



## Use case #2: Decentralized Traffic Management

### In short

Through AI, we explore how traffic management can achieve central network goals while enabling decentralized decision-making.

### Who

TU Delft, TU/e, Arane, d-fine, Technolution, NDW, Rijkswaterstaat, and selected regional and local road authorities

### When

2026-2028

## Background

Active Inference is an emerging AI-based approach to decision-making in mobility systems. While traditional traffic management approaches tend to react to observed traffic conditions or predefined control rules, Active Inference treats decision-making as an inference process in which actors form expectations about system behaviour, explicitly model uncertainty, and act to reduce deviations from desired states.

This makes the approach particularly relevant in traffic contexts where uncertainty is inherent, data is incomplete or delayed, and decisions by different

actors influence one another—for example in route advice, traffic light control, or in-car decision support.

Although Active Inference is gaining increasing attention internationally, many questions remain. For example, it is still unclear which elements are practically useful in traffic management systems, how the approach relates to existing methods such as control strategies and cooperative systems, and how professionals can apply it in daily operations without creating systems that are difficult to interpret or explain.

## Objective

The objective of this use case is to explore how Active Inference can be applied as an AI-based approach in traffic management and traffic information. The aim is not to fully replace existing traffic management concepts, but rather to position it as a hybrid conceptual framework that can complement them.

The focus is on identifying which elements of the approach can support practical decision-making, how they relate to existing tools and methods, and how they can be used in situations involving uncertainty, decentralised control, and interactions between multiple actors. In addition, the use case aims to make this way of thinking accessible to professionals working in traffic management, without increasing system complexity or reducing transparency.

## Approach

This use case is set up as a learning-oriented exploration in which Active Inference is applied to concrete traffic management situations. The approach is tested and discussed in relation to real-world use cases, with a focus on interpretation and practical use rather than system development.

Programmes such as [ARAMIS](#) provide a relevant context, as they address topics such as in-car decision-making, cooperative systems, and public–private collaboration. Within this setting, questions around decentralised decision-making, uncertainty, and responsibility become concrete and can be explored using Active Inference as a guiding perspective.