



ENSEMBLE

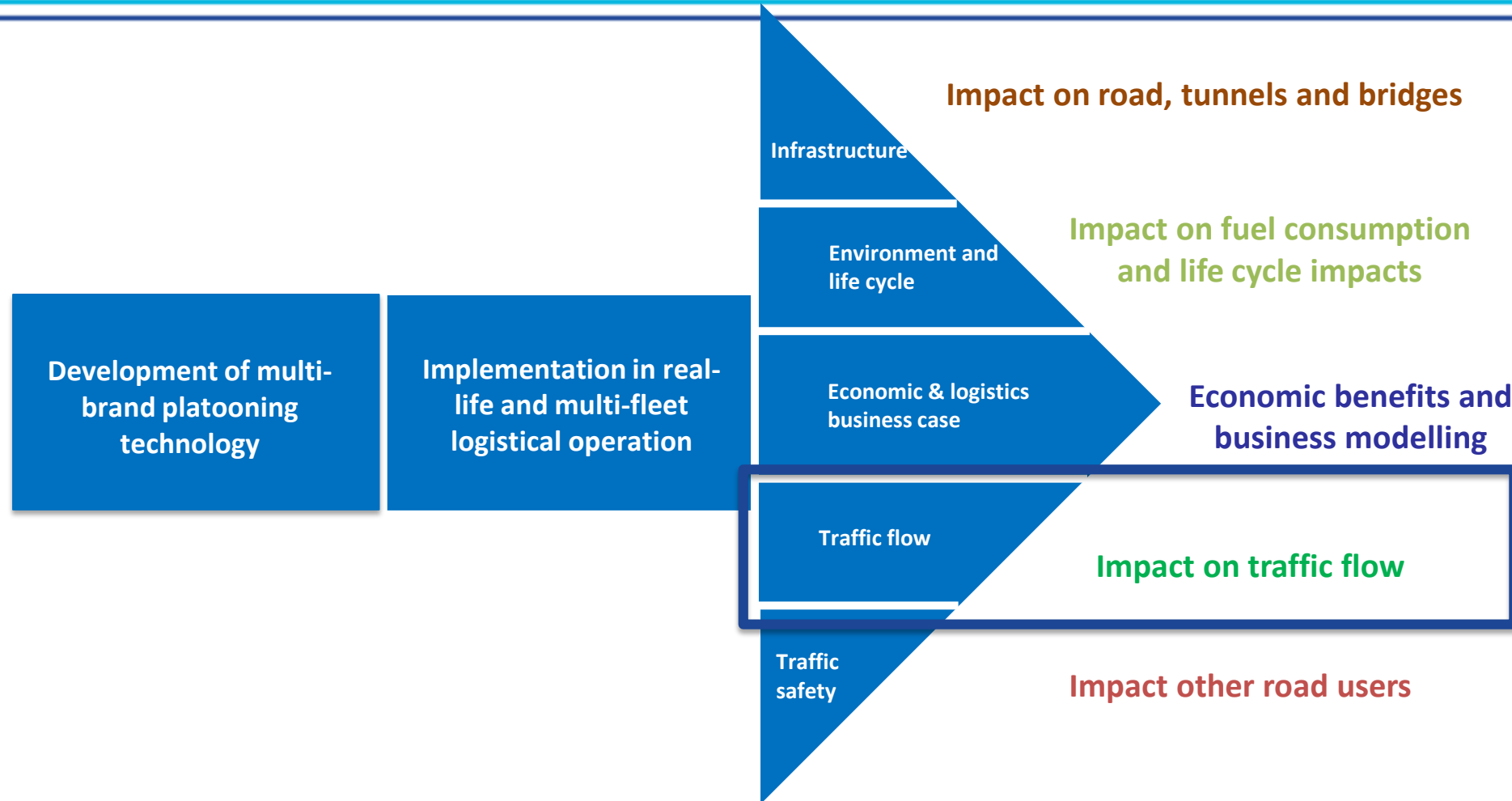
Impact on Traffic Flow

Kinjal Bhattacharyya, Andres Ladino, Lin Xiao, Kingsley Adjenughwure, Gerdien Klunder, Nicolas Deschle

Université Gustave Eiffel

TNO

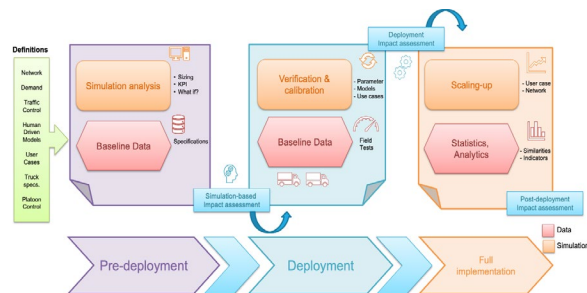
Focus on Traffic Flow



Objective

Determine the impact of **multi-brand truck platoon operation** on **traffic flow performance**

