

POLIS
CITIES AND REGIONS FOR TRANSPORT INNOVATION

ANNUAL
CONFERENCE
2022



TECHNION
Israel Institute
of Technology



30 November
1 December, 2022
Brussels, Belgium



#POLIS2022

Identifying and prioritizing vulnerable road users safety at signalized intersections in Tel Aviv

PARALLEL SESSIONS 3B. TRAFFIC SIGNAL INNOVATIONS

Ebtihal Sheety

Transportation Research Institute - Technion

**Sprout**



Motivation



Sustainable Policy Response to Urban mobility Transition

Preparing a road safety master plan based on Vision Zero principles, with a focus on enhancing the safety of vulnerable populations [e.g. children and senior citizens]

**An appealing place to live in
for a variety of population groups**

**An inclusive and diverse
transportation system**

local entrepreneurship. Commerce in residential and employment districts will balance between the needs and sensitivities of all the uses and create an inclusive, lively and dynamic public space.



From: <https://www.facebook.com/NTAIsrael>



SPROUT Project



Some of the Objectives



Understand the **transition** in urban mobility



Formulate a city-led innovative **policy response**



Provide tools to **enhance local policy-making capacity**

Pilot cities

Budapest

Kalisz

Padua

Tel Aviv

Valencia

Comprehensive approach – Three use cases

Strategic Level

Data-driven analysis of current travel behavior patterns

Tactic Level

Public sphere reallocation: Livability Vs. Capacity/Safety

Operational Level

Prioritizing vulnerable road users at signalized intersections

Reversing the Pyramid



Prioritizing Vulnerable Road Users safety at signalized intersections

Current Situation: Fixed predetermined pedestrian green light duration based on the average walking speed.

Objectives: Develop a methodical infrastructure for identifying vulnerable who begin to cross towards the end of the green light and apply traffic lights logic that support green light extension **only when needed** to allow safe crossing of the vulnerable pedestrians.

Tools: Embedding deep learning methodologies into the traffic management signal control logic.

Alignment with municipal policy: (1) Social inclusion of vulnerable inhabitants (2) locating pedestrians at the top of road users' hierarchy.

“Equality is treating everyone the same. But equity is taking differences into account, so everyone has a chance to succeed.”

Jodi Picoult

Identifying vulnerable road users - Training

Use the Traffic Management Centre cameras installed in the relevant intersections



Real-Time Object Detection

Deep learning

Record videos of pedestrians crossing the street

Manual annotation of vulnerable pedestrians crossing the street

Develop a model for automatic identification of vulnerable pedestrians

Use existing resources

Align with Privacy regulations

Do not expect 100% accuracy

Identification model



Video Time: 0:0:0

2020-12-02
11:40:24

Total Objects: 0

Identification model - Performances

KPI's	Calculation Formula	Results
Negative Prediction (the ability of the algorithm to <u>correctly</u> identify the cases where no VRUs are present in the detection zone)	$\frac{TN}{FN + TN}$	96%
False Positive Rate (false alarms)	$\frac{FP}{FP + TN}$	7.6%
Recall (proportion of all positive video detections that were classified)	$\frac{TP}{TP + FN}$	84.9%

100% accurate identification is not possible.

A balance must be made between vulnerable pedestrians whom will not be identified (FN), and those who will be identified as vulnerable but in fact are not (FP)

Implementation - Challenges

Regulatory

- applying new detection methods interfacing with traffic control, obligates the approval of the Israeli Ministry of Transport
- Lengthy approval procedure

Policy

- Alignment between the political commitment to prioritize pedestrians and social inclusion of vulnerable citizens and the actual implementation of the policy (without knowing the impact on other road users, especially PT)

Technical

- Hardware and communication requirements – Real time performances
- Training model – what are the satisfactory performances

