CASE STUDY

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Michelin Increases Daily Production by 1150 Tyres

WITNESS simulation software has helped to bring substantial improvements in productivity and operational processes to Michelin's tyre manufacturing plant in Dundee, U.K., one of the company's biggest production plants in Europe. With the help of WITNESS, Michelin has been able to achieve a five per cent increase in product flow, streamline the tyre curing press lines, and reduce cycle times on the tyre-making process to reveal a potential production gain of more than 12 per cent.

"WITNESS is fast, and easy to use. It has proven invaluable in optimising product flow, reducing cycle times and increasing production, and in providing justification of capital expenditure."

- Colin McIlraith
XM Services

The WITNESS simulations were undertaken by XM Services, Michelin's consulting division. Set up five years ago and now employing more than 130 people, XM Services has a separate department dedicated to productivity improvement and change engineering, an area in which Michelin is traditionally very strong.

Since Michelin's Dundee plant began operating in 1972, output has more than doubled (now at 24,000 tyres a day) and daily product diversity has increased more than tenfold—from four different tyre types to more than 50. The production of a tyre involves several processes. The timely and coordinated flow of items between them is critical. The plant's output has become determinant on the constraints imposed on product flow; WITNESS has been used to help solve them.

Improved Storage Management

To improve the flow of the increased volume and diversity of tyres between the make-up and curing processes,

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Company	Michelin
Industry	Motor Vehicles
Application	Production Process Improvement
Benefit	1150 More Tyres Produced Per Day

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Michelin proposed to install FSBT (the French acronym for Flexible Tyre Store Unit), a new, fully automated storage, retrieval and conveyor system, at a cost of over £1.75 million. WITNESS was brought in at the feasibility study stage to simulate the proposed solution—and validate the capital expenditure. WITNESS was used primarily to examine the stockholding between the two sections of the plant. The simulation looked at the effect of a proposed expansion in the capacity and flexibility of the multi-tier storage matrix to cope with the increased production volumes and wider diversity of product type.

"We needed to see the effect of the increased stock capacity on product flow," says Colin McIlraith, XM Services' manufacturing systems consultant. "We had to ensure a balance in the FSBT. For every tyre type, for example, each of the tiers in the storage matrix goes through three modes: empty, tyre entering, and full. With WITNESS, we could see the status of the tiers at a glance."

The screen image of the WITNESS model is designed for clarity and ease of use. In the case of the FSBT system, simple lines depicted the conveyors between the storage area and production, with clear graphic indication of the storage bins' status (full, filling or empty).

Running the WITNESS model through a variety of "what-if" scenarios, XM Services determined that adjustments in the mix of product types going through storage would provide the improvement in product flow that had originally been predicted. "WITNESS provided quantitative backup to the logical arguments for the new system," McIlraith reports. "It gave a visual image to help convince doubters of the implications of the proposals, and provided additional weight to the financial justification for the modification."

Since the FSBT system went live, product flow has improved by five per cent—the equivalent of an extra 900 tyres a day. More importantly, it is able to cope with a wider diversity of tyre types than previously possible, with the capacity for even more. The new system has given the Dundee plant one of the best flow rates of all Michelin car tyre plants worldwide.

Increased Throughput in Curing Process

The increasing diversity of tyre types also seemed to be causing problems in the curing process. The Dundee plant has 132 presses in which the tyres undergo curing. Uncured tyres are fed onto the press lines (12 lines each with 11 presses) by an automatically guided vehicle (AGV). Different types of tyres require different curing times, between seven and 15 minutes. With so many tyre types going through the system, Michelin suspected that the variations in curing time, with many presses remaining idle while others were operating flat out, was disrupting throughput and preventing the plant from operating at full capacity.

XM Services turned to WITNESS to discover the truth. "There was no general agreement as to whether varying curing times really did interfere with throughput," says McIlraith. "Our aim was to reduce cycle times and increase throughput, and we needed to know if the plant could cope. But first we had to get a clear picture of the plant's current performance. It was impossible to depict the plant's operation graphically, through Gantt charts, for example. But WITNESS was the perfect tool."

A model was created with graphics showing the press lines, the AGV feeding the lines and returning to collect uncured tyres, and the curing vessels in their open, closed or waiting status. "WITNESS was brilliant in enabling us to run a whole range of 'what-if?' scenarios," says McIlraith. "We tested as many as 30 different options. And it was quick, too; we could simulate a day's production in less than 20 minutes. It was as close to reality as you could get."

WITNESS proved conclusively that interference was occurring. It could clearly be seen on screen

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that the slower-cure vessels were delaying flow, with other presses waiting empty for long periods. The model revealed that this interference was reducing potential capacity by up to five per cent. Michelin was able to make adjustments to the process, mainly in the location of presses where the curing times were similar, to minimise capacity-reduction to between one and two per cent. This equated to a gain in production of up to 200 tyres a day.

"With WITNESS, we were able to persuade the sceptics that there was real interference, and could identify the means to minimise its effect." McIlraith reports. "More importantly, perhaps, with a clear understanding of all the constraints, we were able to create accurate rules for planning the plant in the future to ensure minimum disruption."

Choosing the Right Option to Hit Production Targets

A WITNESS simulation was also used for Michelin's MAC (Machine Automatique de la Confection, or Automatic Fabrication Machine), the Dundee plant's main tyre-building process. Michelin wanted to reduce cycle times on the MAC to boost production from six tyres per minute to more than seven tyres (7.4 tyres per minute was the actual target). Two proposals were presented. The first was to increase the physical speed of the process; the other was to change the operating sequence of the MAC. WITNESS was used to make a comparative analysis of the two proposals.

Tyres are transported between processes on the MAC by carriers called "tambours." Full tambours travel along an overhead track, empty units return on a lower track, with elevator cages at either end of the machine. There was a suspicion that the speed differential between the movement of empty and full tambours, and the timing at which they arrived at the cages, was causing delays.

"If indeed this was the case, increasing the speed of the operation would not help boost throughput," McIllraith explains. "In fact, it could have the opposite effect. But because of the sheer size of the plant (the MACs are almost 55 feet long), it was virtually impossible to see where any interruption was occurring."

XM Services built a WITNESS model of the existing plant process, with details of the process stations, the tambour feed and return, and the interface with the cages. The model was then run at increasing speed. It showed that the process peaked at 6.8 tyres a minute, short of the target. Alternative scenarios were simulated but, while marginally increasing throughput, they still fell short.

A second WITNESS model was then built to assess the other option; changing the operating sequence. This involved developing a new logic for the machine's return track and its interface with the cages. By testing various options in WITNESS, it was revealed that, with the addition of just one extra tambour, the MAC could achieve the goal of 7.4 tyres a minute. This represented an increase in productivity of around 12 per cent, equal to 50 tyres an hour. WITNESS also showed that the plant could be run at lower speed, while still achieving the target figure, which meant improved reliability.

The changes to the operation sequence have now been implemented on one of the MACs, and the system is currently under assessment. "The key benefit of WITNESS is that it's probably the most effective and easily understood way to evaluate complex systems where there is a lot of interdependent equipment," says McIlraith. "WITNESS is fast, and easy to use. It has proven invaluable in optimising product flow, reducing cycle times and increasing production, and in providing justification of capital expenditure. And it's very useful in convincing sceptics that proposed solutions will work. WITNESS is a powerful weapon in our arsenal."

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