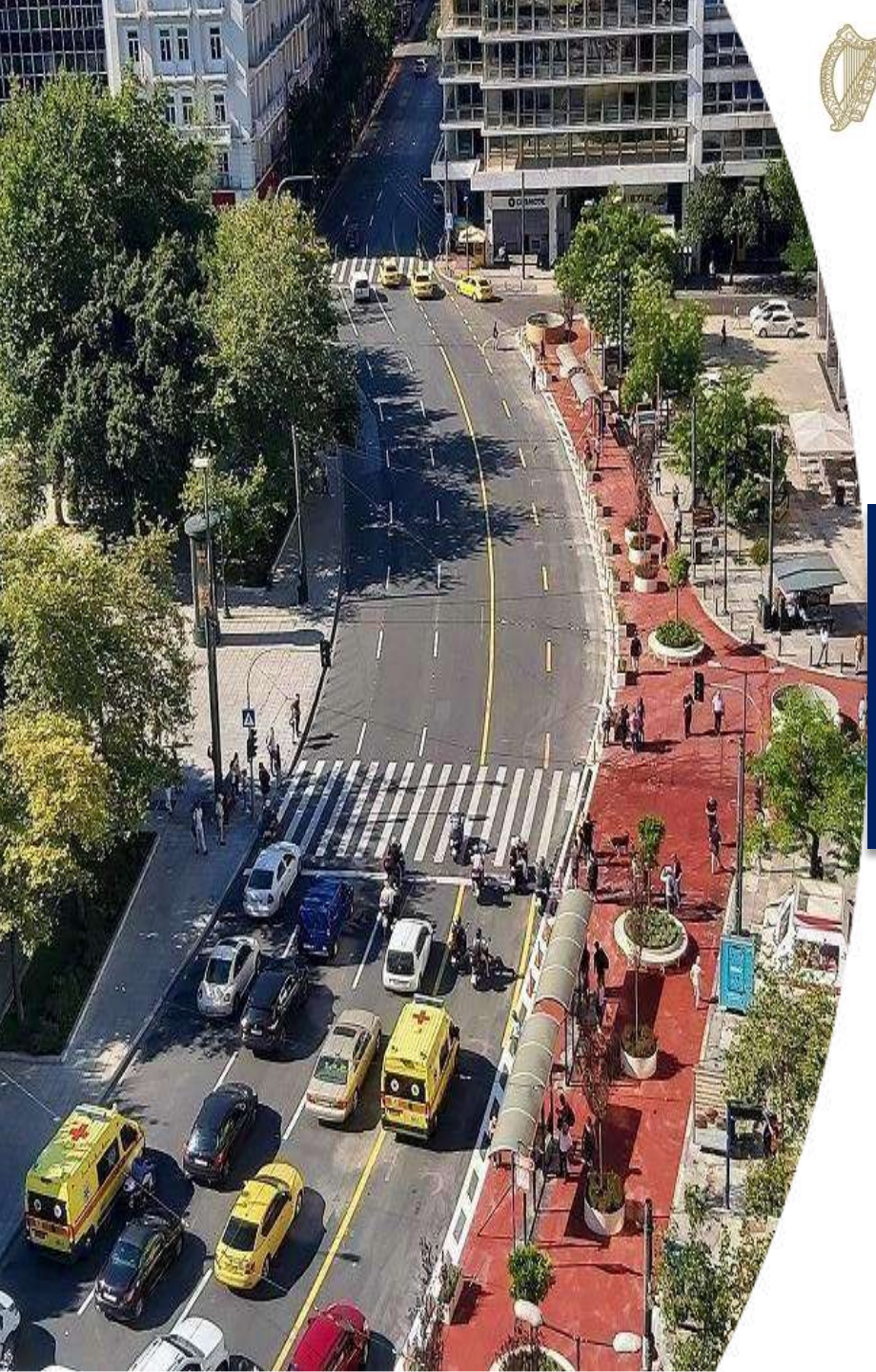

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Dublin, Ireland, April 15-18, 2024

Integration of road user behavior models to traffic safety analytic tools - PHOEBE

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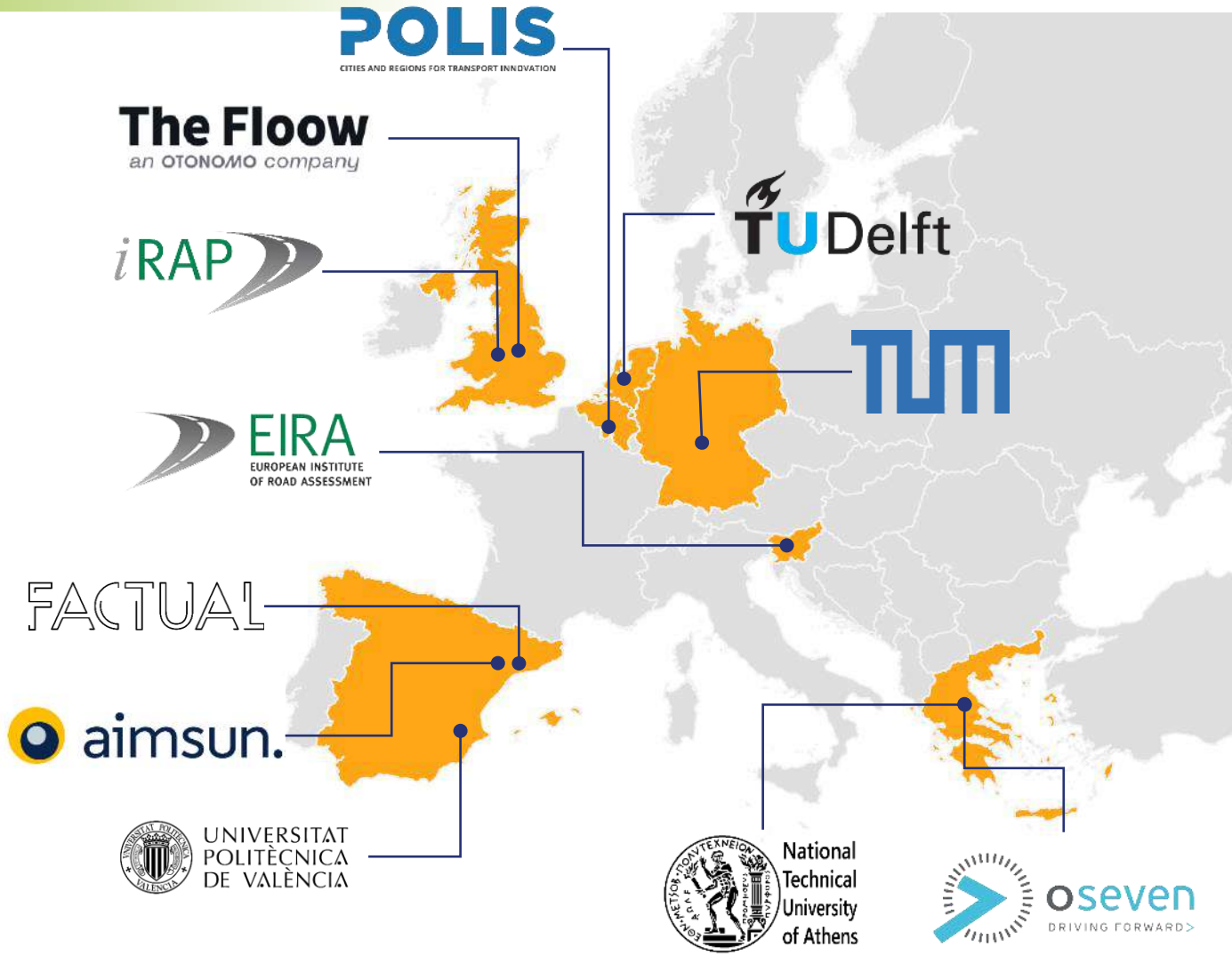
PHOEBE

