

Analysis On Night-time Public Transportation Access In Seoul: How Do People Travel At Night In Seoul Using Taxies?

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Introduction

- Seoul is one of the mega cities in the world
 - Area: 605.21km²/ Pop: 9,770,638(2019)
- Despite its socio-economic, and demographic power, its night-time public transport system is not as much supportive as they are in the other mega cities.
 - What about the night-time public transportation system in other mega cities like London, NYC, Melbourne and Tokyo?
 - Does the night-bus (Owl Bus) introduced in Sept. 2013 provide enough service?
 - Currently, discussion on expanding subway operation hour and introducing another type of night-bus

Literature Review

- No single consensus regarding walking distance to public transit

Table 1. Literature review on walking distance to bus stop

Author	Year	City	Area	Pop	Walking distance to public transit
Burke & Brown	2007	Brisbane, Australia	15,826km ²	2,408,223 (2016)	600m(median), 1.3km(85th percentile)
Daniels & Mulley	2013	Sydney, Australia	12,368km ²	5,230,330 (2018)	400m and 800m
TCQSM	2013	Washington D.C.	177km ²	702,445 (2018)	maximum 700m
Borowska-Stefańska, Wiśniewski	2016	Łódź, Poland	293.2km ²	687,702 (2018)	500m

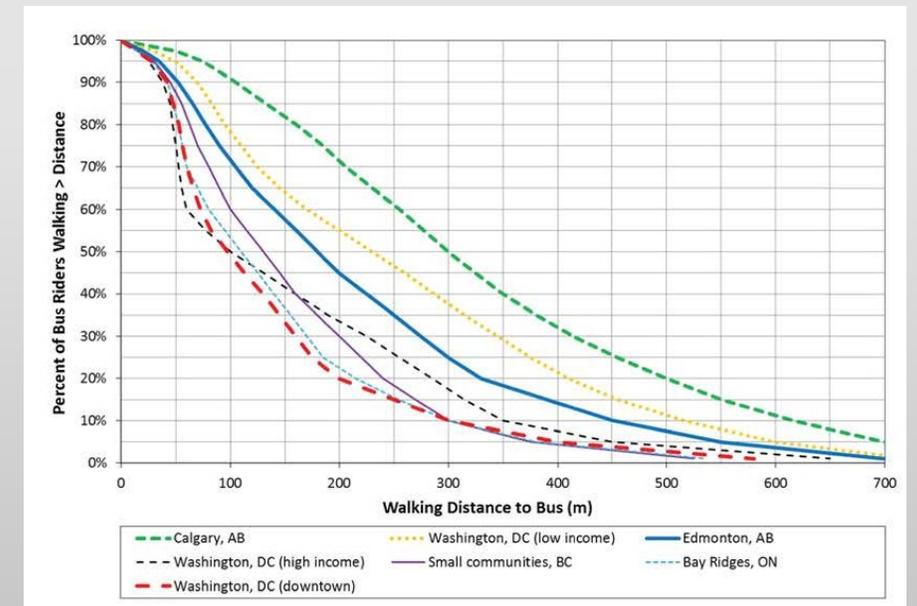


Figure 1. Walking distance to bus stop (TCQSM, 2013: 4-48)

