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SMALOG
EXPERIENCE and OUTCOMES

assoc. prof. Alexander Rossolov

O.M. Beketov National University of Urban Economy in Kharkiv

Department of Transport Systems and Logistics

SmaLog TRAINING

RESEARCH and EDUCATION activities

assoc. prof. Alexander Rossolov

National University of Urban Economy in Kharkiv

Department of Transport Systems and Logistics

TRAINING RESULTS INTERMEDIATE REPORT #1

assoc. prof. Alexander Rossolov

National University of Urban Economy in Kharkiv

Department of Transport Systems and Logistics

TRAINING RESULTS INTERMEDIATE REPORT #2

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National University of Urban Economy in Kharkiv

Department of Transport Systems and Logistics

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TRAINING RESULTS

FINAL REPORT

assoc. prof. Alexander Rossolov

National University of Urban Economy in Kharkiv

Department of Transport Systems and Logistics

RESEARCH (Freight)

Last mile deliveries problems – case of Casablanca (1/2)

Parameter of service polygon	Numerical value
City area, km²	384
City population, thousand people	3,356
Type of street-road network	radial-circular
Number of Bim Stores customers, units	40
Density of Bim Stores customers location, units/km²	0.104
Average radius of servicing a single Bim Stores' shop, km	1.75

No. of alternative delivery system	Number of routes in the system, units	Total mileage when loaded, km	Total mileage along the routes, km	Mean value of the cargo capacity utilization factor	Mean value of the mileage utilization coefficient	Total delivery time, h	Daily volume of transportation, pallets
1	7	294.2	467.0	1.00	0.63	34.76	70
2	12	414.4	722.0	0.90	0.57	50.86	108
3	5	233.7	360.7	0.86	0.65	28.73	69
4	7	284.9	468.4	0.96	0.61	37.31	108
5	9	323.4	563.0	0.93	0.57	40.84	84
6	6	246.1	398.9	0.88	0.62	31.97	84
7	5	222.0	356.1	0.94	0.62	28.67	69
8	7	284.9	468.4	0.96	0.61	37.31	108
9	6	234.3	387.1	0.92	0.61	31.62	85

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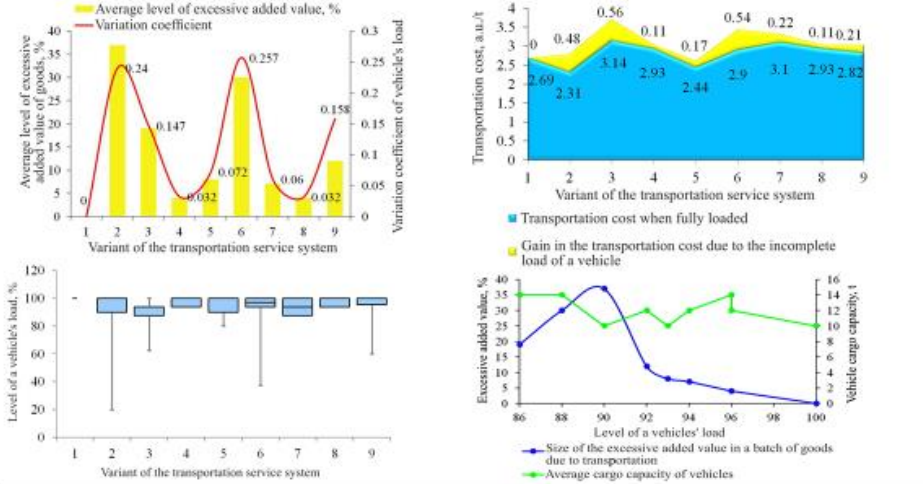
RESEARCH (Freight)

Last mile deliveries problems – case of Casablanca (2/2)



