ETH zürich

tmp
Transportation and Mobility Planning

TECHNION
Israel Institute of Technology

Can we mitigate congestion without major investments in mass transit?

A travel behavior perspective

Yoram Shiftan

Technion – Israel Institute of Technology

Visiting Professor
TMP, IVT, ETH Zurich

STRC – Ascona, Switzerland – May 20, 2026

Can we mitigate congestion / improve accessibility without major investments in mass transit?

A travel behavior perspective

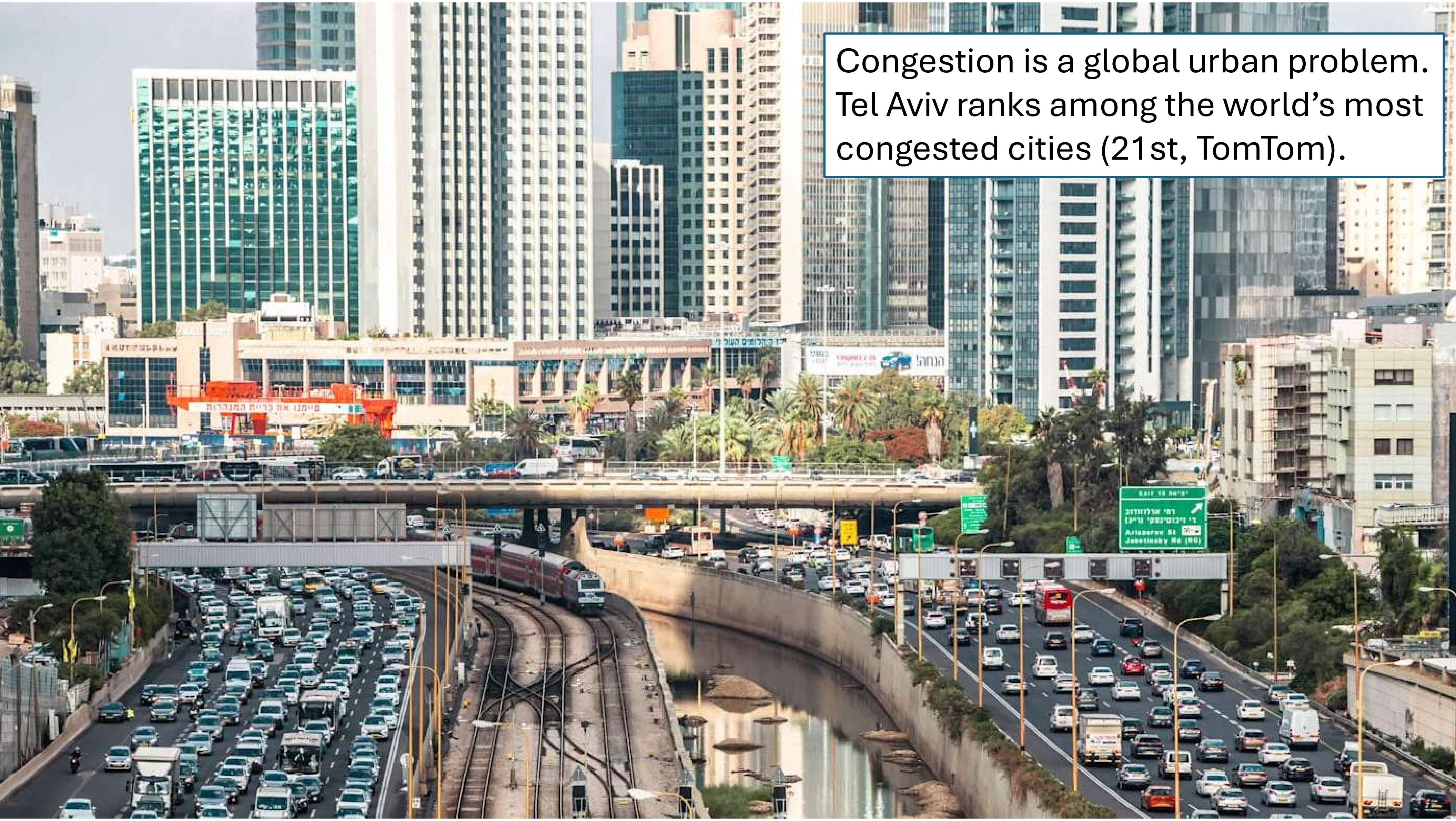
Yoram Shiftan

Technion – Israel Institute of Technology

Visiting Professor

TMP, IVT, ETH Zurich

STRC – Ascona, Switzerland – May 20, 2026



Congestion is a global urban problem. Tel Aviv ranks among the world’s most congested cities (21st, TomTom).

Tel-Aviv in comparison to selected cities in Europe

City	Population (mil.)	No. of metro lines	% travel by PT (of motorized journeys)
London	9.1	11	40%
Madrid	6.8	13	34%
Berlin	3.6	10	40%
Barcelona	3.2	12	50%
Rome	2.7	3	30%
Lisbon	2.8	4	41%
Tel Aviv 2018	4	0	10%
Tel Aviv 2040	5.4	3	40%

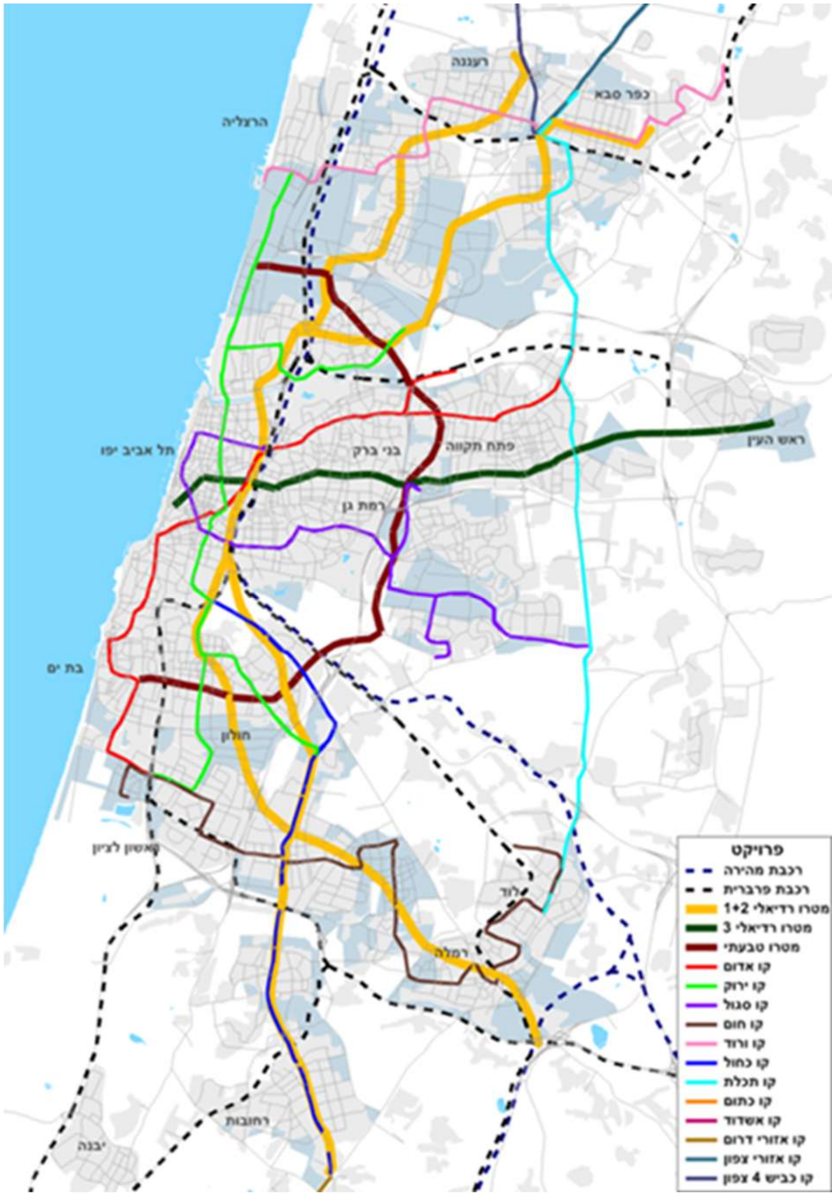
Updated May 2026 | Sources: ONS, Eurostat, TfL, INE, ATM Barcelona, OMM Spain

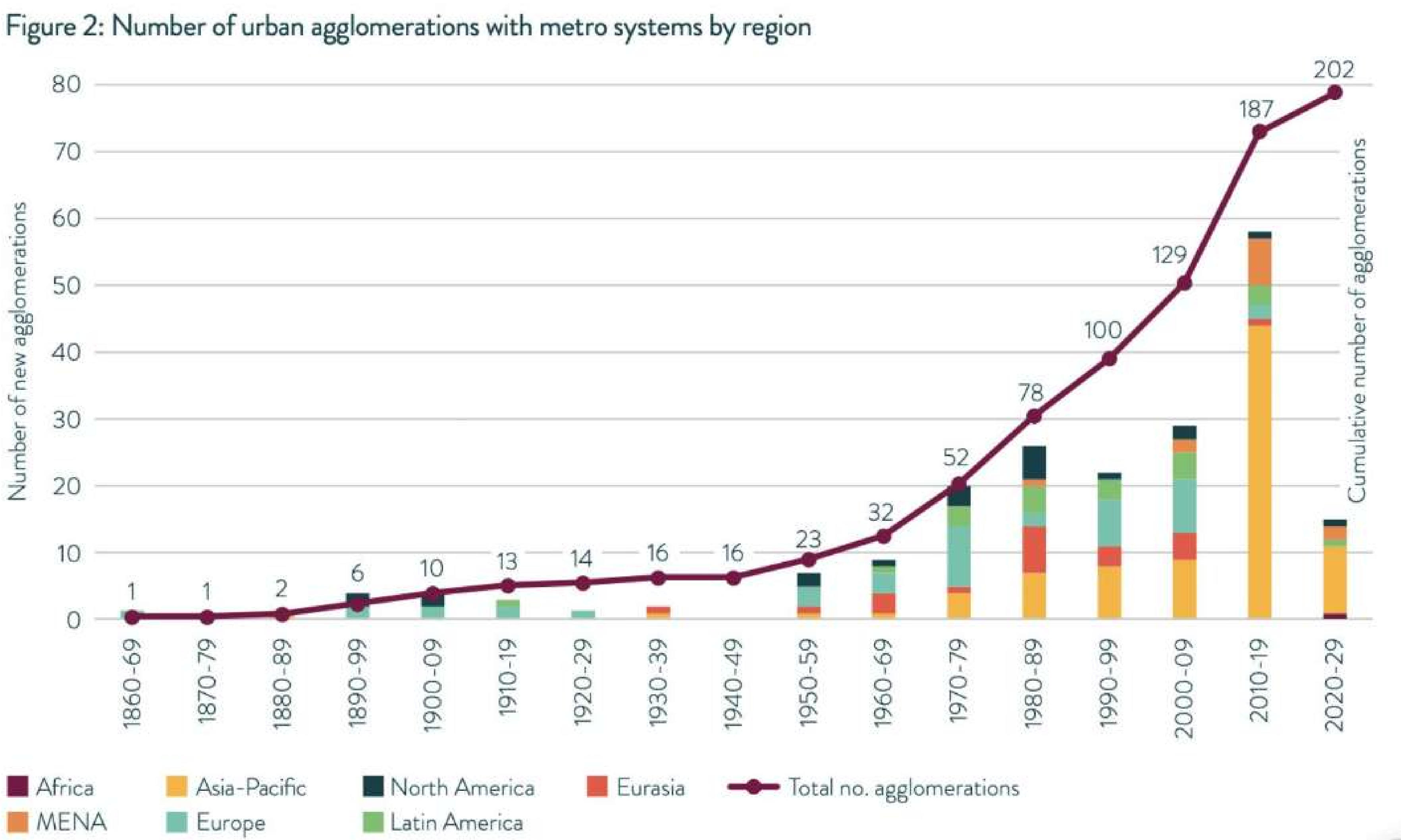
Transit expansion planned for the Tel-Aviv Metropolitan Area (TMA)

Status	Transit investment
In operation	LRT Red Line
Under construction	LRT Green Line and LRT Purple Line
Planned / proposed	BRT network: Brown, Light Blue, and Pink lines
Existing / expanding	Suburban rail lines
Long-term planned	Metro system of 3 lines serving the: M1 – North-south line (yellow) M2 – East-west line (green) M3 – Inner-ring line (brown) Approx. 150 km and 109 stations

Cost estimate of over €50 billion

Source: NSA HUB





Global Metro Figures 2024 – Statistics Brief, UITP (International Association of Public Transport), May 2025

Critiques of the Metro plan

- Too expensive
  - $150-$600 M/km – construction only, underground
  - Tel Aviv estimate $350 M/km
  - New York Second Ave > 2B/km
- Technology, AV+
- COVID-19, e-activities
- Policy measures - Congestion pricing

Behavior is the key – How people will react?

