Resource Optimisation for Transportation

Introduction

Systecon Consultants have in-depth knowledge and experience of balancing and optimising resources; manpower, spares, test equipment, to meet the twin objectives of fleet availability and budgets.

Our experience covers the following areas:

- Requirements capture and analysis
- Assessing requirements on Availability and LCC
- Assurance of vehicle reliability/LCC performance during and after warranty
- Project management support
  - Review of the supplier's RAM/LCC/Logistics work
  - Information handling
  - Evaluation of vehicle fleet availability
  - Definition of the maintenance concept
- Warranty verification
  - Organisation, tools and performance
- Support for introduction of maintenance program and resource dimensioning
  - Location and number of Workshops
  - Spares
  - Maintenance plan

If Systecon does not possess a particular skill set it can meet the requirement through its network of specialist partners. Systecon uses a number of tools to aid its consultancy including:

- Capacity analysis
  - Enables visualization of the work load over time
  - Supports planning and identification of the peak work loads
- Resource optimisation
  - Definition the need for resources such as spare parts
  - Determination of the most cost effective spare solution with respect to performance (availability)
- Simulation
  - Verification of the maintenance plan with respect to; time, usage, organization and performance
  - Verification that the maintenance plan will meet the required performance levels

Our approach enables a number of key performance indicators to be met, such as:

- Improved maintenance plan with a balance between Corrective and Preventive Maintenace and the size of the maintenance tasks.
  - Higher vehicle availability
- Balance between performance of CM and PM
- Dimensioning of workshop capacity
  - Number and type of maintenance facilities and resources
  - Location of workshops
- Vehicle usage profile
  - How the profile affects the vehicle fleet availability
- Resource optimisation such as spares
  - Dimensioning of consignment stock
  - Investment in high cost components

AN EXAMPLE OF THE EVALUATION OF A MAINTENANCE SOLUTION

The commuter train operator recently purchased a number of trains to gradually replace older versions. The train deliveries will commence during the second half of 2005 and are to be completed within two years from the delivery of the first train. The requirements on the reliability and total operating cost are extensive, which has lead to commitments from the supplier regarding reliability performance and the operator regarding operation and maintenance.

Systecon was engaged in this project to cover RAM/LCC (Reliability Availability Maintainability / Life Cycle Cost) aspects and to assist in the dimensioning of resources. The model

In order to analyse and evaluate the operating situation and the requirements, the Systecon ILS toolbox has been utilised. This toolbox includes OPUS10™ for deriving cost efficient spare part allocation solutions and SIMLOX for evaluating complex operation and maintenance processes.

To analyse and evaluate the requirements, a train system availability model was built in SIMLOX according to the diagram below. The model evaluates the commuter service availability based on a planned timetable, available resources, reliability performance and the maintenance plan.