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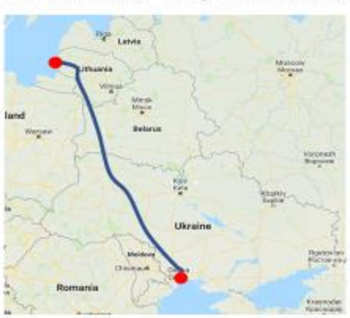
RESEARCH (Freight)

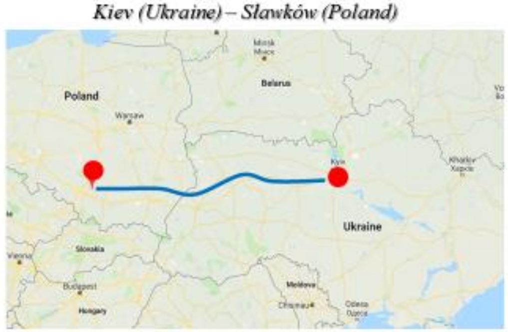
Multimodal transportation (piggy back) (1/2)

<u>The aim</u> – to compare the effectiveness of usage of unimodal (automobile) and multimodal (piggy back) variants of transportation and define the rational parameters of the alternative transportation systems.

"Piggy back" train
Illichivsk (Ukraine) – Klaipeda (Lithuania)



"Piggy back" train
Kiev (Ukraine) – Slawków (Poland)



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RESEARCH (Freight)

Multimodal transportation (piggy back) (2/2)

<u>The equilibrium point</u> → <u>Delivery costs for unimodal and multimodal transportation are equal</u>

delivery distance ≤ equlibrium distance → unimodal transportation
delivery distance > equlibrium distance → piggy back transportation

Truck capacity, t	Waiting time for departure at the railway terminal, days	Class of cargo								
		1			2			3		
		Trucking distance specific weight, ratio								
		0.1	0.2	0.3	0.1	0.2	0.3	0.1	0.2	0.3
20	0	351	400	465	394	450	523	449	513	597
	3,5	680	776	901	689	786	913	699	798	929
25,5	0	298	339	393	339	385	447	391	445	518
	3,5	656	746	866	662	754	875	669	763	887

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National University of Urban Economy in Kharkiv

EDUCATION MATERIALS BRANCH

Finalizing the distance learning lesson for teachers

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SMA LOG

Cooperation for innovation and the exchange of good practices
Capacity Building in Higher Education
Joint project
distance learning course for teachers

Direction – Freight
Lesson 1
Topic:

E-COMMERCE

E-Commerce

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Aim:

To study the current trends, performances, delivery structure and purchases number in case of e-commerce in cities.

The content of the lesson:

1. Current trends of e-commerce.
2. E-commerce performances.
3. E-commerce infrastructures and delivery structure.
4. E-commerce: purchasing number.

E-Commerce

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Competences:

- to know the general typology of e-commerce delivery systems;
- to analyze the end consumer behavior in purchasing both in store and on line
- to analyze and forecast of e-commerce (shopping) demand;
- to design, manage and control e-commerce supply systems in cities.

E-Commerce

1. Current trends

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- E-commerce is the buying and selling of products through the use of internet.

- Internet of things (IoT)

Positive effect

Benefits of e-shopping on passenger transportation demand could push to the reduction of related trips

>>??

<<??

Negative effect

The purchased products have to be delivered to end consumers (at home or at pick-up points; sprawl) and Failed deliveries
increasing of veh-km of commercial vehicles

E-Commerce

Finalizing the distance learning lesson for teachers

1. Current trends

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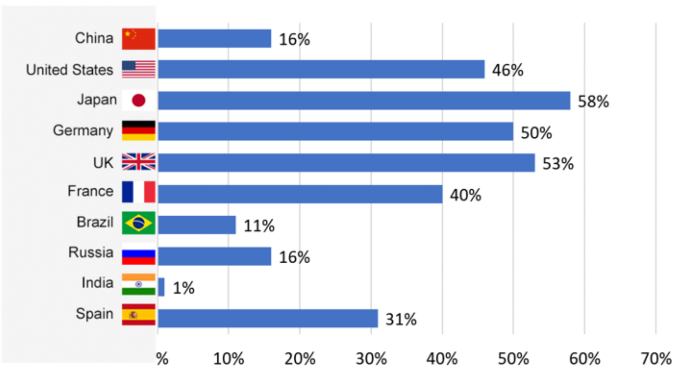
Percentage of online buyers in general population (2012)