SILVER BULLET: more sharing…

- e-work
- sharing
- efficiency

Gridlock: more travel…

- comfort
- non-drivers
- less transit
- on-demand
- suburbanization

>> **Increased Vehicle Miles Travel (VMT)**

TMA modeling tools

Data inputs

- GPS-app-based travel habits survey (MMM) - Conducted 2017–2018
- Cellular data sources – big data
- Dedicated surveys
- Many other: live transit data, google, statistical bureau…

Behavioral and simulation models

- Activity-Based Model (ABM) - First ABM used by a planning agency **in the world**!
- MATSim model application
- Sim-Mobility model application

Evaluation and learning tools

- Advanced appraisal tools
- World cases review

Travel and Emissions Analysis of Sustainable Transportation Policies with Activity-Based Modeling

Yoram Shiftan, Leonid Kheifits, and Michael Sorani

Although activity-based models (ABMs) are starting to be used for metropolitan area transportation planning and policy making, experience is lacking in the use of the wealth of information and measures that such models offer. This paper reports on the implementation of an advanced ABM developed for the Tel Aviv, Israel, metropolitan area to analyze the various transport, activity, and emissions impacts of auto restraint, transit, and land use policies. The policy implications of various scenarios are presented. The results showed that a combination of aggressive pull-and-push measures to encourage more transit and less car use had only marginal impacts on total vehicle kilometers traveled, emissions, and greenhouse gas emissions. Other findings showed no synergic effects and suggested that some policies might have had unintended outcomes. All of the policies tested led to less congestion but increased accessibility at the same time; the increased accessibility attracted more trips to the city. Overall, this study showed that ABMs could provide important advantages in the analysis of various transport policies to improve sustainable transportation development and to enable detailed analyses of the synergic effects of various policies and their impact on many indicators. The paper advances the state of the practice of the use of ABMs for policy analysis, but much more experience and insight are needed on the best way to use the rich information and abundant measures obtained from such models.

Activity-based models (ABMs) are starting to be employed for transportation planning and policy making in metropolitan areas. Still, there is a lack of experience in the use of the rich information and measures that such models can provide. This paper describes the implementation of an ABM developed for the metropolis of Tel Aviv, Israel, and its application to analyses of the various impacts of auto restraint, transit, and land use policies.

The ABM treats travel as derived from the demand to pursue personal activities. Travel decisions thus become part of a broader scheduling process that takes into account time and space constraints. This approach provides a better understanding of travel behavior and enables a better analysis of responses to policies and their effect on traffic and air quality (*1*). The various advantages of ABMs are well documented in the analysis of transport policies, including their capability to account for secondary effects, induce demand, and offer a better link to the effect of emissions on air quality and land use (*1–3*).

Tour-based models and ABMs have been estimated and applied since the 1990s. Early examples included ones in Boise, Idaho (*4*), the New Hampshire statewide model (*5*), and the activity mobility simulator (*6*). In Europe, tour-based models have been developed in the Netherlands (*7*), Sweden (*8*), Germany (*9*), and Italy (*10*). However, although the topic has been widely discussed in the literature, relatively few large-scale applications have been performed. Notable examples of such applications occurred in Portland, Oregon (*11*), San Francisco, California (*12*), New York (*13*), Phoenix and Tucson, Arizona (*14, 15*), the Netherlands (*16*) and Switzerland (*17*).

Few have tried to use the activity-based approach to analyze the potential effect of various policies. Kitamura et al. (*6*) used a dynamic, integrated microsimulation forecasting approach to test various travel demand management (TDM) strategies in the Washington, D.C., area (*18*). Kitamura also compared structural equation and microsimulation models (*19*). Other attempts included those of Bonnel (*20*), Recker et al. (*21*), and Garling et al. (*22*).

Researchers undertook most of these efforts, whereas the practical advantages of these systems in the context of planning and decision making have hardly been discussed or documented (*23*). Initial efforts were made by Shiftan and Suhrbier, who analyzed the impact of TDM policies with the Portland ABM, the first such metropolitan model (*1*). Vovsha and Bradley (*23*) and Castiglione et al. (*24*) summarized some of the initial applications. These included investment in a major highway and a new light rail transit (LRT) line in San Francisco, air quality conformity analysis and congestion pricing in New York, a large-scale, toll road traffic and revenue study in Montreal, Quebec, Canada, and the study of a new LRT line in Columbus, Ohio. Hatzopoulou et al. used activity-based and emissions modeling to assess ambient air quality and population exposure to a range of policy interventions in the greater Toronto, Ontario, Canada, area (*25*).

This paper aims to advance the current state of the practice through a description of the implementation of the Tel Aviv ABM, which was used to analyze the various impacts of different policies intended to contribute to more sustainable transportation development. The next section describes the structure of the Tel Aviv ABM, followed by a section that discusses model implementation issues. Subsequent sections present, respectively, the various policy scenarios analyzed, selected results and a discussion of them, and the applicability of the model to policy analysis.

Y. Shiftan, Department of Transportation and Geo-Information Engineering, Faculty of Civil and Environmental Engineering, Technion–Israel Institute of Technology, Technion City, Haifa 32000, Israel. L. Kheifits, P.O. Box 62166, Tel Aviv 61621, Israel. M. Sorani, Tel Aviv Activity-Based Transportation Model, Public Transportation Division, Ayalon Highways Company Ltd., P.O. Box 32294, Tel Aviv 61322, Israel. Corresponding author: Y. Shiftan, shiftan@technion.ac.il.

Transportation Research Record: Journal of the Transportation Research Board, No. 2531, Transportation Research Board, Washington, D.C., 2015, pp. 93–102.
DOI: 10.3141/2531-11

Transport Project Appraisal in Israel

Yoram Shiftan, Nir Sharaby, and Charles Solomon

Major investments in transport projects currently under way in Israel account for 1.2% of gross domestic product. The government is allocating budgets for new roads, intercity rail lines, and mass transit systems in all major metropolitan areas, with a growing share of private financing of public infrastructure. The government issued a new guide for transport project appraisal in 2006 to improve the decision-making process and the efficient allocation of funds. The guide is a result of substantial research and comprehensive review of worldwide developments, positioning project appraisal technique in line with best practices and state-of-the-art transport economics. The paper focuses on the main methodologies and changes in the new guide. The 2006 guide broadens the project impacts taking into account cost–benefit analysis (CBA) and thus reduces potential bias among different types of projects. New safety and environmental impact analysis are now part of CBA. Other impacts include equity analysis and accessibility and level-of-service indices. Special attention was given to improve the interaction between the transportation model and the economic model, integrating the various project impacts under a broad systematic analysis. Benefits are calculated based on welfare theory, and a special procedure is introduced to evaluate the potential bias under fixed demand travel demand models. It was shown that benefits are usually overestimated by use of the fixed demand assumption. These overestimates are negligible under normal flow conditions, but the bias is high under congestion conditions and elastic demand.

Investment in transport infrastructure improves mobility and is considered to have a major effect on economic activity and growth. National accounts of European Union countries show that the transport sector amounted to 8% of their gross domestic product (GDP) (*1*). Although there is significant evidence of the economic impact of transport infrastructure, its actual contribution to the GDP or welfare is a subject of great debate among researchers [see for example Banister and Berechman (*2*)].

In Israel, the Ministry of Transport and Road Safety is in charge of transport policy, infrastructure financing, and strategic planning; and local authorities are in charge of project planning, building, and maintenance. Intercity roads are planned, built, and maintained by the Israel National Roads Company. Intercity rail is planned, built, and maintained by the Israel Railways Company.

Transport infrastructure investment accounts for 1.2% of Israel's GDP (2006). Investments increased significantly during the past decade (67% since 1996), and the Ministry of Transport and Road Safety aims to reach an annual investment of 1.9% of GDP by 2011.

Israel's government is allocating budgets for new intercity rail lines and mass transit systems in all major metropolitan areas with a growing share of private financing. As a result of this policy change, the public transport share of total investment has increased dramatically from 5% in 1996 to almost 50% in 2004–2006 (see Figure 1).

Project appraisal is carried out for all new infrastructure investments. The appraisal framework aims to assist decision makers in the building and advancement of projects that will improve accessibility, safety, and the environment; contribute to economic growth and the national economy; and maximize social welfare. The uniqueness of the appraisal framework is in integrating all project impacts under a broad systematic analysis of the project and transport network.

The first official project appraisal guide titled *Transport Projects Manual* (*3*), published in 1996, was based on the cost–benefit analysis (CBA) technique and included new features and methodologies. Before this guide, project appraisal was carried out to best practice but was not necessarily consistent and comparable. The 1996 guide was appropriate for road projects and set new national standards for project appraisal, but had serious limitations in evaluating public transport projects and projects in congested areas.

In 1998 the government, recognizing the guide's limitations, initiated reassessment of the methodology for the purpose of using a better evaluation procedure and values mainly for rail projects. In response, recommendations for methodological improvements were introduced by the Hague Consulting Group (*4*) aiming mainly to improve public transport appraisal capabilities. However, this work was not adopted as part of the official guide.

The need for an improved guide has grown gradually. New complex projects under planning, including major mass transit systems and various transport policies, demand a more realistic modeling and evaluation process. Private-sector financing of transport projects is becoming more and more popular and requires specific consideration. Theoretical developments and new approaches toward traffic safety, environmental impacts, and equity considerations have increased the requirement for broader project impact assessment.

The new 2006 guide, *Transport Project Appraisal (TPA)* (*5*), is a result of substantial research aimed at dealing with the new needs and putting project appraisal technique in line with best practice and theoretical developments. The guide is currently available only in Hebrew; this paper describes its main elements and some of the new research that was incorporated into it.

LITERATURE REVIEW

Many researchers and agencies are involved in the research and improvement of appraisal methods. Most research in this area has been conducted by various institutions seeking to improve their own methods, along with some academic research. Most notable are the

Y. Shiftan, Transportation Research Institute, Technion City, Haifa 32000, Israel. N. Sharaby, NSH Strategic Investment, 89 Yehoshua Bin Noon Street, Tel Aviv 62497, Israel. C. Solomon, Economics and Planning Department, Ministry of Transport and Road Safety, 5 Bank Israel Street, Jerusalem 91950, Israel. Corresponding author: Y. Shiftan, shiftan@tx.technion.ac.il.