The PHOEBE project

- 11 Project partners
- Profile of the project:
  - 45 months (November 2022 – July 2026)
  - Horizon Europe Framework
- Development of an integrated, dynamic and scalable human-centered predictive safety assessment framework for all road user types in urban areas.
- Brings together traffic simulation, road safety assessment, human behaviour, mode shift and induced demand modelling and new and emerging mobility data into a harmonised, prospective assessment framework for road safety.



Project Objectives

To **embody social components into risk assessments** to take into account changes in human behaviour, and mode and trip choices

To apply the proposed methodological framework and enhanced and integrated predictive modelling tools in an **experimental multi-use-case**

To **harmonise safety definitions** in traffic simulation models

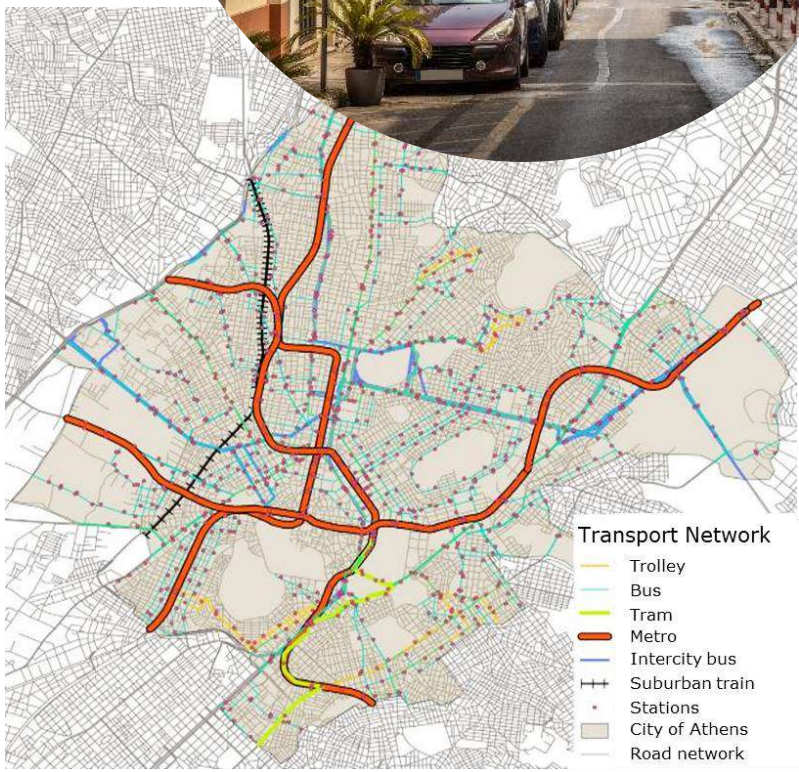
To develop a new, replicable methodology for **dynamic safety prediction and socio-economic evaluation**

To develop enhanced and integrated **urban risk assessment models and tools**

To **exploit big data and telematics** through AI and ML data analysis techniques that are innovative and efficient

Athens Use Case

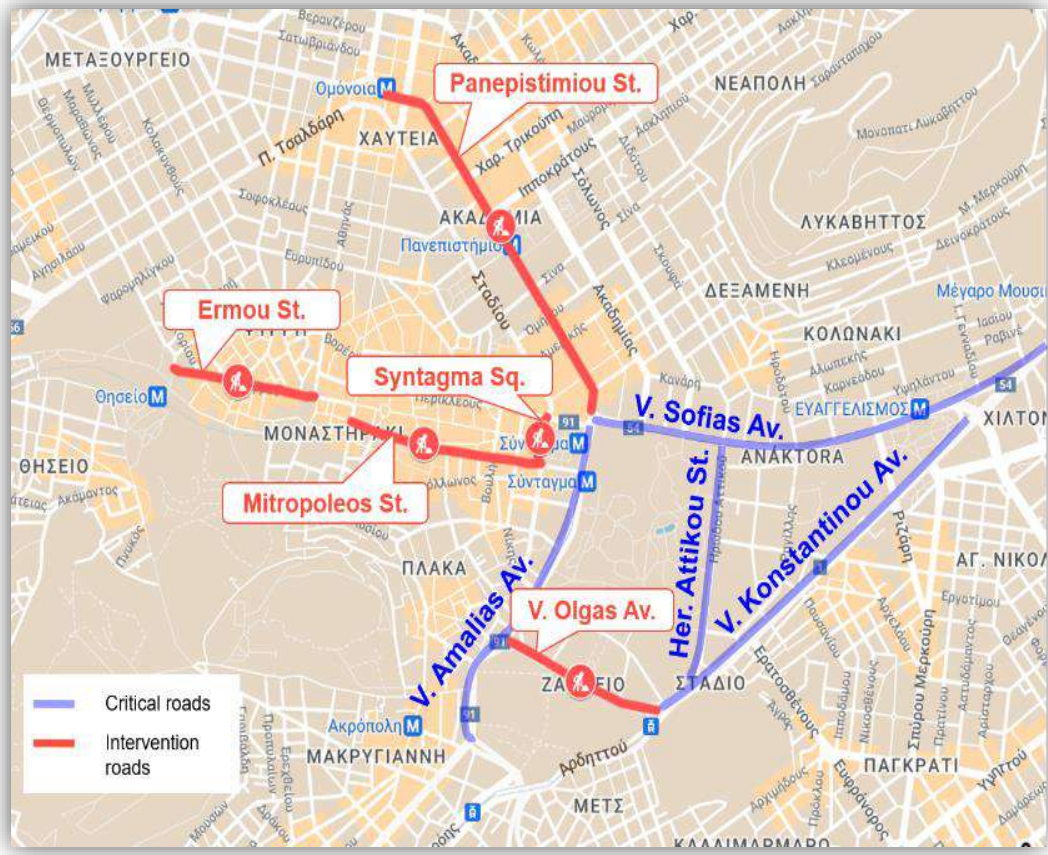
- The City of Athens (pop. 664,000) is in the Attica metropolitan region (pop. 3.75 million)
- Passenger vehicles make up 69% of the total vehicle fleet in Attica, followed by motorcycles and mopeds at 24%, trucks at 6.7% and buses at 0.3%
- The public transport network of Athens consists of buses, trolleybuses, trams and metro lines for urban transport, complemented by the network of Suburban bus and train services
- The focus of the Athens pilot is pedestrian road safety
- In order to measure it, profiles and example travel patterns are defined
- The analysis place critical emphasis on VRU KPIs, such as speed measurements and modal share of pedestrians, cyclists and similar modes, such as e-scooters
- Different parameters are taken into consideration, such as disability rate, gender or age
- Scenarios are also created for different times of the day, such as day- or nighttime, as well as during peak or off-peak hours