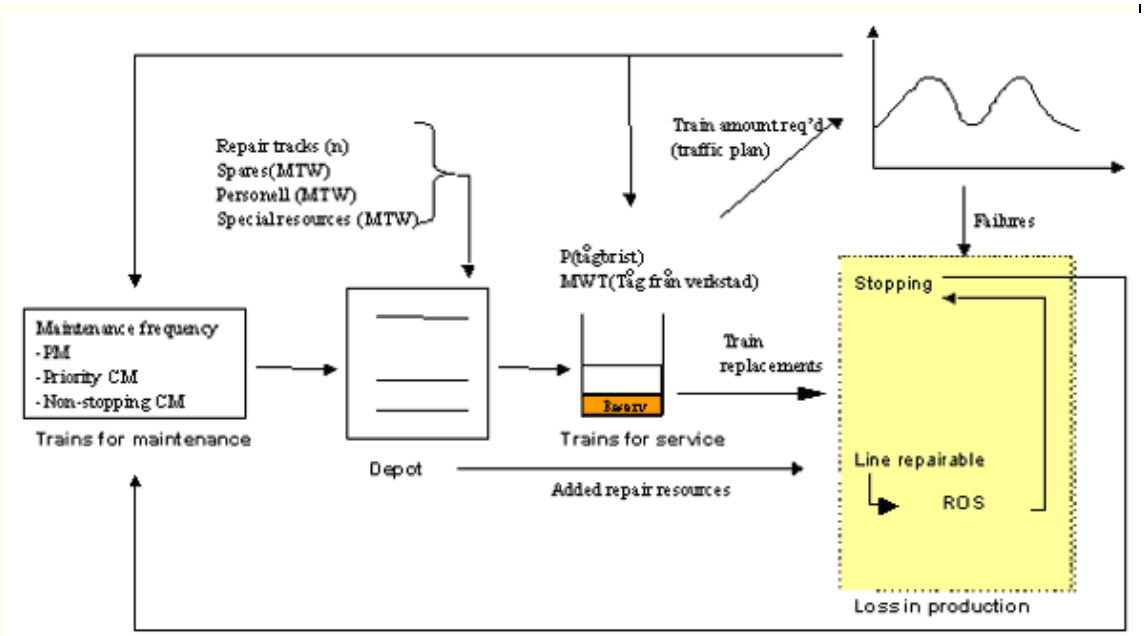


Fig. The principle for the commuter train availability model

Performed analyses

Two alternative depot organisations were analysed in terms of system availability.

- The first alternative included two depots with three repair tracks in the first depot and two tracks in the other.
- The second alternative included three depots with three repair tracks in the first depot and one track each in the other two depots.

The analyses of the two alternatives were based on identical conditions concerning number of vehicles, train reliability estimates, operating profile etc. Only maintenance resources and maintenance strategies were varied.

Repair tracks

An important operator issue is the number of repair tracks needed to simultaneously maintain an acceptable availability and an efficient resource utilisation. SIMLOX calculations are fast which makes variation of the number of tracks and the allocation to depots an efficient way of deriving the optimal number and allocation of tracks. In this case five tracks turned out to be the most cost efficient number.

Maintenance solutions (preventive maintenance)

The commuter service availability depends on several factors. Besides the number of depots and repair tracks, the maintenance solution is of major importance. As the incentive is to plan maintenance to be performed during low (or no) traffic hours, a comparison has been made between split maintenance and a more traditional overhaul approach.

Again, SIMLOX proved to be a convenient tool for evaluation of different maintenance solutions due to ease of changes in the maintenance part of the model, showing the direct consequences of applying different maintenance strategies.

Spares allocation

Cost effective spare part allocations based on the two depot alternatives with the same overall LSC cost have been calculated with OPUS10™.

