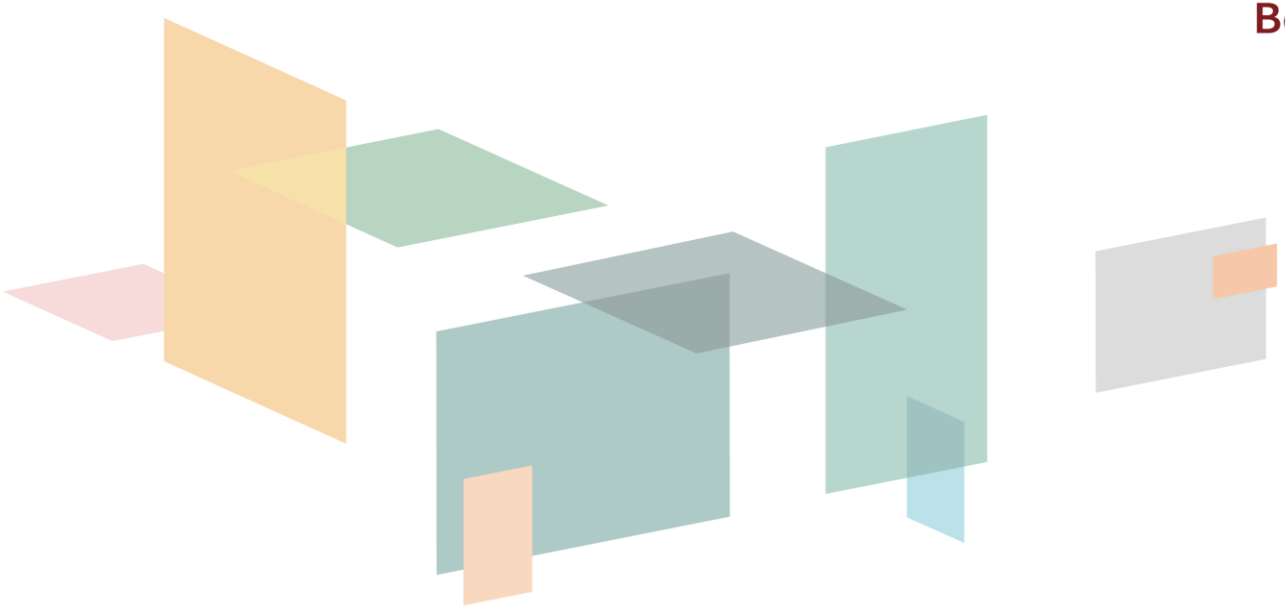
Track 5
Smart futures and sustainability: planning for innovation

Presenting the Prospects for Ropeway Implementation as a Public Transport Mode, the Case of Moscow



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INSTITUTE FOR
TRANSPORT
ECONOMICS AND
TRANSPORT POLICY
STUDIES

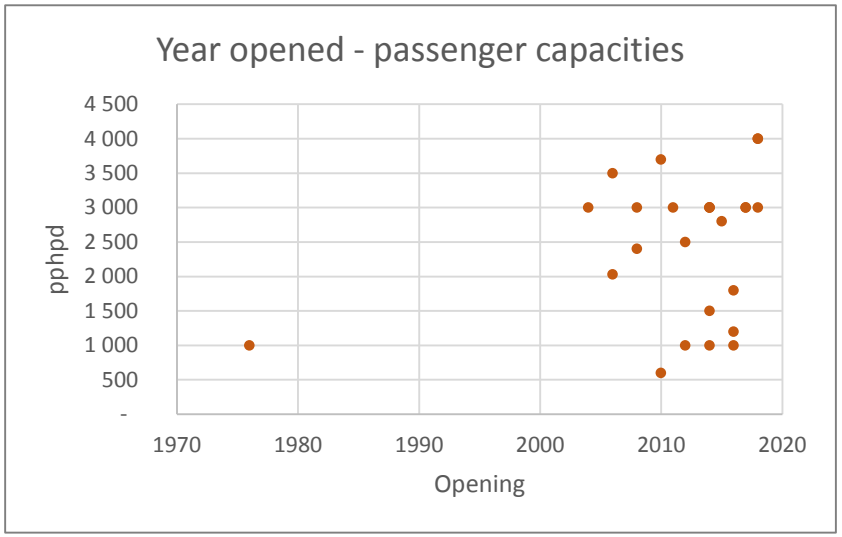
Andrew Borisow
National Research University Higher School of Economics

