tanning. This integrated intelligence allows reading rates to be achieved for more than 90% of production. With a well built base, this approach allows for better efficiency than human operators could achieve in deciphering marks. Automation makes it possible to adapt to the vast variations in the quality of markings that result from the processes of individual tanneries.

The first acquisition station, which is the least technically complex, made it possible to carry out the feasibility study and algorithmic modelling. It is composed of an area scan camera and a portable grazing light (Figure 3). The operator places this station on the mark and presses a button to trigger the image capture. The system then automatically locates and rotates the



An example of the automatic wet blue stage mark reading system using an in-line camera.

mark, decodes all the characters and sends it to a piece of software to be associated with the defects found on the hide. The second acquisition station, which is fully automated, is designed for tanners equipped with a conveyor and an automatic stacker unit for sorting. Each hide passes under a linear camera and a grazing light, allowing for an image of the whole hide to be reconstructed and the algorithms then automatically search for the mark, rotate it and decode it to store the code in a database. The latest acquisition station, which is again fully automated, is intended for tanneries that sort hides piled on a pallet placed on a lifting table in front of the sorter. This station consists of a simple, very high-resolution area-scan camera and a specific light. It scans the shoulder and the entire decoding operation is carried out by artificial intelligence algorithms that adapt to changes in image capture conditions over the course of the sorting operation. The feasibility study for this station is currently coming to an end and has yielded promising results. In all cases, algorithmic processing takes about one second, which is much less time than is needed to sort a wet blue hide and determine its quality potential.

Following this series of studies, a harmonisation phase has allowed CTC to generalise the algorithm to all acquisition stations. This algorithm is being improved as the learning curve progresses, thus ensuring that the solution is optimal and scalable over time. The technology can also be applied to exotic hides so as to transfer the CITES



Figure 3: Matrix camera automatic mark reading device.

tag's code to the core of the material and remove the tag itself, thus making it possible to work on the entire skin. The algorithms developed in this third phase have all been patented by CTC.

PHASE 4 Centralised management system for material quality and traceability data

The last phase of the proposed comprehensive solution is to set up a data management system. To do so, two solutions are currently offered. The first is to use a regular database, in

which information only flows downward. This solution aims at improving hide quality. With this in mind, CTC has defined a quality standard for hides, in collaboration with tanners and abattoirs. This 'raw material quality' data architecture, combined with a single and complete tracking solution going back to the animal's birth, opens up possibilities to implement quality charters specifying the origin of raw materials and providing information pertaining to animal welfare.

The second data management solution consists of implementing a generalised information management system for the entire supply chain based on blockchain technology, which allows digital information to be distributed but not copied. The principle would be to connect all the CTC tools described here within this blockchain in order to automatically feed it with reliable and non-declaratory information.

The blockchain will be secure and guarantee safe storage of data entered by all participants in the database. In addition, many types of information pertaining to the craft could also be integrated such as the dates of interventions for corrective action or notes on defects found on wet blues. This type of implementation (regular or blockchain database) makes it possible to meet all of the traceability project's goals including improvement of hide quality, animal welfare, origin of hides and full monitoring of the supply chain. 🔗

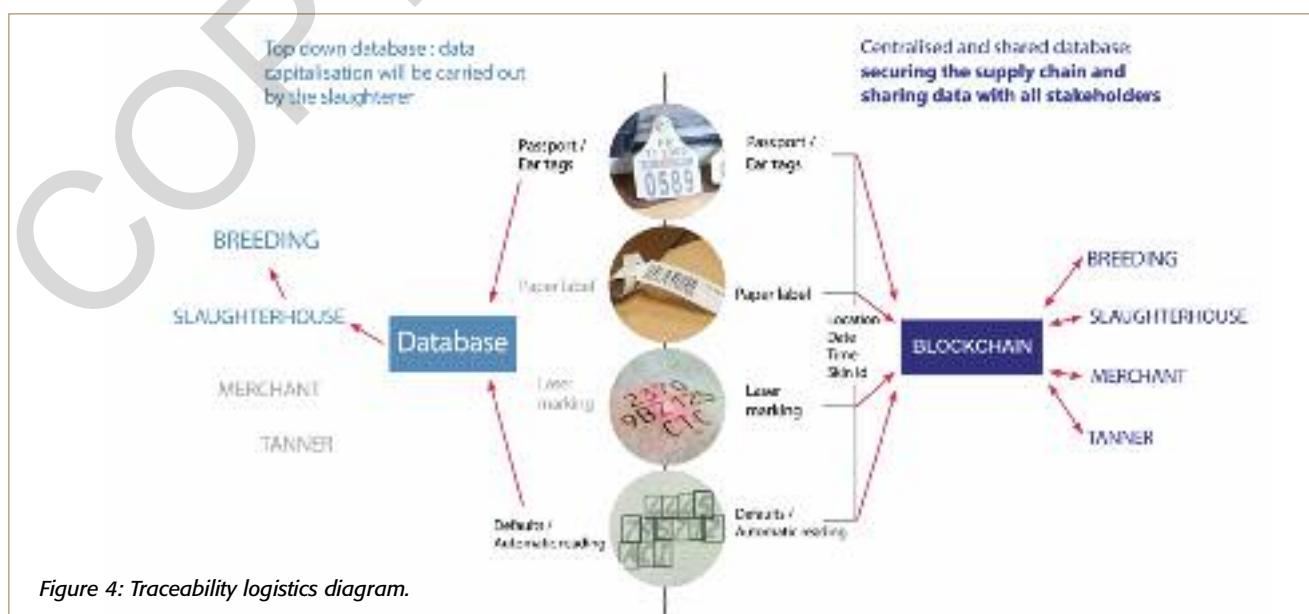


Figure 4: Traceability logistics diagram.