Tire Track Identification

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Abstract

Tire Track Identification is based on different software products today. The aim is to find the car type and/or the mounted tires on the car of a suspect based on a tire track from a crime scene.

During the last decades, the “Tire Book”, with about 5,000 printed tire patterns, was the only way to find the identity of a tire from a corresponding tire track.

The “Tire Database” is now available on two different standard software platforms - Access and Excel. It was developed in cooperation with ENFSI (European Network of forensic Science Institutes). To find 1 tire out of about 15,000 you have 7 different search criteria, so all in all there are about 3 million possible variations. The result is a short technical description of the specific tire, a Figure of the tread pattern and its classification. The history of each tire will give important information on patent disputes.

The “Car Database” is available in standard Excel-format for worldwide use. The database is based on the original tire equipment of cars at their delivery. Conversion tables will help to find corresponding tire sizes on the legal and illegal replacement market. About 12,000 different passenger cars, SUVs and light truck models of more than 300 different car manufacturers are listed. Wheel base, front and rear track and the tire size of the original equipment are listed for search.

The tire database is used by “TreadMate”, a product of our partner Foster&Freeman, too. All products are updated annually.

Introduction

“Each tire on the street is unique … that is the strategy of our business”

The identification of tire tracks at crime scenes has become very popular during the last 20 years. A positive identification of a specific tire pattern and the car of the suspects are very difficult because of our global tire and car market. With the help of modern IT equipment it will be more efficient for the investigators of forensic tire impression to analyze crime scenes [1-4].

Our product, a worldwide car and tire database, is focused on the Worlds market. That is necessary because approximately 60% of tires in the replacement market of the United States are imported from Europe and Asia. For easy use we decided to use a standard database format: Excel® and/or Access®.

The target of our database is mainly the identification of tire patterns, but they can also be used for copyright violation, mainly by Asian companies, and information on the import and export market of tires.

The foundations of each crime scene examination by our software are photographs or castings [1,5], including measurements from the pattern found (reference scales). The pattern can be taken from almost any surface. Mainly there are tire tracks on solid ground, sand, snow or mud, but we also have Figures of patterns on the skin of a person, imprints on the inside of trousers and objects lying on the street which were driven over by the car.

The first step is to classify specific properties of the pattern. The 7 classification criteria are: Vehicle type, pattern type, structure, center of the tire, circumferential groove near the centerline, characteristic of main blocks and shapes of main fine cuts.

Normally you will get between 1 and 15,000 results. In that case (normally up to 10 results) you have to manually compare the Figure from the crime scene to the photos in our database.

For further information on the specific footprint you have to know some technical details of cars, tires and a basic knowledge in physics. Knowledge [2,6-9] of the influence on air pressure, irregular wear, load of car, regular wear based on millage and condition of shock absorbers can narrow your result.

For the identification of vehicle tire tracks at the crime scene, you can measure the wheel base and front and rear tracks. The quality of these measurements depends on the soil texture, the axle design of the car and its weight. Based on the tire size of the original equipment of the car at its delivery, other sizes are permitted on the replacement market.

In most criminal cases cars are involved. That is why it can be helpful to know more about the car and its tires quickly. Our databases of cars and tires are a useful resource for crime scene investigators to find specific cars and tires at a crime scene.

Materials and Methods

There are 2 main fields in identification:

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- Identification of tire pattern
- Identification of a car by its track on the ground

Tire identification

The first step in tire identification is to get a high resolution photo or a cast from the crime scene, including a measuring tape [1,5] to show scale (Figure 1).

For the identification our company offers 2 different possibilities – manual or electronic searching [10,11].

Tire book (manual search): The tire book is a list of about 5,000 different tire patterns from all over the world in the following categories:
  * Passenger car tires (new and retread pattern)
  * SUV and light truck tires (new and retread pattern)
  * Agricultural tires
  * Industrial tires

Tire Figures will be given by the industry in different resolutions and qualities. The patterns are sorted by type (see list above) and company. Tires older than 10 years are taken out due to the quantity (limitation: 400 printed pages with about 8000 Figures). A short technical description is included (Figure 2).

The correspondence to the Figure from the crime scene must be done manually.

Tire database (Electronic Search): The 2013 database contains 15,838 tire patterns from 357 different tire companies worldwide.

The data in the database is the same as in the book, but there are the differences in:
  * Quantity: no tire will be taken out (present: 15,000 pattern)
  * Including motorcycle tires
  * Searching criteria on tire name and/or producing company
  * Searching criteria on pattern characteristic

Pattern characteristics
  * Vehicle type (e.g. passenger tire)
  * Pattern characteristic (e.g. directional pattern)
  * Structure of tire pattern (e.g. snow tire)
  * Center of the tire (e.g. groove)
  * Circumferential grooves at the center (e.g. straight groove)
  * Shape of blocks (e.g. V-Shape – letter design)
  * Shape of fine cuts inside the blocks (e.g. curved)

An electronic manual is added to the database. There you will find detailed instruction for using the filter functions.

As a result you will get 1 or more goals for your search. In Figure 3 (bottom, left) you will see the result in the Access version.

The results of Access and Excel version are equal. It is subject to the user which program they want to use (Figure 4).

Car identification

The 2013 database contains 12,706 different car models from 191 car producers worldwide.

The database is written in excel format. Based on car producers and model, front and rear track and wheelbase are listed (Figure 5). The given tire size is the original equipment which is used on the new car. This tire size should be the same for the delivery in every country. It is known that some countries use a replacement tire size.
Figure 4: Database in Excel format.

Figure 5: Car dimensions (here in [mm]; [inch] available).

Figure 6: Example of a tire track on the road (60,42" = 1535 mm).
Figure 6 shows a front or rear track on a paved road. On unpaved roads you will normally find front and rear track including the wheel base. Depending on the axle geometry you can sometimes decide if the car was used under full load. In one crime case, some years ago, it was important to know, if the stolen car was still under load.

The Excel database in Figure 7 is listed in [mm] and [inch]. In column K you will find the typical original equipment tire size.

For the replacement market there is a separate database to find equivalent tire sizes. Regarding to law you should use the same diameter of tires. If somebody does not use the diameter of the original tire size, it is nearly impossible to find the corresponding car.

**Database library**

Figure 8 shows the main menu (a pdf file with links) of our “Database Library”. Each button will open an Excel or Access file or the “tire book” in pdf format. A link to our website <http://www.tgi.co.at> and mail address <lux@tgi.co.at> is included.

**Content of database library**

* Top left: 3 different versions of the car database (book, excel and access)

* Top center: car database
Summary

To find a car or tire involved in a crime it is easy to use the databases to get preliminary results. No database will replace person evaluating the results. The aim of our databases is to reduce time for the crime scene team in order to get an overview of relevant tire tracks and start the search for the involved vehicles.

The database is written in standard Microsoft format "Excel" and "Access" so that it can be used worldwide.

References