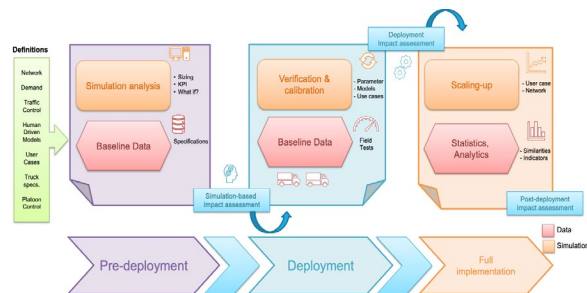
Impact assessment methodology



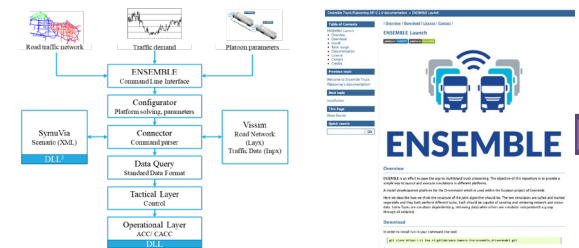
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Determine the impact of **multi-brand truck platoon operation** on **traffic flow performance**

Impact assessment methodology



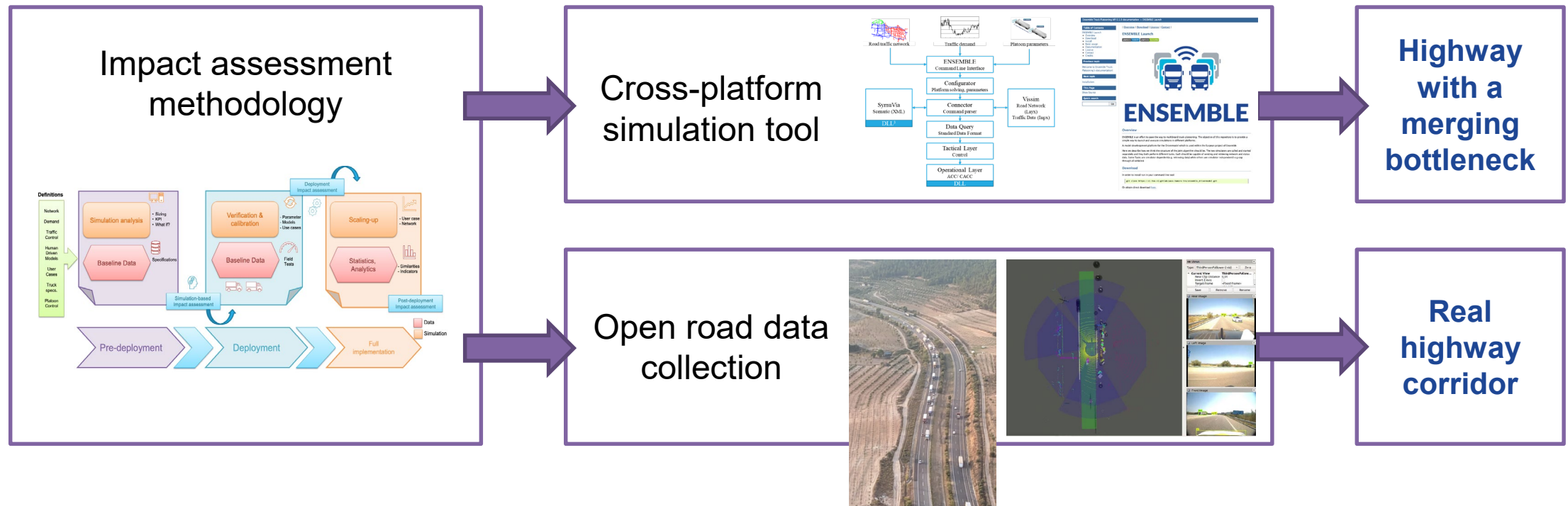
Cross-platform simulation tool



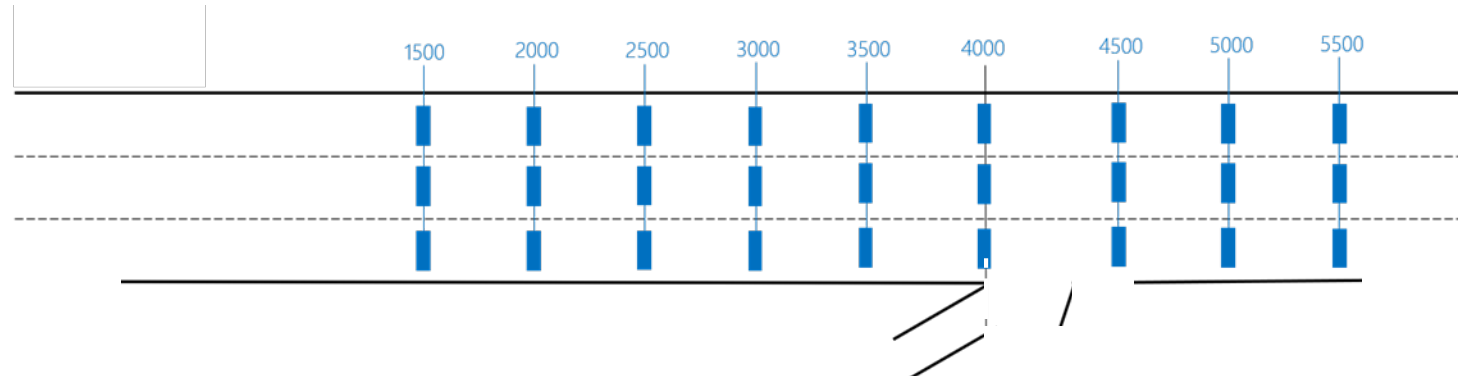
Highway with a merging bottleneck

Objective

Determine the impact of **multi-brand truck platoon operation** on **traffic flow performance**



