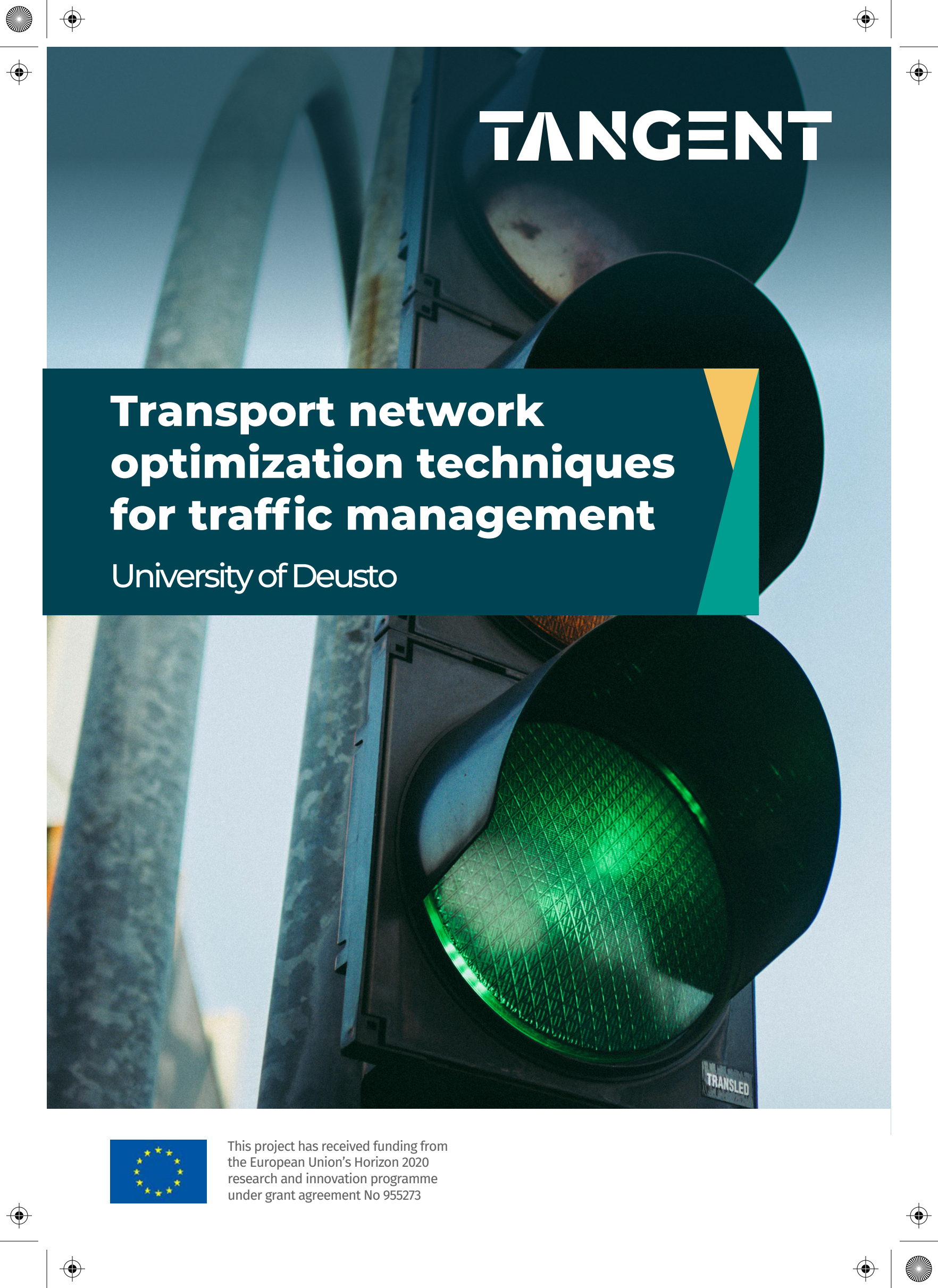




# TANGENT

## Transport network optimization techniques for traffic management

University of Deusto



This project has received funding from  
the European Union's Horizon 2020  
research and innovation programme  
under grant agreement No 955273