COVID-19

**Uncertainty
regarding the
impact**

Simulation Model – Real-world data



Identification of a vulnerable pedestrian starting to cross

Continue as usual

Traffic simulation



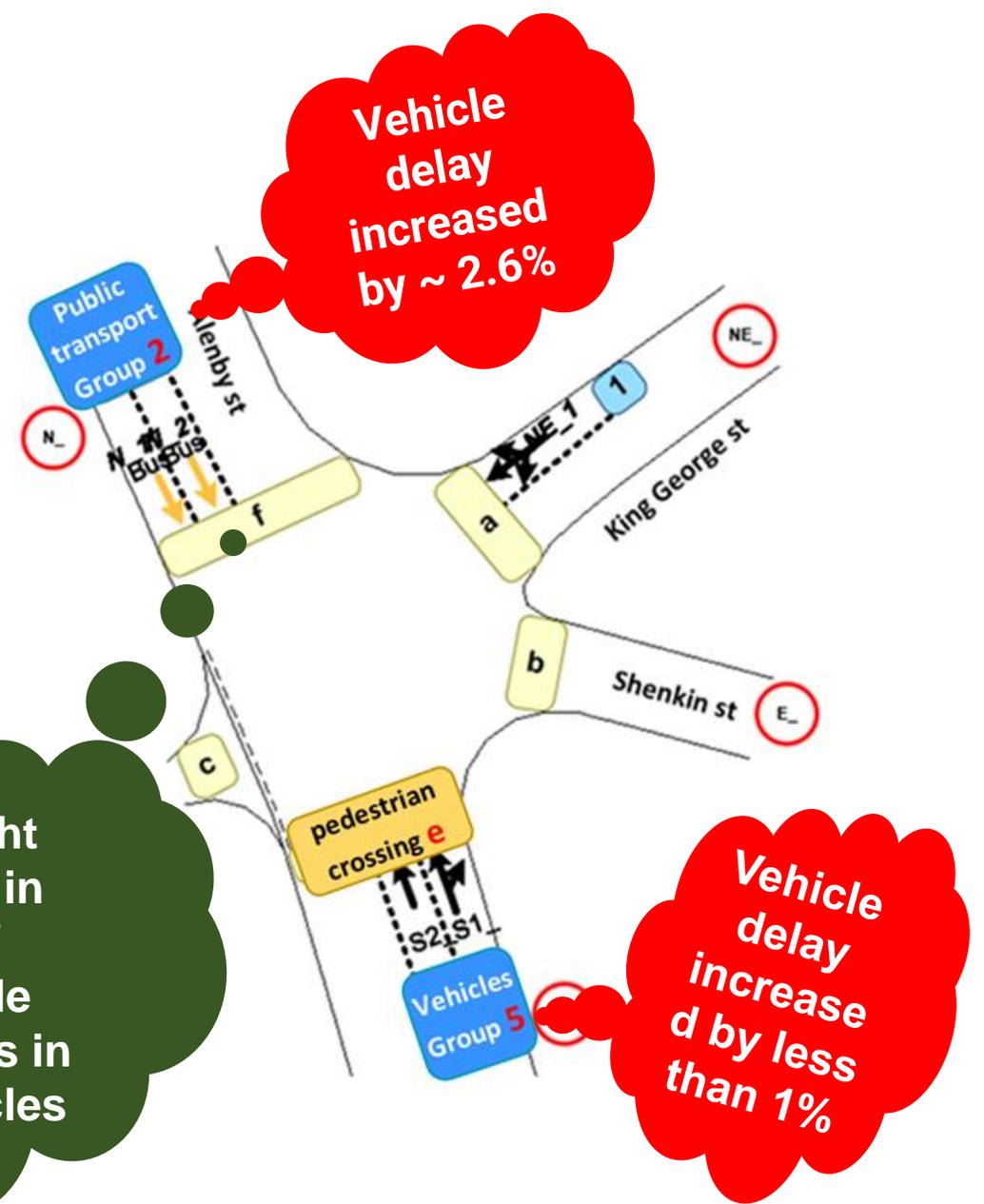
Did the pedestrians' traffic light turn green less than 5 seconds ago?

Extend the green light



Outcomes

Signal Group	Baseline	With Pedestrian Green Extension	% change
2	20.88	21.42	2.59%
5	29.47	29.66	0.63%



Preventing potential unsafe crossing in 15% of the cycles



Green light extended in favor of vulnerable pedestrians in 15% of cycles

Lessons Learned

- ✓ It is possible to create more inclusive and safer streets for vulnerable road users, with negligible impact on other road users and transport means.
- ✓ Simulation results create a supportive ecosystem and make it easier for the decision-makers to implement the declared policy.
- ✓ The availability of real-time data and advanced digital analytical techniques enrich decision-making and is a step toward developing a city mobility digital twin.
- ✓ The debate regarding the authority to approve experiments involving interfacing with traffic control (local authority/Ministry of Transport) was not resolved. However, the approval process has become easier and faster.
- ✓ Regulatory barriers are addressed. Tel Aviv aims to obtain the required approvals to connect the pedestrian detectors directly to the traffic light controller. (work in progress)

POLIS

CITIES AND REGIONS FOR TRANSPORT INNOVATION

ANNUAL
CONFERENCE
2022



TECHNION

Israel Institute
of Technology



30 November
1 December, 2022
Brussels, Belgium



#POLIS2022

Thank you for your attention

Ebtihal Sheety Ebtihal@technion.ac.il

Ilya Finkelberg, Jimmy Adda, Dr. Ayelet Gal-Tzur
Transportation Research Institute – Technion

Haggai Yaron, Batel Eshkol
Mass Transit Unit - Tel Aviv Municipality

Sprout