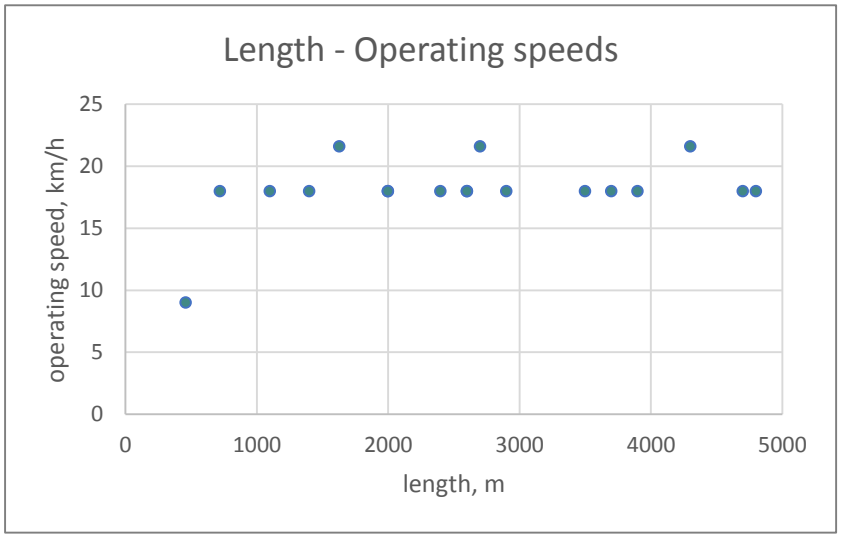
Aim of research

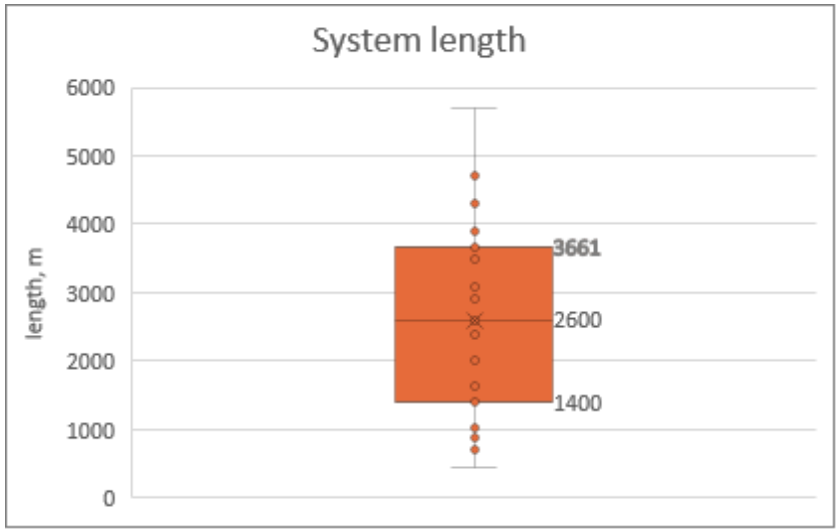
- The paper analyses international experience of CPT* technology as a mass transit component used in urban environments
- The paper proposes an approach that identifies areas suffering from poor connectivity and continuous blocked borders in favor of CPT implementation
- Moscow is considered as a rapidly developing city suffering from local inter-district connectivity
- We identify pairs of adjacent districts where cableways could be adequate as an element of an intermodal transit system

