At CAPE, we currently offer the following Master Thesis Assignments:

1. **Optimize route planning for electric and diesel trucks to improve logistics efficiency**
2. **Improve logistic efficiency and fleet management using a real-time AI support system, utilizing vehicle data, predict and mitigate delays in truck deliveries**
3. **Optimization of Fleet Composition under Kilometer-Based Truck Toll**
4. **Integrating Kilometer-Based Truck Toll into Route Optimization**
5. **Impact of Kilometer-Based Toll on Package Weight Allocation and Vehicle Type Selection**

1) **Optimize route planning for electric and diesel trucks to improve logistics efficiency**

This research aims to optimize an existing algorithm for route planning of electric and diesel trucks by developing an extended optimization model to automatically identify rest places and gas/charge stations. An analysis of real-time data, such as traffic patterns, vehicle performance, and charging station availability, will be automatized and integrated into the system to generate model parameters and to enhance logistics efficiency and fleet management.

2) **Improve logistic efficiency and fleet management using a real-time AI support system, utilizing vehicle data, predict and mitigate delays in truck deliveries**

This research aims to develop a real-time decision support system for transportation that predicts potential delays in truck deliveries. By analyzing (vehicle) data, a predictive model (based, for example, on machine learning techniques) can identify if a truck will miss its estimated time of arrival (ETA) due to mandatory breaks, unexpected breakdowns or other events. The system will generate solutions, such as rerouting or dispatching assistance, to enhance logistics efficiency and improve fleet management.

3) **Optimization of Fleet Composition under Kilometer-Based Truck Toll**

Starting July 2026, the Netherlands will introduce a kilometer-based truck toll on most highways and selected provincial roads. The toll will vary based on vehicle weight and CO_2 emission class, creating a direct financial incentive for transport companies to rethink their fleet strategies. This policy aims to reduce emissions and encourage cleaner technologies, but it also introduces new complexity in operational decision-making. Companies must now balance cost efficiency, environmental impact, and logistical performance when selecting vehicle types and planning routes. Additionally, the toll may influence the viability of alternative distribution models, such as microhubs in urban areas.

This research aims to design and implement an optimization framework that determines the optimal fleet composition and routing strategy under kilometer-based tolling, considering cost, CO_2 emissions, and load capacity.

4) **Integrating Kilometer-Based Truck Toll into Route Optimization**

The Dutch kilometer-based truck toll, starting in 2026, introduces variable costs per kilometer based on vehicle weight and CO_2 emission class. This disrupts traditional route planning, which typically optimizes for distance or time, by adding dynamic cost and sustainability objectives. The challenge is to design algorithms that can incorporate toll costs and emissions into routing decisions while satisfying delivery constraints. This transforms the classical Vehicle Routing Problem (VRP) into a multi-objective

optimization problem with non-linear cost structures, making it scientifically interesting for algorithm development and computational complexity analysis.

5) **Impact of Kilometer-Based Toll on Package Weight Allocation and Vehicle Type Selection**

The Dutch truck toll introduces variable costs based on vehicle weight and CO_2 emission class, which directly affects the economics of load distribution and vehicle selection. Transport companies must now decide not only which routes to take but also how to allocate packages across different vehicle types to minimize toll costs while maintaining efficiency. This creates a combinatorial optimization problem: balancing load capacity, toll rates, and operational constraints. Traditional load planning methods often assume fixed cost structures, but the toll introduces dynamic, weight-dependent pricing, making algorithmic solutions essential.

Interested in one of these assignments? Feel free to contact us at jessie.ensing@cape.nl and include your resume. You can also contact us if you want more information regarding the assignments.

Graduating at CAPE means receiving one-on-one guidance from one of our experienced consultants. Many graduates have gone before you! Additionally, a compensation of €550 per month is provided.

Proficiency in Dutch is required.