E-Commerce

1. Current trends

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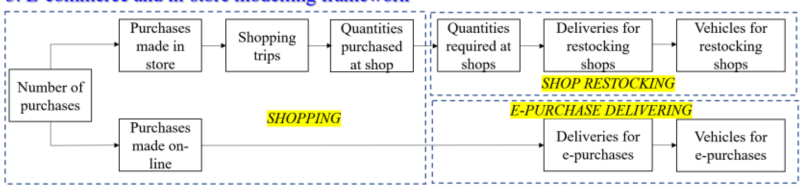
E-shopping delivery systems

- Attended delivering (*may cause costs increase*)
- Alternative delivery solutions to minimise the problem of failed deliveries and the high costs of failed attended home deliveries.
  - Unattended delivery systems at the customer's home include the use of:
    - Reception boxes
    - Delivery boxes
    - Controlled access systems
  - Unattended delivery systems away from the customer's home include:
    - Pick-up points
    - Collection points
    - Locker banks

E-Commerce

3. E-commerce and in-store modelling framework



Shopping model sub-system

it allows to simulate end-consumer shopping behavior, and estimates quantities bought at store and the number of e-purchases

Shop restocking model sub-system

given the quantity attracted by the shops in each traffic zone, it allows to estimate the restocking origin-destination (O-D) matrices by goods type and type of vehicle used

E-purchase delivering model sub-system

given the number of purchases made on-line by end consumers living in each traffic zone, it allows to estimate the e-purchase delivering O-D matrices by goods type and type of vehicle used.

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E-Commerce

4. E-commerce: purchasing number

THE UTILITY FUNCTION PARAMETERS VALUES

Type of goods	The parameters of the utility function								
	Demographic						Economic		
	young	male	fem	high	medium	comp	student	housewife	employee
clothing	0.34	-	-	-	-	-	0.41	-	-
electronics	-	1.44	-	-	0.78	-	-	-	-
hygiene and household products	-	-	0.27	-0.57	-	-	-	0.50	-
other	-	0.71	-	-	0.23	-0.22	-	-	-0.24

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E-Commerce

RESEARCH BRANCH

PAPERS REVIEW ON VEHICLES GPS DATA

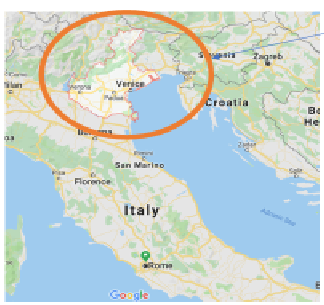
1. Marra, Alessio D.; Becker, Henrik; Axhausen, Kay W.; Corman, Francesco (2018). Developing a passive GPS tracking system to study long-term travel behavior. Research Collection, ETH Zurich, 29 p.
2. Jameson L. Toole, Serdar Colak, Bradley Sturt, Lauren P. Alexander, Alexandre Evsukoff, Marta C. González (2015). The path most traveled: Travel demand estimation using big data resources. Transportation Research Part C, 16 p.
3. Anda C., Fourie P., Erath A. (2016). Transport Modelling in the Age of Big Data. Work Report, Singapore-ETH Centre, 44 p.
4. Croce A. I., Musolino G., Rindone C., Vitetta A. (2019). Transport System Models and Big Data: Zoning and Graph Building with Traditional Surveys, FCD and GIS. ISPRS Int. J. Geo-Inf., 17 p.
5. Grengs J., Wang X., Kostyniuk L. (2008). Using GPS Data to Understand Driving Behavior, Journal of Urban Technology, Volume 15, Number 2, p. 33–53.
6. Jiang B. (2019). Spatial Heterogeneity, Scale, Data Character, and Sustainable Transport in the Big Data Era. E. G. Nathanail and I. D. Karakikes (Eds.): CSUM 2018, AISC 879, pp. 730–736.
7. Richard J. Lee, Ipek N. Sener, and James A. Mullins (2014). EMERGING DATA COLLECTION TECHNIQUES FOR TRAVEL DEMAND MODELING: A LITERATURE REVIEW. Texas A&M Transportation Institute College Station, Texas.