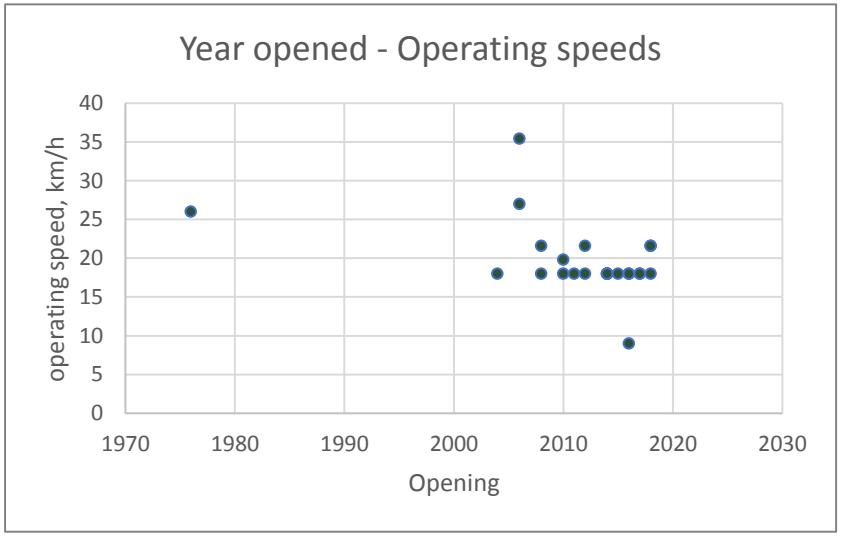
** CPT – cable propelled transit*

Assessment (1)









Assessment (2)

City	Opening	Type	Length, meters	Cabin capacity	Number of cabins	Operating speed, km/h	Peak headway, seconds	pphpd	Tariff, US dollars	Ticket menu integration	1 km cost, mio US dollars
New York	1976	Aerial	3100	78	2	26	7,5 min.	1 000	2,75		8,6*
Portland	2006	Tram	1027	126	2	35,4	5 min.	2 028	4,7	yes	55,5
Medelin (Line K)	2004		2072	10	93	18	12	3 000	0,75		11,58
Nizhny Novgorod	2012	MDG	3661	10	28	18	60	1 000	1,2	no	4,21
London	2012		1100	10	36	21,6	60	2 500	4,67	yes	72,57
Hong Kong	2006	BDG	5700	17	112	27	18	3 500	9,43	no	16,75
Coblenz	2010	TDG/3S	890	35	18	19,8	34	3 700	8,41		13,35

Transit mode	RoW	Operating speed, km/h	max. speed, km/h	Passenger capacity (3,5pax/m2)	Passenger capacity (5pax/m2)	1 km cost, US dollars*	pphpd	max. pphpd	Number of cars	max. Number of cars
Tramline	C	23,1	до 30	197	430	3 - 10	7880	20 000	3	5
BRT	B	26	до 40	100	250	1 - 10	4000	12 000	1	2
LRT	B	38,5	до 70	200	750	5 - 50	8000	36 000	5	7
Subway	A	48	до 80	1200	2632	40 - 130	48000	70 000	4	8
Urban rail	A	53,6	до 90	2043	4700	40 - 150	81720	90 000	6	10
CPT	A	21,6	up to 48**	up to 8-10	up to 230**	5 - 8	1800	4 000	1	1

** Includes all capital costs: rolling stock and other infrastructure facilities*

*** Peak operational speed values at the spans, as well as the maximum passenger capacity are calculated for aerial tram, while the maximum passenger capacity for TDS/3S reaches 6000 pphpd*

Some interim pins

- Became popular in last decade
- Do not depend on length in terms of speed
- Are almost set on lengths no more than 4 000 meters (3 661 as the top value on the box plot)
- Despite the technological advances speed is stable (at average 18 km/h)
- Commissioning costs are basically understated in most studies, but fair when accounting for operating costs and depreciation
- Niche if passenger flow is moderate and low volatility

Why Moscow?

