Using a spatial decision support system for solving the vehicle routing problem

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http://www.msl.aueb.gr/management_science/networks.htm

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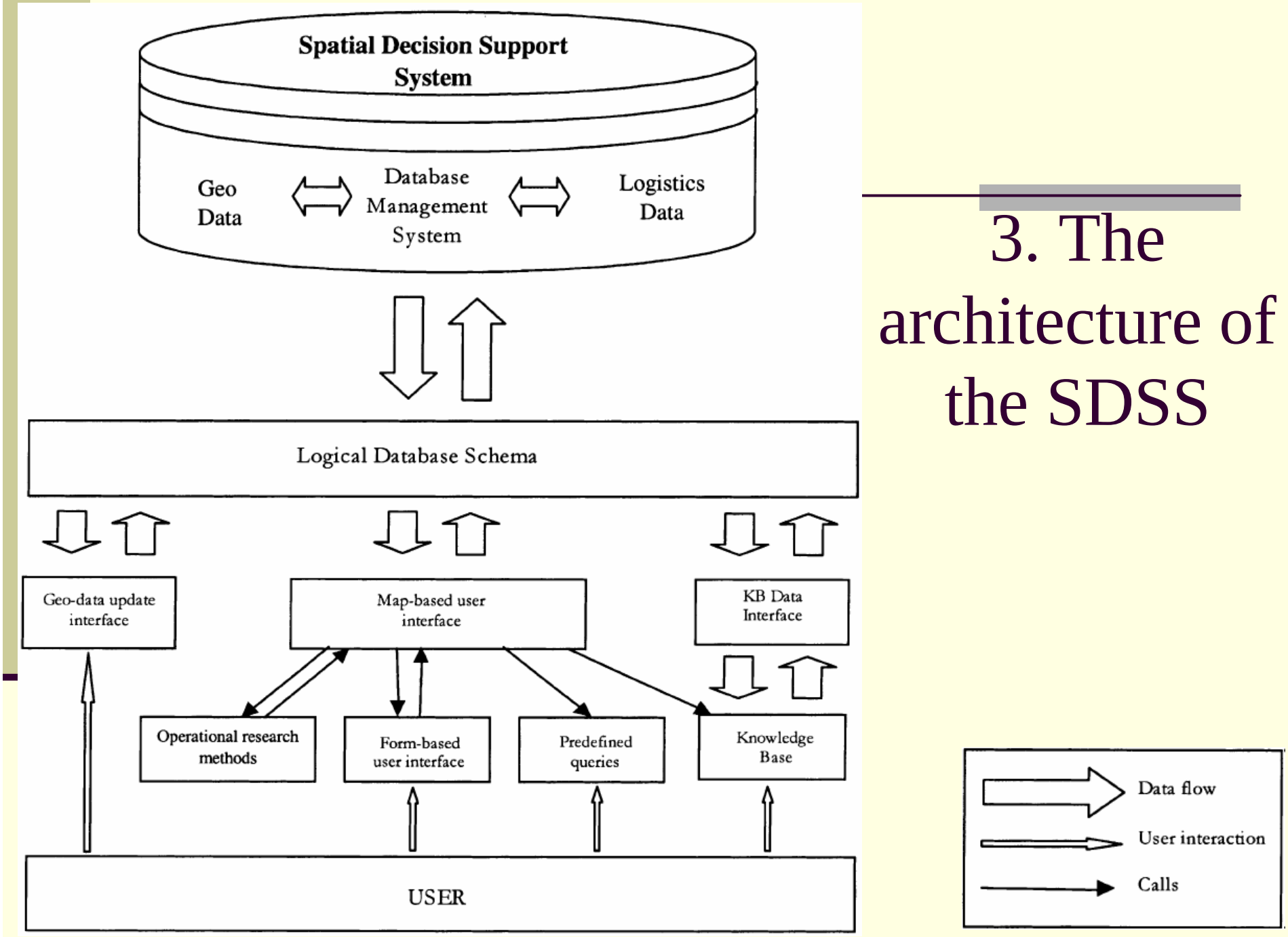
1. Introduction

- The total distance traveled by the vehicles is minimized.
- The capacity of a vehicle cannot be exceeded.
- A single vehicle supplies each customer's demand.