PAPERS REVIEW ON VEHICLES GPS DATA

8. Marra, Alessio D.; Becker, Henrik; Axhausen, Kay W.; Corman, Francesco (2018). Developing a passive GPS tracking system to study long-term travel behavior. Research Collection, ETH Zurich, 29 p.
9. Marcelle D. Ribeiroa, Ana M. Larrañagaa, Julian Arellanab, Helena B. B. Cybis (2014). Influence of GPS and self-reported data in travel demand models. Procedia - Social and Behavioral Sciences, 162, pp. 467 – 476.
10. Chris McCahill (2017). Understanding Trip-Making with Big Data. State Smart Transportation Initiative, 12 p.
11. Marija Nikoli, Michel Bierlaire (2017). Review of transportation mode detection approaches based on smartphone data. 17th Swiss Transport Research Conference, 18 p.
12. Montini, Lara; Prost, Sebastian; Schrammel, Johann; Rieser-Schüssler, Nadine; Axhausen, Kay W. (2015). Comparison of travel diaries generated from smartphone data and dedicated GPS devices. Transportation Research Procedia 11, 227 – 241.
13. Montini, L., K. W. Axhausen and C. Antoniou (2017). ROUTE AND MODE CHOICE MODELS USING GPS DATA. 96th Annual Meeting of the Transportation Research Board (TRB 2017), Washington, DC, USA, January 8-12, 29 p.
14. Stefan SCHÖNFELDER, Kay W. AXHAUSEN, Nicolas ANTILLE, Michel BIERLAIRE (2002). GI-Technologien für Verkehr und Logistik, 13, 155—179.
15. Andre Carrel, Peter S.C. Lau, Rabi G. Mishalani, Raja Sengupta, Joan L. Walker (2017). Quantifying transit travel experiences from the users' perspective withhig high-resolution smartphone and vehicle location data. 15 p.

SETTING UP METHODOLOGY FOR THE ANALYSIS OF ORIGIN-DESTINATION FLOWS

Statistic data evaluation:



Case study – Veneto Region :

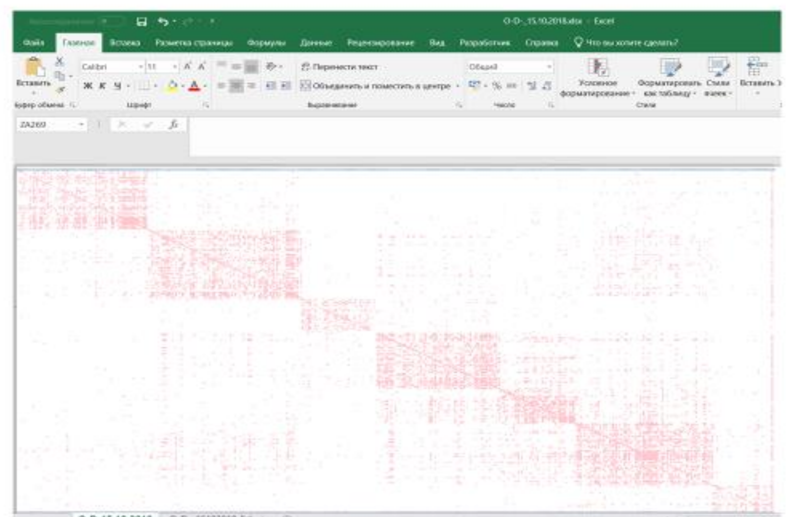
Sampling units – Private cars trips

The observation period:
October – November 2018.