Transportation Research Record: Journal of the Transportation Research Board, No. 2079, Transportation Research Board of the National Academies, Washington, D.C., 2008, pp. 136–145.
DOI: 10.3141/2079-17

Technology

Technology is rapidly improving:

- Automation
- Connectivity
- AI
- Platformization
- Electrification
- New services - MaaS

AVs are moving from experimentation to commercial deployment

Waymo fleet, San Francisco (The Driverless Digest, 2025)

After a decade of skepticism, AV services appear to be entering a more mature phase, supported by advances in AI and growing real-world deployment experience.

*Karl Iagnemma (*former President & CEO, *Motional); MIT Mobility Forum #173 April 2026*

Alphabet committed cumulative spending for Waymo estimated at $30B (TechCrunch, 2024)

The field is moving from “AV adoption” to “AV governance.” The question is less “will AVs arrive?” and more “under what pricing, ownership, sharing, and integration model?”

Hardaway & Cai, 2025 - Transport Reviews

AVs are moving into commercial service

Company	Market status	Locations
Waymo	Commercial driverless robotaxi service	**U.S.** Phoenix, San Francisco Bay Area, Los Angeles, Austin, Atlanta, Miami, and more
Baidu Apollo G	Commercial robotaxi service at scale	**China** Beijing, Shanghai, Shenzhen, Wuhan, Chengdu, and more
Pony.ai	Commercial / driverless robotaxi operations	**China** Beijing, Shanghai, Guangzhou, Shenzhen, and more
WeRide + Uber	Driverless robotaxi service via Uber	**Abu Dhabi**
Zoox	Purpose-built robotaxi; limited public service / testing expansion	**U.S.** Las Vegas, San Francisco, Austin and Miami
Tesla Robotaxi	Limited robotaxi rollout; early unsupervised operations	**U.S.** Austin
Mobileye / VW MOIA	Autonomous ride-pooling / robotaxi platform; pilot-to-deployment	**Europe** Hamburg, Berlin and more

The utopian promise

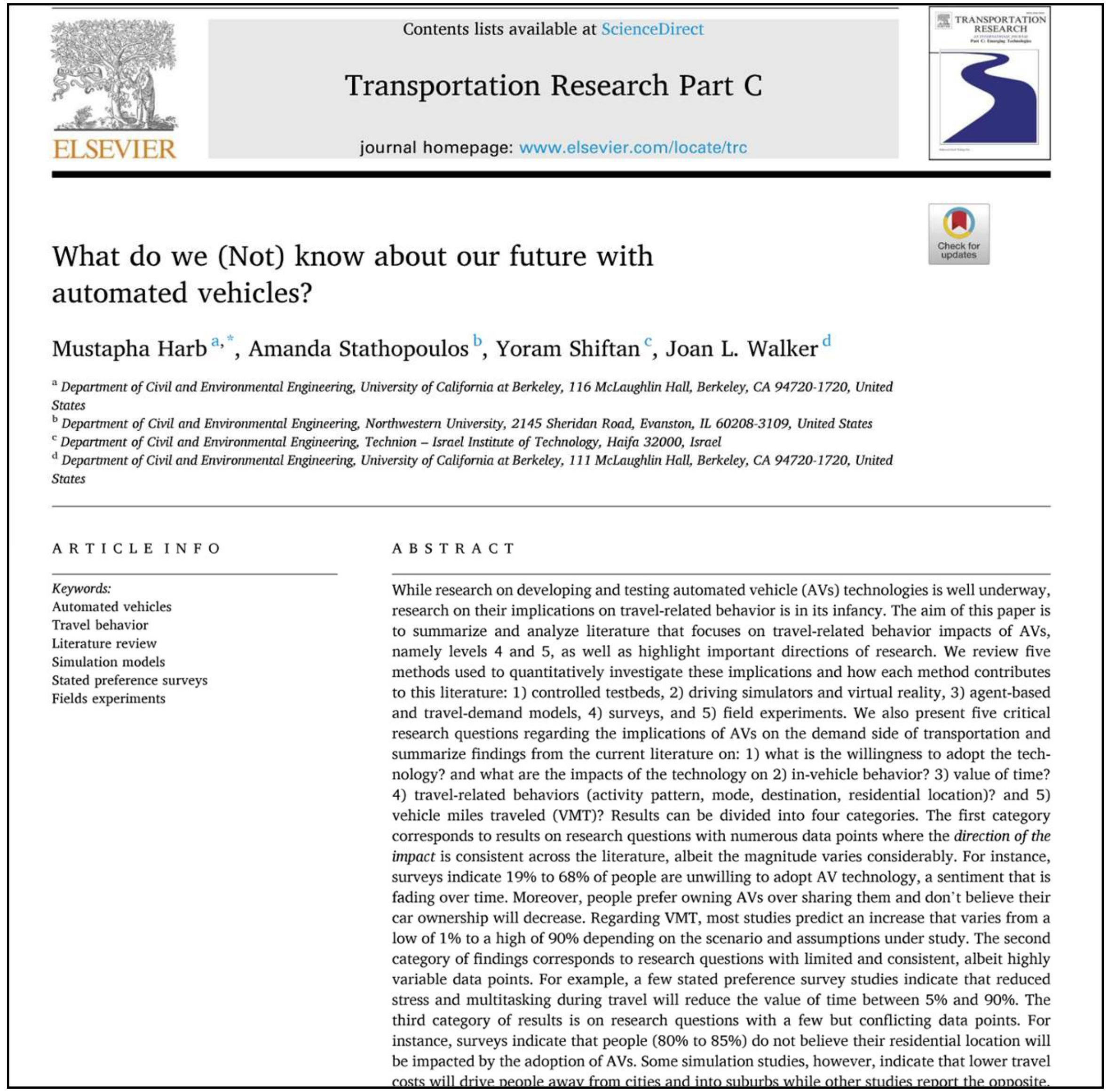
- Improved road safety
- Cleaner transportation (reduced emissions and noise)
- Improved accessibility for all (social equity)
- Increased capacity, lower congestion
- Lower generalized travel costs
    - Reduced burden of driving (drastic reduction in disutility of travel)
    - More productive and flexible use of travel time (multi-tasking, mobile office)

The behavioral reality

How would technology affect people?
Our life? Our cities?

Behavioral findings

- Harb, Stathopoulos, Shiftan, and Walker (2021)
- Continuous review since 2021
  - Main concerns have remained
  - Similar results, better supported and more nuanced



Contents lists available at ScienceDirect

Transportation Research Part C

journal homepage: www.elsevier.com/locate/trc

What do we (Not) know about our future with automated vehicles?

Mustapha Harb [a,*], Amanda Stathopoulos [b], Yoram Shiftan [c], Joan L. Walker [d]

[a] *Department of Civil and Environmental Engineering, University of California at Berkeley, 116 McLaughlin Hall, Berkeley, CA 94720-1720, United States*

[b] *Department of Civil and Environmental Engineering, Northwestern University, 2145 Sheridan Road, Evanston, IL 60208-3109, United States*

[c] *Department of Civil and Environmental Engineering, Technion – Israel Institute of Technology, Haifa 32000, Israel*

[d] *Department of Civil and Environmental Engineering, University of California at Berkeley, 111 McLaughlin Hall, Berkeley, CA 94720-1720, United States*

ARTICLE INFO

Keywords:
Automated vehicles
Travel behavior
Literature review
Simulation models
Stated preference surveys
Fields experiments

ABSTRACT

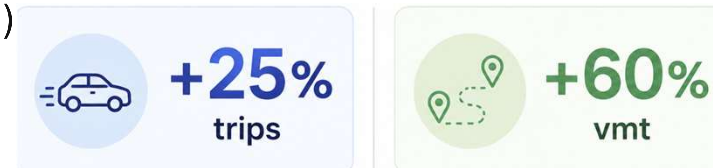
While research on developing and testing automated vehicle (AVs) technologies is well underway, research on their implications on travel-related behavior is in its infancy. The aim of this paper is to summarize and analyze literature that focuses on travel-related behavior impacts of AVs, namely levels 4 and 5, as well as highlight important directions of research. We review five methods used to quantitatively investigate these implications and how each method contributes to this literature: 1) controlled testbeds, 2) driving simulators and virtual reality, 3) agent-based and travel-demand models, 4) surveys, and 5) field experiments. We also present five critical research questions regarding the implications of AVs on the demand side of transportation and summarize findings from the current literature on: 1) what is the willingness to adopt the technology? and what are the impacts of the technology on 2) in-vehicle behavior? 3) value of time? 4) travel-related behaviors (activity pattern, mode, destination, residential location)? and 5) vehicle miles traveled (VMT)? Results can be divided into four categories. The first category corresponds to results on research questions with numerous data points where the *direction of the impact* is consistent across the literature, albeit the magnitude varies considerably. For instance, surveys indicate 19% to 68% of people are unwilling to adopt AV technology, a sentiment that is fading over time. Moreover, people prefer owning AVs over sharing them and don't believe their car ownership will decrease. Regarding VMT, most studies predict an increase that varies from a low of 1% to a high of 90% depending on the scenario and assumptions under study. The second category of findings corresponds to research questions with limited and consistent, albeit highly variable data points. For example, a few stated preference survey studies indicate that reduced stress and multitasking during travel will reduce the value of time between 5% and 90%. The third category of results is on research questions with a few but conflicting data points. For instance, surveys indicate that people (80% to 85%) do not believe their residential location will be impacted by the adoption of AVs. Some simulation studies, however, indicate that lower travel costs will drive people away from cities and into suburbs while other studies report the opposite.

Typology of methodologies

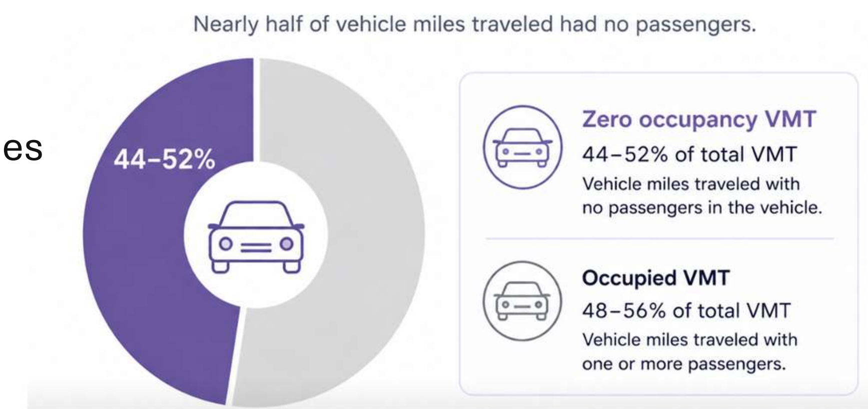
1. Perform simulation based/scenario analysis studies (Review by Hardaway & Cai, 2025)
2. Stated Preference (SP) surveys
3. Virtual reality/games/simulators
4. Qualitative/focus groups/in-depth interviews
5. Revealed Preference (RP)/analog modes/naturalistic experiments/chauffer
6. Panel/longitudinal analysis
7. Integrated approaches: Data/disciplines

Naturalistic studies

- The Chauffer experiment, CA (Harb, Malik, Circella & Walker, 2022)
  - Big part of the VMT increase from zero-occupancy trips, drop in transit, ride-hailing, and cycling



- Waymo 2024-25 operational data (California Public Utilities Commission (CPUC), Quarterly Reports 2024–2025



- Baidu's Apollo Robotaxi service, China (Cai, Wang, 2025)
  - Survey of users
  - Low-priced fully driverless AV generates new trips

The behavioral reality: How travelers will react?

