The main aim of the present work is the investigation of the dynamical properties of traffic on preexisting ant trails. It is mainly divided into two parts which are based on the interplay between theory and experiment. Both parts are developed independently and compared later on in a final discussion. Methods from statistical and non-equilibrium physics were employed for theoretical studies. New models for bidirectional traffic on preexisting ant trails were introduced. Also the understanding of the already existing unidirectional ant trail model was improved. The results of the presented empirical studies are compared to the models predictions. Ant-traffic data are extracted using methods from traffic engineering and behavioural biology. Similar approaches have already been employed successfully for vehicular traffic. Nevertheless the crucial differences between the already investigated systems and ant-traffic are the main motivation of the present study.

Chapters 2,3 and 4 cover the theoretical part. In *chapter 2* a broad intoduction to driven non-equilibrium systems in the context of traffic flow is given. Standard models like the *TASEP* and the *Nagel-Schreckenberg* model for vehicular traffic are introduced. As the ant trail models are based on the TASEP with dynamically induced disorder, a review of the TASEP with static particlewise- and latticewise disorder is given.

Chapter 3 introduces a model for unidirectional traffic on ant trails. *Pheromone marks* lead to different hopping rates depending on the distance headway to the preceding ant. As a result *dynamically induced* particlewise disorder emerges. Phase separation namely the formation of *moving particle clusters* is observed. The fundamental diagram exhibits a *non-monotoncity* in the average velocity when particlewise disorder is dissolved at high densities. New techniques like measuring the density profile within the moving system seen from a modified second-class particle are applied and analogies to the static case are drawn. Also the coarsening behaviour is investigated. Obviously the process is describe by a power-law with two *dynamic exponents* depending on the particular temporal regime.

Chapter 4 discusses different extensions of the unidirectional model to the multi-lane case. Bidirectional models incorporating the coupling to counterflow are introduced. A large *localised particle cluster* emerges due to mutual hindrance by *counterflow*. Effectively latticewise disorder is induced *dynamically*. The same tools as for the unidirectional model are applied and a mean-field description based on symmetries of the large localised cluster is developed. Coarsening is investigated and the same dynamic exponents as for the unidirectional model are found. At low densities also the periodic process of *coarsening* and *shredding* is investigated.

The empirical part of the present study is discussed in *chapter 5*. Techniques and strategies for collecting ant-traffic data are introduced. Also an *experimental setup* is described. Uni- as well as bidirectional trails are investigated. Qualitative observations are carried out and compared to quantitative data. *Distance headways* and *single-ant velocities* are extracted. The corresponding distributions as well as the *fundamental diagrams* are discussed. As a main result *platoon formation* and coupling to counterflow is found. Also comparisons between the models' predictions and the empirical data are drawn.

A review of theoretical and empirical results is given in *chapter 6*. Main results from both parts are compared in a final discussion. Also an outlook to future studies is given.