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Decision support tools for dynamic planning of fire and rescue resources

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Introduction

A recent trend among Swedish fire and rescue services (FRS) is to utilize dynamic planning of the resources. This includes using smaller and more numerous units, which leads to extra complexity in the planning situation. For example, deciding which units to dispatch to new accidents, or planning for a continuously good preparedness becomes more difficult. In this project, we developed decision support tools to facilitate this dynamic planning of fire and rescue resources.
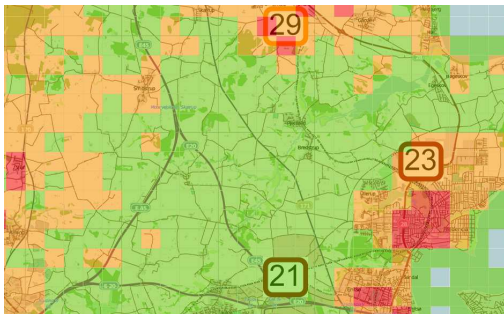

Figure 1: Preparedness visualization. Red = inadequate, Orange = acceptable, Green = good preparedness

Decision Support Tools

The tools that have been developed include a way to calculate and visualize the preparedness in an area. Preparedness describes the ability to respond to accidents in the present and in the future, and depends on the amount of available resources (and their expected response times) as well as the expected number of accidents. The calculations are visualized on a map (see Fig. 1), giving the decision makers information that can be used e.g. when dispatching resources. Another tool can suggest which resources that should be selected for dispatch (see Fig. 2), in order to minimize the response time. A third tool gives suggestions on how the resources can be relocated in order to improve the preparedness in the area (see Fig. 3). The tools were integrated into the research and training system C3Rescue.

Experimental Method

Two sets of experiments were performed to examine the differences between working without the developed decisions support tools, and having access to them. In each experiment, decision makers from the FRS were responsible for managing fire and rescue resources in a specific geographic region, and had to assign resources for preventive work, dispatch resources to accidents, and maintain an adequate preparedness. In the first set of experiments, the players did not have access to the developed decision support tools, while in the second set, they had access. This way, it was possible to assess the impact the decision support tools had on the operations.
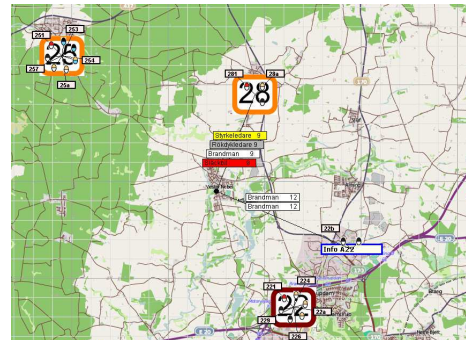

Figure 2: Dispatch suggestions

Results

The results show that for a variety of measures, the calculated preparedness was better in the second set of experiments, than in the first. This indicate that the tools can help the users select resources and relocate resources in a way that will ensure a quick response to new accidents. The results also show that the tools can help the users in their dispatch decisions [1]. However, the results indicate that the time for dispatching and for evaluating the preparedness increases in the second set.
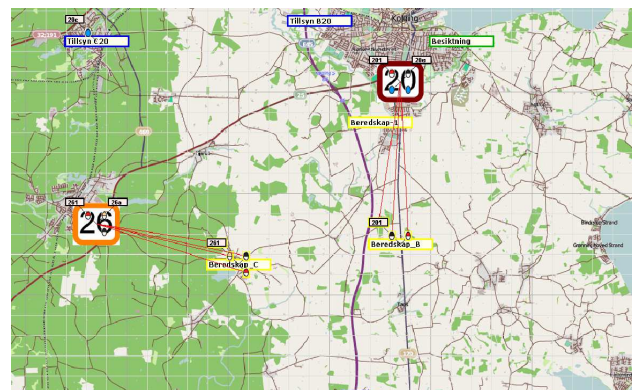

Figure 3: Relocation suggestions

Conclusions

We conclude that the developed decision support tools are useful and can help the fire and rescue services achieve an efficient dynamic planning. We also notice that there is a risk that these benefits comes at a price of longer decision times, which is not entirely surprising since using an extra set of tools likely will take some extra time. It is arguable though, that the time for utilizing the tools would decrease if they were introduced into the daily planning.

References

[1] Andersson Granberg T, Lundberg J, Ulander A, Granlund, R, (2015) "Supporting dispatch decisions for the fire and rescue services". In Proceedings of the 2015 IEEE 18th International Conference on Intelligent Transportation Systems.

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