Athens Use Case Interventions

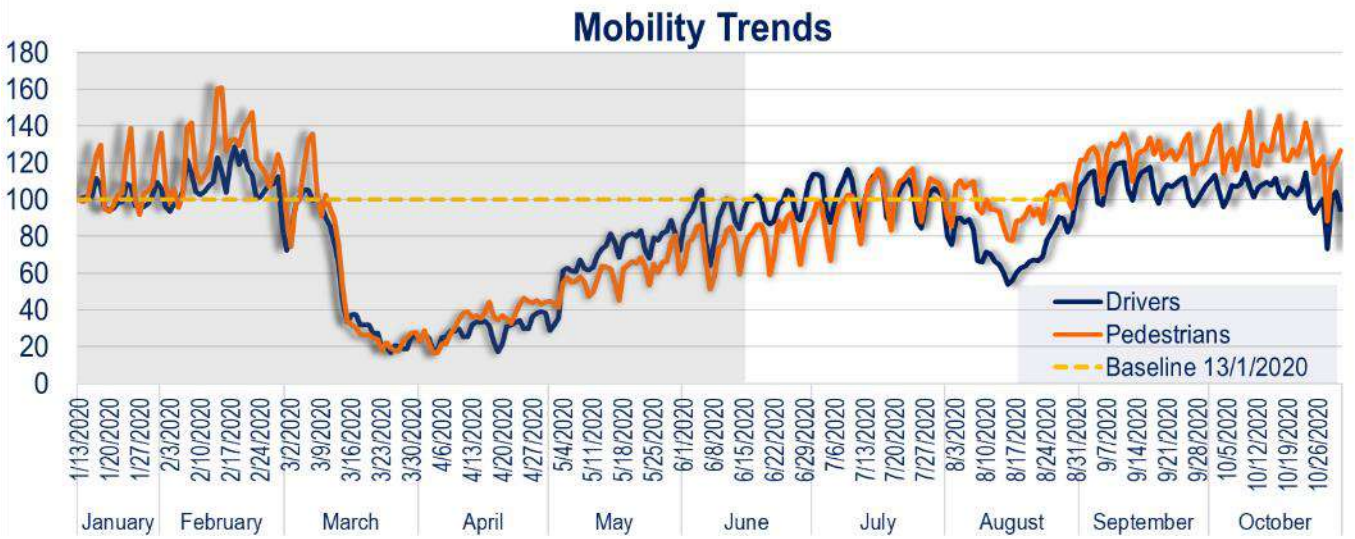
The City of Athens intends to implement three major interventions to promote safety and sustainable mobility:

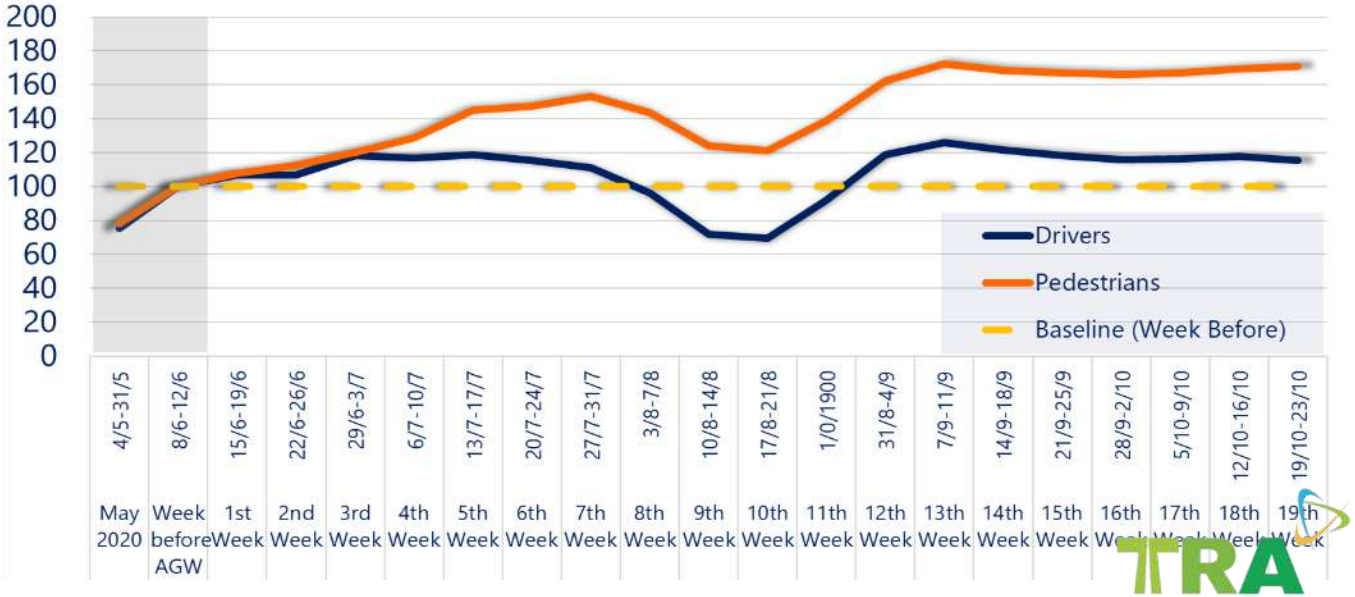
- a 30 km/h speed limit across the network through several regulatory measures, from nominal enforcement to police presence to radars and speed cameras
- the establishment of an extensive network of bicycle routes within the existing road network (mixed traffic, bike/bus lanes and bike lanes on road shoulders)
- the promotion of public transport modes.