Simulation Scenario



Platoon Function

Truck Ratio

PAF



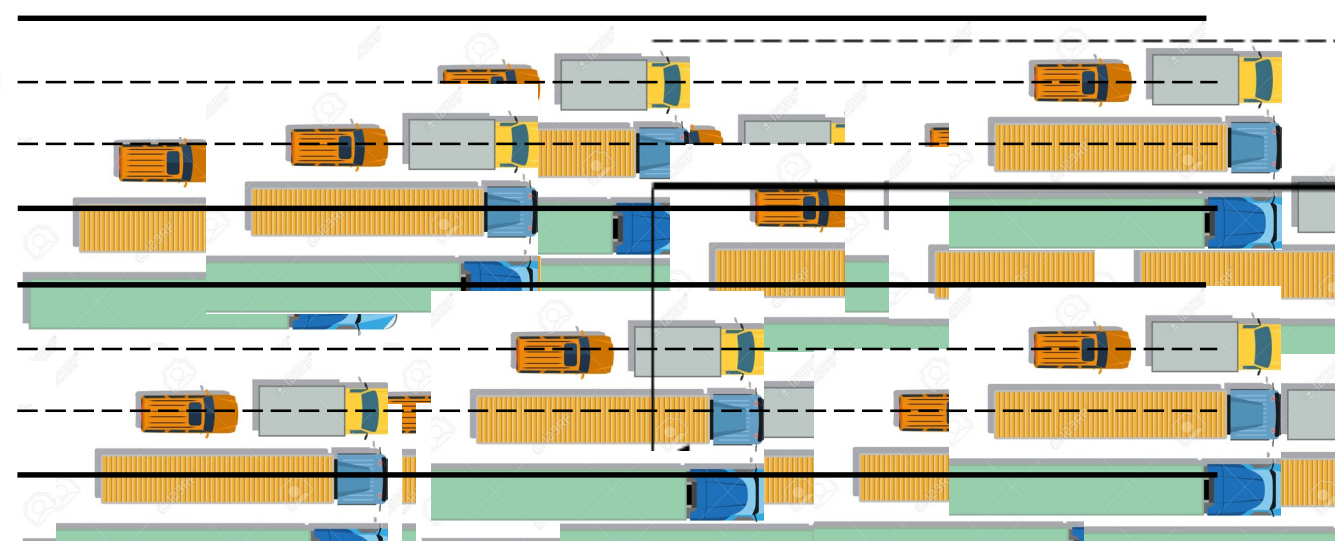
LO



PSF



HI



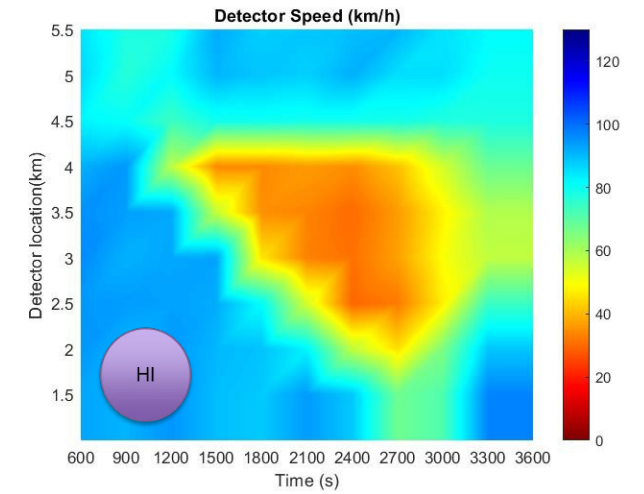
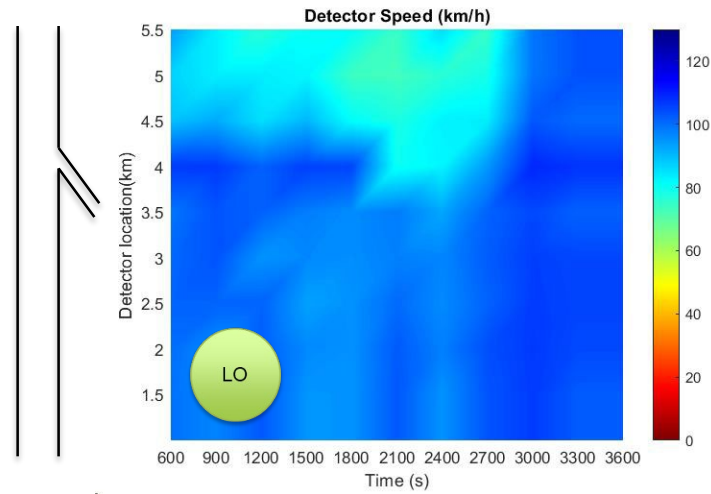
Simulation Results