SETTING UP METHODOLOGY FOR THE ANALYSIS OF ORIGIN-DESTINATION FLOWS

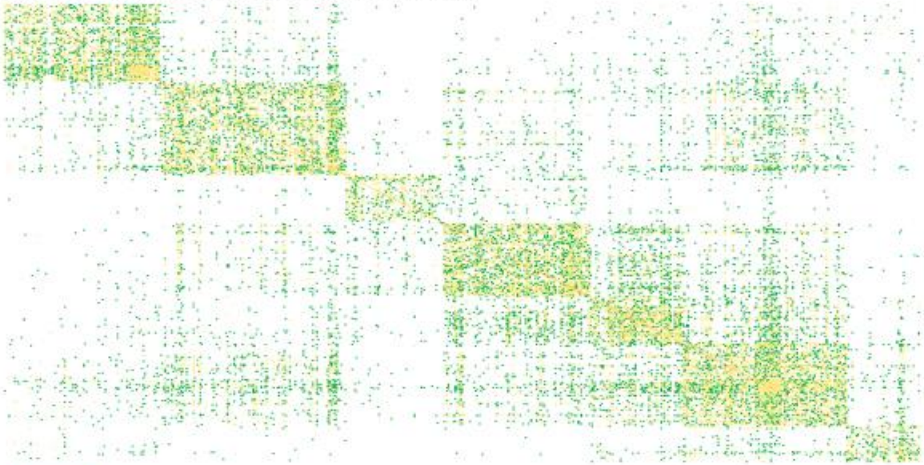
O-D Matrix

15.10.2018



FORMALIZATION OF THE SAMPLE SIZE DEFINITION METHODOLOGY

Average number of trips between 5 days

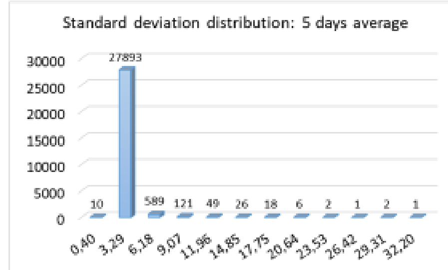


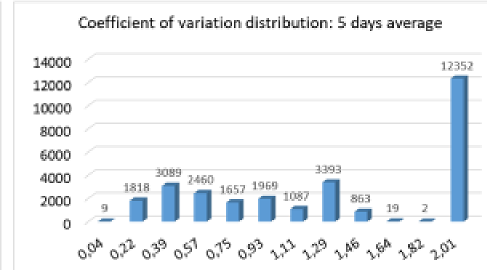
Average trips number (0.2;180)

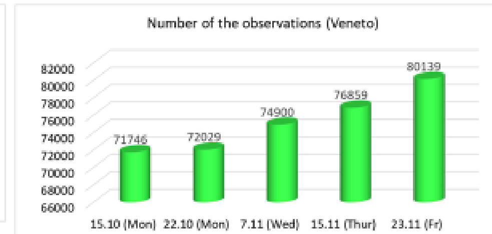
Average trips number(180;380)

