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[기본연구] 버스 전용 차선이 교통 혼잡 완화와 대중교통 활성화에 미치는 영향

국제도시 및 인프라연구센터

Global Urban & Infrastructure Research

GU&I RC Issue Paper Contents

The Effectiveness of Bus-Only Lanes in Reducing Traffic Congestion and Promoting Public Transportation Use

: The Case of Phnom Penh, the Capital City of Cambodia

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ABSTRACT

Traffic accidents and traffic congestion are big problems in Phnom Penh, the capital of the Kingdom of Cambodia. The unfavorable traffic conditions were made worse by poorly educated drivers and a lack of using public transport, the public bus service for citizens of Phnom Penh was implemented. However, due to fluctuating demand, the public bus service's viability remains in doubt. With the recent introduction of Phnom Penh Bus system, citzens are also introduce to public transportation whereas they often see bus as a private transport for them to get to provinces. This paper will use the data from the recent bus system in Phnom Penh as a starting point in order to further make a logical assumption on the more success rate of bus system when bus only lane is implemented.

캄보디아 왕국의 수도 프놈펜에서는 교통사고와 교통 혼잡이 심각한 문제로 대두되고 있다. 이러한 불리한 교통 여건은 운전자들의 낮은 교통 교육 수준과 대중교통 이용 부족으로 인해 더욱 악화되었다. 이에 프놈펜 시민을 위한 시내버스 서비스가 도입되었으나, 수요가 일정하지 않아 버스 서비스의 지속 가능성에는 여전히 의문이 제기되고 있다. 최근 프놈펜 버스 시스템이 도입되면서 시민들은 대중교통을 접하게 되었지만, 여전히 버스를 지방으로 이동할 때 이용하는 사적인 교통수단으로 인식하는 경향이 있다. 본 논문은 최근 도입된 프놈펜 버스 시스템의 데이터를 출발점으로 삼아, 버스 전용차로가 도입될 경우 버스 시스템의 성공률이 더 높아질 것이라는 논리적 가정을 도출하고자 한다.

I Introduction

Phnom Penh, the Capital City of Cambodia, has encountered fast populace development and financial improvement throughout the course of recent many years. By 2035, the city's population is expected to rise to 2.87 million, up from 1.01 million in 1998 and 1.69 million in 2013. Several issues such as urban growth, traffic accident, and traffic congestion are very likely to happen. Moreover, there is no official public transportation system, citizens frequently encounter serious traffic issues like congestion, accidents, and air pollution (Neth et al., 2005; Kov and Yai, 2009; Long et al., 2011a). Private vehicles such as cars and motorbike are a viable and first choice for most of the citizen which result in rapid growth of vehicles on the road. Moreover, drivers and pedestrians alike frequently disregard traffic regulations. It isn't interesting to see a vehicle driver or cruiser rider disregarding a red light when there is no traffic on the intersection. In order to take a shortcut, they sometimes drive on the wrong side of the road and reverse. Yellow boxes at some intersections that warn drivers not to stay within the intersection are not respected, and the give-way rule is not followed.

As drivers move on, congestion at an intersection quickly spreads to other areas. There may not be a clear exit from the intersection, and nobody wants to give way to other people. Compared to other Southeast Asian nations like Malaysia and Vietnam, where 90% of motorcycle riders wear helmets, the number of riders without helmets is lower. The way motorcycle riders drive makes the situation even worse. They weave around vehicles and disrupt the orderly flow because they are not separated from four-wheel vehicles.Traffic congestion hinders the efficient movement of people and goods, which has a negative impact on economic activities. It also contributes to the occurrence of numerous car accidents and the deterioration of the living environment as a result of air pollution. Those are serious social issues and critical activity is expected to address them.