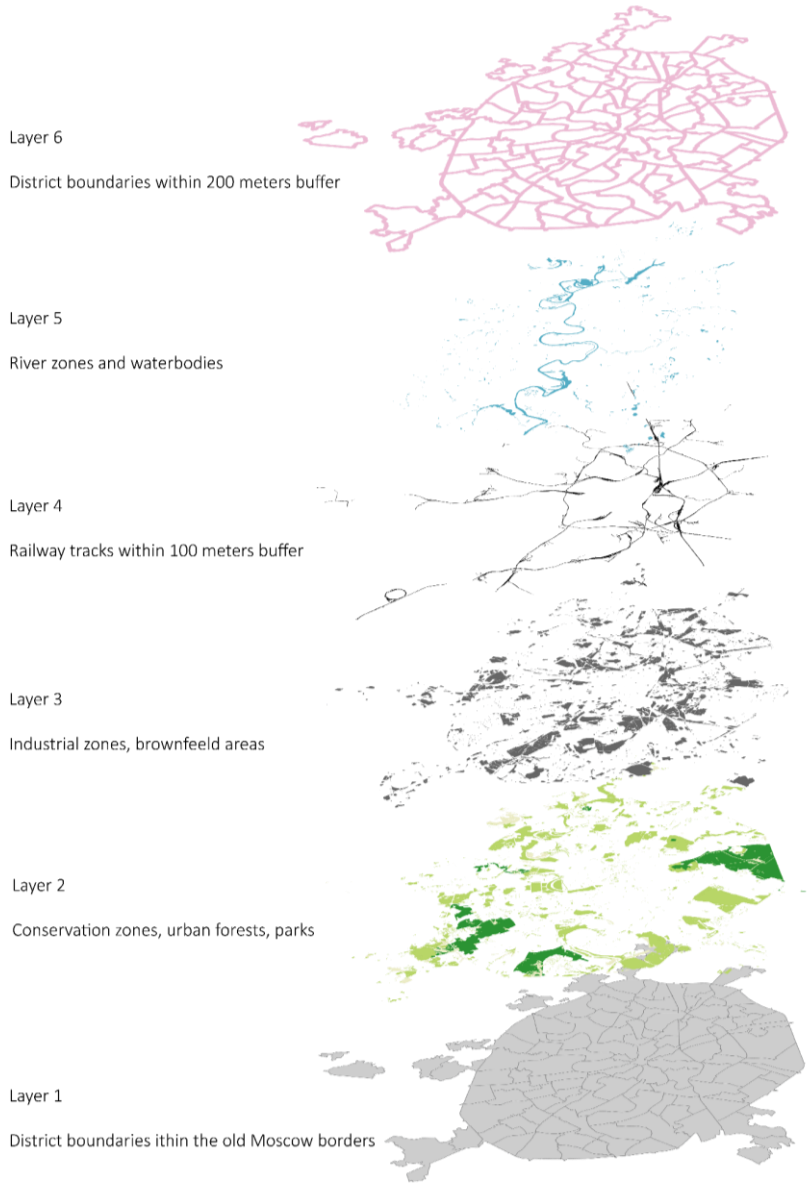
- Poor road network development
- Lack of overpasses through railways and bridge crossings over water barriers, as well as the presence of blocked areas (usually industrial zones) between neighboring areas
- An extremely high overmileage rate, amounting to 1.7 in Moscow versus 1.2-1.4 for cities with a developed street network

Basic hypothesis suggests the need to establish direct transport links between isolated areas of the city of Moscow, while the solution could be met by incorporating modern aerial ropeways into urban transport systems

