



DUSMoT: Designed Urban Systems Modelling Tool

No. 5

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DUSMoT is an essential part of the toolkit architects, engineers, planners, and politicians need to help them cope with the complexity of today's cities. As we take steps towards the liveable city of tomorrow, we have to take account of the complicated, designed systems that are already in place. We have to make sure that the changes we make deliver the anticipated benefits, and do not adversely affect the existing system.

DUSMoT provides an objective and repeatable way of modelling the designed systems already operating in cities, whatever they are: waste management, water supply, traffic management; etc. DUSMoT elicits system data from publically available documents and integrates it using Vitech's CORE product, to create a model of the existing system that can be used as a virtual testbed. This way, the impact of change can be assessed before significant investment is made.

Tool Contents

DUSMoT is essentially in 2 parts. The first is a systematic methodology for identifying the discrete set of documents describing the system of interest and eliciting the system data. This straightforward process utilises an Excel spreadsheet. The second part makes use of CORE, a proprietary system modelling tool produced by Vitech Corporation. This is used to integrate the system data to create a model with full traceability, that can be run as a simulation.

How has it been delivered?

DUSMoT was delivered over time across a number of EPSRC-funded research projects. Initial development and outline proof of concept were carried out in the context of railway systems. Further development was carried out on the Liveable Cities Project in the context of solid waste management systems



Figure 1. Designed system for solid waste management

Where has it been published?

The ideas, research and testing behind DUSMoT have been published in the following conference papers:

Developing System Models to Help Railways Embrace Innovative Technologies with Confidence IncoSE International Symposium Volume 23, Issue 1, June 2013, Pages: 1131–1144, Christopher Bouch and Clive Roberts

A Novel Methodology for the Application of Middle-Out, Model-Based Systems Engineering Techniques for City Waste Management Systems Development, IncoSE International Symposium Volume 25, Issue 1, October 2015, Pages: 697–711, Christopher J. Bouch, Richard Kenny, Dexter Hunt, Tommy Wallace, Christopher D. F. Rogers and Susan Lee

Who participated?

University of Birmingham; Birmingham City Council; Engineering and Physical Sciences Research Council (grant numbers GR/S12784/01 and EP/K012398/1).

With acknowledgements to Arriva Trains and Vitech Corporation, developers of the CORE system modelling tool.



Levels of Usability/Testability

DUSMoT can be used by any competent graduate; there is no requirement for extensive knowledge of urban infrastructure systems. DUSMoT has been tested on UK rail and solid waste management systems of interest.

Once the model had been constructed it was interrogated in a variety of ways to demonstrate to the Council how it could be used to assist them in the development of the future waste management system. The model was able to provide 'traceability' between requirements, functions and components; it also provided visualisations of processes, such as the household collection process shown in Figure 4, which could be 'run' as simulations to explore activity durations and the potential impact of proposed system changes.

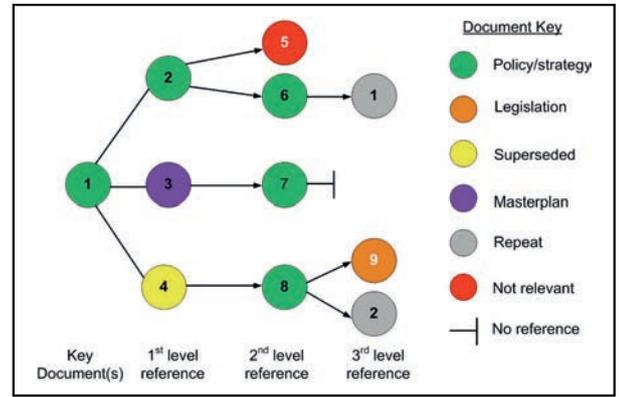


Figure 2. Document trace tree schema

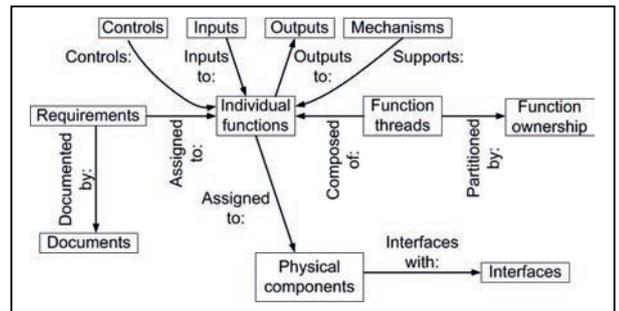


Figure 3. CORE database

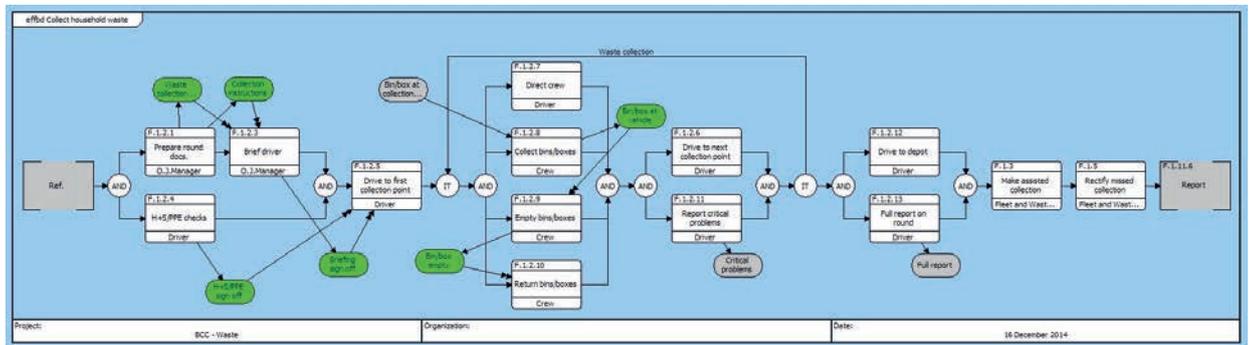


Figure 4: Diagram showing the principal functions (square boxes) in Birmingham's household waste collection process, together with inputs and outputs (lozenge-shaped boxes)