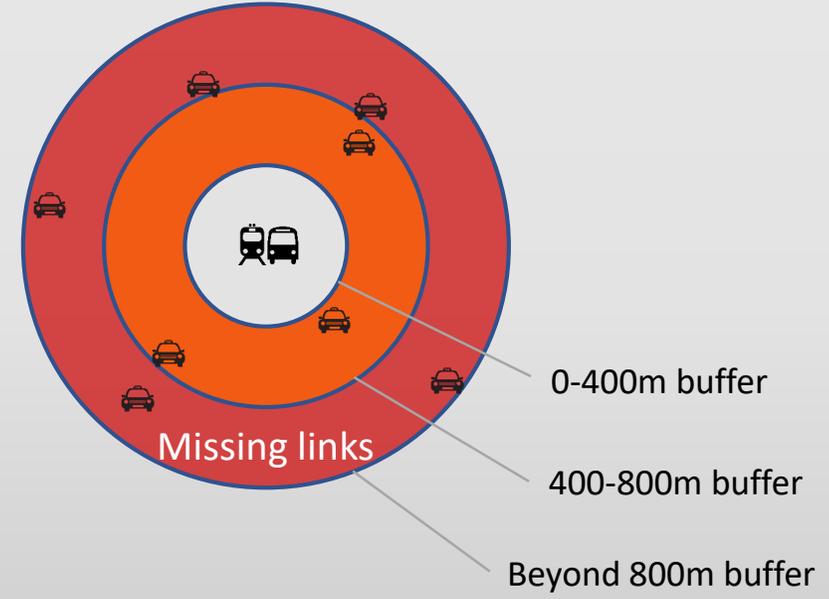
Methodology

- Mapping public transportation stops in operation between 0am – 5am;

Operation hour	Weekday	Weekend	Mapping info
Subway	5am - next day 1am	5am - midnight	Operation hour
Bus	Early 4am – over midnight		Passenger
Night bus	Early 23pm – around next day 4am		Passenger
Community bus	Early 5am – around midnight		Passenger

- Building public transit access buffer for 0-400m, 400-800m and beyond 800m, respectively
- Analysing night-time taxi ridership at 150m road links in each buffer: by hour, by weekday/weekend
- Identify the night-time missing links by measuring daily taxi ridership in beyond 800m buffer

PUBLIC TRANSIT ACCESS BUFFER



Data

Table 2. Dataset

No.	Name	Period	Data	Provider
1	Administrative area boundary	2016.12.31	Administrative area boundary	Statistics Korea
2	TaxiMatch Link dataset	2016.9-2017.8	link ID, day of week, time of day, weather, destination, on-board trips, off-board trips, empty trips	Seoul City Government
3	Bus ridership data	2017.8	location of bus stops, hourly ridership at bus stops	Seoul City Government
4	Statistics on Public Transportation Use	2017	location of subway stations(shp.)	Seoul City Government – Big Data Campus

T_Link_ID	Day	Time	Weather	Dest ^(주)	CntOn	CntOff	CntEmp
Link ID	Day of week	Time of day	Weath er	Destina tion	On-board trips	Off-board trips	Empty trips

Primary Key

T_Link_ID, Day, Time, Weather, Dest, CntOn, CntOff, CntEmp

T10001, 1, 0, 1, 1114, 512, 0, 0
 T10001, 1, 0, 1, 1123, 254, 0, 0
 T10001, 1, 0, 1, 1168, 312, 0, 0
 T10001, 1, 0, 1, 112, 15685

Example

* Mapping the standard node link ID

T_Link_ID	Reassigned ID after splitting standard node links into 150m
Link_ID	Standard node link ID

Results

1) Spatial areas covered by public transit service in Seoul during night-time

- Buffer with high accessibility (0-400m) comes narrower and buffer with low accessibility (beyond 800m) comes wider during 2-3am.

2) Travel demands underserved within 400-800m buffer and beyond 800m buffer

- Buffers after 400m have noticeably high demands on taxi at 1am on weekdays (35.0%)
- On weekdays, buffers farther than 400m shows noticeably high demands on taxi at 3am (46.3%).