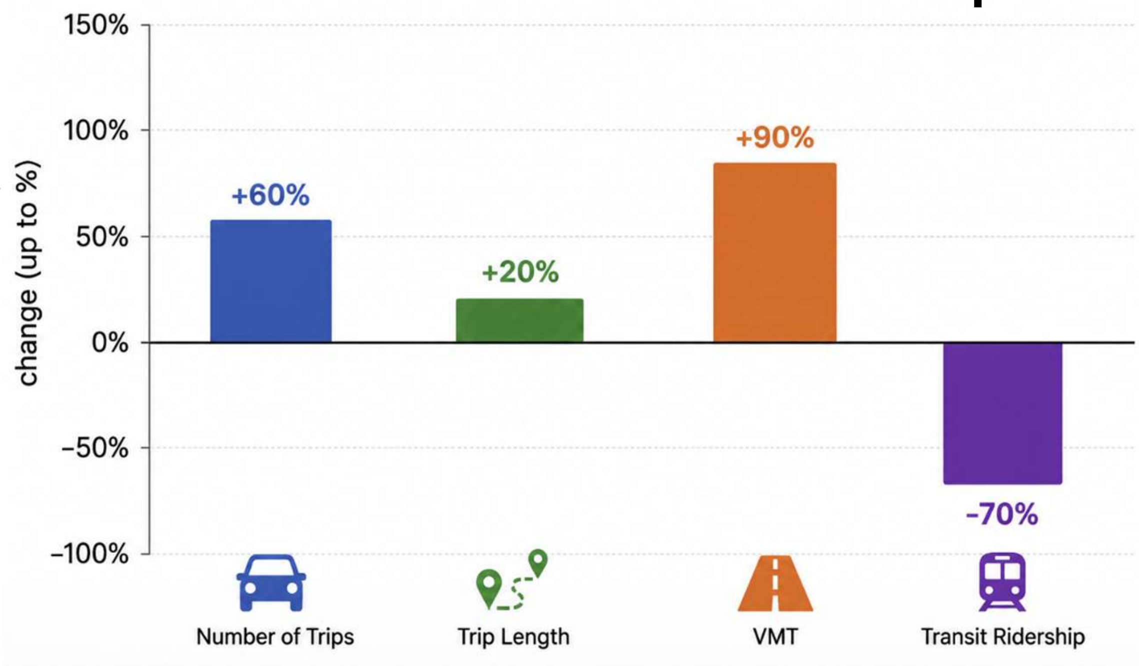
- Experience shows that human behavior often outpaces technological optimism.
- The extent of the impact is vast and multidimensional.
- Multitasking – one of the core benefit – mixed results, from not multitasking to increase trip length and reduce Value of Time

Ownership/ use	New car users	Activity participation	Destination choice	Mode choice	Residential choice
Likely minimum impact Zero occupancy trips	Young, old, people with disabilities	More travel	Longer distances	More solo modes Less transit	Can work both ways but likely minimum impact

Intermediate conclusions

- True naturalistic / RP evidence is still rare and should be the main future research direction.
- AV have great advantages, but recent evidence/estimates reinforces the core concern.
- Public transport integration is the key policy variable to make AV and MaaS complement transit and not compete with it.

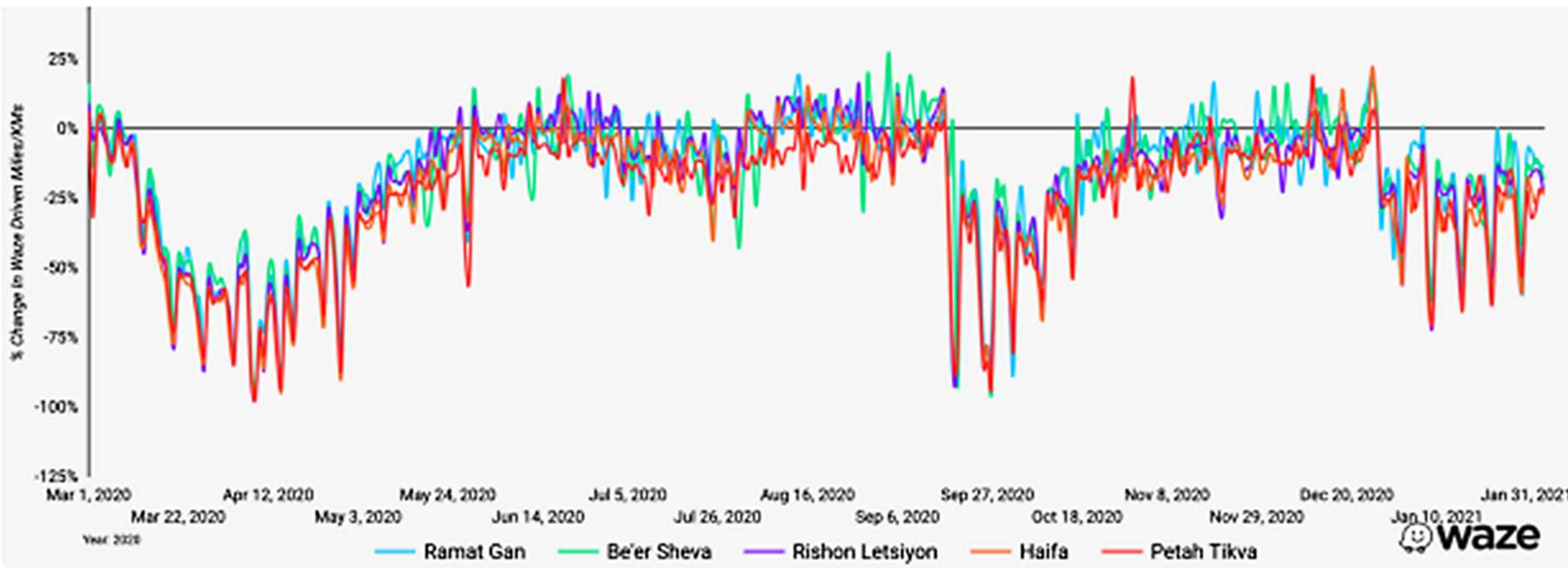
AV convenience and cost impact



COVID-19 impacts on travel behavior

Societal shifts reshaping mobility demand

Pandemic-induced mobility changes:



As lockdowns lifted, car trips returned to pre-COVID levels (Waze, 2021).

Joint Israel-Czech research

Shiftan, Kogus, Gal-Tzur, and Brůhová-Foltýnová, 2022 + Paper in preparation

1 April-May 2020

- RP – Before COVID
- RP – While lockdown
- SP – After pandemic
- Personal data

2,400 Participants

2 June 2020

- RP – After first lockdown
- SP – After pandemic

2,000 Participants

3 July 2022

- RP – After COVID 1
- Changes in personal data

1,070 Participants

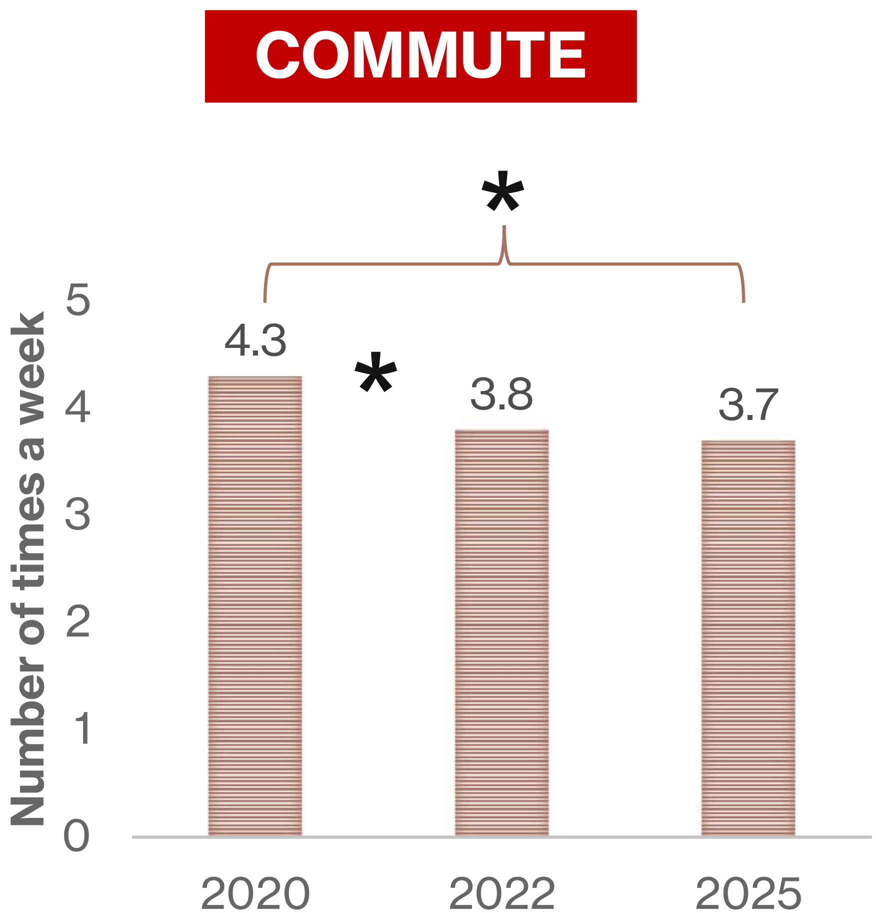
4 September 2025

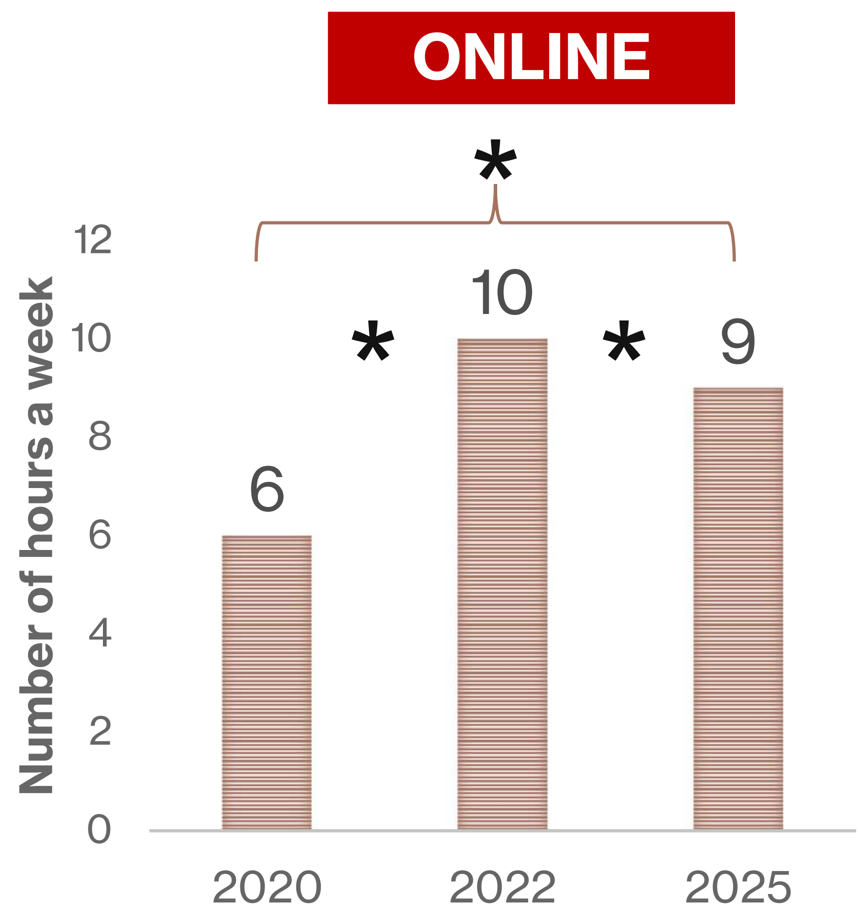
- RP – After COVID 2
- Changes in personal data

320 Participants

Relevant Set (workers who answered all four surveys): 320 participants

Israel results





Transit is recovering

Sweet and Scott (2026): Teleworking declined between 2021 and 2023, became less concentrated in downtown areas, and no longer disproportionately reduced transit use.