Average trips number: more then 380 trips

FORMALIZATION OF THE SAMPLE SIZE DEFINITION METHODOLOGY



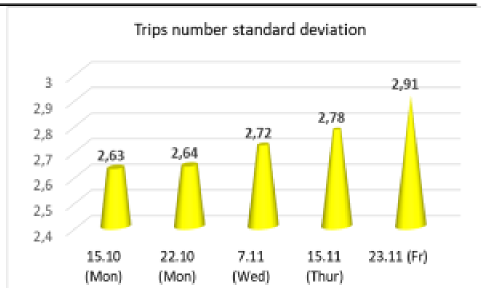


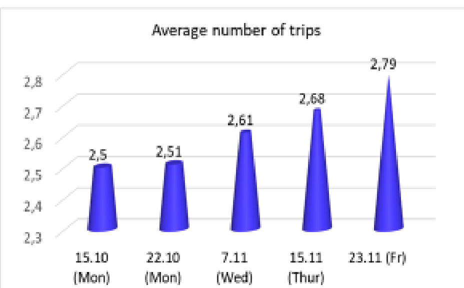


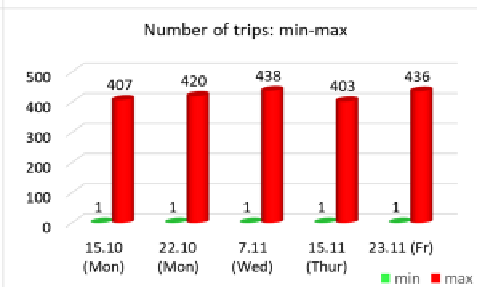
FORMALIZATION OF THE SAMPLE SIZE DEFINITION METHODOLOGY

The characteristics for each day of the observation

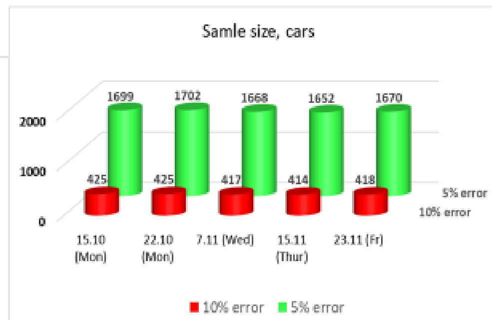
- average number of o-d pairs;
- standard deviation for each day;
- min-max diagram.



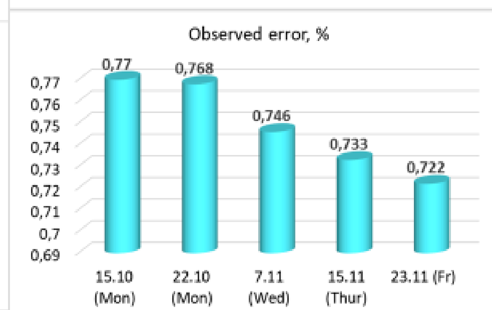


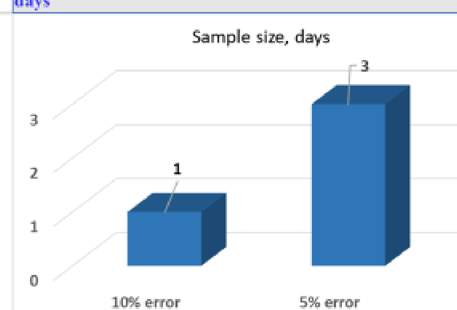


SAMPLE SIZES DEFINITION



Error of the observations	10 %	5 %	Samle size, cars		Observed error, %
	Standard error		10% error	5% error	
15.10 (Mon)	0,1276	0,0638	425	1699	0,77
22.10 (Mon)	0,1281	0,064	425	1702	0,768
7.11 (Wed)	0,1332	0,0666	417	1668	0,746
15.11 (Thu)	0,1367	0,0684	414	1652	0,733
23.11 (Fr)	0,1423	0,0712	418	1670	0,722
Sample size, days	**0,1336**	**0,0668**	**1**	**3**	**3,649**





LECTURING BRANCH

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University of Rome Tor Vergata Italy
Department of Enterprise Engineering

KA2 - Cooperation for innovation and the exchange of good practices
Capacity Building in Higher Education
Joint project

Master in Smart Transport and Logistics for Cities / SmaLog

Urban goods flows modelling:
Vehicle O/D matrices

Antonio Comi
comi@ing.uniroma2.it
University of Rome Tor Vergata Italy
Department of Enterprise Engineering