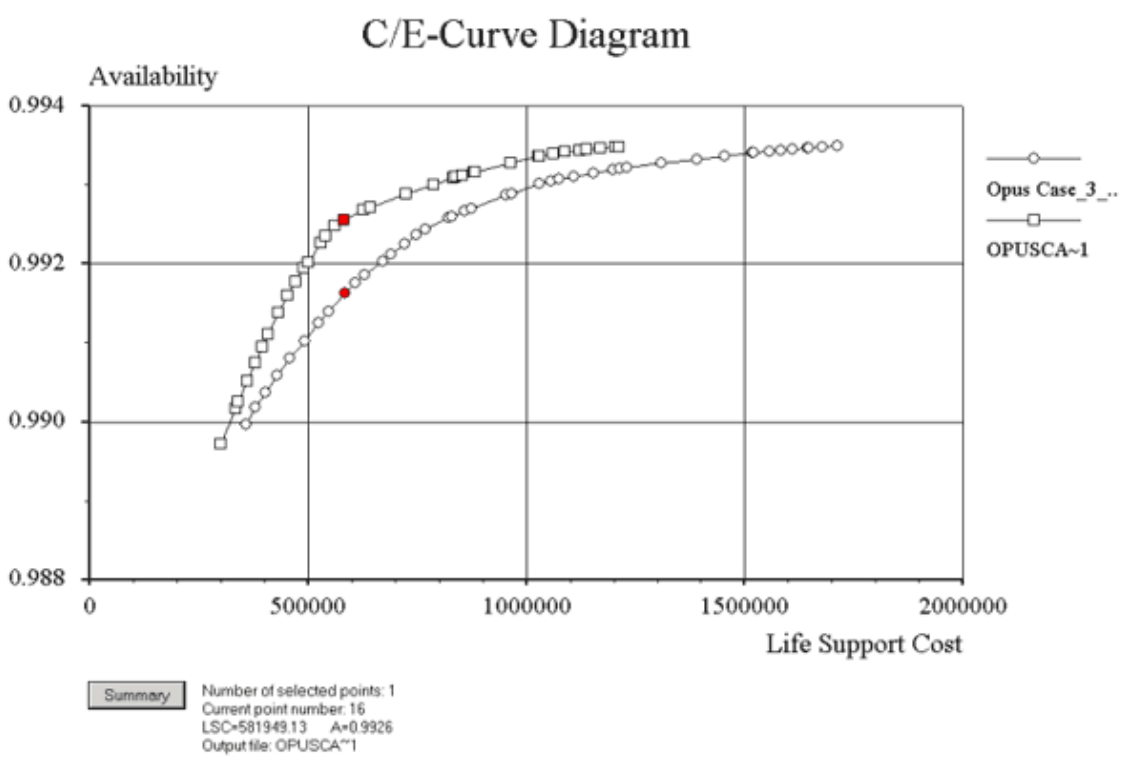
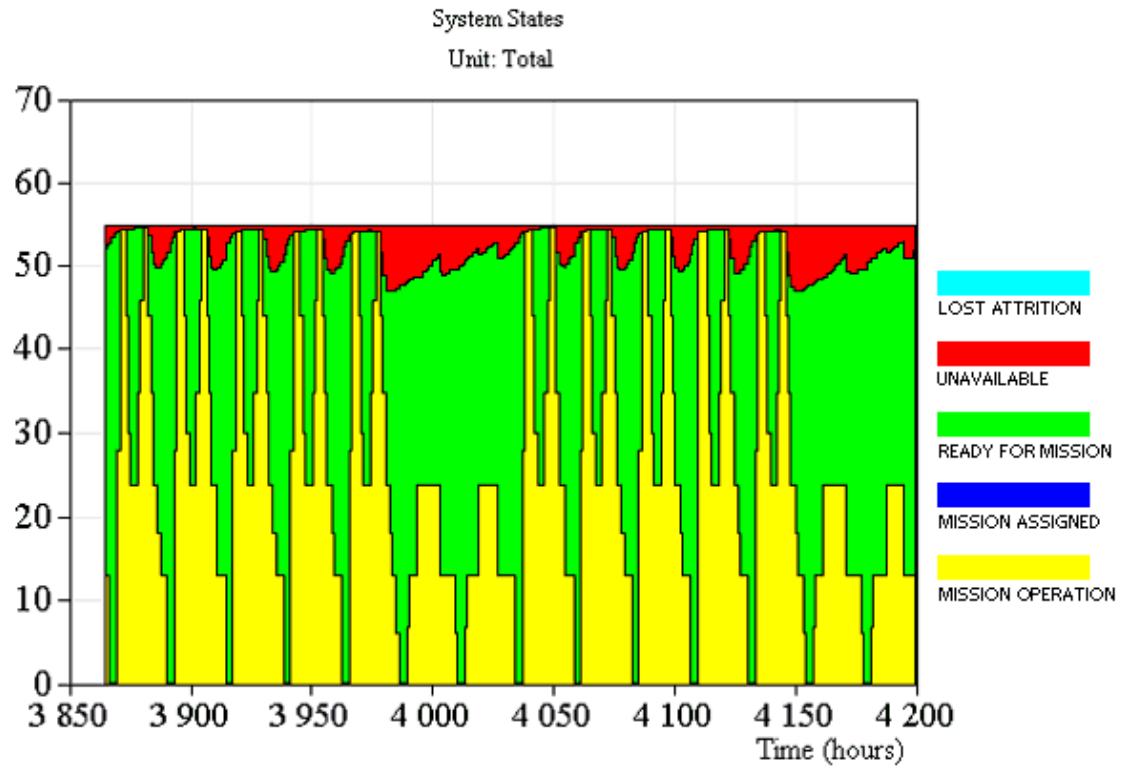