Fig. 1. Public transport trips relative to 2019 (=100 %) in the USA, Canada, Germany, GB, and Australia Sources: APTA, 2024b; APTA, 2025a;

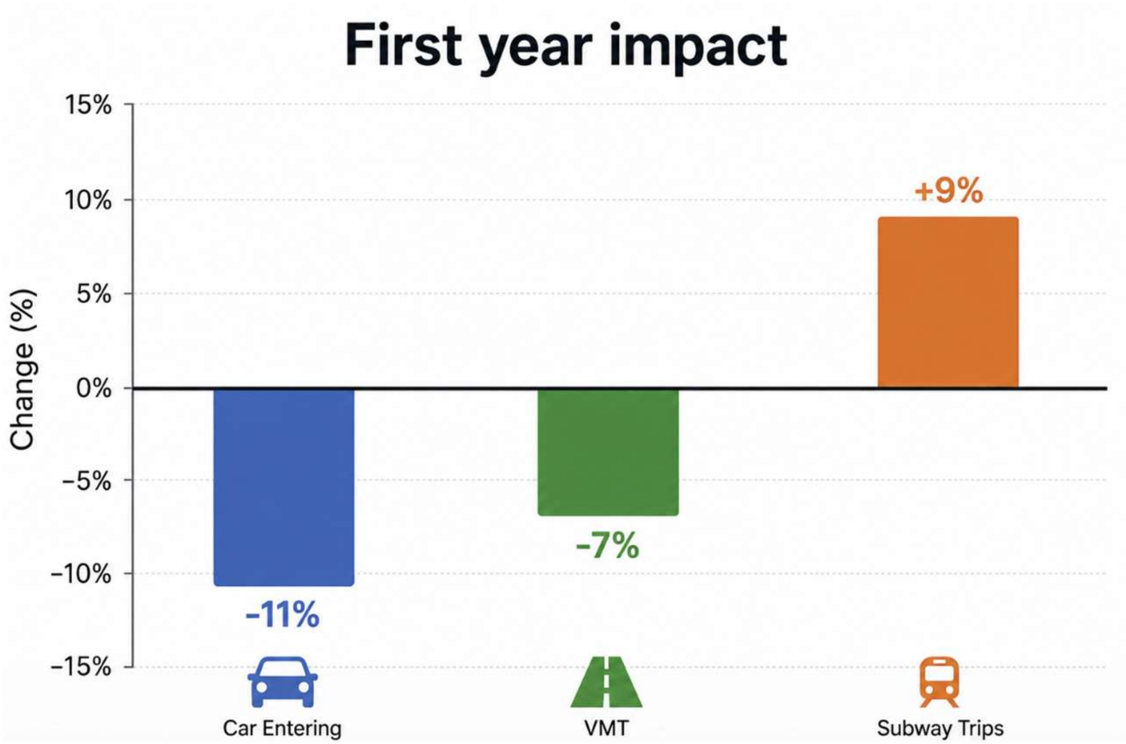
Policy measures: Congestion pricing

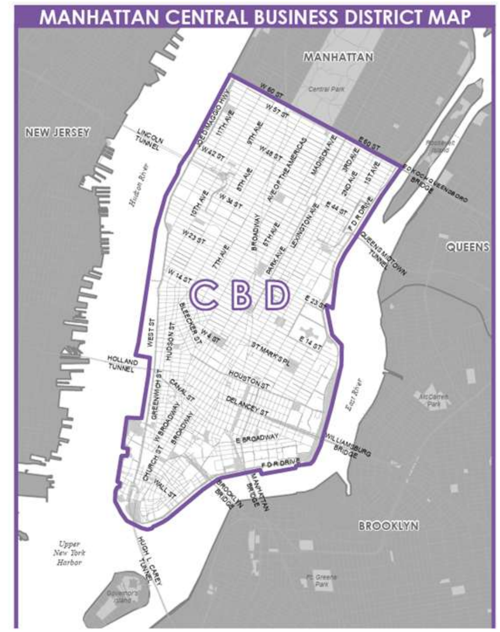
Congestion pricing and the Metro

City	Starting year of congestion pricing	Total metro track length (km)	Additional metro lines being planned
Singapore	1975	243	2
London	2003	400	5
Stockholm	2007	125	2
Milan	2008	104	3
New York	2025	1071	1

New York congestion pricing

- First proposed in 2007, implemented January 2025
- Tarif (EZ- Pass): $13.50 peak time, $3.30 off-peak



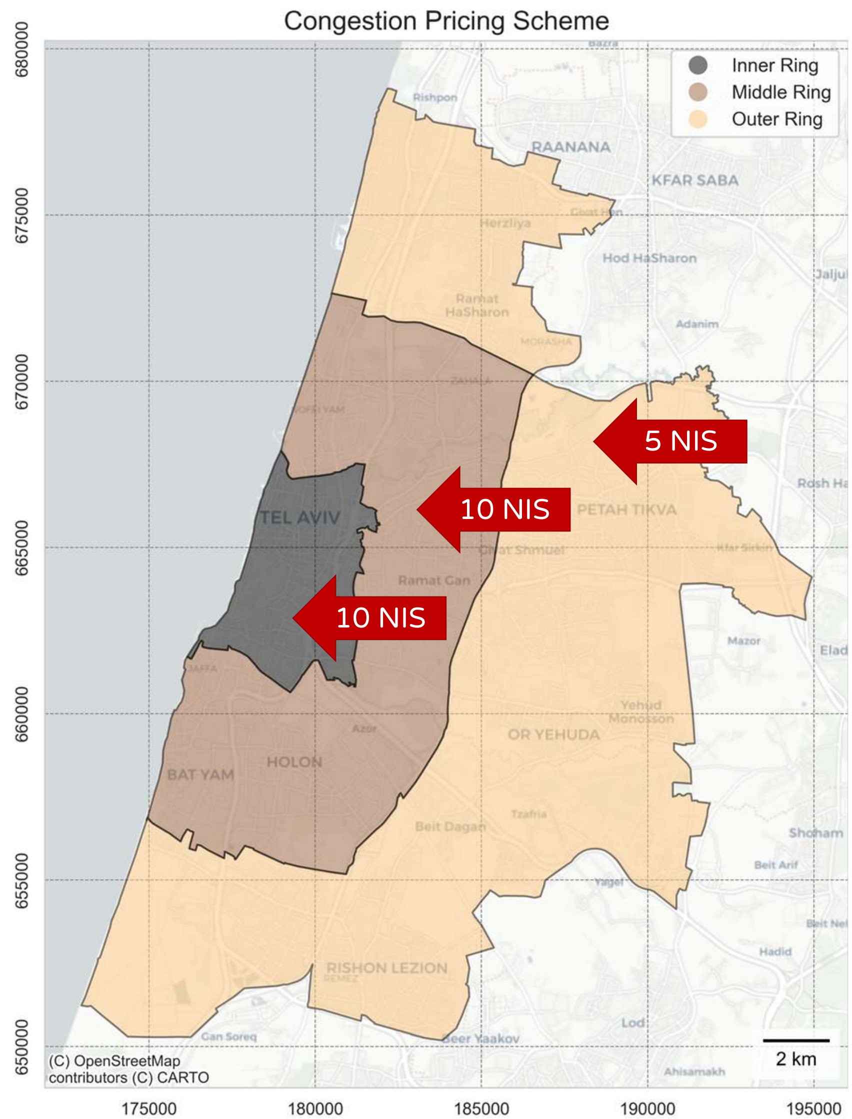


Tel-Aviv congestion pricing scheme

A congestion pricing plan has been developed for TMA based on extensive analysis, including surveys and the evaluation of multiple scenarios.

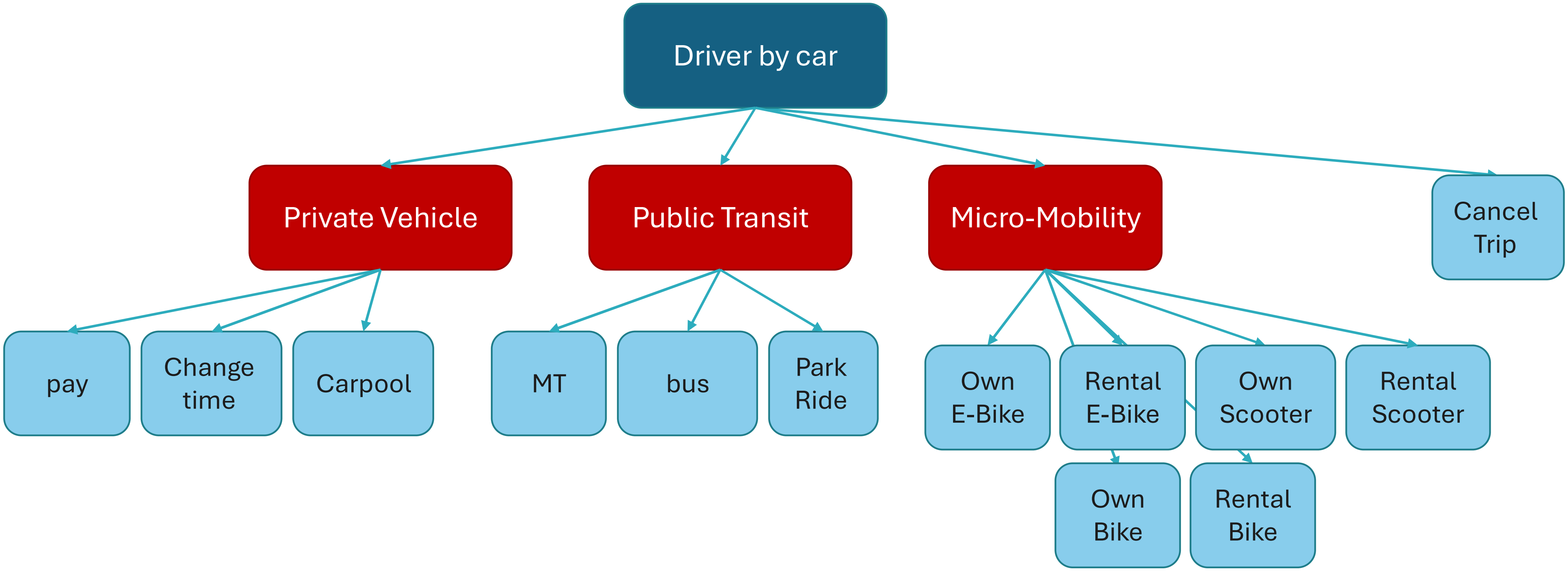
Daily Maximum: 37.5 NIS ($12.80)

