PUBLIC SUMMARY OF DELIVERABLE

D4.3 – SMART HIGHWAYS Release 1

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This document is a public summary of a confidential deliverable of the TT project. It serves as a summary of the release 1 demonstrators and provides links for external actors to connect to the TT pilot leaders if they are interested in more information.

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Motivation

TransformingTransport (TT) demonstrates, in a realistic, measurable, and replicable way the transformations that big data can bring to the mobility and logistics market. TT is structured into 13 different pilots in 7 pilot domains, which cover areas of major importance for the mobility and logistics sector in Europe.

The **Smart Highways domain** and its two pilots aim to validate the impact of Big Data technology for reshaping transport processes and services by increasing operational efficiency, improving customer experience, and fostering new business models. The main ambitions are to deploy – in near real-world conditions – the technological platform needed to run models and display value-added information in real time to Traffic Management Control, and to foster data-driven decision making.

The Smart Highways domain's pilots are aimed at measuring the technical and economic impacts of Big Data technologies on operations, applied to Cintra's Highways concessions. The two pilots will work out the same Big Data solutions and approaches, even when data sources, models and cases might clearly differ from each other.

The challenge addressed by the two pilots is to improve traffic flows (mitigate congestion, reduce accidents, etc.) along the corridor **and increase the efficiency of the current infrastructure, while enhancing user experience**. As a result, Smart Highways domain's pilots will demonstrate the technical and economic feasibility of Big Data and Machine Learning techniques to the road transport operation.

Ausol Pilot

The pilot is deployed in the Ausol toll highway and A7 free motorway, a highly congested semi-urban corridor of 105 km connecting the city of Málaga with Marbella, Estepona and other coast populations until near Gibraltar, with average 66.000 vehicles a day – up to 100.000 in peak season, 24% of them driving the tolled sections.

One of the promises and the most valuable contribution to this project is the **real-time integration** with external data sources, so we could model traffic not only in the toll highway, but in the whole corridor. Thus, Traffic Management Control of the highway can access accurate and up-to-date information in a tailored interface. A Dashboard has been designed so that operators can monitor at a glance actual **traffic flows and prediction models, bottle-neck warnings** at toll stations, **incident alarms** in the corridor and surroundings, **maintenance vehicles position** and other user generated data to **keep track of user experience** – such as Waze and Twitter.

Currently, 16 data sources are available to Ausol's Dashboard and prediction models, where **the most valuable** in terms of novelty are:

- Real time traffic counters along the route – different sensors like license plate recognition (LPR) and loop sensors;
- Real time maintenance Vehicle Routes – Highway;
- Real time queue length at toll stations: by means of integration with internal AI system;
- Real time toll events (category, payment type, etc.), by means of integration with internal FI-CO system;
- Real Time Incidents, by means of integration with Concession's Asset Management System (Maximo);
- Real time weather information, by means of integration with Open Weather and AEMET;
- Real time congestion level and travel time, by means of integration with TOMTOM;
- Real time traffic incidents information (DATEXT II), by means of integration with DGT;
- Real time traffic incidents information, by means of integration with WAZE;
- Real time traffic signalling information (Variable Messaging Signals), by means of integration with DGT (Department of Transportation, ES) and Highway's own panels.

The Dashboard displays the traffic data in a visual way and to make it easier to analyse by operations and business departments. Providing a ***short-time*** **traffic forecast** (maximum **120 min** approach) which the aim of adapting the operation of the highway according to the real needs. Based on that traffic forecast, Control Centre operators might act on:

- **Toll stations' configuration**, to get ready in time for predicted peaks of traffic. By increasing toll-boxes flow and lane configuration we want to reduce queues and enhance user experience, while reducing fuel consumption and pollutant emissions.
- **Maintenance tasks planning** (lane closures, shoulder cleaning, painting, etc.), by including new boundary conditions such as predicted traffic flows and descriptive incidents heat map.
- **Traffic monitoring and control**, by providing meaningful information to road users on variable messaging panels to adapt their behaviour to changing driving conditions.

Norte-Litoral Pilot

The pilot is deployed in Cintra's concession Norte-Litoral, a free-flow (no barriers) toll highway of 109 km that connects Oporto to the northern cities of Caminha Do Ponte (A28) and Ponte De Lima (A27, forked from A28).

The main remarkable difference between Norte-Litoral and the Ausol pilot is the business model: **Norte-Litoral is based in SLA contract with the Portuguese Government**, while Ausol incomes come from traffic. On top of that, the Norte-Litoral pilot is based on a free-flow system operated by a third party – Via Livre. Such a difference in operation maintenance may cause the Norte-

Litoral pilot to be limited to procedures and methodologies. For instance, there's no way to describe toll stations at Norte-Litoral – so reducing operation cost through toll station optimization would simply make no sense.

On the other hand, although technology deployed in both pilots will be part of a unique block, **data sources, integrations, models and dashboards might significantly differ from each other**, as well as a few subsystems available only for Ausol or Norte-Litoral independently.

Objectives of the replication pilot were stated at the beginning of the project to hit the following goals:

- Understand better the road traffic and **mobility patterns**.
- **Optimize highway operation** and grant SLA compliance.
- Guarantee **safer roads** and make a better use of them.

In this pilot, the most important difference with respect to the Ausol pilot is **the absence of toll plazas on the highway**, so the data sources from the toll are non-existent. Most valuable data sources available are:

- Real time traffic Data from traffic counters buried at every node along the highway;
- Traffic events that might have an impact on traffic coming from different sources, such as internal work orders and incidents on Asset Management System and external warnings on traffic behaviour - from new hi-tech Distributed Acoustic Sensing System;
- Travel Times, from TomTom's API, retrieved every 5 minutes;
- VMP Messages: historical messages displayed on highway panels (Scada integration).

Conclusions

In general, it is worth mentioning that the recently developed **traffic prediction models can already prevent bottlenecks at toll stations up to 120 minutes in advance**, which suppose a great gain from the previous 20 minutes of reaction time to accomplish changes on the lanes and payments modes of each toll box. To understand better the positive impact that those extra 100 minutes can make on daily operation, take into account that just moving the appropriate staff members from Control Centre to the critical place might take from 20 to 25 minutes – in good traffic conditions.

Finally, while we develop parallel initiatives under the project framework to foster technological and business synergies among partners, we stay focused on **deploying in near real conditions the technological platform needed to manage all data, run models and display information to**

the Traffic Management Control – which will make a "before and after" on Highway Management.

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