Road Operator

Road Capacity

Queue Discharge Rate

Congestion Pattern



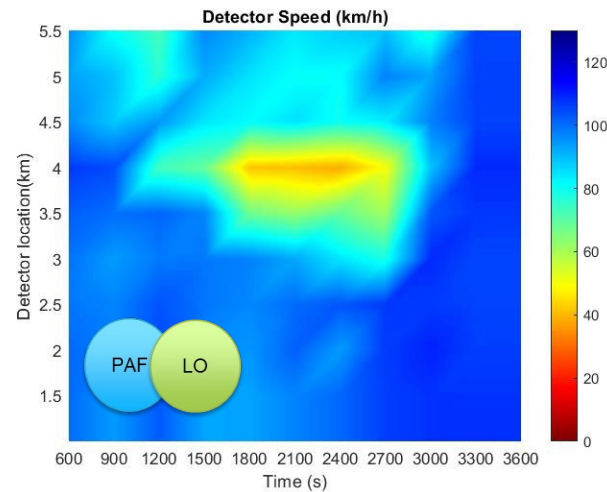
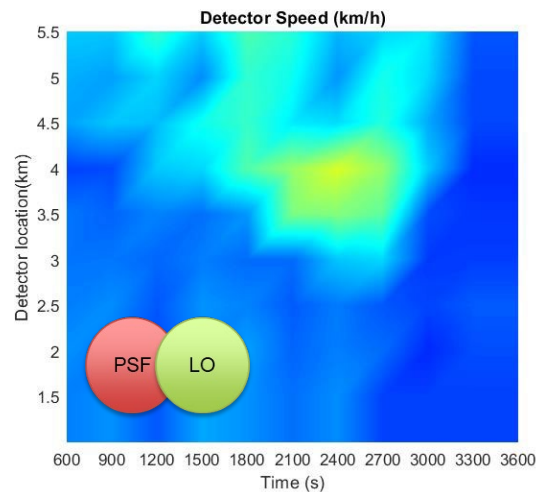
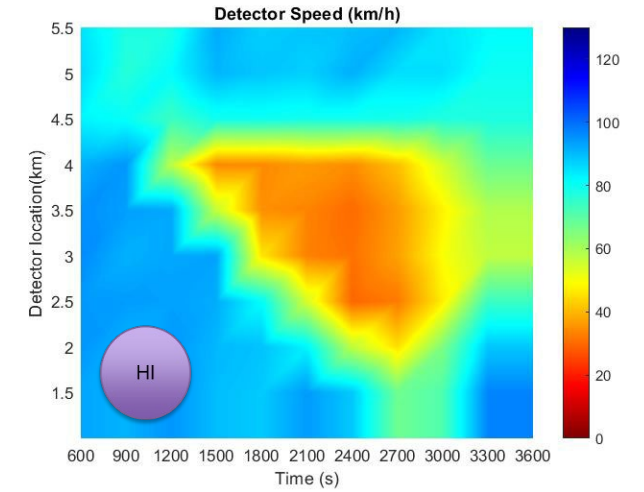
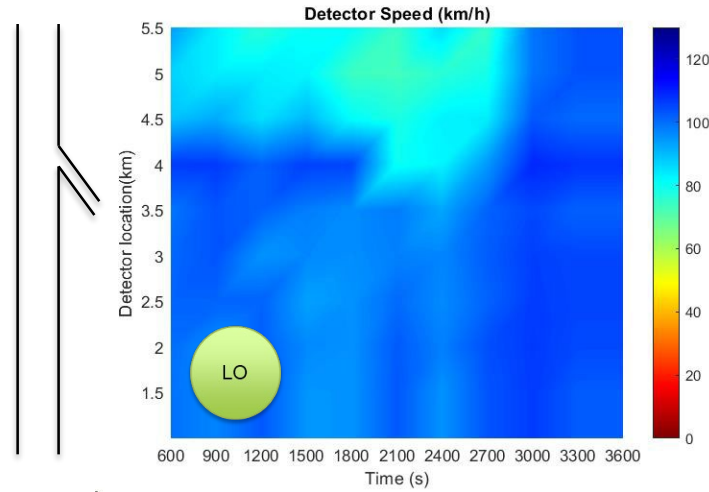
Simulation Results