2. The evolution of the vehicle routing systems (VRS)

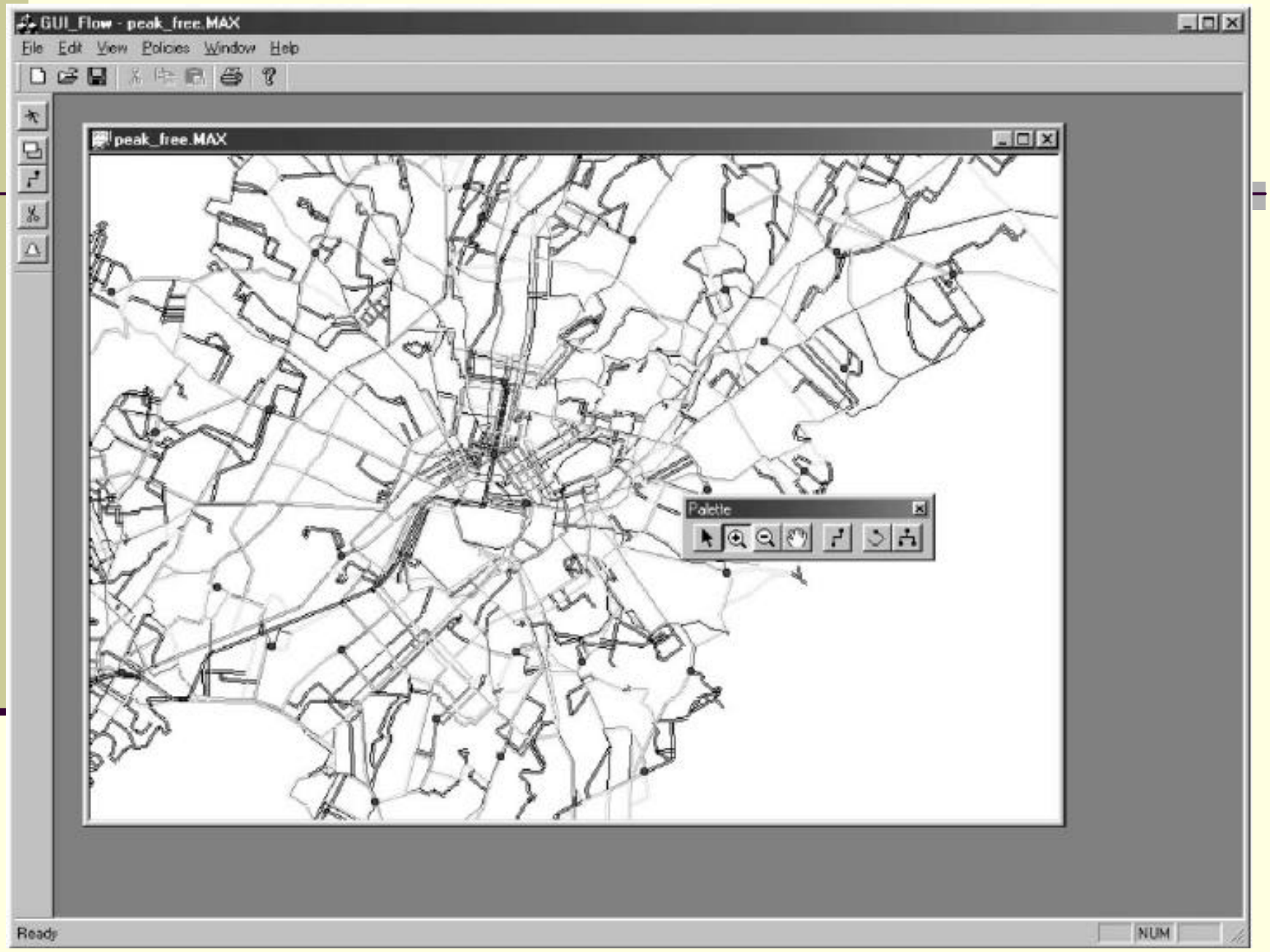
- In the mid-1960s, VRP solutions were based on non-computerized methods.
- The early 1980s every VRS was seen as a decision support system (DSS).
- During the same time period, the area of IS gave birth to systems for analyzing, storing and displaying spatially or geographically related data.
- Such systems are characterized as VRP–SDSS and they support semi-structured or unstructured vehicle routing decision.