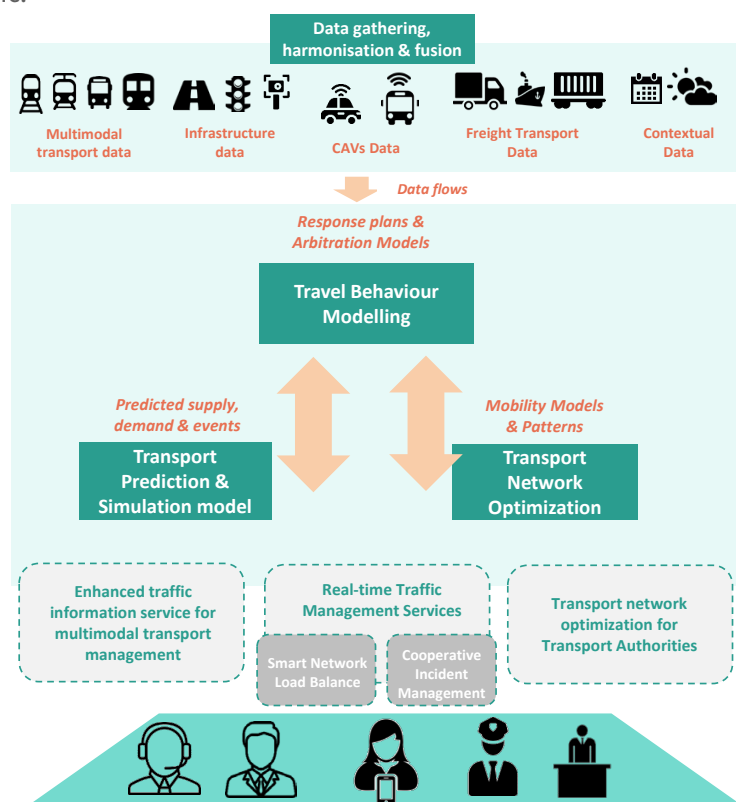




# What's TANGENT?

TANGENT delivers new tools for optimizing **traffic management operations** in a **dynamic way** considering different modes of transport. For that, TANGENT has taken advantage of **state-of-the-art technological advances**, in **data gathering& fusion**, **travel behaviour** modelling, **artificial intelligence**, **simulation** and **optimization** techniques for traffic management.

- **Data gathering& fusion** of intermodal mobility, from sensors, users, vehicles. Transport schedules, pricing, traffic flows, events, etc.
- **Travel behaviour modelling** focused on studying travel patterns of the individual transport users, identifying their needs and motivations for choosing the transport modes and routes (based on historical and real time data).
- **Traffic Network prediction & simulation**, delivering new predictive models of demand and supply of transport in different time horizons ahead. Studying the sensitivity of different factors: seasonality, time of the day, trip distance, price, public transport schedules etc. enabling to predict traffic congestion and potential bottlenecks.
- **Optimisation techniques applied to the transport network**, this module determines a set of actions for optimizing the traffic flows, considering the status of traffic in real time, the predictions and simulations of the future progress of traffic.





# Optimisation techniques for transport operations management

Multimodal transport network management is gaining complexity due to new modes of transport (micromobility, CAVs...) and public authorities must orchestrate both current and future transport modes. Public authorities demand new tools to support decision-making for transport management operations.

TANGENT developed a framework for transport network-wide optimisation using artificial intelligence

techniques, transport modelling and simulation. Particularly the University of Deusto has applied the concept of Computer Optimized Design (COD) for the generation of transport policies and/or intervention (based on Artificial Intelligence). Four functionalities have been tested in the project.

## 1. DYNAMIC CONGESTION PRICING (DCP)

**Dynamic Congestion Pricing (DCP)** is an effective policy to reduce congestion and pollution in urban areas by decreasing use of private car, and it can be easily implemented by the city authorities. It can reduce traffic in specific areas, promote sustainable

transport modes (i.e. carpooling and public transportation), restrict specific types of vehicles, reduce traffic at specific times and on specific occasions, and generate revenue.

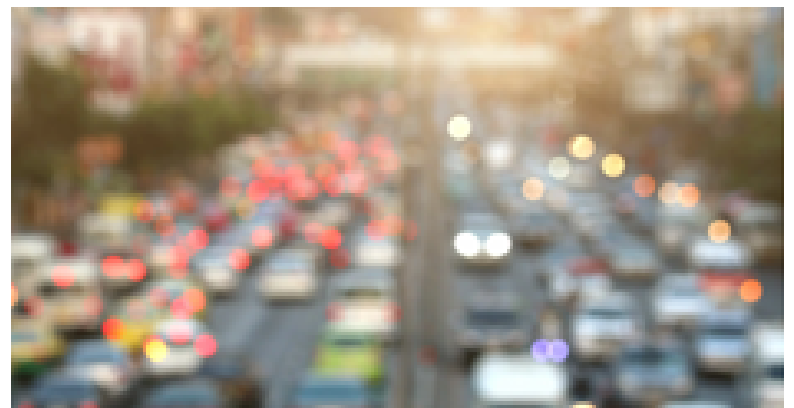
---

TANGENT has developed new methodologies to determine the **optimal or near-optimal pricing policy**: how much the **toll price** should cost **depending on the congestion level** in a predefined zone.

