Analyzing the Impact of Anticipatory Vehicle Routing on the Network Performance

Master's Thesis of Aledia Bilali

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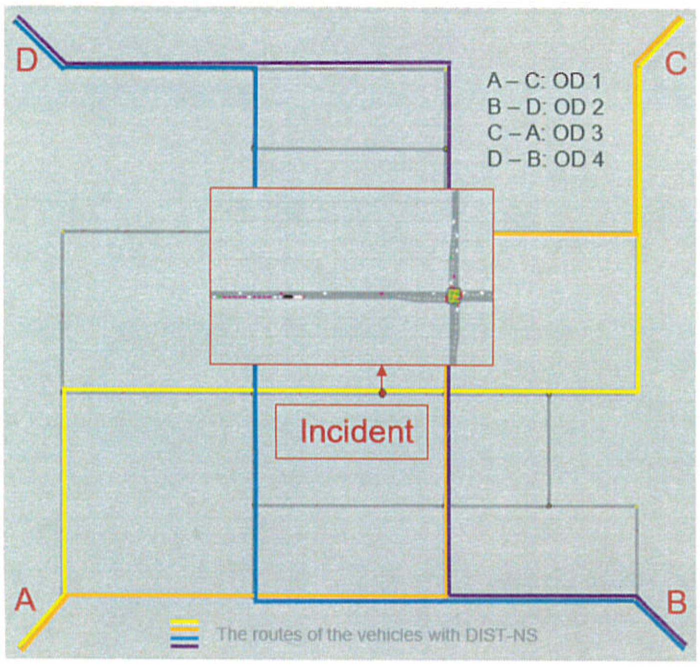

Figure 1. Urban network tested

The main goal of this study is to investigate the impacts of anticipatory vehicle routing strategy on the network performance. To achieve this, the performance of the system during anticipatory routing strategy is compared to current reactive routing strategy and fixed path routing strategy. Different scenarios with different penetration rates of vehicles equipped with predictive navigation system are used for the evaluation. The main performance measures that are selected to compare the results of different routing strategies, are average travel time and total delay time. Moreover, the impacts of anticipatory routing strategy on different drivers are also investigated by evaluating the average travel time of different vehicle types.

Modeling and testing of the different routing strategies is performed by using the microscopic simulation software VISSIM and COM interface in combination with Python.

Scenario F refers to the fixed path routing strategy. Two vehicle types are present: the experienced drivers (70 %), which choose the route based on experience and vehicles with distance navigation system (DIST-NS) (30 %), which are assumed to take two best routes based on free flow conditions.

Scenario R belongs to the reactive routing strategy. Despite the experienced drivers (50 %) and the vehicles with DIST-NS (30 %), the vehicles which have real-time traffic information navigation system (RTTI-NS) (20 %) are also part of the network system. These vehicles will have an updated path every five minutes, based on real-time traffic information.

Scenario A comprises all the scenarios based on anticipatory routing strategy. In addition to experienced drivers, vehicles with DIST-NS (30 %) and RTTI-NS (20 %), vehicles equipped with predicted traffic information navigation system (PREDTI-NS) will also be present. Percentage of vehicles with PREDTI-NS is 5 %, 10 %, 20 %, 25 %, 30 %, 40 %, respectively for Scenario A1, Scenario A2, Scenario A3, Scenario A4, Scenario A5 and Scenario A6.