Traffic trends on Athens centre

- Drivers and pedestrians mobility in Athens decreases significantly during the first restriction on mobility due to the pandemic (February, March, April)
- There is a recovery on May and June close to the typical levels for the respective time period
- From the 2nd week of June 2020 and for the next 7 weeks, drivers and pedestrians mobility is gradually increasing
- On September and October the traffic reaches the traffic level of the first two months of 2020, & season typical levels





Walking measurements

Panepistimiou St.:

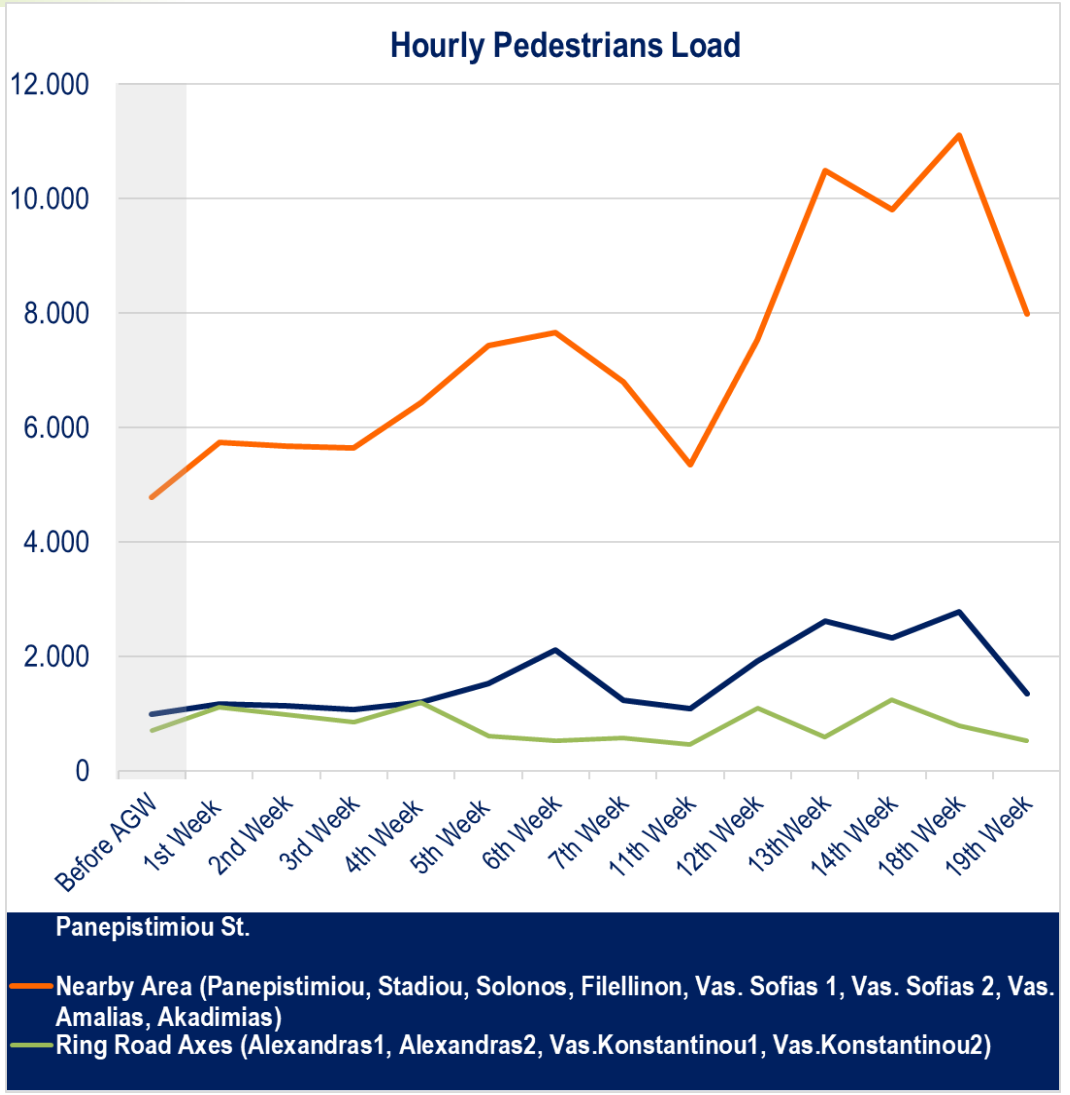
- Significant increase in walking by 56% compared to the week before the implementation of interventions

Nearby Area:

- Average weekly increase in walking, on the road axes of Panepistimiou, Stadiou, Solonos and Filellinon in total, by 47% compared to the period before the implementation of interventions
- The increase can be attributed to the widening of the sidewalks on Panepistimiou St., Syntagma Sq. and Ermou St.

Ring Road Axes:

- Increase in walking on Alexandra Av. and Vas. Konstantinou Av. by 18.3% compared to the week before the implementation of interventions
- The highest hourly pedestrian load is observed in the 14th week of pilot implementation of the Athens Great Walk



Traffic comparison of operations of 3 and 4 lanes

- The travel time on Panepistimiou St. during the 1st period (3 traffic lanes) increased by 1.1 minutes while during the 2nd period (4 lanes) increased by 0.4 minutes