10 NIS = 3.4 USD



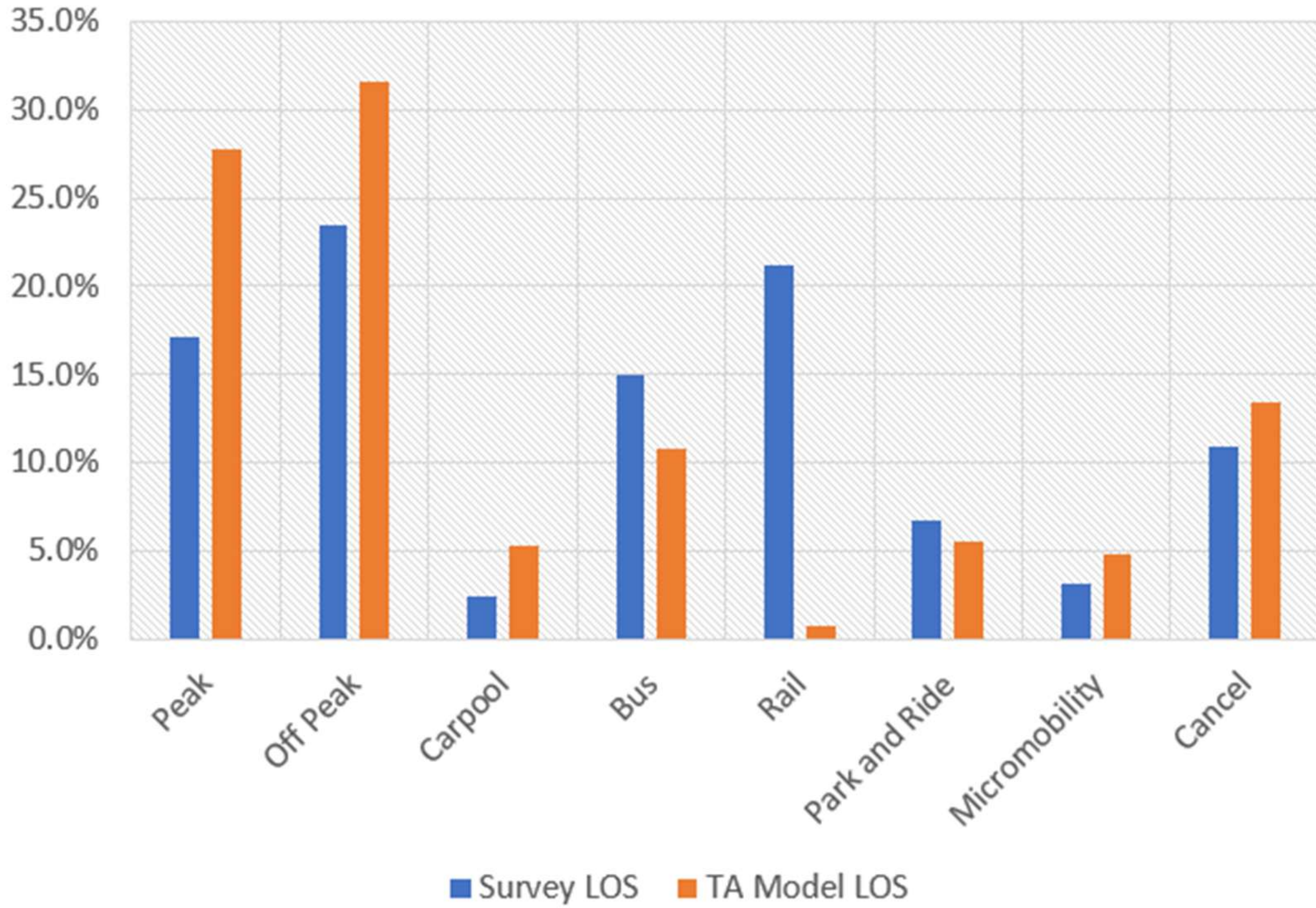
Source: NSA HUB

SP survey - Generated choice set / series of conditional probability choices



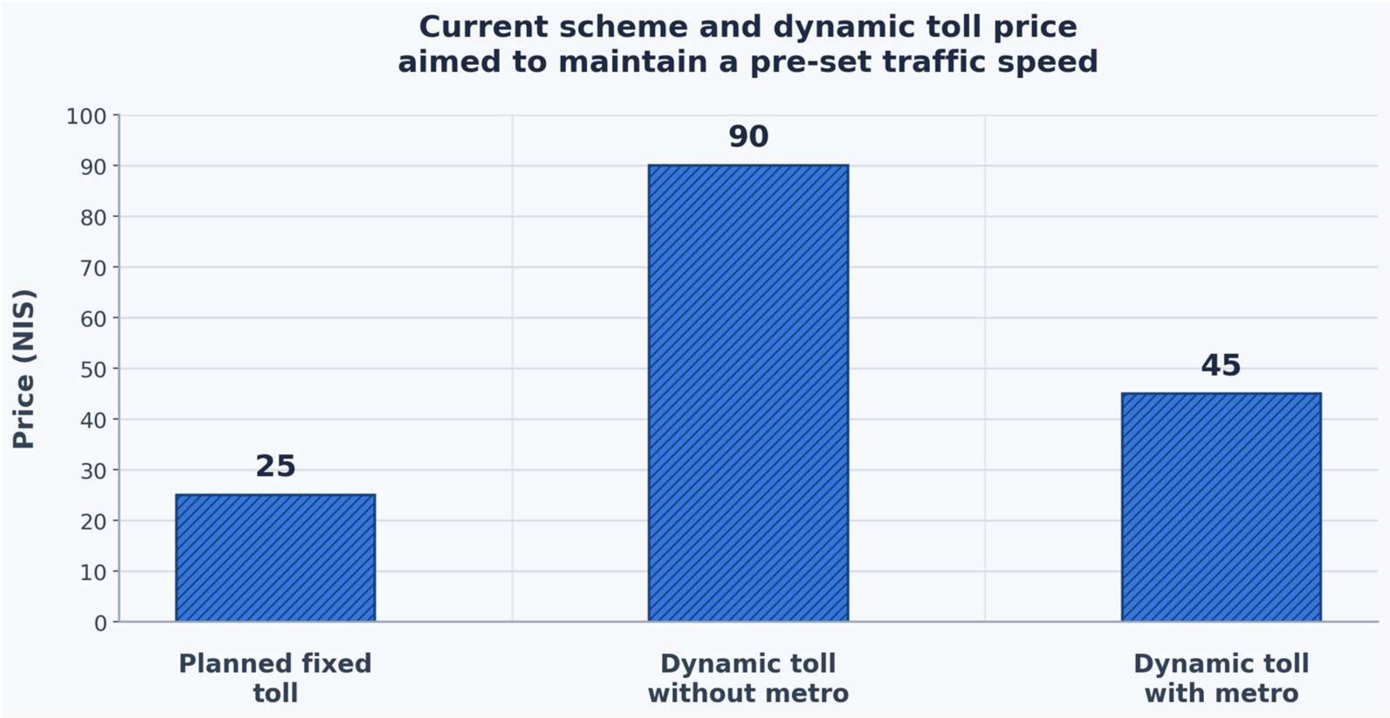
Source: NSA HUB

Drivers' mode choice under congestion (survey rate) for Survey LOS (with Metro) and Tel Aviv LOS



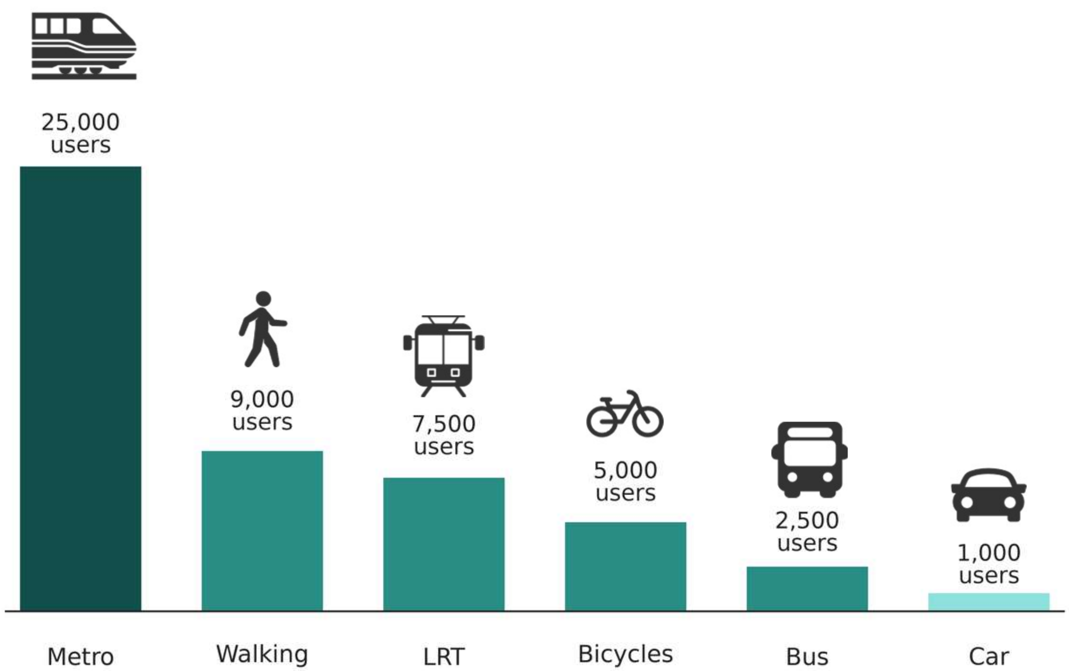
Source: NSA HUB

Congestion pricing and the Metro



Source: NSA HUB

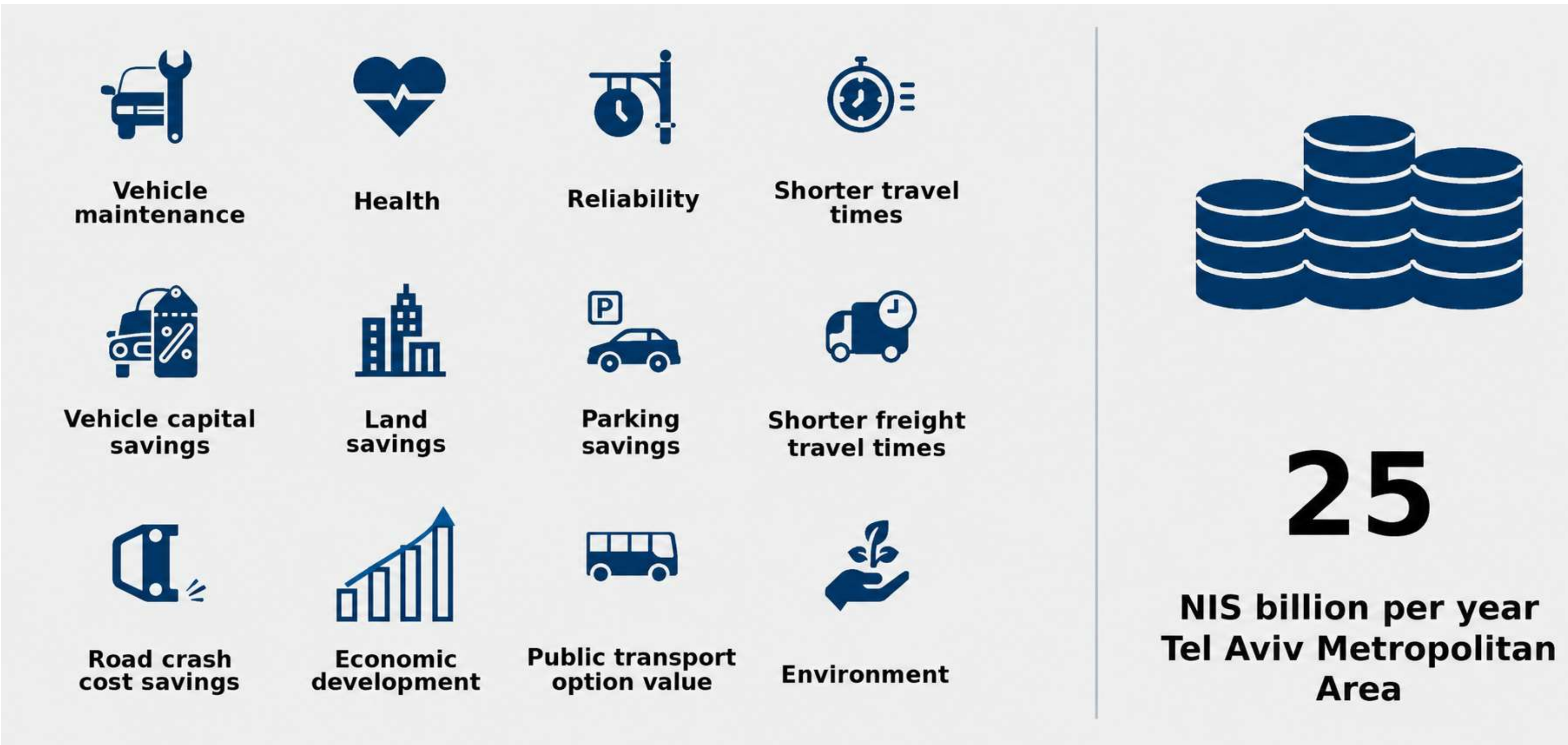
Hourly capacity per direction, by urban travel mode



Moving to sustainable transport

Do we need Metro?