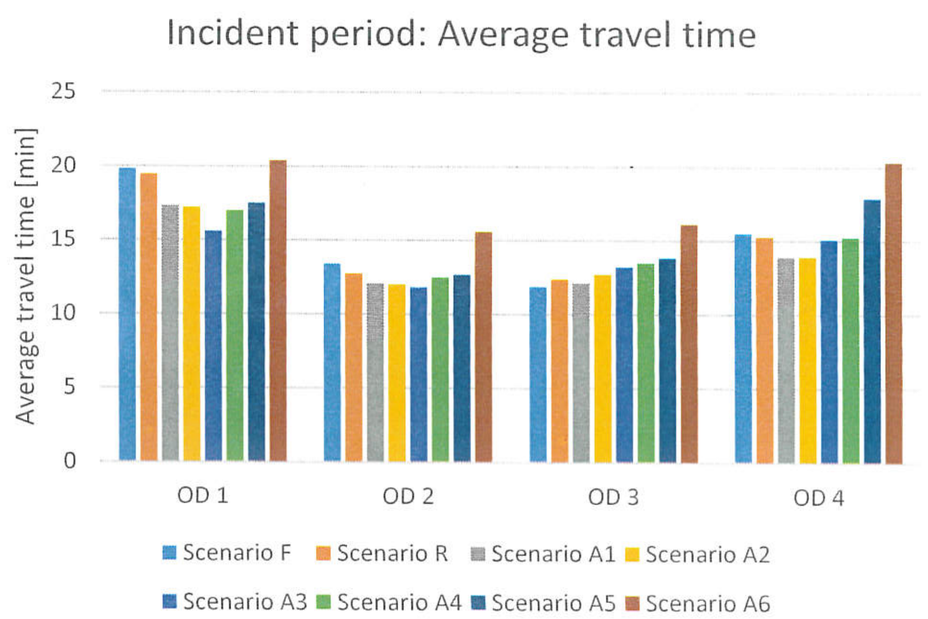

Figure 2. Incident period: Average travel time of all vehicle types

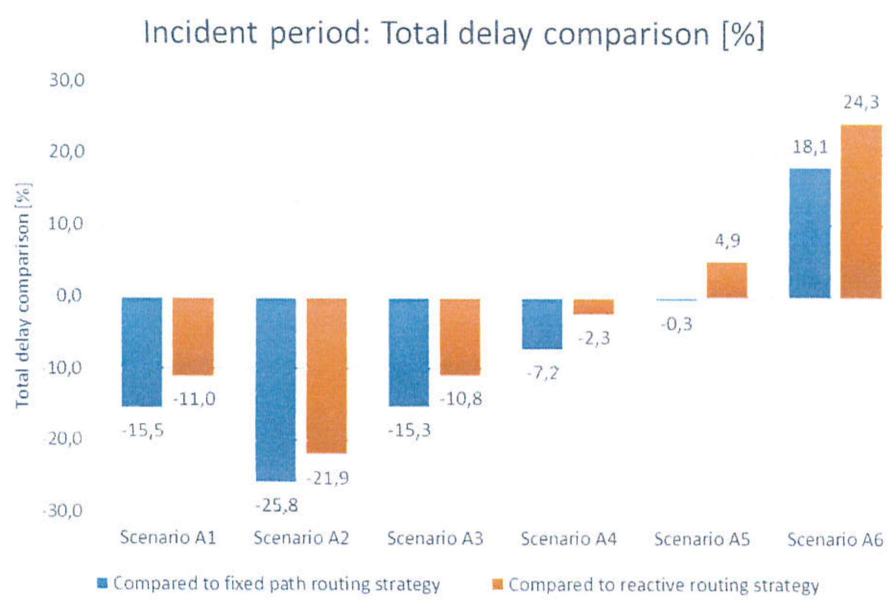

Figure 3. Incident period: Total delay comparison

The analysis shows that anticipatory routing strategy can improve the network performance until a certain penetration rate of vehicles equipped with PREDTI-NS. Compared to reactive routing, in terms of average travel time reduction, the profit is noticed until a level of 30 % of the vehicles with PREDTI-NS. The highest profit of 20 % in travel time reduction is recorded when the penetration rate of this vehicle type is 20 %. For higher levels than 30 % of vehicles with PREDTI-NS, anticipatory routing strategy does not improve the average travel time to any further extent due to high amount of vehicles rerouted which switch the congestion to other parts of the network. In terms of total delay time, the advantage of anticipatory routing compared to reactive routing was shown until a penetration rate of 25 % of vehicles with PREDTI-NS. The highest improvement is 22 % decrease in total delay time when the penetration level of vehicles with PREDTI-NS was 10 %. Vehicles which profit the most from anticipatory routing strategy are the vehicles equipped with PREDTI-NS.