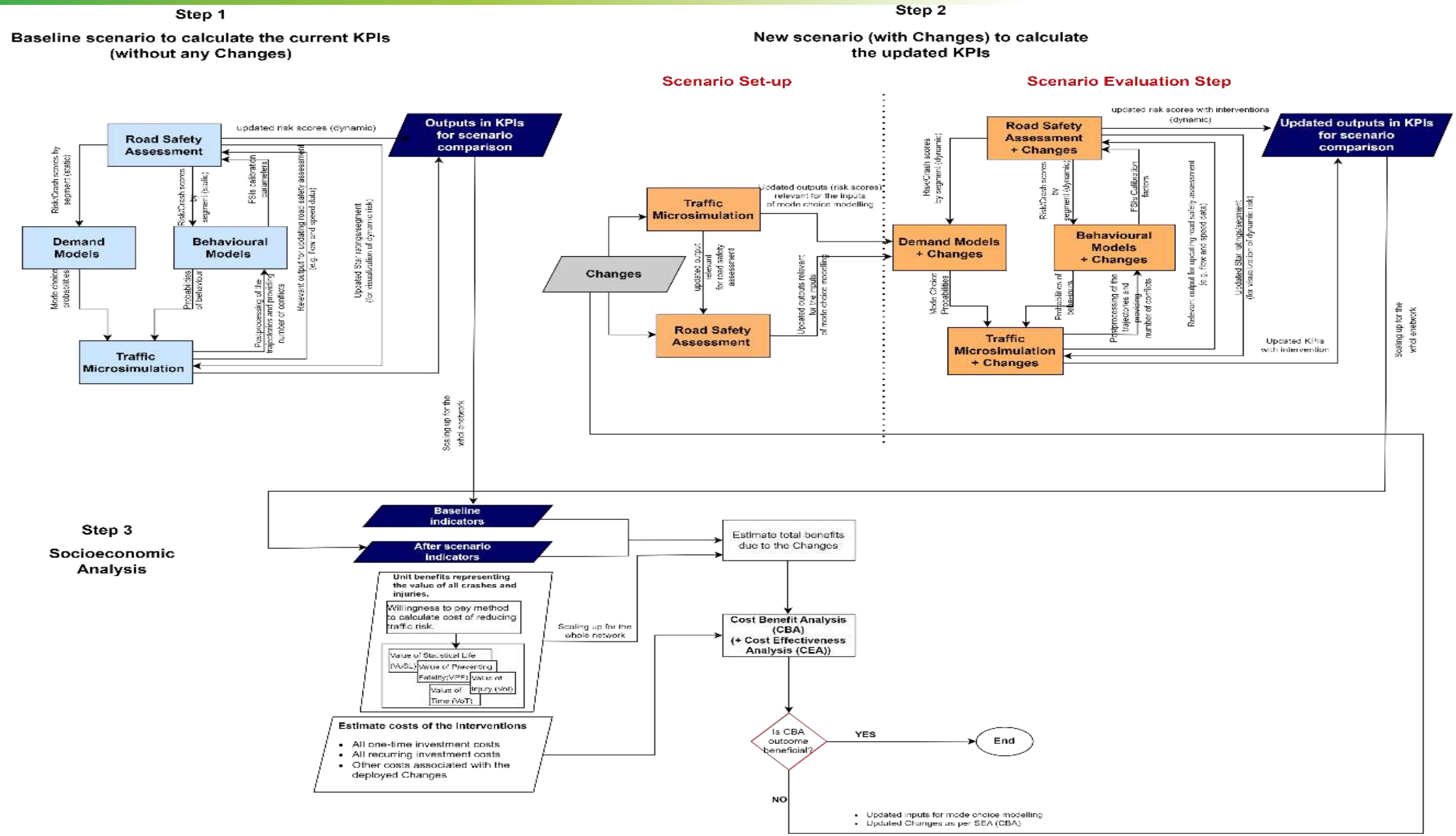
- Traffic conditions on the entry road axes are the same as before. The travel time on Vas. Amalias is reduced by 1.4 minutes with the addition of the fourth traffic lane

- The influence of the mobility interventions on the majority of the exit road axes is negligible

- Travel times on the ring road axes were increased during the 2nd period of operation

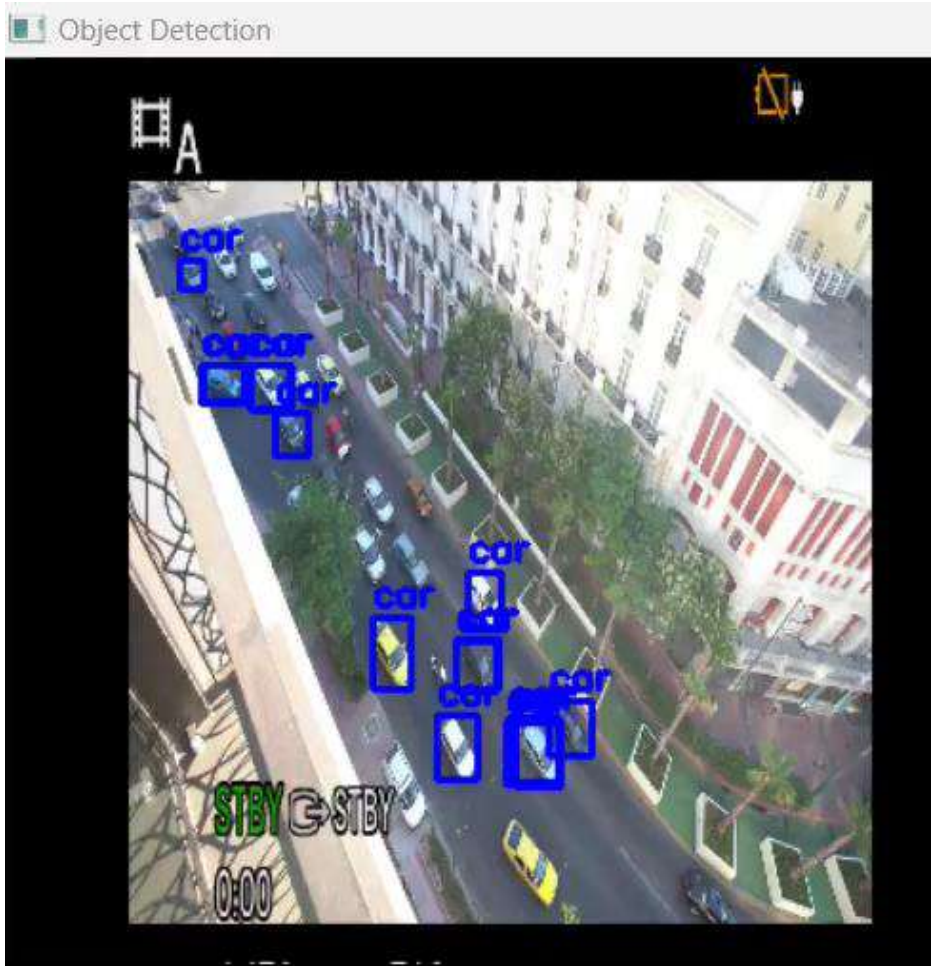
	Observations (min.)			Difference (min.)	
Route	Before AGW 12/6/20	1ST period 13/7-17/7/20	2nd period 14/9-18/9/20	Before AGW 1ST period	Before AGW 2nd period
Central Road Axes					
Panepistimiou (from Vas. Sofias to Patision)	**2.7**	**3.8**	**3.1**	**1.1**	**0.4**
Akadimias (from Patision to Vas.Sofias)	4.9	4.2	4.5	-0.7	-0.4
Solonos (from Vas. Sofias to Patision)	**7.1**	**6.9**	**7.5**	**-0.2**	**0.4**
Stadiou (from Aiolou to Vas. Georgiou)	2.7	2.3	2.4	-0.4	-0.3
Entry Road Axes					
Vas. Sofias (from Vas. Konstantinou to Panepistimiou)	**4.6**	**4.2**	**4.6**	**-0.3**	**0.0**
Vas. Sofias (from Kifisias to Vas. Konstantinou)	4.3	4.2	4.2	-0.1	-0.1
Vas. Amalias (from Ath. Diakou to Panepistimiou)	**3.6**	**5.3**	**3.9**	**1.7**	**0.3**
Patision (from Alexandras to Stadiou)	3.0	3.0	2.8	0.0	-0.3
Exit Road Axes					
Vas. Sofias (from Panepistimiou to Vas. Konstantinou)	**5.2**	**4.1**	**5.0**	**-1.1**	**-0.2**
Vas. Sofias (from Vas. Konstantinou to Kifisias)	5.7	4.9	5.2	-0.8	-0.5
Vas Amalias (from Filellinon to Ath. Diakou)	1.3	1.3	1.2	0.0	-0.1
Filellinon (from Vas. Georgiou to Vas. Amalias)	1.3	1.2	1.2	-0.1	-0.1
Ring Road Axes					
Vas. Konstantinou (from Arditou/ Ath. Diakou to Vas. Sofias)	**6.7**	**6.2**	**8.1**	**-0.5**	**1.4**
Vas. Konstantinou (from Vas. Sofias to Arditou/ Ath. Diakou)	5.6	4.3	4.3	-1.3	-1.3
Alexandras (from Kifisias to Patision)	**7.8**	**9.0**	**8.9**	**1.1**	**1.1**
Alexandras (from Patision to Kifisias)	9.2	9.7	11.1	0.5	1.9

