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Integrated automotive manufacturing supply

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ABSTRACT

Integrated automotive manufacturing supply

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Supply planning and traffic flow planning are major activities in the automotive manufacturing environment worldwide. Supply planning directly influences the traffic within a manufacturing plant. The impact of supply planning strategies like Just-in-Time, Just-in-Sequence and Direct Supply on plant traffic is rarely considered, as supply and traffic flow planning are traditionally seen as separate activities.

BMW SA and other automotive manufacturers are facing various specific problems relating to supply and traffic flow planning. One of these problems is in selecting the best supplier transportation medium among various alternatives for the supply of each part family, taking into account the effects on plant traffic. Several variables have to be considered during this decision making process, and no concrete decision support tool exists at present to assist during this process.

Another specific problem faced by automotive manufacturers today lies in accessing the impact of physical relocation decisions on plant traffic. Several proposed plant layout changes and changes to the location of

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supplier delivery points exist for BMW Plant 9 in Rosslyn. These proposed changes will imply large relocation expenses, and will inevitably have a major impact on the traffic flow within the plant. The respective impact of these proposed layout changes have to be investigated, analysed and compared.

Tools developed during this project will assist automotive manufacturers during the supply planning phase of their logistics planning process. Even though these tools can function independently, their real value is only realised once they are used in conjunction with each other as a Decision Support System (DSS) (see *chapter 6: Decision Support Systems).* In essence, this DSS consists of a Supply Medium Decision Support Tool (SMDST) and a traffic flow simulation model.

The effects of certain decisions considered during the supply planning process (as described in *Chapter 2: Problem Statement*) and the impact of these decisions on plant traffic can now be systematically evaluated (see Figure A):

- Firstly: by means of the SMDST, which provides critical information about the cost implication and number of deliveries required for all possible combinations of part families and delivery vehicles used
- Secondly: the simulation model's input data file can easily be updated in accordance to the SMDST's information in preparation of a new simulation experiment
- Thirdly: the traffic flow simulation model can be run. The model will automatically use the updated input data file and create unique results files for the scenario currently under analysis
- Fourthly: the simulation model's results files can be viewed and compared to those of previous scenarios

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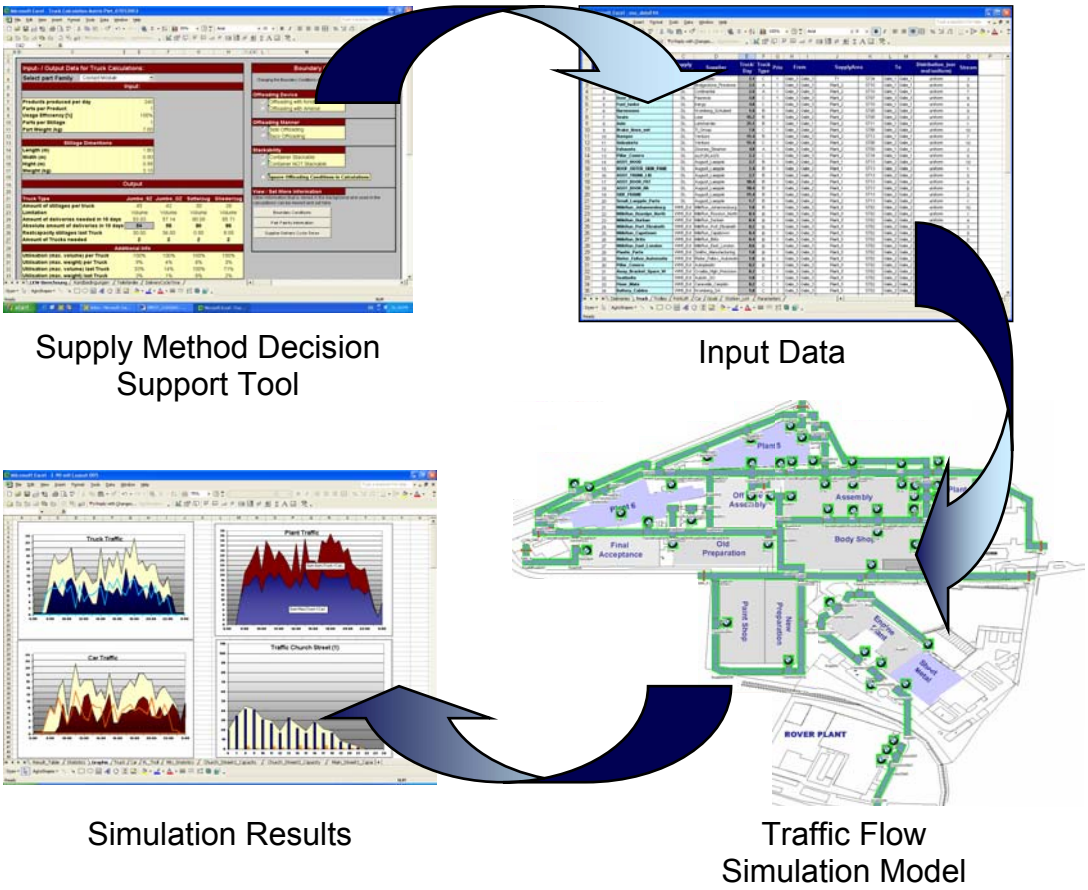