OUTLINE

CALCULATION OF DEMAND EXAMPLE

SOCIAL COST BENEFIT ANALYSIS-CBA

1-Introduction to Social cost-benefit analysis
2-Microeconomics: welfare economics
Adapted from: Basics of Transport Economics
L.H. Immers - J.E. Stada
3- Surplus variation with
Descriptive Demand Model Approach
Adapted from: Ennio Cascetta
Transportation System Engineering:
Theory and Methods- Kluwer

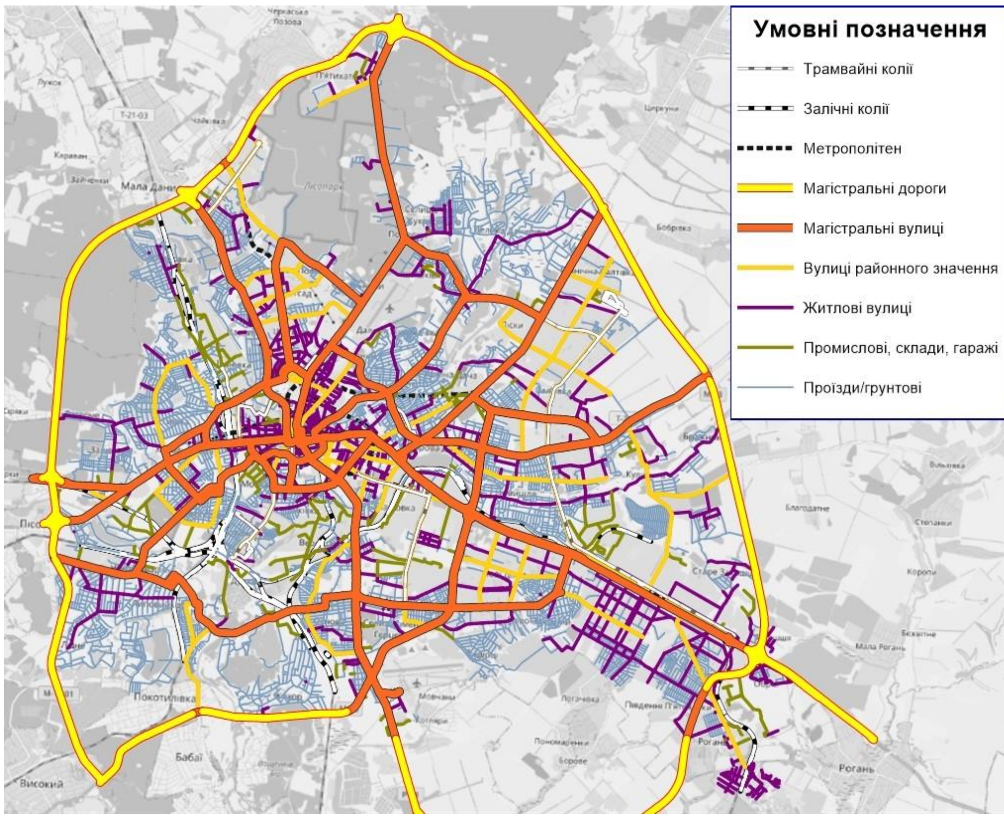
COST-BENEFIT ANALYSIS BASIC THEORY:
Microeconomics:
welfare economics

ADAPTED FROM
Basics of Transport Economics
L.H. Immers
J.E. Stada
KATHOLIEKE UNIVERSITEIT LEUVEN

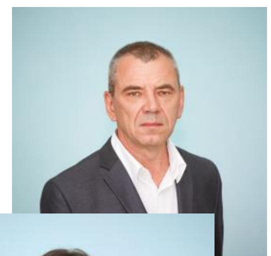
OUTCOMES…

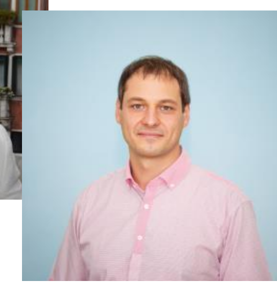
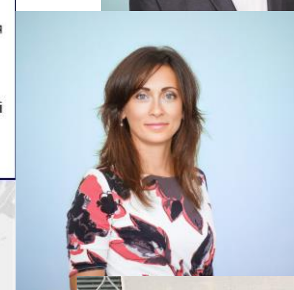
PROJECTS