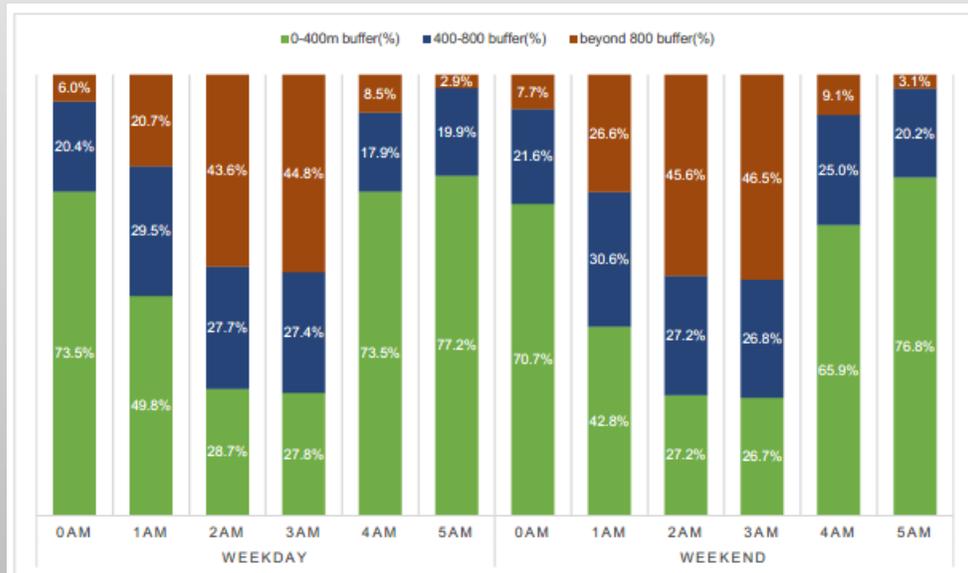


Figure 3. Area of public transit access buffer by hour

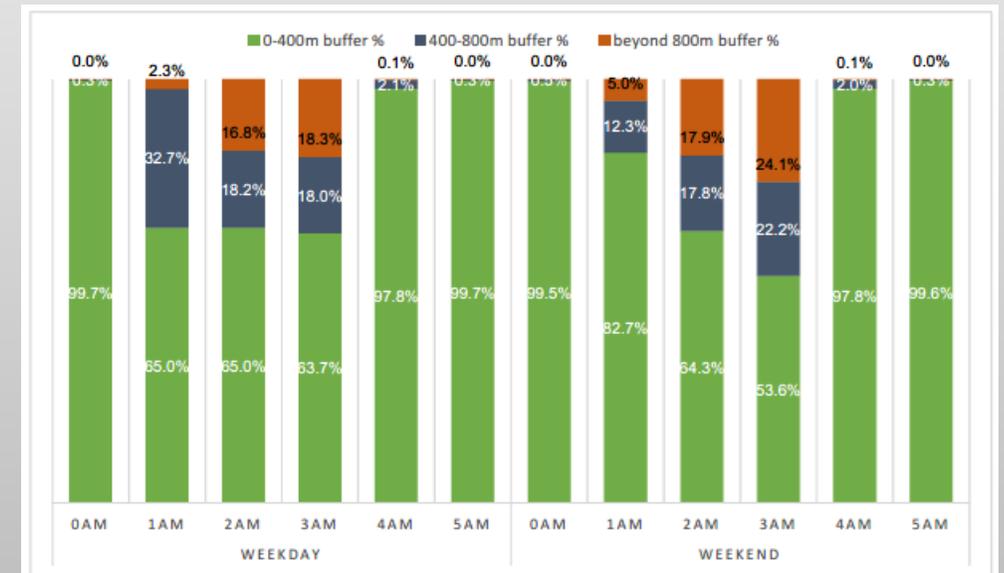
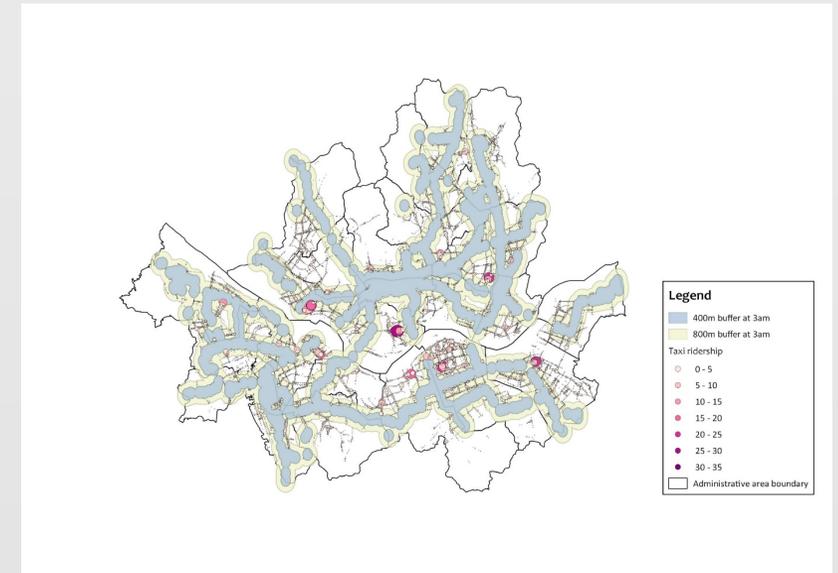