Figure A: Overview of supply and traffic flow Decision Support System (DSS)

All the user requirements as stated in the user requirements specifications (sections 8.2 and 9.2) have been met. Every component of the DSS was developed generically as far as possible, allowing the user to adapt it to other similar manufacturing plants with relative ease.

By utilising this DSS, scenarios can be evaluated and compared faster, more efficiently and by means of more quantitative measures than before, considerably reducing uncertainty and risk of planning. Certainly, this system supports automotive manufacturers in their quest towards manufacturing excellence in an ever-increasing internationally competitive and complex environment.

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OPSOMMING

Integrated automotive manufacturing supply

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Verskaffingsbeplanning en verkeersvloeibeplanning is belangrike aktiwiteite in die motorvervaardigingsbedryf wêreldwyd. Verskaffingsbeplanning beinvloed die verkeer binne ‘n vervaardigingsaanleg direk. Die uitwerking van verskaffingsbeplanningsstrategië soos “Just-in-Time”, “Just-in-Sequence” en “Direct Supply” op aanleg verkeer word selde in ag geneem, aangesien verskaffings- en verkeersvloeibeplanning tradisioneel as onafhanklike aktiwiteite beskou word.

BMW SA en ander motorvervaardigers ondervind talle spesifieke probleme met verskaffings- en verkeersvloeibeplanning. Een van hierdie probleme is in die keuse van die beste verskaffingsvervoermiddel uit ‘n paar moontlikhede vir die verskaffing van elke partfamilie, terwyl die uitwerking daarvan op die aanleg se verkeersvloei in ag geneem moet word. Talle veranderlikes moet in ag geneem word tydens hierdie besluitnemingsproses, en daar bestaan tans geen besluitnemingondersteuningprogrammatuur hiervoor nie.

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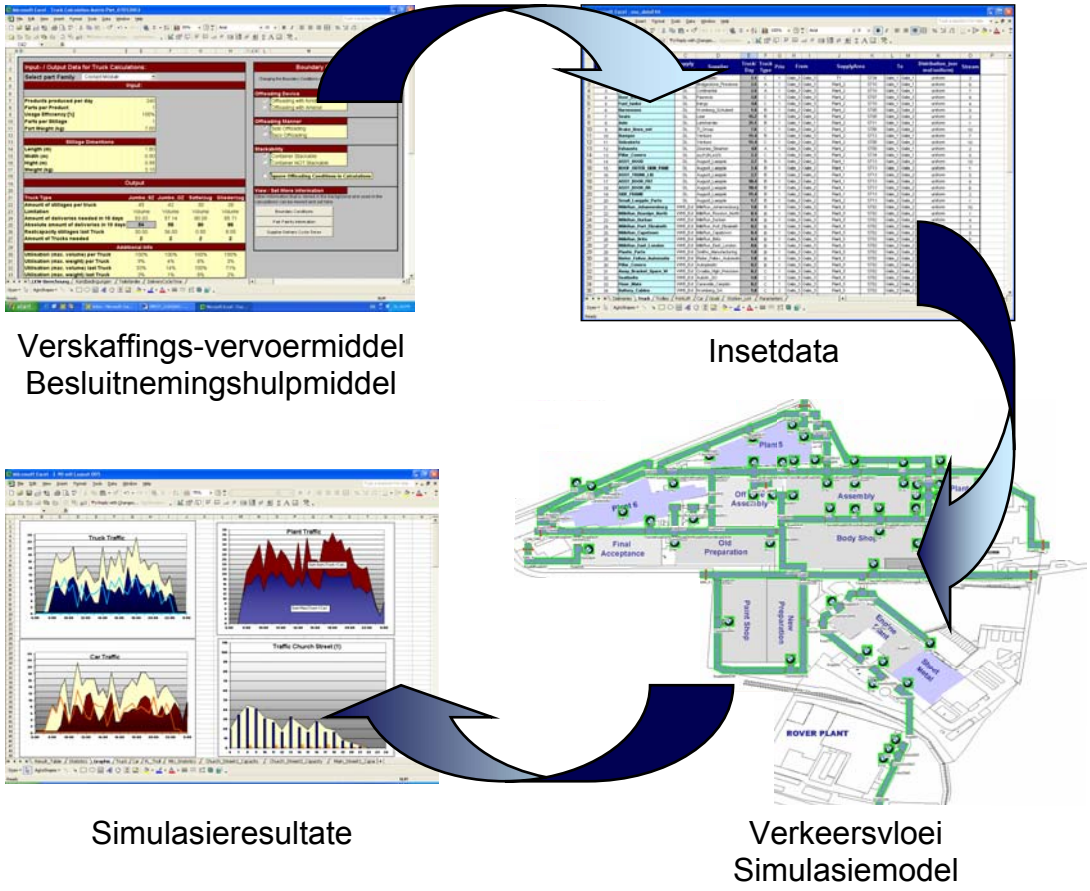
Nog ’n spesifieke probleem waarmee motorvervaardigers worstel is die bepaling van die impak van fisiese uitlegveranderinge op aanleg verkeer. Daar bestaan tans ’n paar voorgestelde uitlegveranderinge asook veranderinge in die posisies van verskaffer-afleweringspunte vir BMW SA se aanleg 9 in Rosslyn. Hierdie voorgestelde veranderinge impliseer groot uitgawes en sal beslis ‘n groot impak op die verkeersvloei binne die aanleg hê. Die impak van hierdie voorgestelde uitlegveranderinge moet ondersoek, geanaliseer en vergelyk word.