The PHOEBE framework



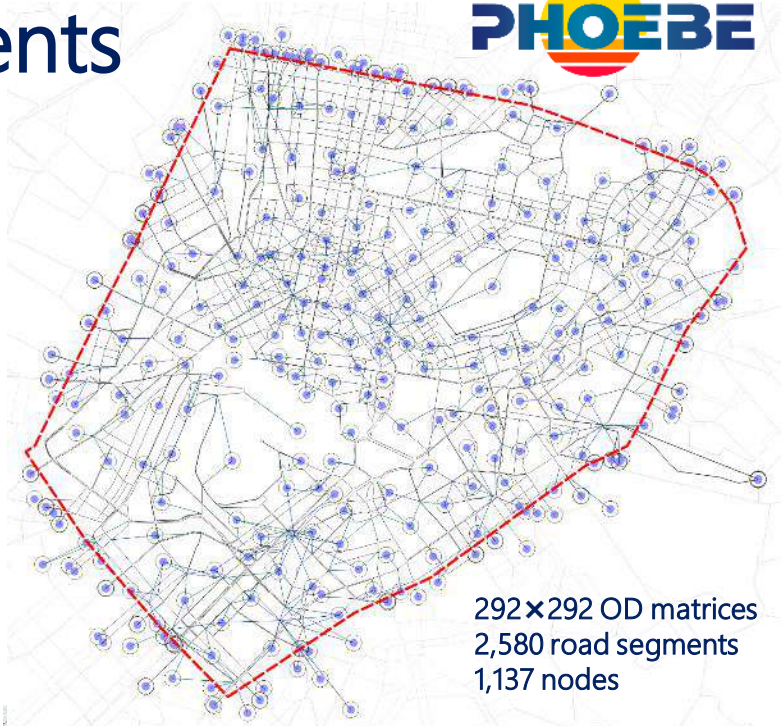
Video Recognition – YOLO

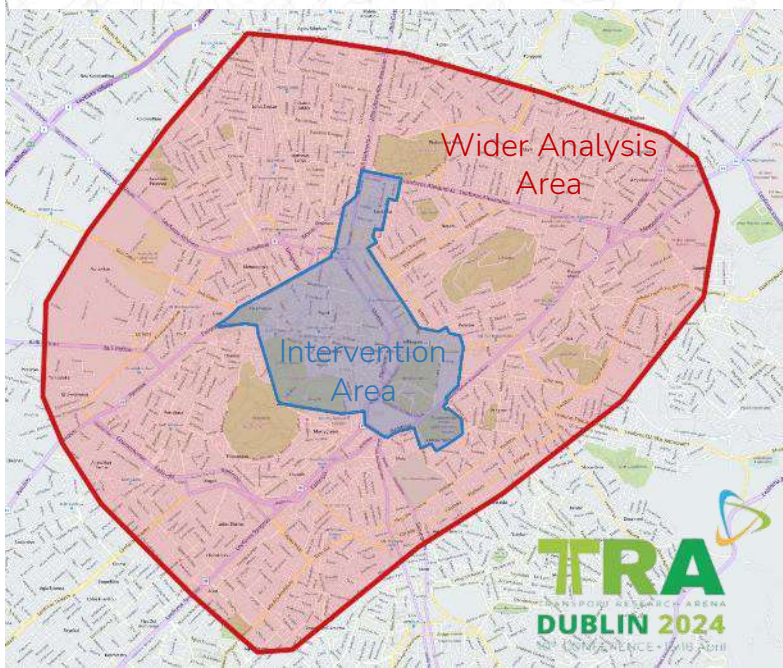
- Video footage from cameras placed at strategic locations where pedestrian crossings exist
- Pre-processing of the video footage to enhance the quality, remove noise and define the pedestrian crossings zones
- An object detection model named YOLO (You Only Look Once) has been used to detect pedestrians and vehicles.
- The algorithm is being trained to track the illegal crossings of the pedestrians in specific locations



Testing alternative traffic and parking arrangements

- The examination of alternative traffic management schemes was performed through macroscopic simulation using the Athens network in Aimsun software.
- The traffic impact assessment was evaluated in relation to two areas of analysis: the Intervention Area and also the Wider Analysis Area.
- The simulated scenarios were the current conditions and four alternative scenarios (B1, B3, C1, C0) that included interventions related to:
  - Enlargement of sidewalks in several streets
  - Adding new exclusive lanes for VRUs and PT
  - Parking management and traffic arrangements
  - Setting 30 km/h speed limit





Pilot implementation

- The scenarios differed in the traffic conditions of Panepistimiou Str. (reference area):
  - A: as a six-lane street (one contraflow PT lane)
  - B1: as a three-lane street (one parallel PT lane)
  - B3: as a four-lane street (one parallel PT lane)
  - C1: as a two-lane street (one parallel PT lane)
  - C0: as a pedestrianized street
- Two additional scenarios B2 and B4 were investigated, concerning the modal shift from passenger cars to PT in the corresponding scenarios B1 and B3.
- According to the Analytical Hierarchy Process analysis, scenario B1/B2 presented overall the optimal performance and its pilot implementation was performed.