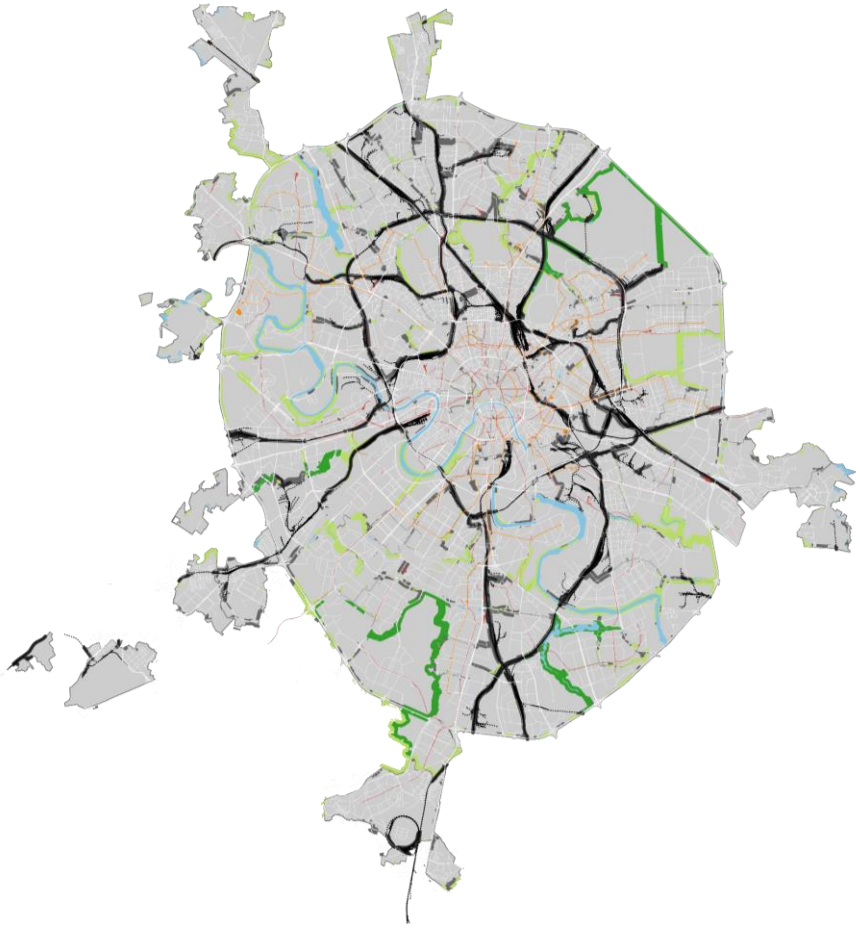
Approach (1)

