











10th Transport Research Arena Conference Advancing Sustainable and Inclusive Mobility Dublin, Ireland, April 15-18, 2024

Economic Assessment of Free Public Transport in Athens

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The MetaCCaze project

- > 43 Project partners:
 - National Technical University of Athens

MaasLab, Bable, Factual Consulting, Steinbeis Innovation, TRT, Gemeente Amsterdam, AMS Institute, TU Delft, ZoevCity, Townmaking Institute, Argaleo, Technolution, Landeshauptstadt Munchen, TUM, Stadtraum, OXYGONO, Nextbike CY, Tampereen Kaupunki, Remoted, Anaplassis Athina, Organismos Astikon Sygkoinonion Athinon, Universita Ta Malta, AMAT Milano, NExT SRL, MVK Miskolc Varosi Kozlekedesi Zrt, Institut Vedecom, Agenzia TPL, Mobilysis SARL, etc.

- > Duration of the project:
 - 48 months (January 2024 December 2027)
- **Framework Program**:
 - <u>Horizon 2020</u> The EU Union Framework Programme for Research and Innovation – Climate, Energy and Mobility



Introduction

- Free Public Transport (FTP) is being explored as a potential path for the control and reduction of environmental, social and economic problems.
- More than 100 cities around the world offer a form of FPT to their citizens, such as Taihung in Taiwan, Miami in USA and Verenje in Slovenia.
- The three main benefits of FPT interventions are:
 - Encouragement of **modal shift** from private cars to Public Transport (PT).
 - Improvement of social inclusion.
 - Enhancement of the **urban and economic development** of cities.





Objectives

The investigation of the **socio-economic feasibility** of introducing FPT in Athens

- The investigation of the Athenians' acceptance towards FPT.
- The estimation of the socio-economic impacts from the FPT operation in Athens regarding:
 - Travel Time
 - Fuel Consumption
 - Road Safety
 - Environmental Pollution
- The estimation of investment and operating costs for the FPT operation in Athens.

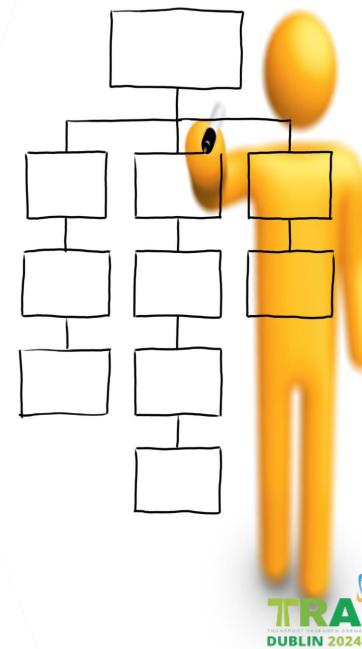






Methodological Overview

- Literature review on the international experience of FPT to identify the potential effects related to the implementation of this measure.
- Comprehensive investigation of the current PT situation in Athens.
- Social Cost-Benefit Analysis development based on the following steps:
 - **Binomial logistic model** development to quantify the modal shift to PT, using a stated preference questionnaire survey
 - Four Scenarios depending on the PT fare discount: S0: no discount (do-nothing)
 S1: 50% fare discount
 S2: 75% fare discount
 S3: 100% fare discount (FPT)
 - Estimation of socio-economic impacts until 2030 and discounted using the Social Discount Rate
 - Estimation of Net Present Value and Internal Rate of Return for each Scenario



Data Description

- Main data source to depict the current situation of PT was the annual reports of the Athens Urban Transport Organization (OASA), responsible for the operation and maintenance of all Athens PT. These reports include:
 - Financial data
 - Fleet size
- Traffic data obtained through the OASA traffic simulation model for 2018
 - Vehicle-kilometers
 - Passenger hours
 - Trips
- Modal shift to FPT estimation through a stated preference questionnaire survey

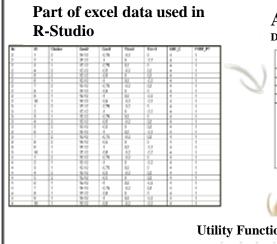




Binomial Logistic Model

 \succ A binomial logistic model was developed to quantify the modal shift from private passenger cars to FPT, using a stated preference questionnaire survey

> https://www.nrso.ntua.gr/geyannis/wpcontent/uploads/vagdatli-ad138c.pdf



Analysis results Dependent variable: modal shift from private cars to FPT

	Estimate b	z/value	Pr(>[z])	
Σταθερός όρος	-0,402	-1,649	0:121	
Έκπτωση κομίστρου (-έκπτωση%)	-0,683	-1,945	0,05184	
Χρόνος ταβδίου	-1,712	-8,571	0,000	***
Χαμηλό επίπεδο άνεσης	-0,121	-1,423	0,155	
Υψηλό επίπεδο άνεσης	0,683	7,719	0,000	
Signif. codes: 0 **** 0.001 *** 0.01 *** 0.05 *.* 0.				
Log-Likelihood: -1381.3				
Log-Likelihood: -1381.3 McFedden R*: 0.14207				
McFadden R ² : 0.14207	e 2 23e-16)			
*	< 2.22e-16)			