Tydens hierdie projek is gereedskapstukke ontwikkel om motor-vervaardigers te ondersteun tydens die verskaffingsbeplanningsfase van hulle logistieke beplanningsproses. Al kan hierdie gereedskap-stukke onafhanklik funksioneer, word hulle ware waarde eers gerealiseer sodra hulle saam gebruik word as ’n Besluitnemings Ondersteuningstelsel (DSS). (sien *hoofstuk 6: Decision Support Systems).* Hierdie DSS bestaan hoofsaaklik uit ’n Verskaffings-vervoermiddel Besluitnemingshulpmiddel (SMDST) asook ’n simulasiemodel van verkeersvloei.

Die effek van sekere besluite wat gedurende die verskaffings-beplanningsproses oorweeg word (soos verduidelik in hoofstuk *2: Problem Statement*) asook die impak van hierdie besluite op die aanleg se verkeer kan nou stelselmatig evalueer word (sien Figuur A):

- Eerstens: deur middel van die SMDST, wat kritiese informasie verskaf oor die koste implikasie en aantal aflewerings benodig vir elke moontlike kombinasie van partfamilies en verskaffings-vervoermiddel
- Tweedens: die simulasiemodel se insetdatadokument kan maklik opdateer word aan die hand van die SMDST se inligting in voorbereiding vir ‘n nuwe simulasie-eksperiment
- Derdens: die verkeersvloeisimulasiemodel kan uitgevoer word. Die model sal outomaties die opgedateerde insetdatadokument gebruik en unieke resultaatdokumente genereer

- Vierdens: die simulasiemodel se resultate kan vergelyk word



Figuur A: Oorsig van verskaffings- en verkeersvloeibeplanning Besluitnemings Ondersteuningstelsel (DSS)

Al die vereistes soos gespesifiseer in die gebruikersvereistespesifikasie (sien 8.2 en 8.3) is nagekom. Elke komponent van die DSS was sovêr moontlik generies ontwikkel, wat die gebruiker in staat stel om dit relatief maklik aan te pas vir ander soortgelyke vervaardigingsaanlegte.

Deur hierdie DSS te gebruik kan verskillende moontlikhede vinniger, meer effektief en deur middel van meer kwantitatiewe maatstawwe as tevore geevalueer en vergelyk word, waardeur die onsekerheid en risiko verbonde aan beplanning aansienlik verlaag word. Dit ondersteun motorvervaardigers se strewe na wêreldklasvervaardiging.

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LIST OF ABBREVIATIONS

AIDC - Automotive Industry Development Centre
DS - Direct Supply
DSS - Decision Support System
DST - Decision Support Tool
JIS - Just in Sequence
JIT - Just in Time
MU - Moving Unit *(can be a truck, trolley, forklift or car)*
OEM - Original Equipment Manufacturer
SMDST - Supply Medium Decision Support Tool
VBA - Visual Basic for Applications