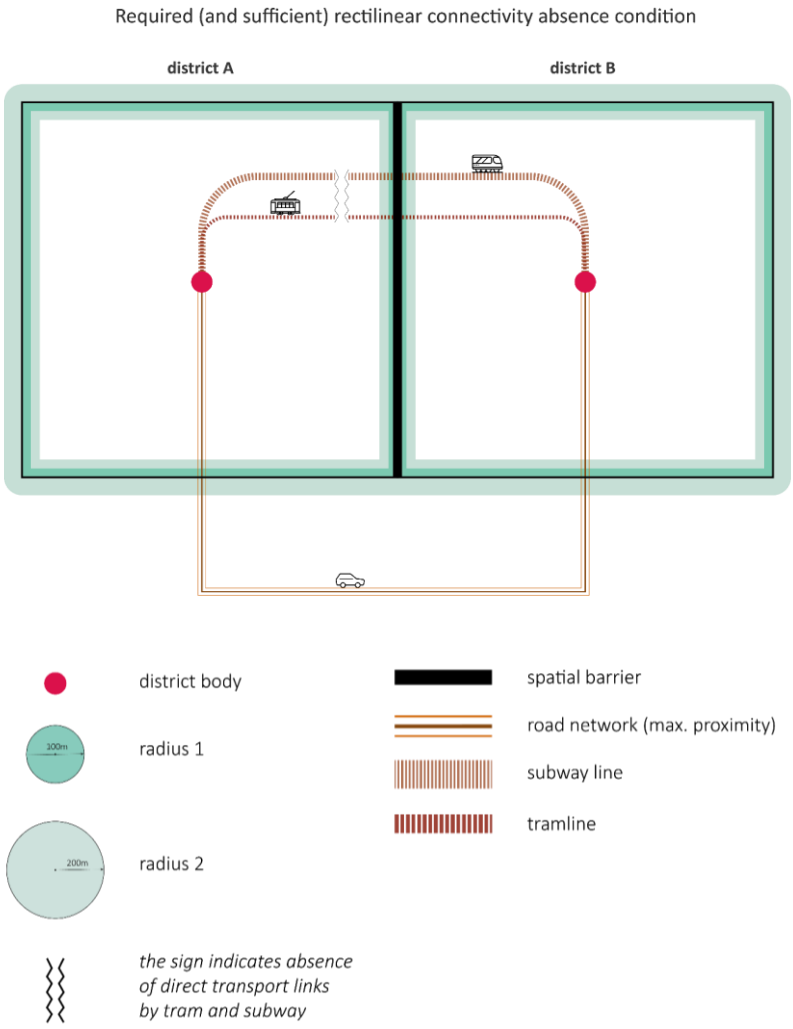
We propose an evaluation methodology corresponding to connectivity estimates of Moscow districts. The results of the analysis show for which areas of the city implementation of aerial cableways as a public transport system element is appropriate and valid.

Stage one consists of overlapping the layers representing lowest throw movement potential.