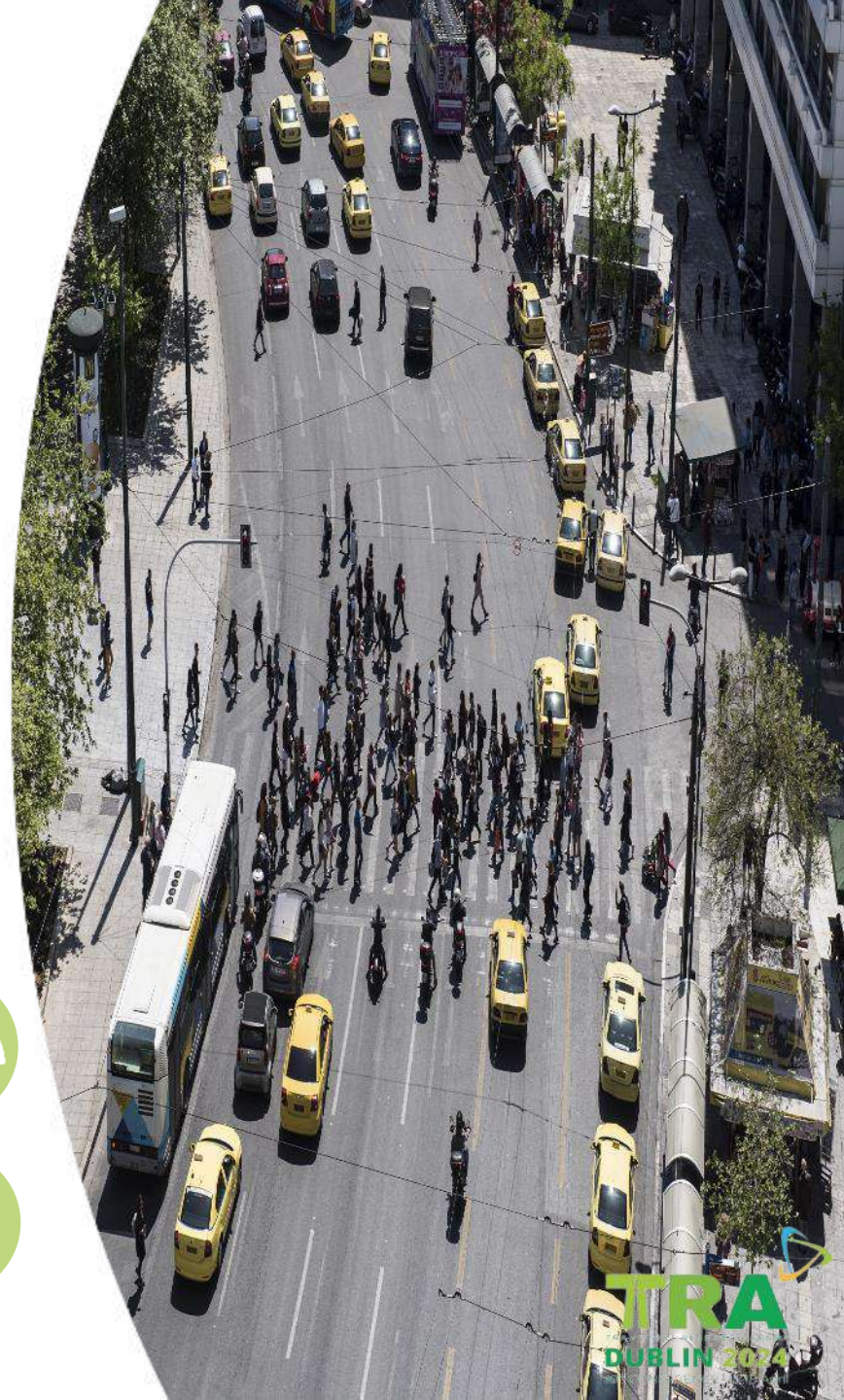
KPI	B1	B2	B3	B4	C1	C0
Vehicle-hours for private cars (Intervention Area)	+7.2%	-22.6%	+4.3%	-22.5%	+24.5%	+6.7%
Average vehicle speed (Intervention Area)	-18.1%	-3.1%	-13.5%	-0.4%	-28.3%	-16.5%
Level of service (Intervention Area)	+7.8%	+4.2%	+6.7%	-5.5%	+13.6%	+3.6%
Level of service (Wider Analysis Area)	+1.8%	-3.7%	+1.1%	-3.6%	+4.4%	+2.3%
Travel times (Intervention Area)	+18.1%	+3.1%	+13.5%	+0.4%	+28.3%	+16.5%
Urban reforms on road axes	+10ha	+10ha	+9ha	+9ha	+10ha	+6ha
Streets with limited access to passenger cars	+5ha	+5ha	+5ha	+5ha	+5ha	+4ha
Bus lanes length (affecting 50 bus lines)	+3.8km	+3.8km	+2.6km	+2.6km	+2.1km	+2.1km
Average public transport speed (Panepistimiou Str.)	+28%	+35%	+32%	+37%	-7.2%	+28%
Average public transport speed (Akadimias Str.)	+22%	+26%	+23%	+27%	-	+22%

Road user modeling

- To accurately estimate the behavioural model, a comprehensive set of variables is required to analyse behaviours at the individual and segment levels. Some of those are:
  - Demographics and personality traits
  - Location characteristics (infrastructure and traffic)
  - Road enforcement levels