Road Operator

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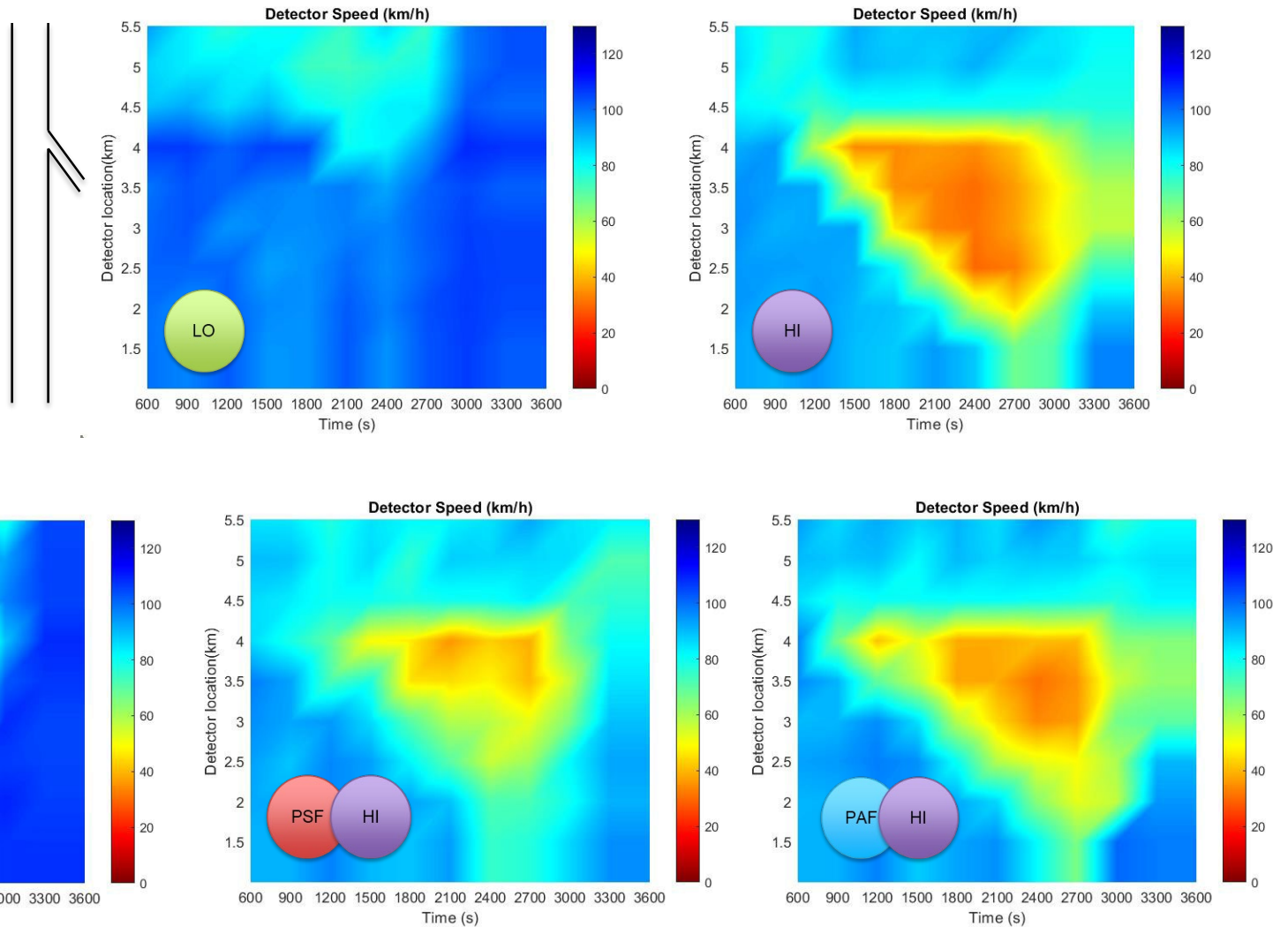
Simulation Results

Road Operator

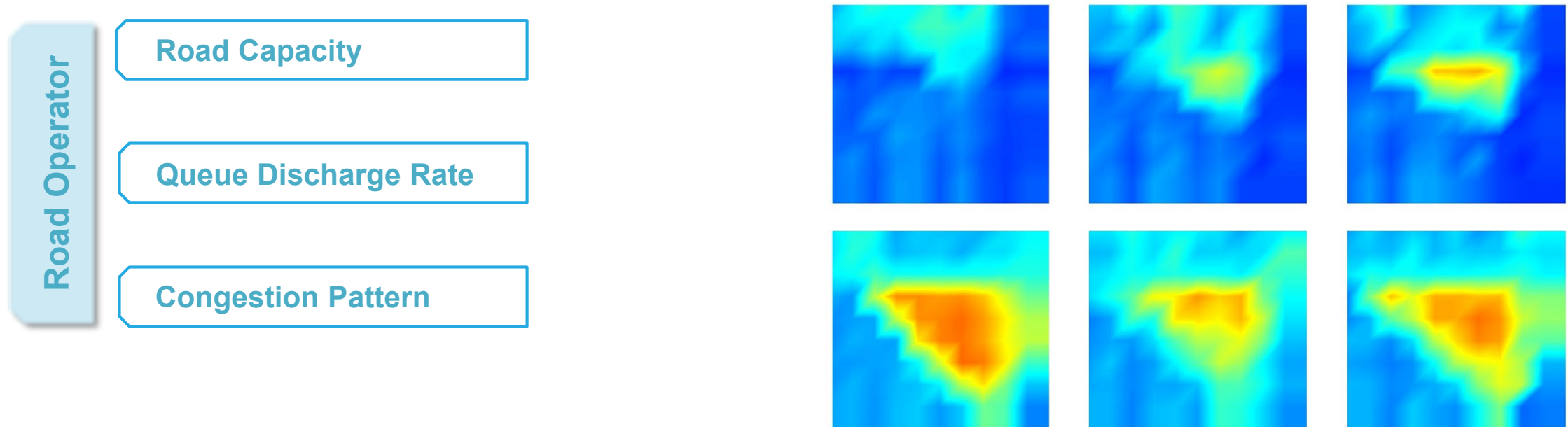
Road Capacity

Queue Discharge Rate

Congestion Pattern



Simulation Results



- Multi-brand truck platoons can **increase road capacity** at a merging bottleneck at a high truck ratio, however, the increase of queue discharge rate is insignificant.
- A multi-brand truck platoon can be more effective in **preventing or postponing traffic congestion** but have less influence after traffic congestion has occurred.
- With **larger following gaps**, the merging vehicles are more likely to find **suitable gaps** in between platooned trucks, and therefore they result in a **higher cut-in speed** that reduces the negative impacts on mainline traffic.

