

## **Introduction to the Minitrack Intelligent Systems in Traffic and Transportation**

H.-J. Sebastian

*Dept. of Operations Research and  
Logistics Management  
Aachen Institute of Technology  
Templergraben 64  
D-52062 Aachen  
e-mail: sebasti@or.rwth-aachen.de*

T. Grünert

*Dept. of Operations Research and  
Logistics Management  
Aachen Institute of Technology  
Templergraben 64  
D-52062 Aachen  
e-mail: tore@or.rwth-aachen.de*

### **1. Introduction**

Traffic, transportation and logistics are important components of human life. Moreover, they are absolutely necessary for most social and economic activity. Traffic and transportation are both complex areas involving several decision levels, decision makers and customers. Both fields are also characterized by different uncertainties and considerable capital expenditures. To remain competitive, countries and in particular industries must deal with a large amount of data, sophisticated models, optimization techniques as well as powerful computer and information technology.

Today's software systems in traffic and transportation are often isolated IT-tools that cannot solve large scale complex problems. The main reasons are that those tools fail to address important constraints, cannot deal with conflicting objectives, do not react to dynamics, and, cannot interact with the user in a timely and meaningful way. However, recent scientific and technological advances in the fields of Artificial Intelligence, Computational Intelligence, Optimization-Metaheuristics, Geographical Information Systems, Simulation and others allow to build Intelligent Systems, which are able to support decision analysis and problem solving in the field of Traffic and Transportation.

### **2. Focus, Topics and Presentations**

The minitrack focuses on Intelligent Systems which are able to assist the design-phase (strategic planning) of traffic and transportation systems and/or the management-phase (tactical and operational planning). The purpose of transportation logistics is to design, to organize and to manage transportation in order to meet customer service demands and cost and environmental requirements. Such logistics systems must comply with regulations on traffic, laws on labor and other types of constraints. In the field of transportation logistics we will focus on the analysis of urban, regional and intercity transportation networks for both passenger and freight transportation. Complex hybrid-type systems which include air-, road- and rail transportation are of particular interest.

Intelligent Systems which are designed to solve real world applications in traffic and transportation are built on the basis of an advanced software engineering concept including object-oriented software development and integration with non-standard databases and GIS. On the algorithmic side several so-called Intelligent Techniques coming from the AI, the OR and the CI, such as Tabu Search, Evolutionary and Genetic Algorithms, Constraint Programming, Intelligent Agents, Flow Models, etc. All these can be characterized as high performance Optimization and Simulation techniques.

Relevant topics for the minitrack include

(1) Modeling Intelligent Systems in Traffic and Transportation

- Models for the estimation of future volume of traffic likely to be affected by planned projects or management policy
- Models introducing changes in travel behavior
- Agent-based modeling and simulation of traffic related problems
- Transportation Network Design Problems, including different modes of transportation and hubs
- Vehicle Routing and Scheduling, Crew Scheduling

(2) Intelligent Techniques applied to combinatorial optimization problems in traffic and transportation

- Heuristics and Search Techniques
- Metaheuristics (Tabu Search, Simulated Annealing, Ants, GRASP, etc.)
- Population-based methods (Genetic and Evolutionary Algorithms)
- Large-Scale Optimization (Branch & Cut, Branch and Price)
- Constraint programming
- Multi-Agent Approaches

The three presentations of the minitrack within HICSS-35 are focused on Vehicle Routing and Scheduling problems. In particular Arc Routing and interactive solving of Vehicle Routing and Scheduling problems will be discussed in detail.