

Three car models, two lines, one solution for Nissan



Lanner's WITNESS simulation software has helped Nissan achieve the formidable task of shoe-horning the production of three separate high-volume models into just two assembly lines at its Sunderland plant in the United Kingdom. By the close of the 1990s, Nissan's Sunderland plant, Europe's most productive car factory, was producing the Primera and Micra models on two separate assembly lines. When the Almera mid-range hatchback was launched in 2000, the company decided to integrate its production into the existing two-model plant configuration rather than add a third assembly line. The Almera had to be introduced without disrupting existing production.



Initial engineering evaluations indicated that it was feasible to produce three models on two lines, but Nissan then needed to examine in fine detail how each model should be sequenced through the various stages of production. "This was such a complex task that it was impossible to do manually," explains Paul Wreglesworth, Nissan's production controller. "Creating a computer model to simulate the processes was the best solution, and with its proven track record in the manufacturing industry, particularly in the automotive sector, WITNESS was the obvious choice."

Working closely with engineers, Wreglesworth's team created separate WITNESS models for the main line and sub-assembly facilities—the body shop, paint shop and trim shop—on both the existing production lines. The fundamental premise was that the Primera and new Almera models would move down separate lines; the Micra would share the Almera line and also be able to switch between both lines.

"WITNESS has been invaluable in enabling us to understand the scheduling and try a range of 'what-if' scenarios to ensure we make the right decisions. Since the introduction of the new system, production volumes of all three vehicles have gone up."

— Paul Wreglesworth, Nissan Motors

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Company	● Nissan Motors
Industry	● Automotive Manufacturing
Application	● Assembly Line Efficiency
Benefit	● Three Models Assembled on Two Lines

The WITNESS models were not concerned with achieving target volumes. What was critical, however, was establishing efficient new body build sequencing to accommodate all three models (and their numerous variants) and identifying and eliminating potential bottlenecks.

Building a realistic model

Nissan identified three sets of issues that would have to be addressed when developing the WITNESS models. First, Nissan determined which elements of the assembly process would need to be modeled and to what level of detail. Three distinct areas were identified: the main line and sub-assembly facilities, and the buffering arrangements. "Real life" data on cycle times within these processes was supplied by the Engineering department and validated by the Production department. Then the "inter-elemental" logic had to be specified—body movements in the body shop, sequencing in the paint shop and the prioritization protocols in the buffer storage areas.

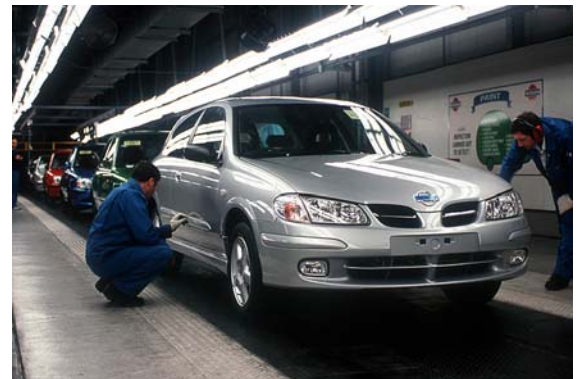
Second, Nissan had to examine the proposed weekly working patterns to accommodate the three models, taking into account strip-out operations. The question of breakdowns also had to be addressed, initially using actual data gathered from the existing Primera and Micra assembly operations and then developing predictive breakdown profiles taking into account the integration of the new Almera assembly.

Finally, Nissan turned its attention to creating input schedules, which in turn led to the development of work in progress (WIP) schedules. "By the time we arrived at this stage, we had a clear understanding of the output data required of the WITNESS model to quantify production volumes, to identify the efficiency of the various facilities and predict stoppage times, and to assess WIP levels," says Wreglesworth. "More

importantly, we could predict the accuracy of achieving the most efficient sequencing of the three models down the two lines."

Challenges in body, paint and trim

The body, paint and trim shops all presented individual challenges that the WITNESS model helped to address. In the body shop, the objective was to maintain the correct sequences at the merge-points with the engine compartment and manual assembly (mainly for the Micra) lines, and to clearly identify possible bottlenecks. These could, for example, be caused by the longer assembly cycle times involved in the Almera build, or certain sequences falling out of sync to impair throughput.



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In the paint shop, Nissan had to look at the questions of quality control reject rates after touch-up and the timely delivery of the jigs to carry individual vehicle panels through the process. Again, sequencing was critical to sustain efficient flow through the ovens. Sequencing logic was vital in the trim shop too, simulating the *douki seisan* ("ideal manufacturing system") concept recently adopted in Nissan plants worldwide.



Making sure the right decisions get made

WITNESS has played a substantial role in enabling Nissan to gear up for and sustain the successful production of three models on two assembly lines. For the Body Shop operations, it has enabled Nissan to assess the impact of schedule mix and loss of sequence, and to devise action plans to handle breakdowns. In the Paint Shop, "first-time OK" rates have risen to minimize disruptions. The capacity to accommodate and resolve breakdowns has also been improved. In addition, recirculation levels in the Trim Shop have been cut and the levels of vehicles held have been reduced.

Says Paul Wreglesworth: "The *douki seisan* concept aims to reduce lead-time throughout the entire supply chain, from customer order to delivery of the finished vehicle. By accurately predicting the time and sequence in which vehicles are built, order lead times, finished vehicle stocks, inventory and distribution costs will all be reduced. Adding a third model to the two existing lines at Sunderland has significantly increased the process complexity and necessitated a radical new 'time and sequence' system. WITNESS has been invaluable in enabling us to understand the scheduling, and try a range of 'what-if' scenarios, in the light of an enormous number of variables, to ensure we got it right.

"WITNESS is continuing to help the company's engineers monitor and fine-tune operations. Since the introduction of the new system, production volumes of all three vehicles have gone up."

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