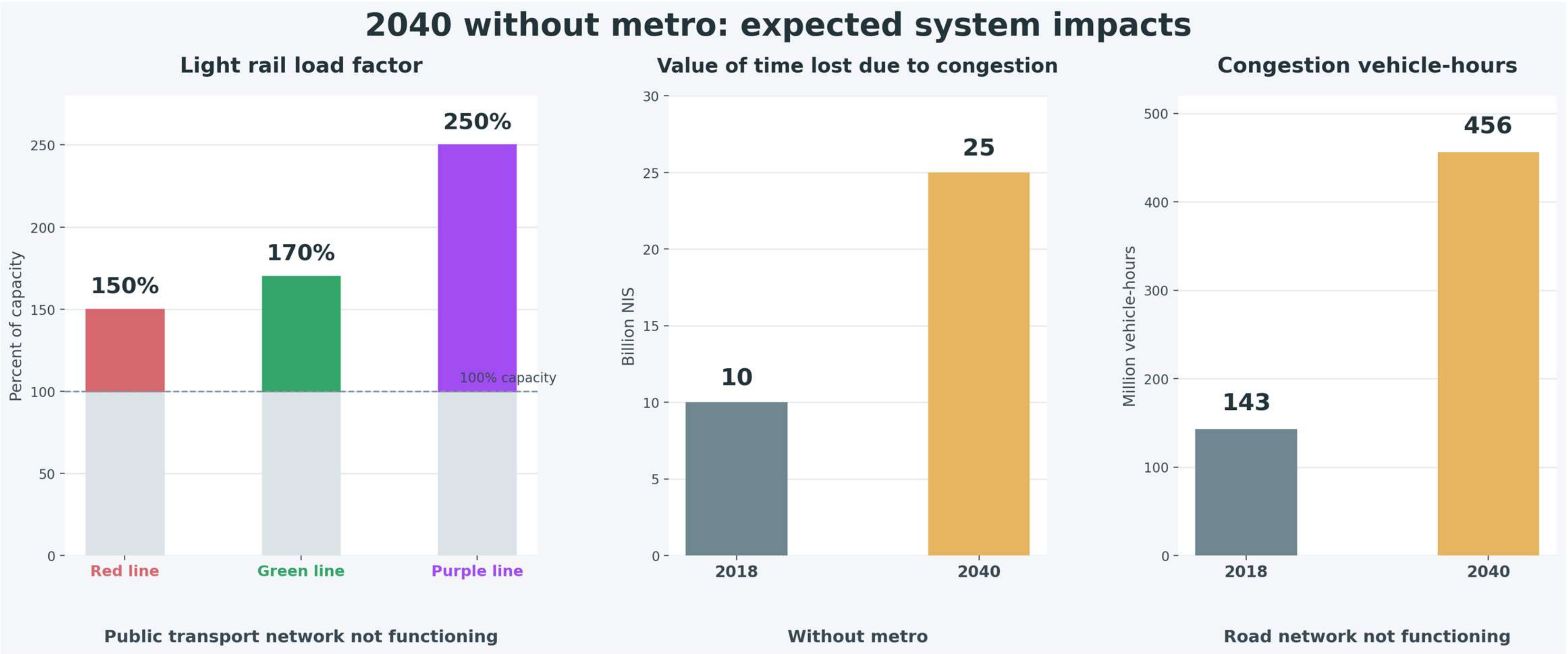
Economic benefits of the Metro - 2040



Source: NSA HUB

City of Vancouver, Arbutus Greenway rendering

2040 No metro scenario



Source: NSA HUB

Response to the critique: Can we replace mass transit?

Technology and MaaS

- People don’t like to share
- Transit is the most sharable mode
- Without Mass Transit, AV and MaaS would increases number of trips, trip length, VMT, and congestion
- We should utilize their benefits to complement and support Mass Transit

COVID: e-activities

- E-activities can replace some travel, but people are social, they like to travel
- Travel that is eliminated by e-activities tends to be replaced by other travel
- E-activities can contribute to people well-being, but people like to travel and we should give the means to do so

Policy – Congestion Pricing

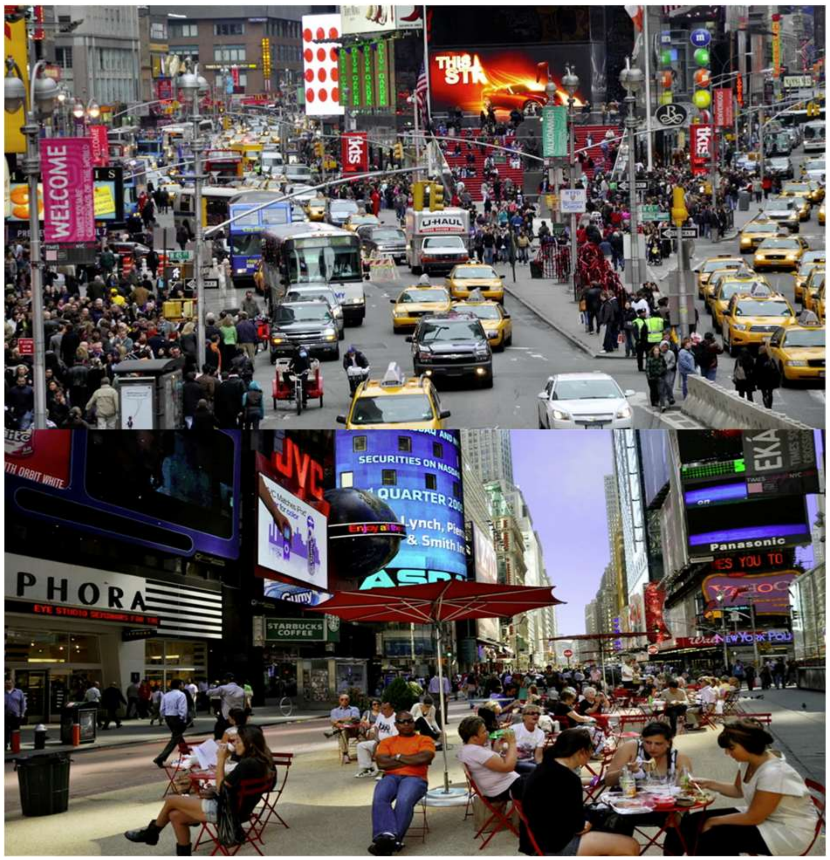
- Congestion pricing and other policies can mitigate congestion but not provide accessibility
- Congestion pricing can be efficient only when people have an alterative mode, otherwise we harm activities
- Policies measures like congestion pricing are important to support mass transit and sustainable travel

Re-thinking transit services - MaaS

- Metropolitan areas are increasing in numbers and continue to growth
- Mass transit is the only solution to such areas and should be the core of their transportation systems.
  - AV funding should be directed at PT
- New mobility services should complement mass transit (last mile, access and egress, local trips) and policies and regulation should be designed so they complement MT and not compete with them.
- Supporting policies are also needed:
  - Pricing (road charging: by occupancy, zero occupancy, parking)
  - Other parking policies
  - Land use (15-minute city)
- Prioritize people! Not cars!
  - Allocate more right of way to pedestrians

Urban form interventions:

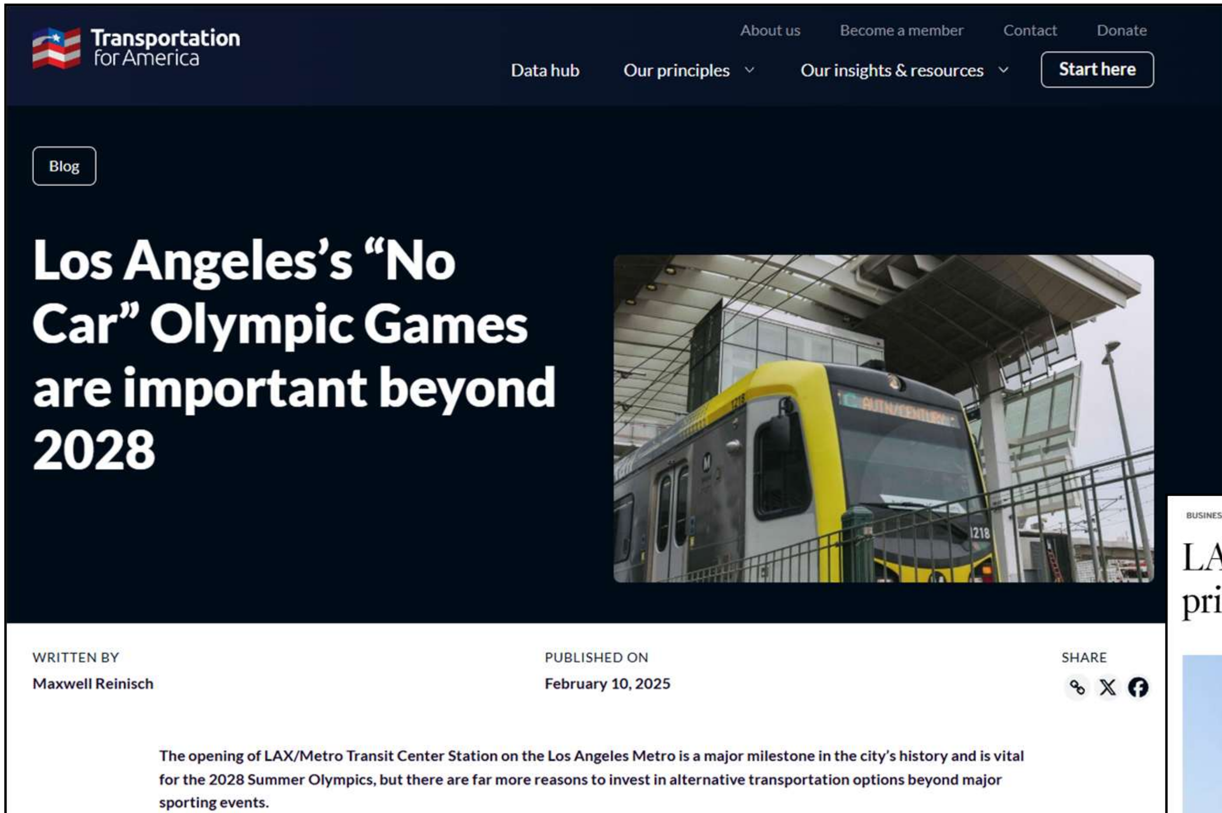
Designing "15-minute cities" and reallocating street space away from cars.