Simulation Results

Road User

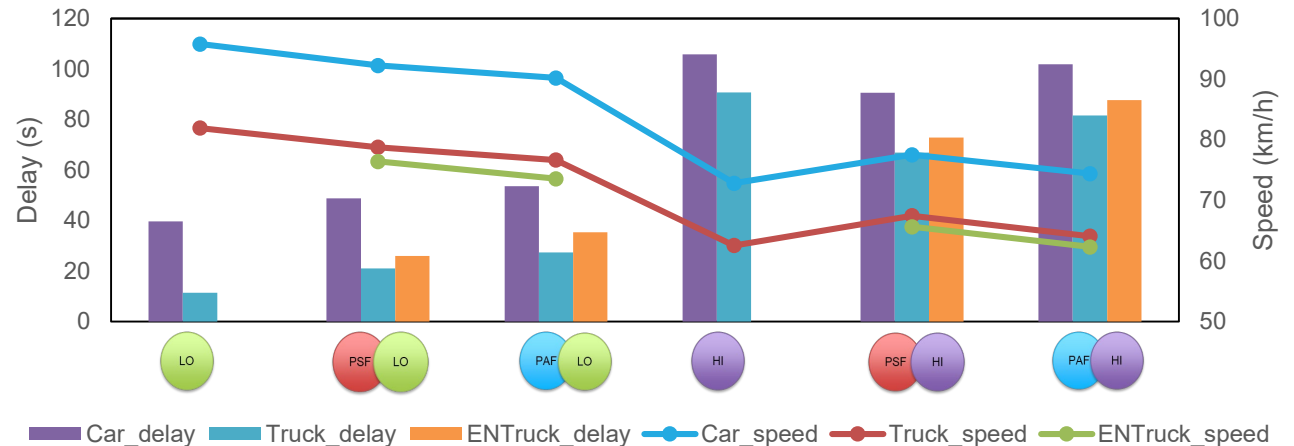
Travel Speed & Delays

Stops

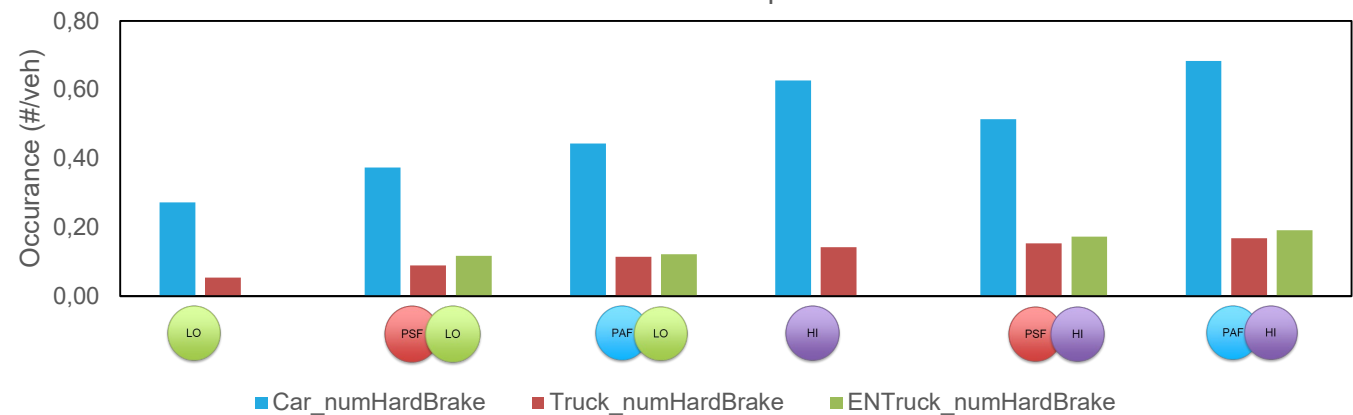
Hard Brakes

- A significant reduction in **hard brake events** is observed for cars, relating to a **higher traffic safety**.

Average Vehicle Speed and Travel Time Delay



Number of Hard Brakes per vehicle



Simulation API



Command Line Interface - CLI

```
> ensemble launch -s /Users/ladino/Documents/03-Code/02-Python/projects/ensemble-api/ensemble/tests/mocks/bottlenecks/bottleneck_001.xml
Successful import of symupy
Platform non compatible with Windows
Solving platform
Simulator path set to default value:
/Users/ladino/Documents/03-Code/04-Platforms/symudev/build/lib/libSymuVia.dylib
Launching Scenario on platform: Darwin
Setting new scenario file(s) path to user input: /Users/ladino/Documents/03-Code/04-Platforms/symudev/build/lib/libSymuVia.dylib
Initializing scenario
State: Compliance
Checking consistency of files
Looking for library path: /Users/ladino/Documents/03-Code/04-Platforms/symudev/build/lib/libSymuVia.dylib
Looking for scenario files: ('/Users/ladino/Documents/03-Code/02-Python/projects/ensemble-api/ensemble/tests/mocks/bottlenecks/bottleneck_001.xml',)
Input File: /Users/ladino/Documents/03-Code/02-Python/projects/ensemble-api/ensemble/tests/mocks/bottlenecks/bottleneck_001.xml Found
State: Connect
Configurator: Initialization
Library successfully loaded!
State: Initialize
No Platoon information provided.
/Users/ladino/Documents/03-Code/02-Python/projects/ensemble-api/ensemble/ensemble/tools/exceptions.py:51: UserWarning: No Platoon information provided.
warnings.warn(warning_message)
Scenario could not be loaded.
Ending simulation
State: Terminate
Successfully accomplished
14:15:8
```

<https://ensemble-docs.readthedocs.io>

Official Package documentation

Ensemble Truck Platooning API 0.1.0 documentation » ENSEMBLE Launch

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ENSEMBLE Launch

platform: [VISSIM](#) platform: [SymuVia](#)



ENSEMBLE

Overview

ENSEMBLE is an effort to pave the way to multibrand truck platooning. The objective of this repository is to provide a simple way to *launch* and *execute* simulations in different platforms.