Acceptance

			Έκπωση εισπηρίου		
P= 40,1% 43,8% 48,5%		-50%	-72,5%	-100%	
	U=	-0,4027	-0,2489	-0,0610	
1,712*(Χρόνος ταξιδιού)	P=	40.1%	43,8%	48.5%	
	 		43,8%	48,5%	

Utility Function U

U = - 0,402 - 0.683*(Έκπτωση κομίστρου) -- 0,121*(Χαμηλό επίπεδο άνεσης) + 0,683*(Υ



Socio-economic Analysis (1/2)

- For each scenario the investment and operating costs, and the socio-economic benefits have been calculated in monetary terms.
- Impact of FPT on travel time estimated based on the annual passenger-hours spent on private cars and PT, and the value of time (VOT).
- Impact of FPT on fuel consumption estimated based on the composition of the vehicles by fuel type, the average consumption of vehicles, as well as the price of fuels per year.
- Impact of FPT on road safety estimated based on the number of road fatalities and injuries in each Scenario, as well as the social cost per fatality and injury.





Socio-economic Analysis (2/2)

- Impact of FPT on the environment estimated based on the cost of emissions and the emissions per vehicle type.
- Investment cost (initial) for scenarios S1-S3 estimated considering the cost of the required study and the purchase of new or used buses.
- Operating costs of FPT estimated based on the operating and maintenance costs of the system, mechanical equipment, as well as costs related to the additional human resources and fuel consumption of the new buses.





CBA Scenario 1

	Present	2023	2024	2025	2026	2027	2028	2029	2030
Costs and Benefits	Value (SDR=0.8%)	Implemen tation	Operation						
C1. Investment Cost (mil.€)	-11.43	-11.52	0	0	0	0	0	0	0
C2. Operating Costs (mil.€)	-83.13	0	-19.48	-18.08	-13.28	-11.41	-9.60	-7.04	-7.09
Total Costs (mil.€)	-94.56	-11.52	-19.48	-18.08	-13.28	-11.41	-9.60	-7.04	-7.09
B1. Travel time (mil.€)	- 237.31	0	-53.35	-54.44	-38.89	-34.02	-28.93	-17.71	-18.08
B2. Fuel consumption (mil.€)	655.30	0	178.58	164.71	105.67	82.56	67.04	39.34	38.28
B3. Road Safety (mil.€)	82.37	0	22.17	21.62	13.13	10.62	8.36	4.60	4.49
B4. Emissions (mil.€)	110.11	0	26.27	26.27	18.19	15.38	12.87	7.42	7.36
Total Benefits (mil.€)	610.47	0	173.69	158.16	98.10	74.54	59.33	33.65	32.05
NPV (SDR=0.8%) (mil.€)	515.92	-11.52	154.21	140.08	84.82	63.13	49.73	26.06	24.96
IRR	1,327.6%								
Benefits/Costs Ratio	6.46								

DUBLIN 2024



Economic Feasibility Results

- Investigation of the economic performance of all scenarios until the year 2030.
- > Identification of beneficial FPT scenarios using specific criteria:
 - ✓ Net Present Value (NPV) of the investment must be **positive NPV>0**.
 - Internal Rate of Return (IRR) should be greater than the Social Discount Rate (SDR).
 - Ratio of benefits to costs should be greater than unity, B/C>1.
- All FPT scenarios are economically viable over time based on the criteria.
- The implementation of FPT in Athens has a significant positive influence on road safety, the environment and society.

Scenario	NPV	IRR	B/C
S1 50% fare reduction	516 mil. €	>100%	6.46
S2 72.5% fare reduction	540 mil. €	>100%	5.24
S3 100% fare reduction	593 mil. €	>100%	4.52





Discussion

- The introduction and operation of partially and fully FPT in the urban network of Athens is expected to significantly improve road safety. By the year 2030:
 - Reduced road fatalities by 20 (S1) 25 (S3)
 - Reduced severe injuries by 38 (S1) 46 (S3)
 - Reduced light injuries by 622 (S1) 733 (S3)
- Significant environmental improvement:
 - Fuel consumption reduction by 1.3 (S1) 1.4 (S3) billion liters of gasoline-equivalent fuel
 - Reduction of CO2 pollutants by 2.5 (S1) 3.1 (S3) mil. tons
- The FPT intervention in the network of Athens is a socioeconomically sustainable investment.





Conclusions

- The introduction and operation of partially and fully FPT in the urban network of Athens is expected to significantly improve road safety, the environment and the quality of life.
- To ensure the successful introduction and operation of FPT in Athens, a pilot operation is proposed as trailhead, to fully assess the effectiveness and efficiency of the system.
- Upgrading the existing infrastructure and PT fleet, as well as the level of service of PT, by increasing itineraries, purchasing new environmentally friendly buses is suggested to attract more commuters to PT and ensure a smoother transition to the FPT.

















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