**MATLAB FS11 – Research Plan TEST17**

(Evacuation bottleneck in case of flood events)

**Document Version:** 1.0

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**General Introduction**

Locations close to water bodies (rivers, lakes) have always been naturally preferred for human settlements, since they provide i) water, ii) food through the animals inhabiting the water body and iii) transportation ways. In earlier times the settlements were usually located at a certain distance from the water body to prevent the settlement to be seriously affected by flooding. With the increase of inhabitants, those settlements grew closer to the water body, thus making it more vulnerable to flooding events.

When a part of a city has to be evacuated because of a flooding event, it is important to have information about the social behavior of the inhabitants. Based on this information, more effective evacuation procedures can be developed that might be crucial in reducing possible fatalities.

**Fundamental Questions**

What is the effect of warning time/rising rate on the number of people that are subjected to a certain depth of water?

How many people are evacuated in a certain time window?

What is the effect of a different warning procedure on the number of evacuated people?

**Expected Results**

A *Nature* paper.

**References**

(Add the bibliographic references you intend to use)

(Explain possible extension to the above models)

(Code / Projects Reports of the previous year)

**Research Methods**

In this study, we want to employ different techniques to model the evacuation behavior of a given umber of people: Since we are interested in the behavior of each individual person, we are planning to use an agent based model, where interactions with other agents/walls are modeled using a social force model as describes in Helbing(??? Nature paper). The exit strategies of each agent are thought to be modeled using a Graph approach, where each agent decides to take the fastest way to any available exit. The cost of using different paths will be computed based on topography and visible persons on the next path.

We intend to model the flooding in a rather simple way, where the water height changes at every timestep depending on given input parameters. Regions, whose height is below the water level, will be inundated immediately. There are more sophisticated models for flood simulations, but given the time available to complete this project, we decided to reduce the complexity in this case. The response of each agent to the flood front will be modeled in a similar way as “wall forces” are modeled.

**Other**