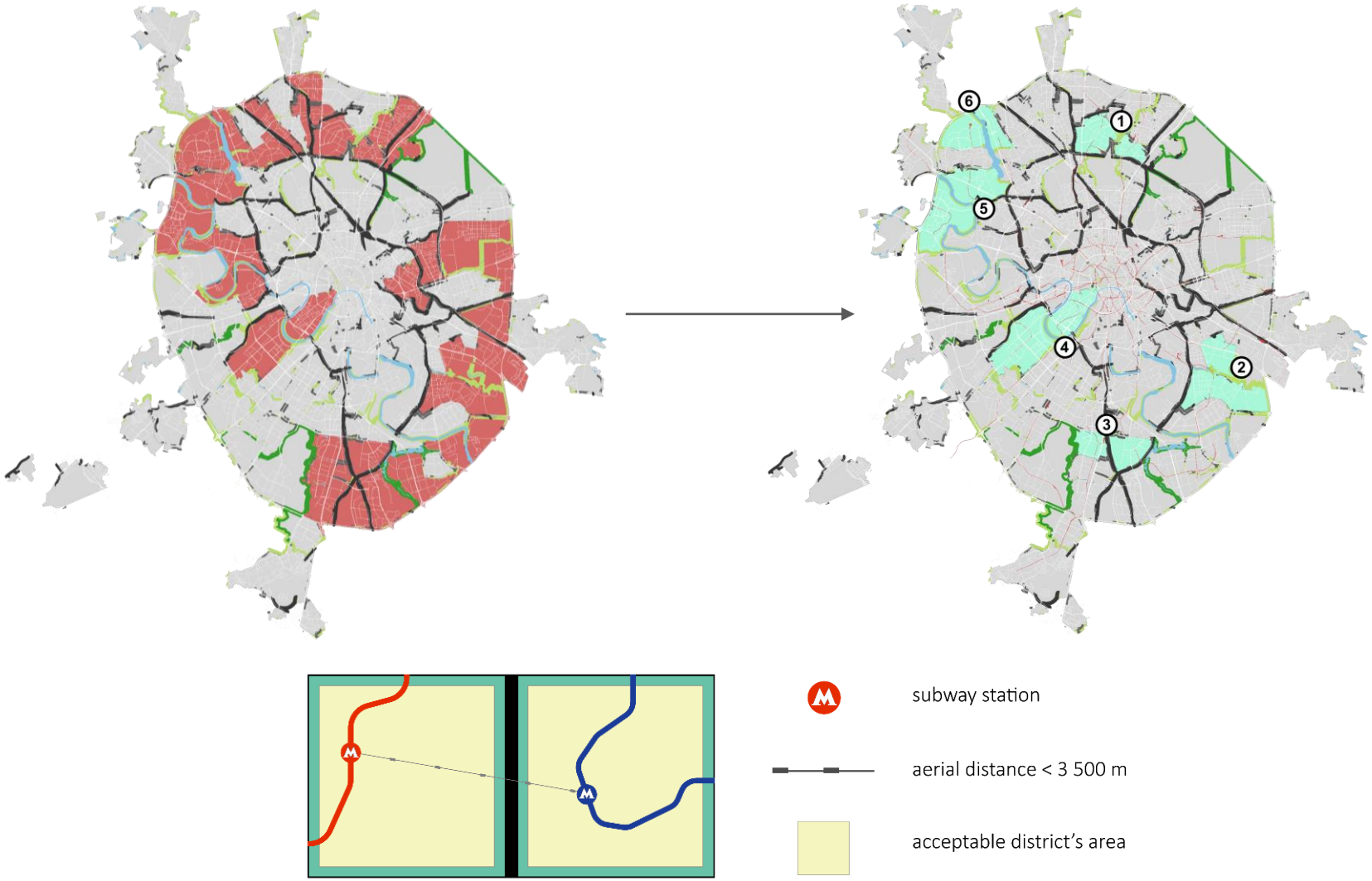


Approach (2)




Required (and sufficient) rectilinear connectivity absence condition
district A
district B
district body
radius 1
radius 2
the sign indicates absence of direct transport links by tram and subway
spatial barrier
road network (max. proximity)
subway line
tramline

Final sample prerequisites



Comparative evaluation

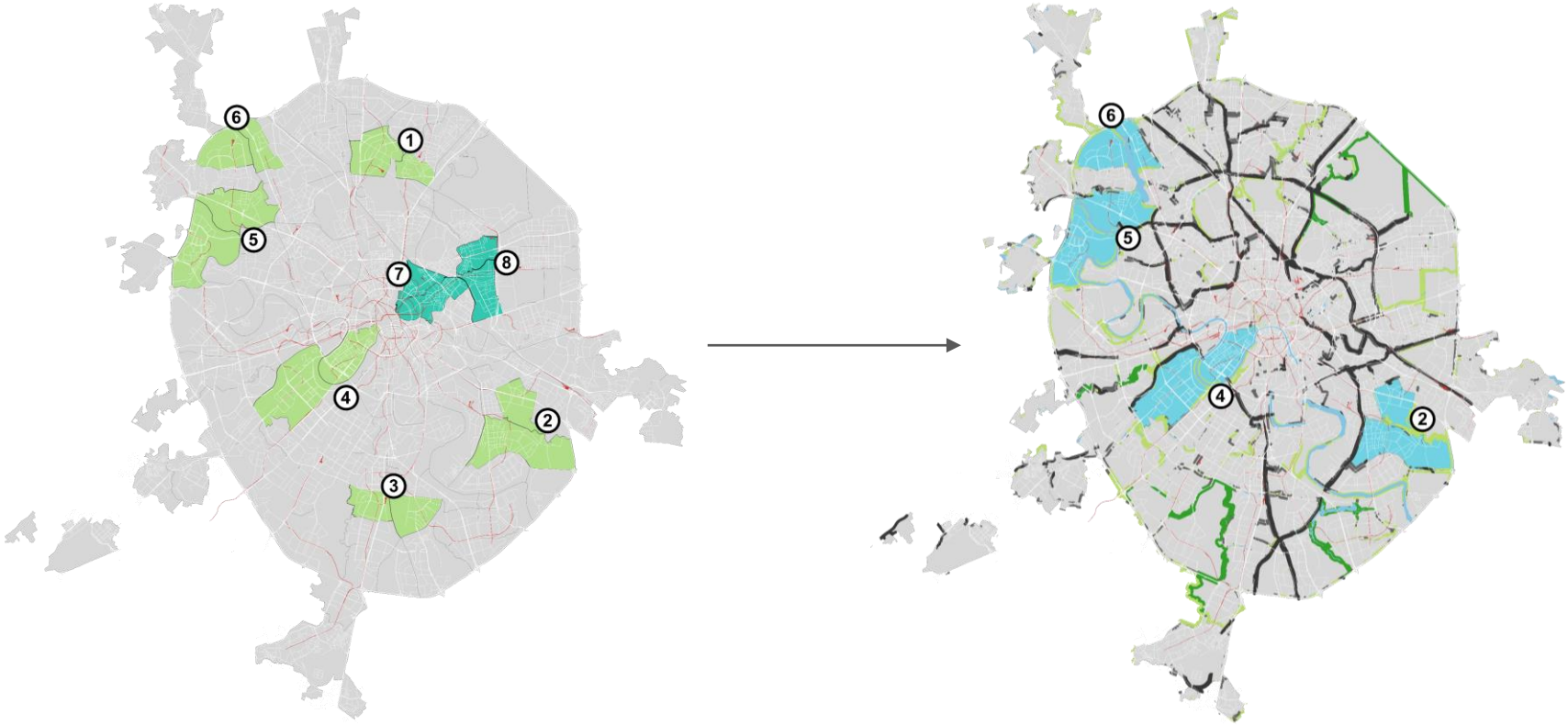
A comparative analysis results with satisfactorily connected pairs of areas in terms of overmileage

