

Method to Identify Potential Corridors for Bus Rapid Transit within an Existing Bus Network

Master's Thesis of Alua Kulmurzina

Mentoring:

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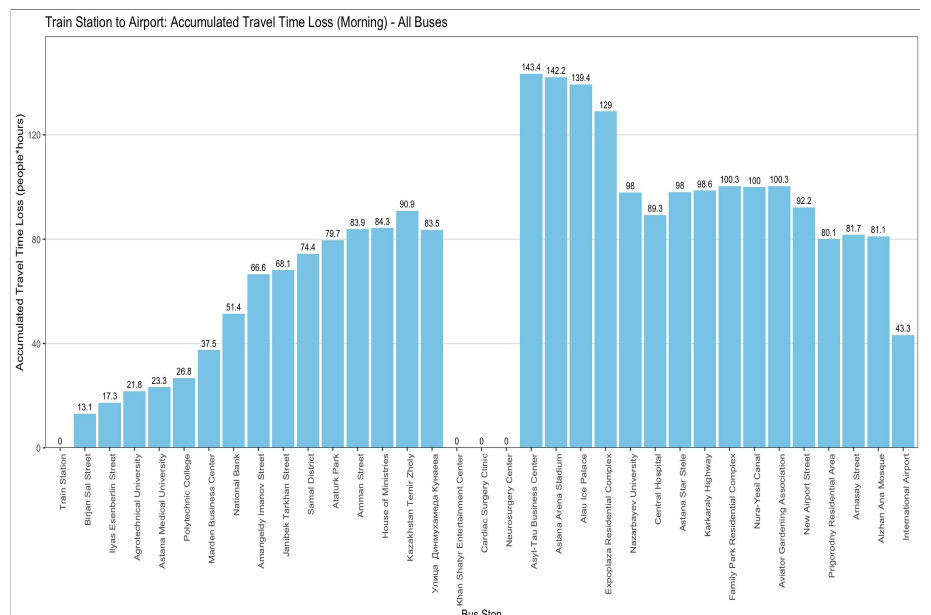
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The aim of this project was to develop a practical methodology for identifying a potential BRT corridor in the existing bus network using limited available data. The methodology is applied to the case of Astana, Kazakhstan. Furthermore, it was demonstrated how a BRT system could support Astana's objectives of reducing motorization, enhancing public transport services, and transitioning to more energy-efficient modes of transportation. In order to determine the potential BRT corridor, the concept of accumulated lost time is introduced. The links that exhibit the greatest time delays for the largest proportion of individuals were identified. It is calculated from the difference between the passenger hours (people*hours) during peak hours in the existing bus system and the passenger hours in the case of the introduction of BRT. All buses that traveled during peak hours were considered, along with a bus that traveled outside of peak period, at a speed of 22,3 km/h, and this was within the speed range equal to the possible BRT.

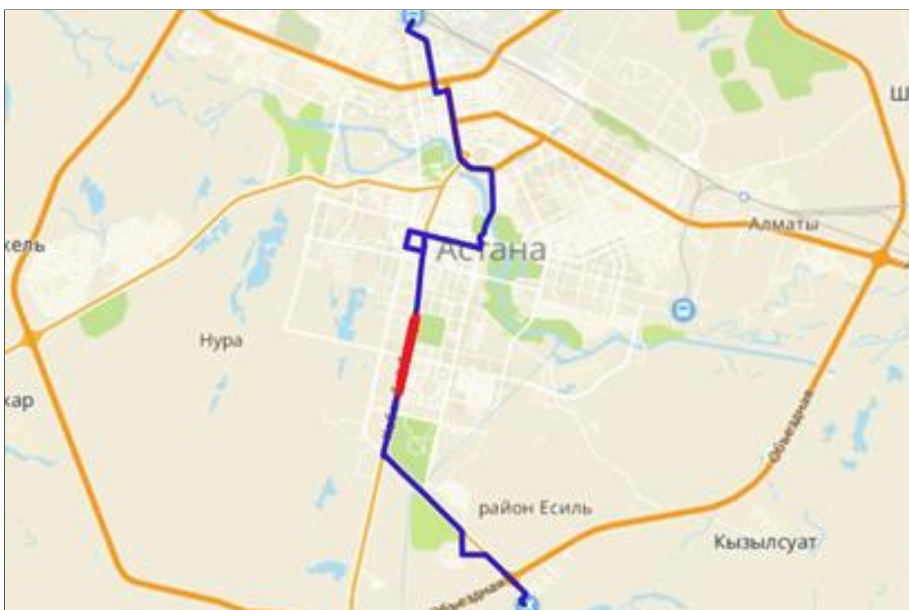
In order to calculate the accumulated lost time between bus stop links a preliminary selection of the most suitable existing bus routes for this purpose must be carried out. Stage one: Identify ridership exceeding 1000 pphpd – 1200 pphpd. Stage two. Select bus routes whose average operation speed on the line is less than 21 km/h during peak hours. Stage three. Exclude routes where the road width is consistently less than 15 meters. Twelve buses were selected as potential routes for the BRT system (7; 9; 10; 12; 26; 37; 40; 44; 46; 51; 56). Using one of the chosen routes as an example (Bus Route №10), the accumulated lost time was calculated for each bus stop link during the morning peak period from 07:00 to 09:00. The bus stops exhibiting the highest accumulated losses, measured in person - hours, are as follows: Business Center Asyl Tau, with 143 person - hours; Stadium Astana Arena, with 142,2 person-hours; Ice Palace Alau, with 139,4 person - hours; and Residential Complex Expo Plaza, with 129 person - hours.

Bus route	Passengers in both directions at the ph	Route distance, km	Average speed during the day, km/h	Infrastructure capability (Road width min -15 m)	Headways at ph, min	Overlap more than 10% - 20%	Average monthly validation	Articulated buses, 3-4 doors	Number of buses in fleet
7	2000-2300	19,8	14,7	+	7	-	21000	+	16
9	2000-2400	22,3	17,8	+	6	-	19000	+	21
10	2400-2800	25,4	16,9 at ph	+	5	12, 37, 51	26000	+	24
12	2200	23,8	17,5	+	10	10, 37, 46, 51	18000	-	17
26	2000-2200	22,5	16,5	+	10	46	21000	-	16
37	2000	22,5	18,8	+	8	10, 12, 51	16000	+	15
40	2100-2300	30,5	15,8	+	10	51, 56	22000	-	20
44	2800	16	16,2	+	8	-	16000	-	12
46	2700	23,5	19,7	+	5	12, 26	18000	-	21
51	2400-2800	25,5	20	+	5	10, 12, 40, 56	22000	+	18
56	2500-3100	20	20	+	8	40, 51	19000	+	18

List of Selected Bus Routes with Indicators



Accumulated Travel Time Loss at Morning Peak Hour (hours)



Route Map of Bus Route №10 (the busy section is highlighted in red)

The research encountered several limitations that must be addressed in future analyses to enhance accuracy and reliability. A primary concern is the need for higher - quality and more comprehensive data. The government of city of Astana has only data about boarding and alighting on buses. One of the primary recommendations is to conduct a citywide mobility survey of the population, segmenting the city into zones and securing approval for these zones across all transportation authorities. In the future, a straightforward economic analysis could be conducted to convert time losses into monetary values for greater clarity. By applying this method of calculating the total accumulated lost time for all the remaining selected routes, it will be possible to compile a list with bus routes ranking from the highest to the lowest, thereby determining the priority and recommended sequence of development of BRT corridors.