3. The architecture of the SDSS



4. Data management of the SDSS

- The locations of the depot and the customers within the road network of Athens.
- The customer demand.
- The capacity of the vehicles.
- The spatial characteristics of road segments of the network.
- The topography of the road network.
- The speed of the vehicle.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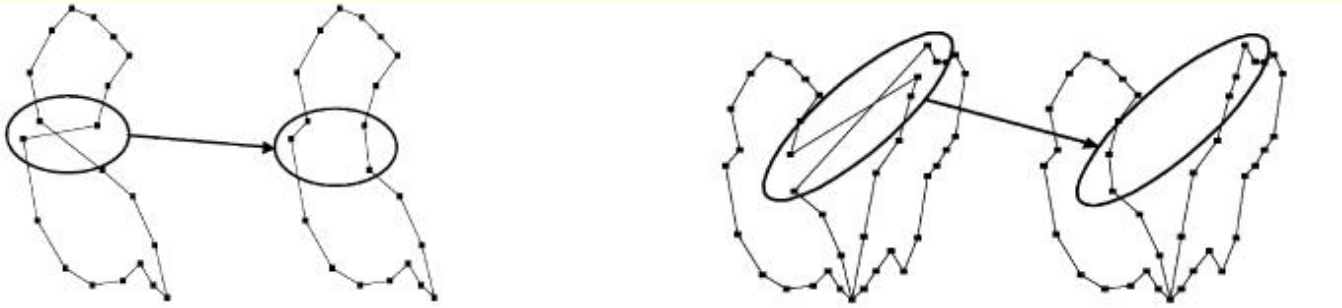
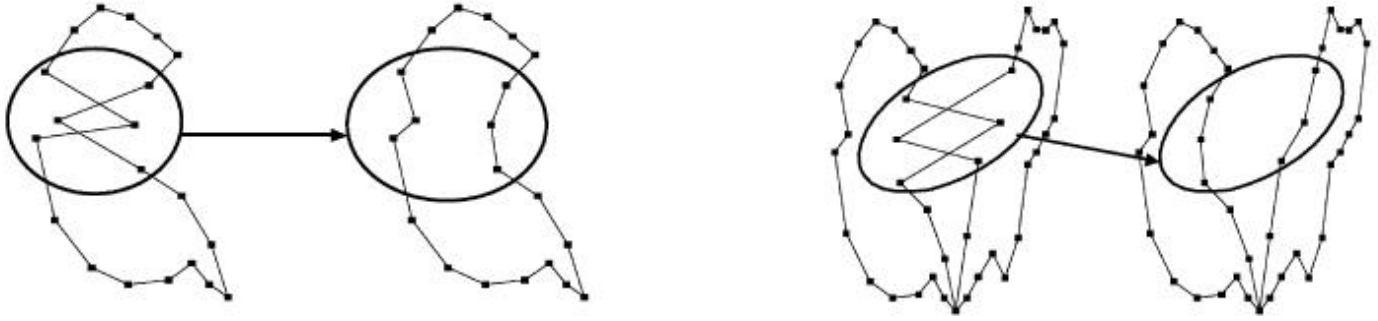
5. Backtracking adaptive threshold accepting (BATA) method

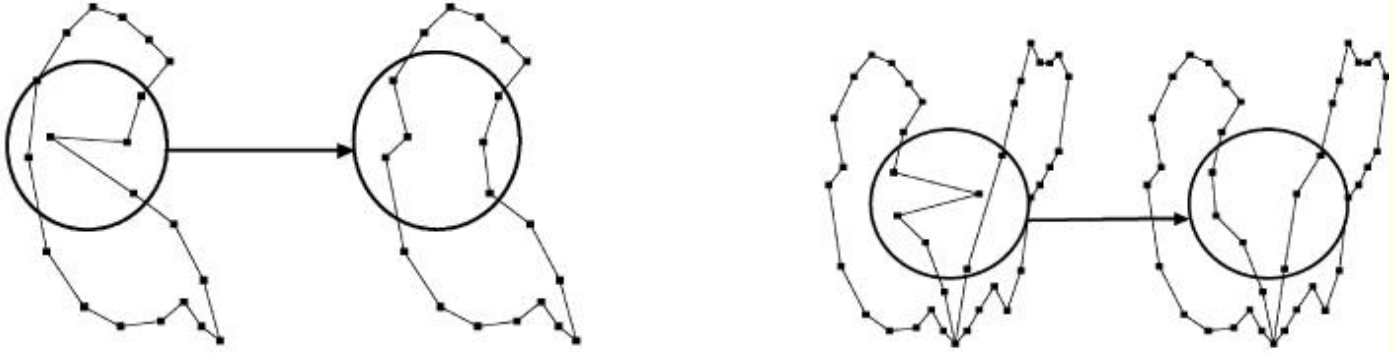
- The classic heuristics used to improve a vehicle routing plan are the tour improvement procedures.
- These can improve a VRP solution by introducing changes in the plan, taking a node (customer) from its position in the routing plan and moving it to another position in the same or different vehicle routes.



2-Opt for single route (a) *2-Opt* for multiple routes



1-1 Exchange for single route (b) *1-1 Exchange* for multiple routes



1-0 Exchange for single route (c) *1-0 Exchange* for multiple routes

Fig. 5. 2-*Opt*, 1-1 and 1-0 *Exchange* moves.