A model development platform for the Drivermodel which is used within the European project of Ensemble

Here we describe how we think the structure of the joint algorithm should be. The two simulators are called and started separately and they both perform different tasks. Each should be capable of sending and retrieving network and status data. Some Tasks are simulator dependent(e.g. retrieving data) while others are simulator independent(e.g oop through all vehicles)

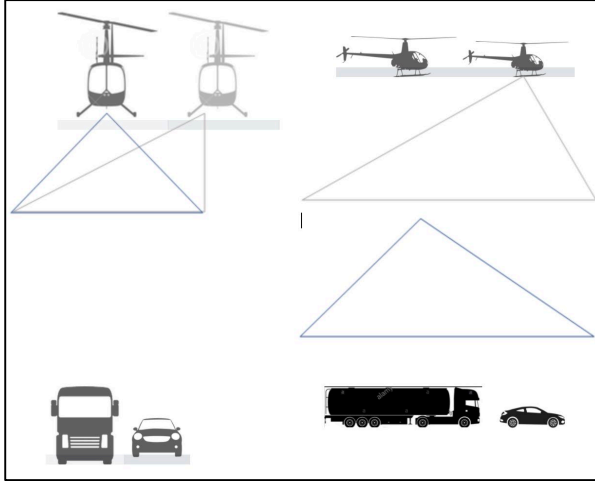
Download

In order to install run in your command line tool:

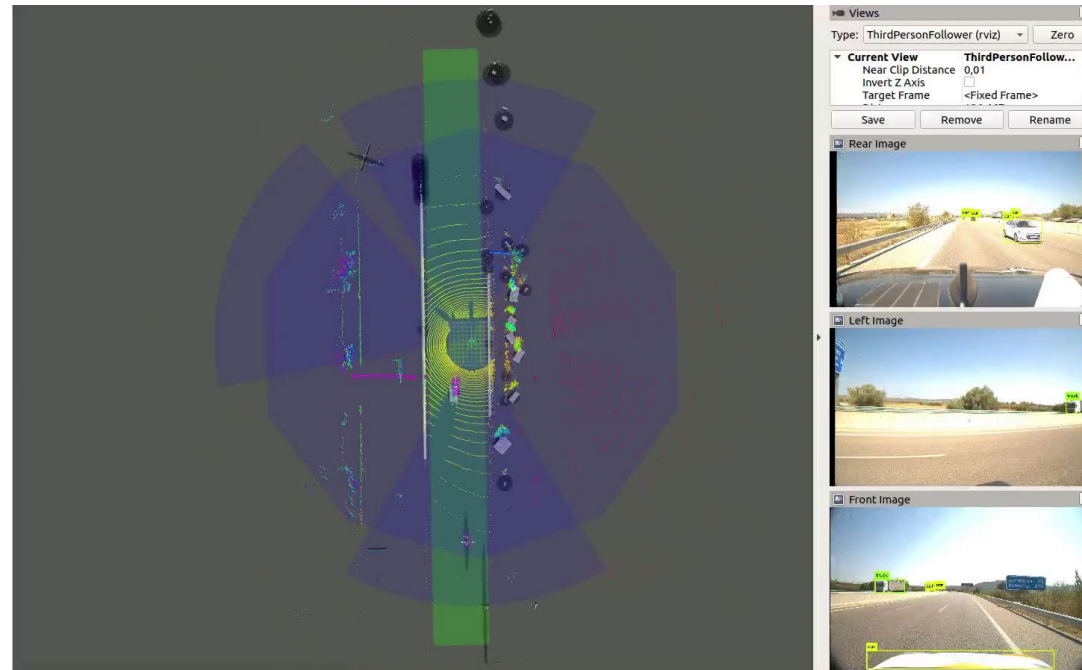
```
git clone https://ci.tno.nl/gitlab/paco.hamers-tno/ensemble_drivermodel.git
```

Or obtain direct download [here](#).