Figure 4. Taxi ridership within public transit buffer

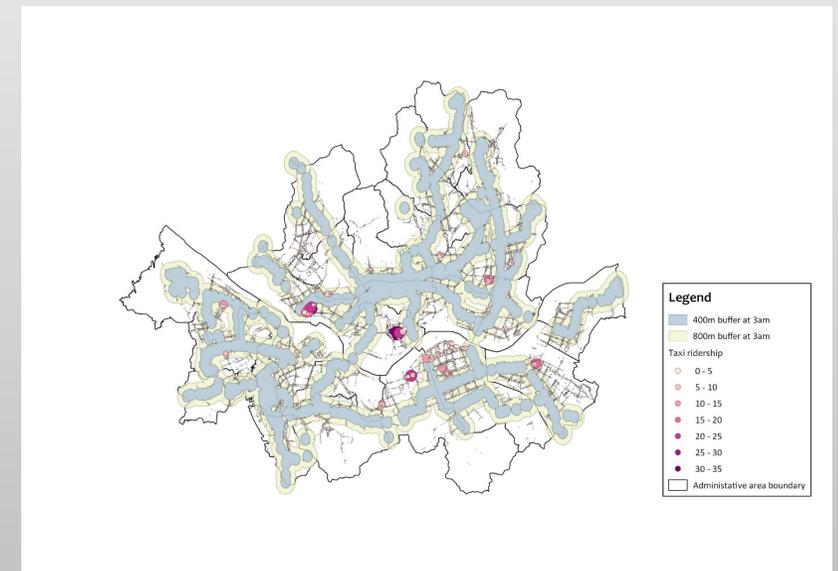
Results

3) Taxi links in medium/low accessibility buffers with high taxi ridership

- In the 400-800m buffer, taxi links with more than 20 taxi ridership per hour are identified. Total 10 links are identified on weekdays—only at 1am, and total 25 links are identified on weekends between 2-4am.
- In the beyond 800m buffer, 14 and 15 taxi links with high ridership are identified for weekday and weekend, respectively.
- Mostly during 2-3am
- Places: hip areas like Itaewon, Bangidong food alley; university town around Hongik university and Korea university; or inter-city transport facilities like Express Bus Terminal
- Low ridership taxi links are amount to about 21000, scattered all around the city.



Taxi links in the buffer beyond 800 at 3am weekday



Taxi links in the buffer beyond 800 at 3am weekend

Conclusion

- Firstly, 2-3am shows the worst coverage of public transport service. Almost 45% of Seoul city is left under the low accessibility buffer which is farther than 800m from public transit stations.
- Secondly, taxi ridership ratio in buffers farther than 400m from public transit stations is turned out to be the most at 1am on weekday and 3am on weekend.
- Lastly, more than 21000 taxi links are used per day regardless of day of week.
- Taxi links used by more than 20 times of boarding are hip places like Itaewon, Bangidong Food Alley, university town around Hongik university and Korea university or inter-city transport facilities like Express Bus Terminal.
- Given the ridership scale of the taxi links, different policy measures—such as expanding night bus routes, carpooling, shared bikes, etc.—could be designed

Reference

- Borowska-Stefanska, M., & Wisniewski, S. (2017). Vehicle Routing Problem as urban public transport optimization tool. *Computer Assisted Methods in Engineering and Science*, 23(4), 213-229.
- Burke, M., & Brown, A. L. (2007). Distances people walk for transport. *Road & Transport Research: A Journal of Australian and New Zealand Research and Practice*, 16(3), 16.
- Daniels, R., & Mulley, C. (2013). Explaining walking distance to public transport: The dominance of public transport supply. *Journal of Transport and Land Use*, 6(2), pp 5-20.
- [TCQSM Chapter 3](#), Appendix A, p. 3-9.