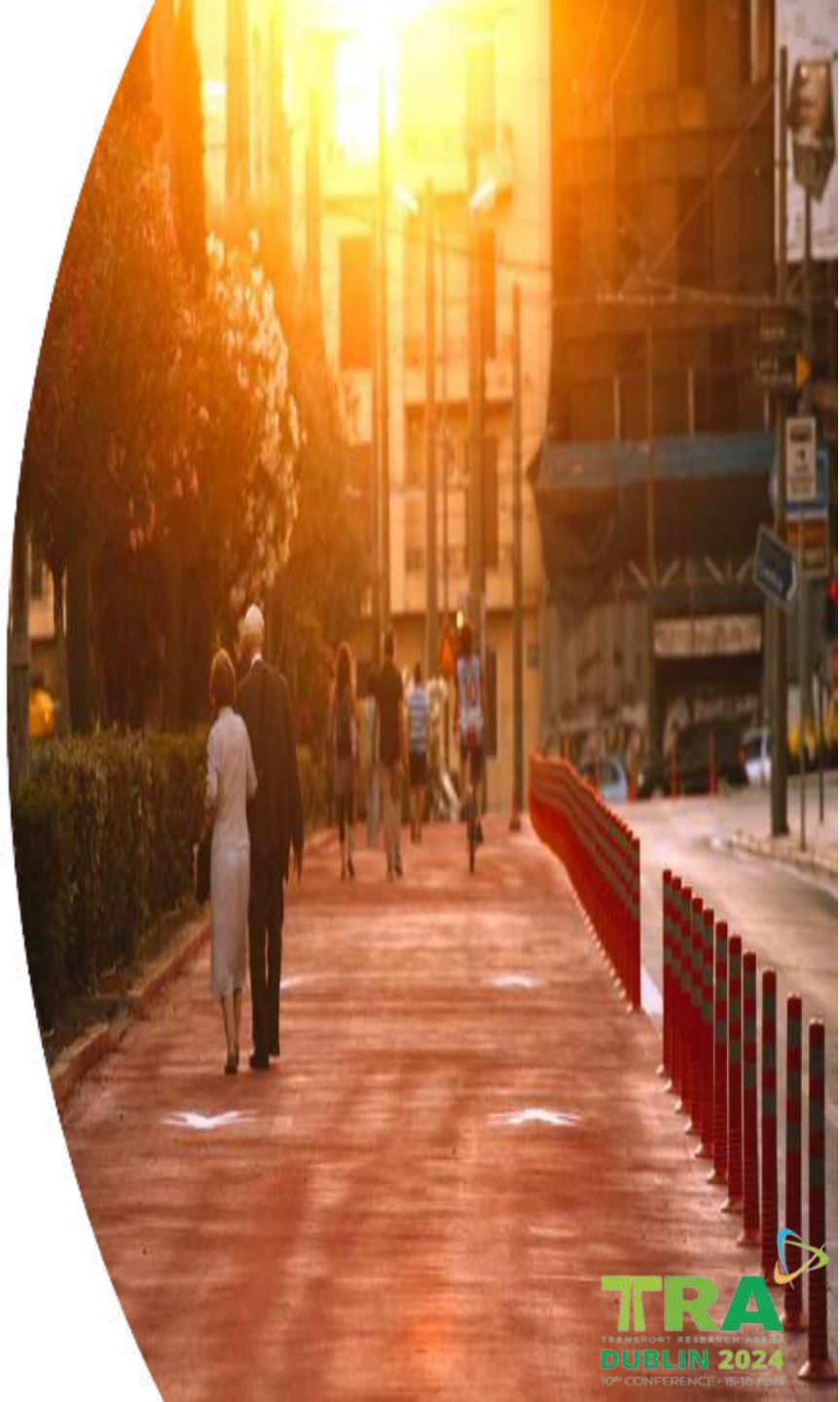
- The Phoebe surveys will consist of two pillars, including:
  - Stated Preference surveys with Discrete Choice Modelling to be used to estimate modal split and induced demand
  - Behavioral surveys including past behaviours and personality traits

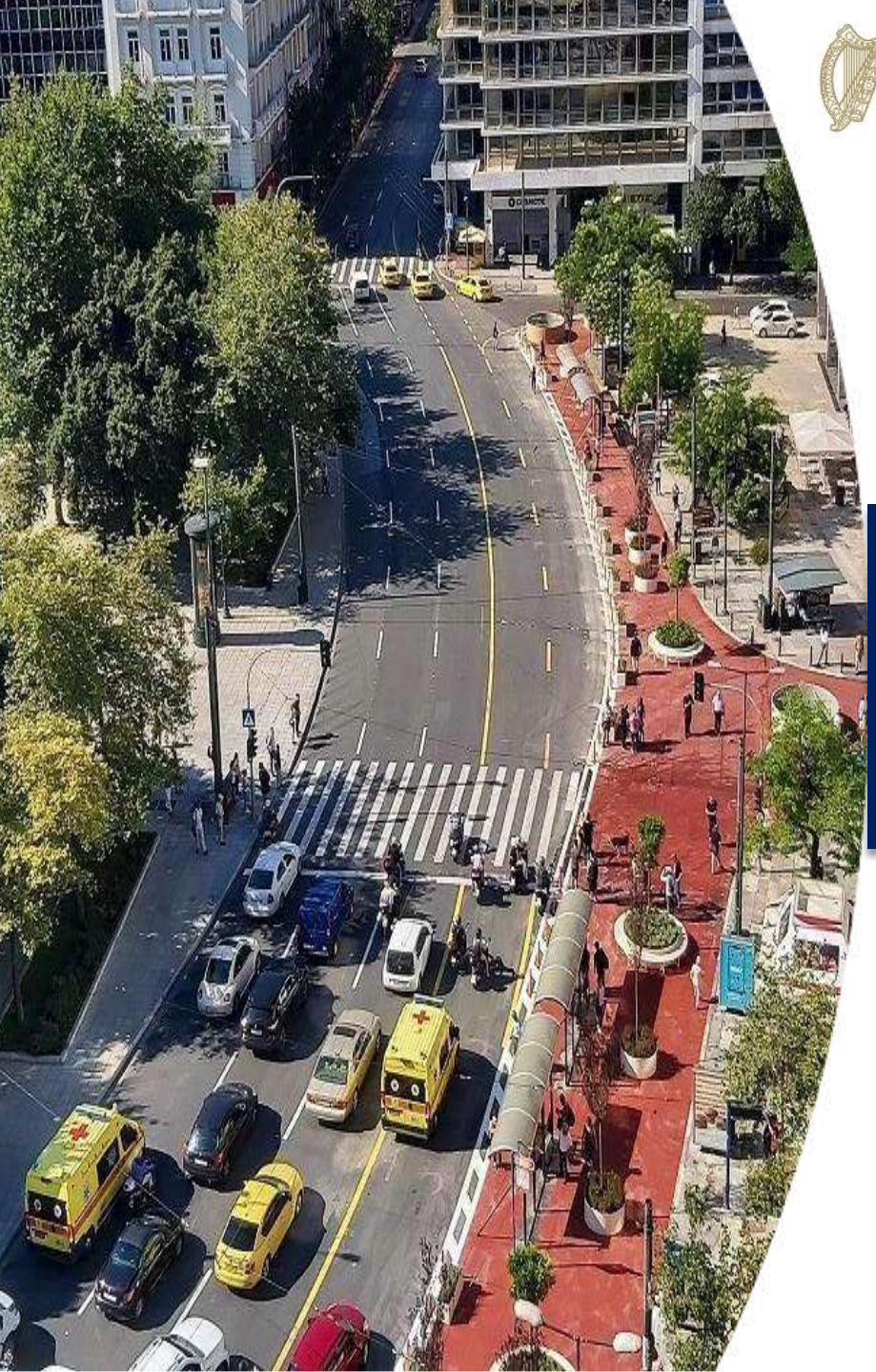
- For Athens the following behaviours are studied:
  - Speeding of motorized users
  - Non-compliant behaviours of pedestrians (red-light violation, jaywalking)



Next steps

- Finalize data collection, cleaning and pre-processing for Athens
- Calculate KPIs for the baseline scenario by enhancing infrastructure, behavioral and stated preference models in turn with each other
- Setup the final interventions scenario model
- Calculate KPIs for the interventions scenario by enhancing infrastructure, behavioral and stated preference models in turn with each other
- Conduct socioeconomic analysis for each planned intervention with updated impacts, comprising Cost-Benefit Analysis and Cost-Effectiveness Analysis
- Investigate methodological transferability





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