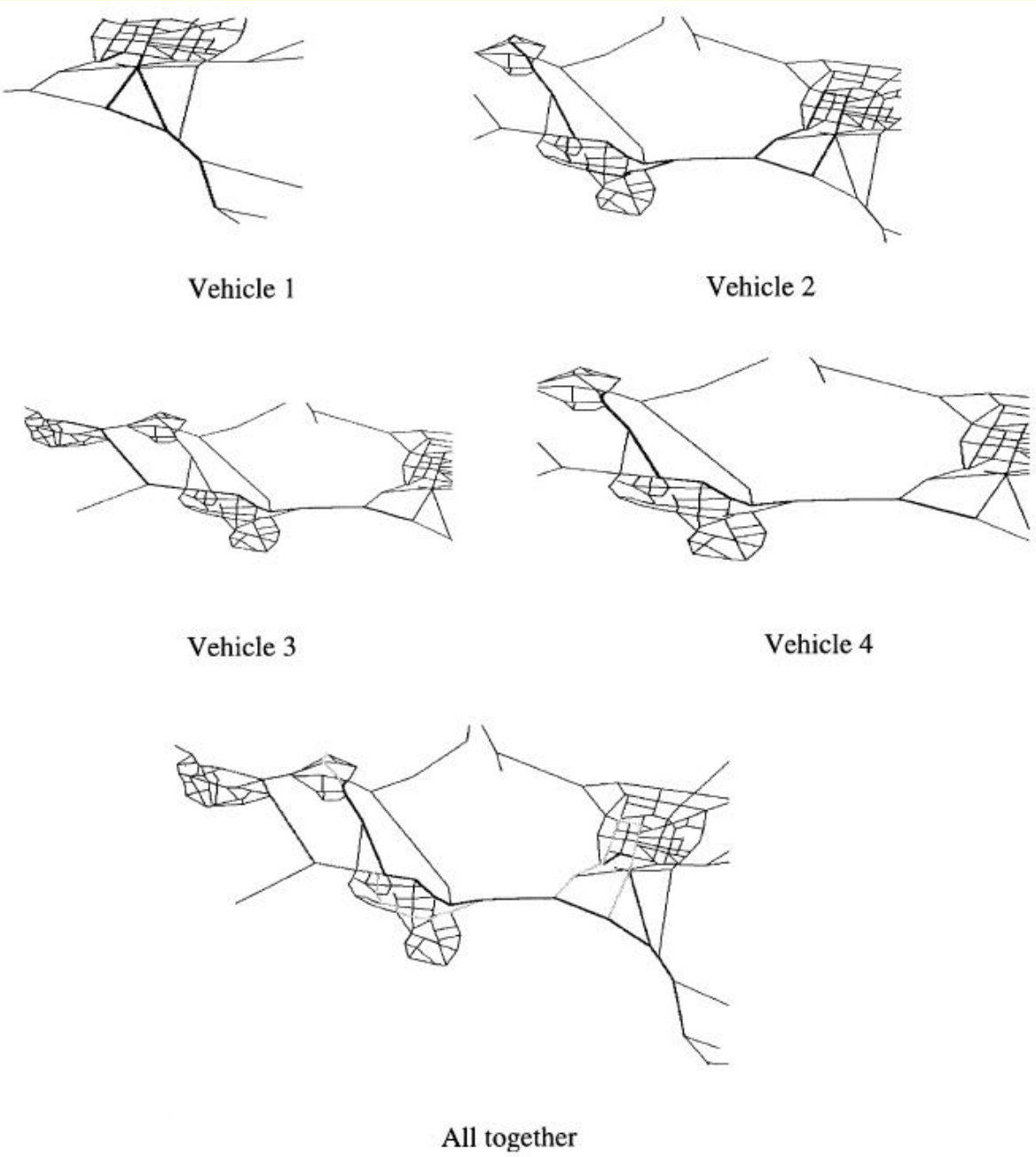


Fig. 7. A vehicle routing plan developed by the proposed SDSS.

Conclusions

- The algorithm performance is very efficient, finds the shortest paths from one to all other nodes of the network in 0,02s. For a typical road network of 10.000 roads.
- The efficient representation of the network, allowing the fast implementation of routing methods.
- The performance of the BATA method in vehicle routing applications, which can solve real life (large) vehicle routing problems quickly and efficiently.

Comentario

- El artículo se encuentra bien estructurado.
- El marco teórico es válido y se aplica de manera apropiada.
- Se hace revisión de trabajos previos.
- La metodología empleada es explicada y empleada claramente.
- El estudio es suficientemente comprensivo y preciso.
- Los resultados son presentados y descritos claramente.

- No hay errores tipográficos.
- Las gráficas presentadas son claras.
- Las pruebas se realizaron con datos reales.