---

To establish an optimal pricing policy, the following performance indicators were considered:

- **level of congestion** inside the DCP zone
- **level of congestion** in the surrounding area of the DCP zone
- total **revenue obtained** by the pricing policy
- reduction of **system-wide emissions**





## 2. SYNCHRONISATION OF DEMAND RESPONSIVE TRANSPORT (DRT) AND PUBLIC TRANSPORT (PT)

A barrier for increasing the use of public transport (PT) in cities and its suburbs is the first and last-mile of the journey, especially in areas that are not

densely populated and where public transport service is infrequent. Demand Responsive Transport (DRT) can act a feeder of passengers for PT;

The **synchronisation of DRT and PT** determines the **optimal or near-optimal DRT fleet** and **operational routes** to serve the first and last-mile legs of a specific area.

It is assumed that the users provide the origin and destination of their trips in advance, and their preferred time windows for departing and arriving.

In this case, the **performance indicators** to be optimised when finding the best DRT fleet and operational routes are:

- the percentage of **demand served**
- the **total emissions** produced by the DRT fleet
- the **operational costs** of the DRT service
- the **average travel time** for the passengers (considering the whole trip: first-mile + PT trip + last-mile)

## 3. SYNCHRONISATION OF PUBLIC TRANSPORT (PT) AND TRAFFIC CONTROL

PT may also suffer from traffic congestion, traffic control schemes, and a lack of flexibility to react to sudden changes. To tackle these problems, TANGENT looked into the possibility that, upon certain planned or unplanned events (e.g. failure of a metro line), the

frequency and/or capacity of some surface **public transport lines** and the **traffic control plan** on the roads on which these lines run are **simultaneously readjusted** to minimise the impact of an event in the transport network.

The **synchronisation of PT and traffic control** is assessed to find the optimal or near-optimal **frequency and/or capacity of the public transport lines** as well as the **traffic control plans** for selected zones or arterials in which these lines run.

In this case, the performance indicators to optimise are:

- **user costs**
- the **operational cost** of the public transport fleet
- **congestion levels** in some predefined areas
- the reduction of the **system-wide emissions**

## 4. SIGNAL VEHICLE COUPLED CONTROL WITH CONNECTED AND AUTOMATED VEHICLES (CAVS)

**Signal Vehicle Coupled Control with Connected and Automated Vehicles (CAVs)** is a traffic management tool for future mobility scenarios.

It aims to improve the **traffic control performance** by leveraging the exchange of information in real-time between signals and vehicles, and the simultaneous optimisation of **signal timing/phases** and **CAVs trajectories and/or routes**, to enhance the performance of the whole traffic network.

The following assumptions are considered: there is a fleet of full CAVs which are connected to and can be managed by the Traffic Management Centre (TMC), and that the origin and destination of each CAV are known by the TMC. Between each origin and destination, there are one or more predefined paths. The objective is to optimise the path assignment for the complete CAV fleet and the traffic control plan on specific arterials of the considered network.

In this case, the **performance indicators** to optimise are:

- system-wide **emissions**
- **traffic congestion** in selected areas
- total **travel time difference** between CAVs and conventional vehicles
- the **total energy consumption** of CAVs



Figure 1 – Connected Vehicles and traffic lights. (Source: Shutterstock (1651650295))



**September 2021**  
-  
**November 2024**

**39 months**  
**13 partners**  
**7 European countries**

## MORE INFORMATION

### Project Coordinator

Leire Serrano  
leire.serrano@deusto.es

### Technical manager

Antonio D. Masegosa  
admasegosa@deusto.es

## FOLLOW US!



[/TANGENT\\_H2020](#)



[/tangent-project](#)



[/TANGENT\\_project](#)



[www.tangent-h2020.eu](http://www.tangent-h2020.eu)

## PARTNERSHIP

**TANGENT** is a collaboration between **13 partners**, including universities, research laboratories and innovation hubs, consultancies, city authorities, a software provider, a public transport company and a network organisation. The project is funded by the **European Union's H2020 Programme**, has a duration of three years and a budget of almost 4.8 million euros. **TANGENT** is coordinated by the University of Deusto, based in Bilbao, Spain.



# TANGENT



[www.tangent-h2020.eu](http://www.tangent-h2020.eu)



[www.youtube.com/tangent](https://www.youtube.com/tangent)