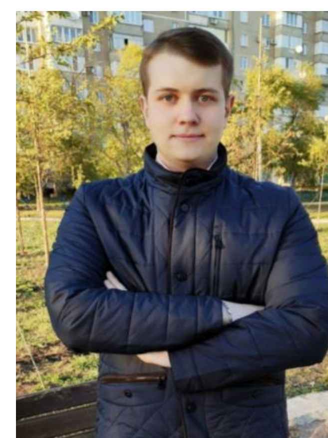
Development of Sustainable Urban Mobility Plan (SUMP) for Kharkiv



NUUE Team





PROJECTS

Fulbright Visiting Scholar 2019-2020

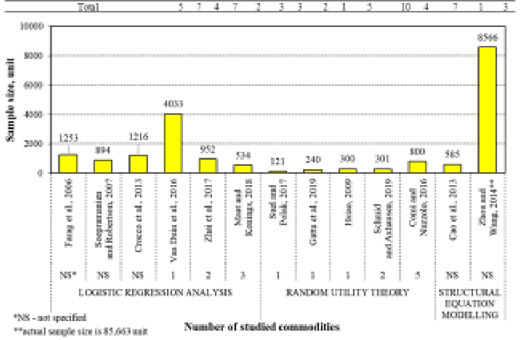
FULBRIGHT

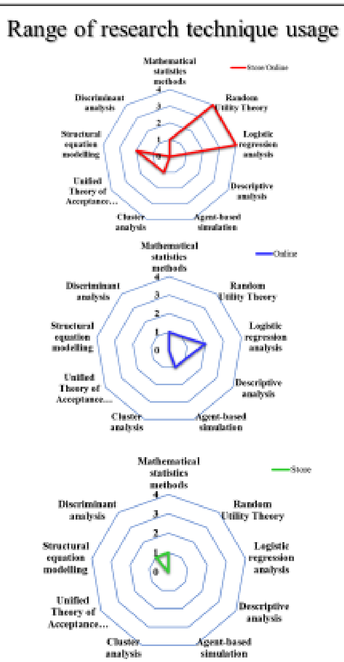
iie The Power of International Education

Department of Civil and Environmental Engineering
Rensselaer Polytechnic Institute

CURRENT STUDIES ON PURCHASE PATTERNS

Reference	Gender	Income	Occupation	Age	Number of vehicles	Household size	Education	Travel cost	Delivery cost	Shopping cost (price)	Travel time	Delivery time	Internet usage	Internet accessibility	Order size
	sociodemographic							economic			spatial		behavioral		
Rohm and Swaminathan, 2004											✓				
Farag et al., 2006	✓	✓	✓								✓		✓		
Rotem-Mindali and Salomon, 2007													✓		
Soopramanien and Robertson, 2007		✓		✓									✓	✓	
Hsiao, 2009				✓				✓		✓	✓	✓			
Cao et al., 2013		✓			✓	✓	✓						✓		
Crocco et al., 2013										✓		✓			
Lian and Yen, 2014	✓			✓											
Zhou and Wang, 2014	✓	✓	✓	✓		✓					✓				
Wang et al., 2015		✓		✓			✓			✓			✓		✓
Comi and Nuzzolo, 2016	✓		✓	✓											
Van Duin et al., 2016		✓	✓	✓	✓	✓					✓				
Suel and Polak, 2017											✓	✓			✓
Zhai et al., 2017	✓										✓		✓		
Maat and Konings, 2018							✓				✓		✓		
Schmid and Axhausen, 2019		✓							✓	✓	✓	✓			✓
Jaewons et al., 2019								✓		✓	✓				
Total	5	7	4	7	2	3	3	2	1	5	10	4	7	1	3





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THANK YOU, OUR DEAR EUROPEAN MENTORS