		Pairs	Aerial distance between metro stations, km	Time travelled by public transport, min	Time travelled by individual vechicle
Unsatisfactory connected	1	Otradnoe - Sviblovo	3,1	29	12
	2	Kuzminki - Lyublino	3,32	32	16
	3	Tsaritsyno - Chertanovo Severnoe	3,32	28	17
	4	Ramenki - Khamovniki	3,51	33	22
	5	Strogino - Pokrovskoe-Streshnevo	3,3	33	20
	6	Severnoe Tushino - Levoberezhniy	2,59	47	20
		average	***3,19***	***34***	***18***
Well-connected	7	Preobbrazhenskaya ploshad - Semenovskaya	1,49	14	6
	8	Basmanny - Krasnoselsky	1,13	10	9
		average	***1,31***	***12***	***8***

Passengers travelled (morning peak), Moscow Metro OD-matrix

Districts (Direct route)	Metro stations	pphpd, cumulative	Districts (Reverse route)	pphpd, cumulative
(1) Otradnoe – Sviblovo	Otradnoe - Sviblovo	14	Sviblovo - Otradnoe	37
(2) Kuzminki – Lyublino	Kuzminki - Lyublino	93	Lyublino - Kuzminki	123
(3) Tsaritsyno - Chertanovo Severnoe	Kantemirovskaya - Yuzhnaya	205	Chertanovo Severnoe - Tsaritsyno	174
(4) Ramenki – Khamovniki	Lomonosovskiy prospekt - Sportivnaya	N/A	Khamovniki - Ramenki	N/A
(5) Strogino - Pokrovskoe-Streshnevo	Strogino - Tushinskaya	65	Pokrovskoe-Streshnevo - Strogino	66
(6) Severnoe Tushino – Levoberezhniy	Planernaya - Rechnoy Vokzal	18	Severnoe Tushino - Levoberezhniy	19

Final set



Conclusions

- We identified the basic principles that should be followed when deciding CPT use in the city.
- The paper proposes an approach for Moscow based on which the straight-line connections creation between neighboring but isolated districts is set. We determine such areas of the city. As a result, four pairs of districts are proposed.