PhD Proposal 2017

School: CentralSupélec	
Laboratory: LGI	**Web site: http://www.lgi.ecp.fr**
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Collaboration with other partner during this PhD: **In France:**	**In China:**

Title: Optimization models and methods for tour planning in smart urban logistics
Scientific field: Computer science, Operations Research
Key words: Vehicle Routing, Mathematical Programming, Metaheuristics

Details for the subject:

Background, Context

The Anthropolis chair (http://chaire-anthropolis) is jointly operated by the Laboratoire Génie Industriel (LGI) of CentraleSupélec and l'IRT-SystemX. The Chair follows a human centered approach for designing novel transport and mobility systems for cities.

In dense agglomerations like Paris, urban goods distribution plays an increasingly important role, same-day delivery is gaining momentum. Recent technological advances as well as new regulations limiting the use of combustion engine vehicles will significantly change urban goods distribution.

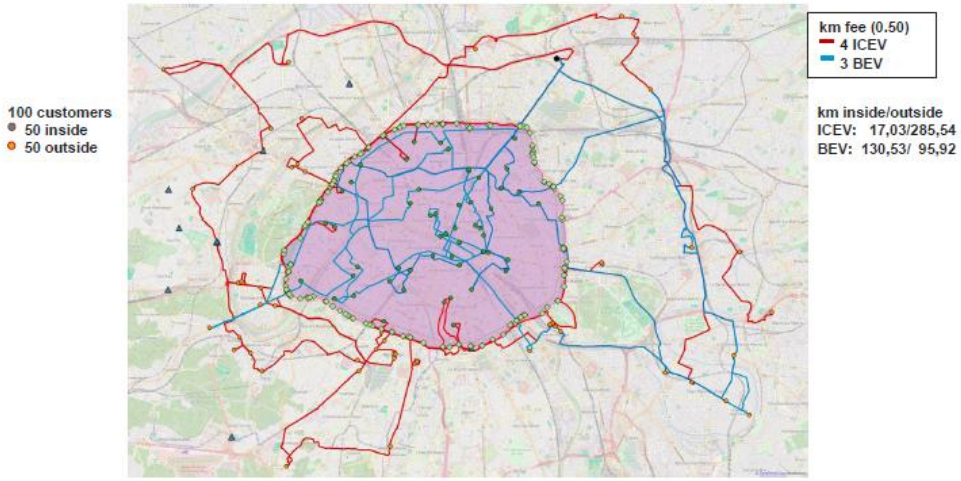

Figure 1 Example showing vehicle tours for electric and conventional vehicles

Figure 1 shows a recent research example on computing optimal fleet composition and routes for electric and combustion engine vehicles in the context of city center access restrictions (Hiermann et al. 2015). The coming years will see significant developments in the functioning of the urban distribution including the integration of new modes of transport and distribution concepts.

The modeling and optimization of distribution operations especially pre-trip and dynamic vehicle routing, will have to integrate these new concepts. In recent articles (Savelsbergh & Van Woensel, 2016) (Cantaruzza et al., 2015), the major issues in urban logistics, with a special emphasis on transport optimization are described.
For the proposed thesis subject we identify, a need for innovative concepts and optimization methods for reorganizing urban distribution on a strategic and operational level:

- Include lightweight zero-emission vehicles (bicycles, pedelecs)
- Include new means of distribution (automated vehicles and drones)
- Dynamic/on-line optimization of distribution operations

Research subject, work plan:

The combination of traditional delivery vans with various other modes of transport adapted for the last mile (such as bicycles, automated vehicles, drones, etc…) will be investigated. Special emphasis will be given to modelling and solving emerging static and dynamic variants of tour planning problems (Ritzinger et al., 2016). A recently introduced problem variant is the vehicle routing problem with drones (Wang et al., 2016) showing the interest of such new concepts.

The work for this thesis consists of four parts:

- In a first step a detailed review of the state-of the art in the area will be performed.
- In a second step a new concept for urban distribution will be elaborated that will combine various innovative low/zero-emission, automated transport means such as lightweight automated vehicles or drones that will be combined with more traditional heavy trucks.
- The operational tour planning problem emerging from this concept will be modeled and solved in a third step.
- In step four a dynamic distribution variant of the problem will be considered.

The planning methods developed in steps three and four will be applied to case-study like problem settings in order to realistically assess the potential of such new distribution concepts. It is expected that the research performed during this thesis will results in three publications (steps 1 and 2, step 3, step 4).

References:

Cattaruzza, D., Absi, N., Feillet, D., & González-Feliu, J. (2015). Vehicle routing problems for city logistics. EURO Journal on Transportation and Logistics, 1-29.

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Ritzinger, U., Puchinger, J., & Hartl, R. F. (2016). A survey on dynamic and stochastic vehicle routing problems. International Journal of Production Research, 54(1), 215-231.

Savelsbergh, M., & Van Woensel, T. (2016). 50th Anniversary Invited Article—City Logistics: Challenges and Opportunities. Transportation Science, 50(2), 579-590.

Wang, X., Poikonen, S., & Golden, B. (2016). The vehicle routing problem with drones: several worst-case results. Optimization Letters, 1-19.