Broadway, NYC

Ferdinand Flocon School Street in Paris

Transportation for America, 2025



Transportation for America

About us | Become a member | Contact | Donate

Data hub | Our principles | Our insights & resources | Start here

Blog

Los Angeles's "No Car" Olympic Games are important beyond 2028

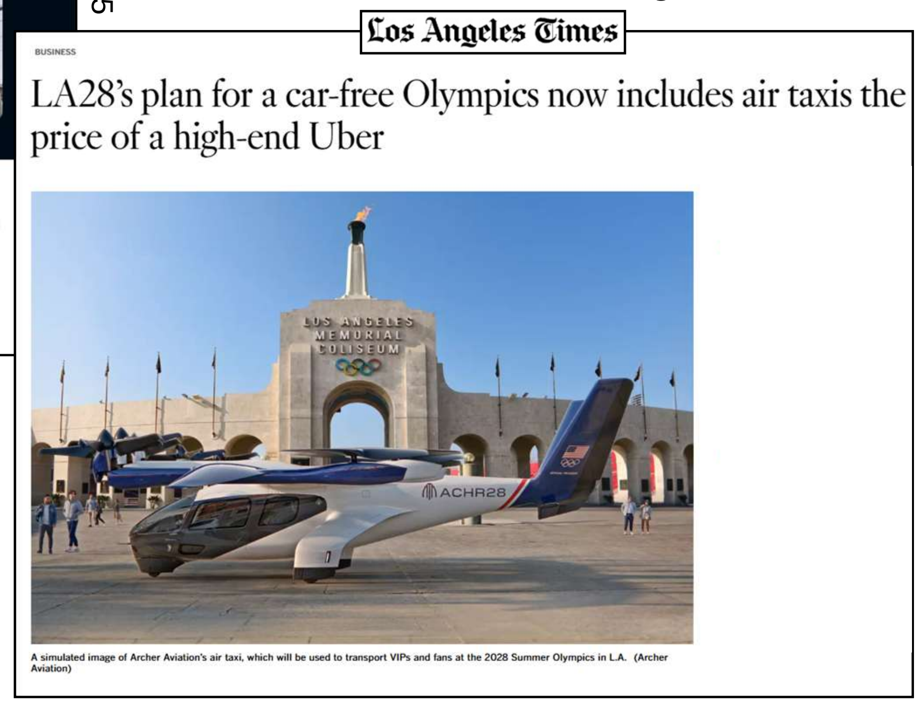
WRITTEN BY
Maxwell Reinisch

PUBLISHED ON
February 10, 2025

SHARE

The opening of LAX/Metro Transit Center Station on the Los Angeles Metro is a major milestone in the city's history and is vital for the 2028 Summer Olympics, but there are far more reasons to invest in alternative transportation options beyond major sporting events.

Los Angeles Times, 2025



Los Angeles Times

BUSINESS

LA28's plan for a car-free Olympics now includes air taxis the price of a high-end Uber

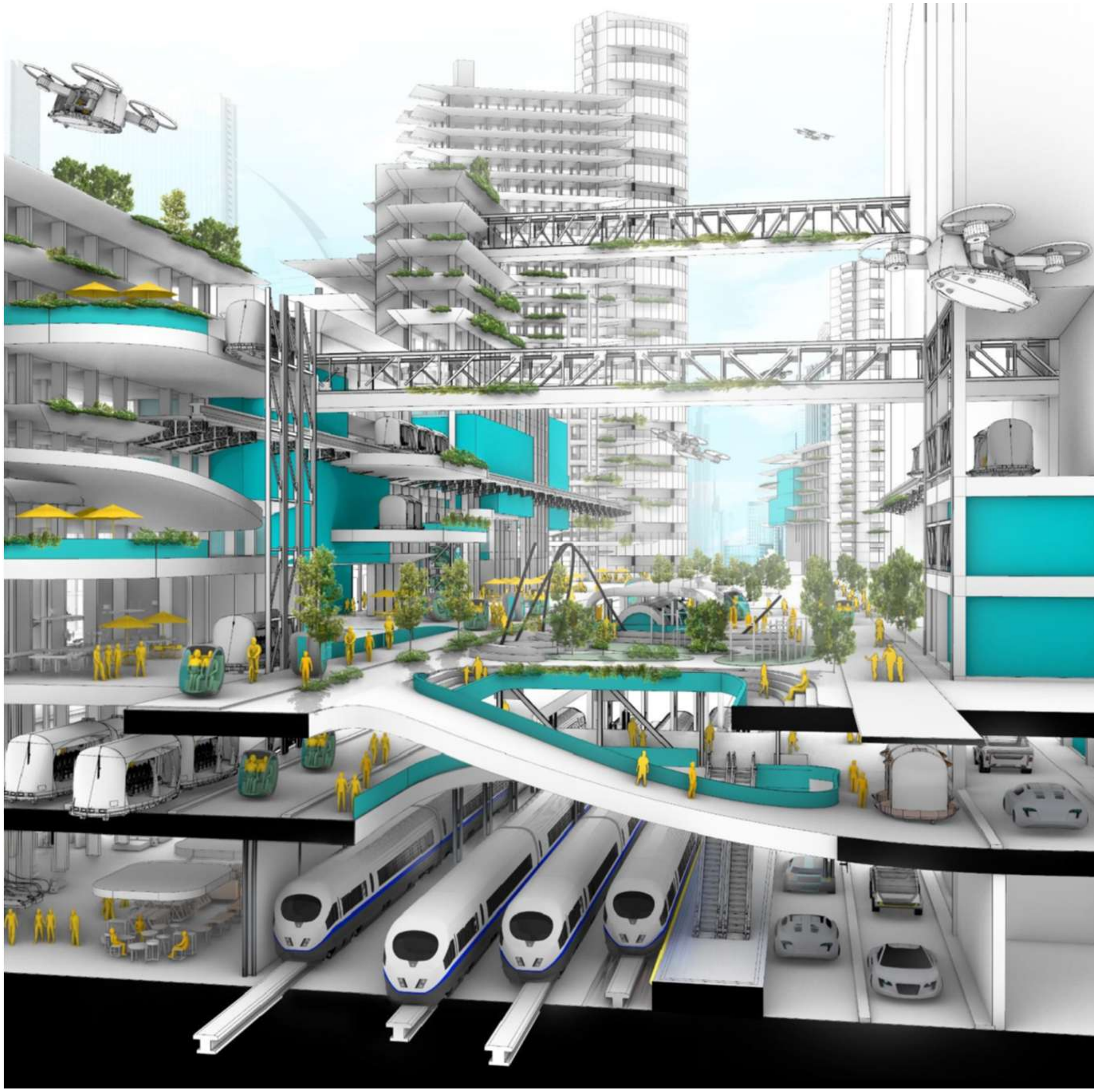
A simulated image of Archer Aviation's air taxi, which will be used to transport VIPs and fans at the 2028 Summer Olympics in L.A. (Archer Aviation)

For LA 2028, organizers are planning a "no-car" Games, with spectators expected to access venues by public transport, walking, cycling, or shuttles, and no public parking at venues.

Vision:
Redesigning urban forms

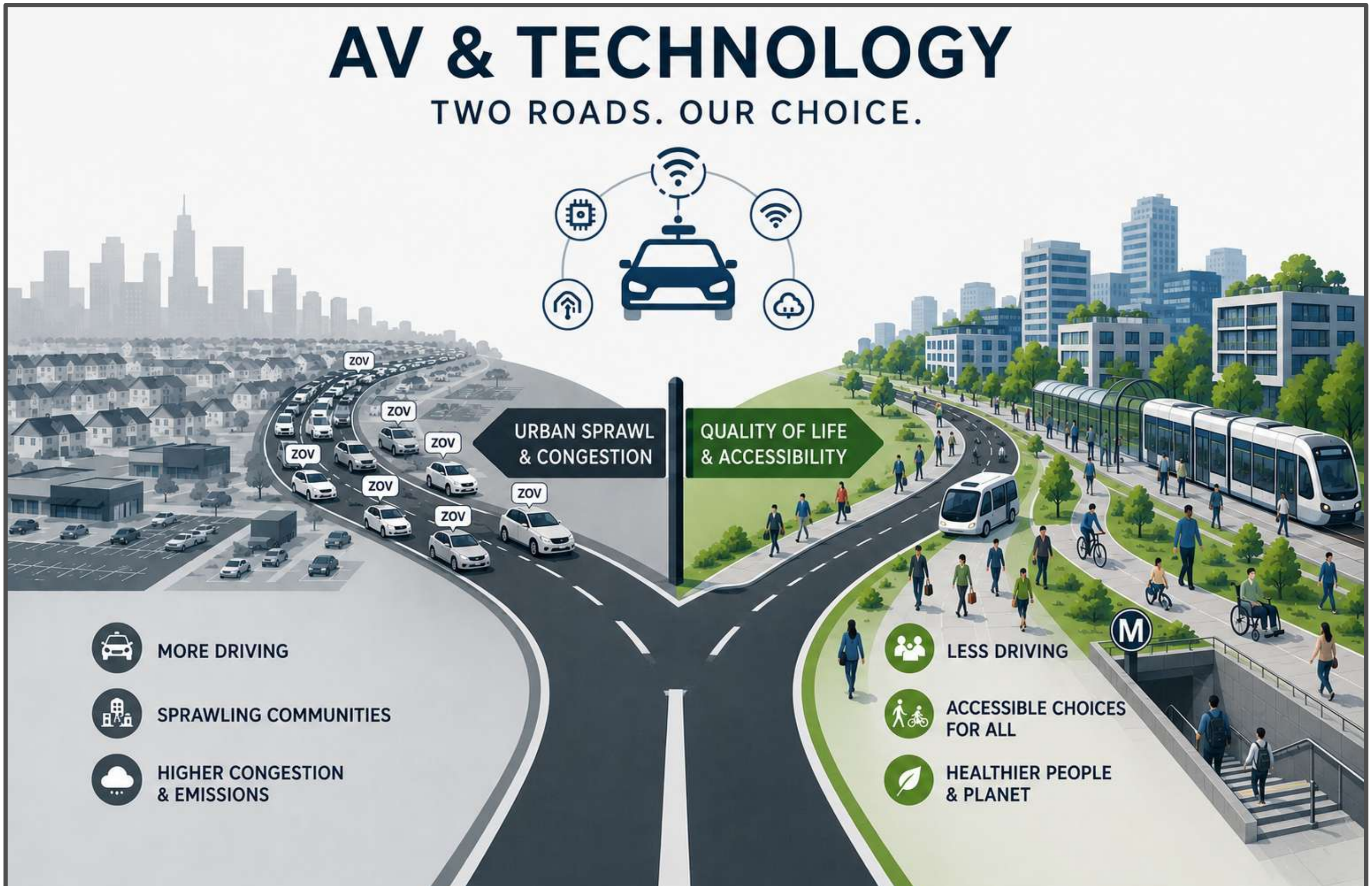
Shiftan & Nitzan-Shiftan (“Mobility and the City in 2100”, 2020):

The future of urban mobility is primarily a governance challenge, not a technological one, requiring strong planning and policy.



Conclusion: The role of travel behavior research

- Technology alone is not a silver bullet—the true wildcard is human behavior.
- **Call for action:** Engineers are solving the hardware and software problems, but travel behavior researchers must solve the human problem.
- Without adequate understanding, guidance, and regulation, novel technologies risk reinforcing existing inefficiencies and even creating new systemic challenges.
- Mass transit should remain the backbone of any future transportation system in large metropolitan areas



Technology dictates what can happen; travel behavior dictates what will happen. **Policy must guide the space in between.**

Final note

- Mass transit systems are very expansive!!!
- The future is unknown!
  - Brand new technologies
  - Shocks (energy crisis, pandemic, war, other?)
  - Social trends that may affect travel
  - There is a risk in mass transit investment
- The risk of not investing in mass transit is larger that the risk in investment.
- APTA Economic Impact of Public Transit (2026) shows that $1 Billion in transit investment sustained over 20 years generate $5 Billions in additional GDP annually.

THANK YOU

Yoram Shiftan

shiftan@technion.ac.il