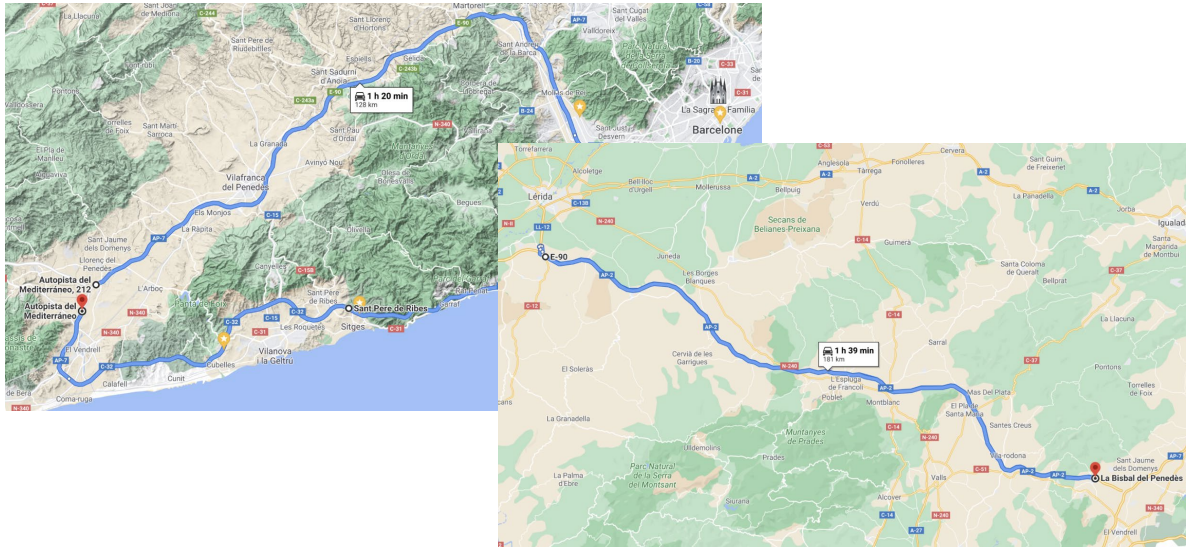
Open Road Testing: Drone



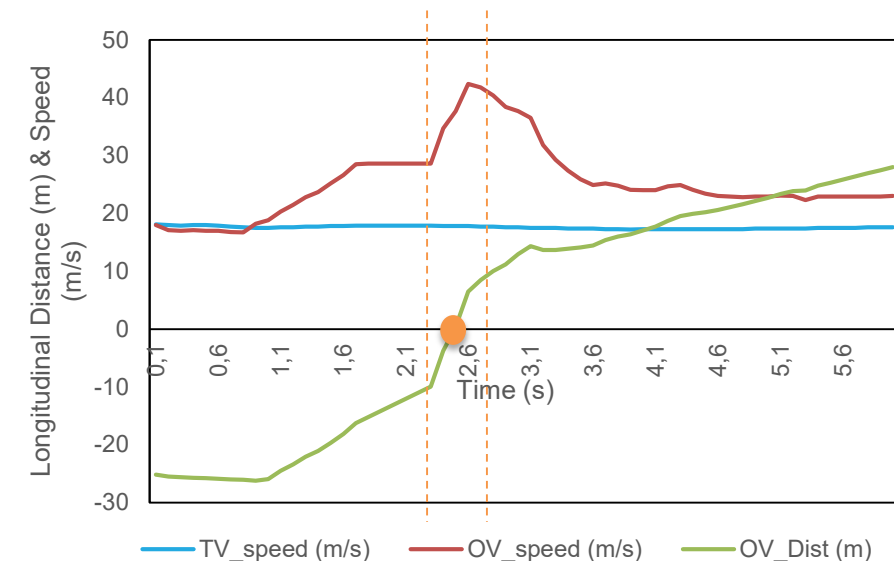
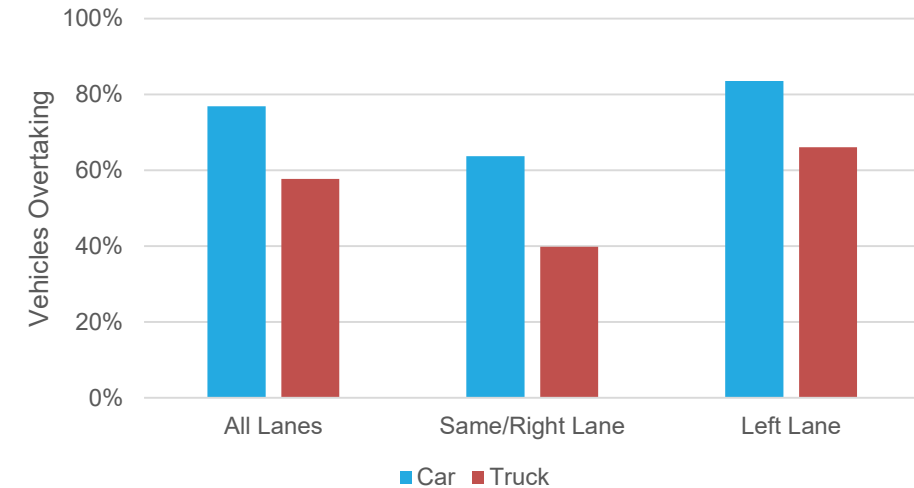
Open Road Testing: LIDAR



Open Road Testing: Observations



- Under free-flowing conditions, the truck platoon observe high overtaking from cars.
- Few trucks are overtaking the truck platoon.
- The stable car speed is about 10 kmph higher than the maximum allowable platoon speed (70 kmph).



Insights to road operators



- The expected improvements and benefits from truck platoon operation largely depend on the **truck ratio** in mixed traffic and the **platoon function**.
- The deployment of truck platoons could first consider the areas or **major freight corridors** where trucks take a large composition of the traffic, e.g., industry area or port area.
- In the mixed traffic with a low truck ratio, adverse impacts of truck platoons could be prevented if certain **traffic management measures** are realized, e.g., advanced coordination near merging, dynamic lane management.
- **Special platoon strategies for the merging areas**, such as applying temporal large following gaps near merging bottlenecks, could be further investigated to enhance the positive impact on traffic flow performance.



Thank you for your attention



ENSEMBLE

platooningensemble.eu