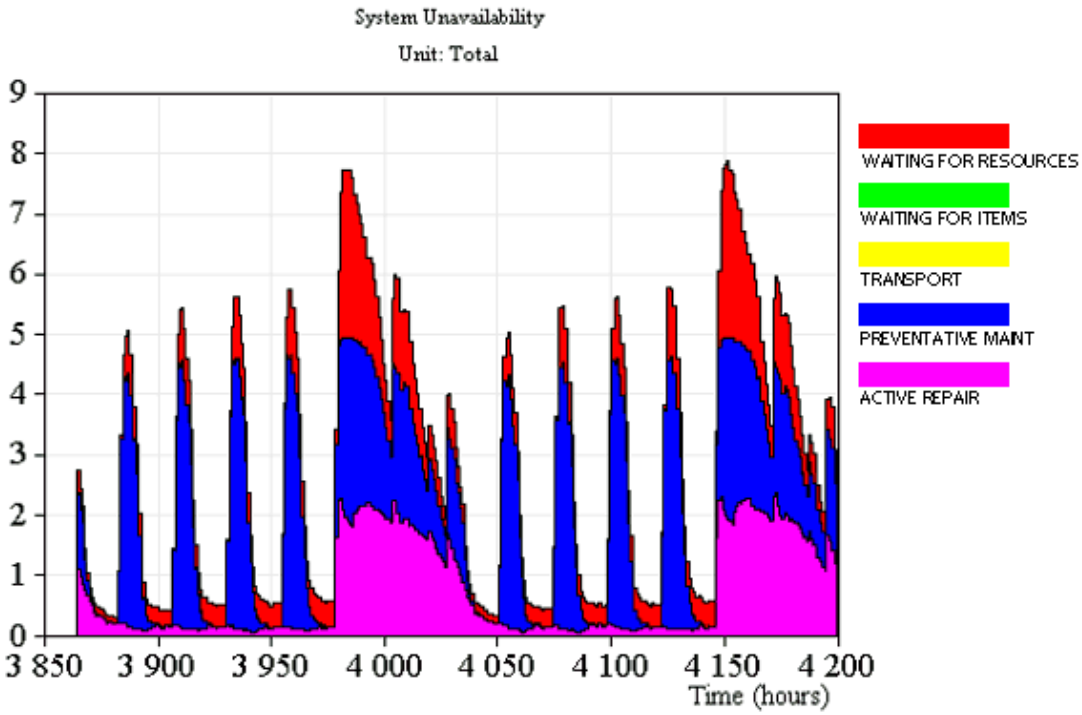
Fig. Comparison of spares assortment for the different depot alternatives

Since OPUS10™ and SIMLOX both are included in the Systecon ILS Toolbox, the selected spare part allocations were easily transferred from OPUS10™ to SIMLOX and combined with the additional information which include maintenance activity duration times, amount of allocated maintenance personnel, transportation times of spares from depots, operating profiles etc.

Results

The figures below present some standard SIMLOX results. The first picture describes the traffic "volume" achieved (yellow). The unavailability is presented in red and follows periods of low operation demands, i.e. during nights and weekends. The green areas symbolize trains ready for mission but not in operation.





The second diagram presents the causes for unavailability in a similar way.

The overall result from the study is that, given the stepwise improvement of maintenance plans and spares assortment, the difference between the studied "main" alternatives is more than 1 % unit of availability. This corresponds to nearly 2 complete rail vehicles and can thus be grasped economically, which has made the results useful in the decision process for the client.

Conclusions

The SIMLOX/OPUS10™ combination has proved to be a useful support in the otherwise complex evaluation of the resources' impact on train system performance. It gives the possibility not only to test different strategies but also to find the most economical solutions within these strategies. The possibility to express differences in terms of required additional resources also makes it powerful as decision support.

If you would like to know more about our services then please contact us on systecon@systecon.co.uk

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Systecon(UK) Systems & Logistics Engineering
PO BOX 4612, Weymouth, Dorset DT4 9YY
T +44(0)870-241-3749 F +44(0)1305-768480 E systecon@systecon.co.uk

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