However, current urban and intercity roads have not been designed to accommodate the current rapid increase in traffic demand and vehicle size, in addition to the absolute capacity shortage of the existing infrastructure. As a result, road alignment renewal and/or road widening work are required which cause a lot of money and sadly can not cope with the rapid growth of private vehicles. The government has considered formal public transportation options like intra-city public buses and urban rail systems like Skyrail, Tramway, Bus Rapid Transit (BRT), and Light Rail Transit (LRT) to address this issue (JICA, 2001; JETRO, 2009; 2012 (SYSTRA). Among these modes, just the public bus transport was really presented in Phnom Penh. This paper will list some of the public bus experiment in Phnom Penh and some of the possible upgrade from some country like Korea that I believe it will futher improve and encourage Cambodian citizens to use public bus as their first choice of daily traveling.

II Literature Review

2.1 Bus Only Lane

A Bus-Only Lane is a lane restricted to buses on certain days and times, and generally used to speed up public transport that would be otherwise held up by traffic congestion. Bus operation in mixed-traffic lanes experience severe congestion and delay due to interaction with other vehicles. Bus Only Lane gives priority to City Buses, increases bus speed. reduces significant travelling time, and increases reliability and safety ("Ex-Ante Evaluation of Exclusive Bus Lanes Implementation," 2006)

2.2 Exclusive Median Bus Lane Network (Korea)

The significance of the elite middle transport path strategy was first stressed according to a hypothetical point of view by traffic scientists from the US and the UK (Downs 1977; Mogridge and Williams 1985). To put it another way, the theory says that if a road is expanded or built new to reduce traffic congestion, it will first improve travel speeds in the short term. However, the policy that only increases the travel speed of public transportation can have a positive effect on relieving traffic congestion by increasing the travel speed of both public transportation modes and private cars by attracting private car users to public transportation. On the other hand, the capacity of the expanded road will encourage new traffic, which will result in an increase in congestion in the long run. In point of fact, it was observed that the exclusive median bus lane system, which was implemented as part of the reorganization of public transportation in Seoul, improved both bus travel times and speeds in normal lanes. At the end of the day, this strategy is an instance of praiseworthy arrangement execution that understood the hypothetically demonstrated impact of speeding up. As a result, it is thought to have been one of the main policies that helped people move more easily between different modes of transportation, which was very hard to do back then because more and more people were using private cars. It is hard to isolate the impacts of individual approaches since public vehicle redesign is being accomplished through a general mix of assorted strategies; However, car owners would have continued to use their vehicles in the absence of such a popular series of public transportation policies. As a result, the car-centered culture would have persisted as car ownership and use continued to rise in other cities in a similar situation. The continued reliance on automobiles would have made the transition to other modes of transportation extremely challenging. This is a crucial policy that has greatly enhanced Seoul's unique transportation flexibility. Car owners no longer rely solely on their automobiles but also on other forms of public transportation, depending on the circumstances, as a mixed result of policies that have increased the bus's competitiveness in comparison to that of the automobile, such as the automation of traffic information and the integration of bus routes and fares (Seoulsolution, 2017).

2.3 Successful of implement Bus Lane in United State

In the mid-1900s, cities like Chicago and Baltimore started creating bus lanes, making travel smoother. Chicago's bus lane on Washington Street handled around 90 buses per hour during busy times. Baltimore allowed bus lanes without political approvals, but many lanes were later abandoned due to changes in traffic and preferences for parking. However, cities like New York and San Francisco kept and expanded bus lanes because of their busy economies and worries about air pollution. Nowadays, cities focus on bus lanes to improve how well cities work and how easy it is to travel (Agrawal et al., 2012).

III Data

3.1 Phnom Penh Bus Experiments

With help from JICA, a one-month public bus transport was first carried out in June 2001 in Phnom Penh as an experiment (JICA, 2001). The primary goals of the public bus transport were to assist residents with understanding the value of the public transport framework, recognize the potential impacts of public transport, and suggest key answers for the arranging issues of the transport administration in the city. Public bus transports were worked along two courses: Highway 1 lied from north (CambodiaJapan Bridge) to south (Chbar Ampov market) along Monivong Street (around 8.5 km) furthermore, highway 2 was a roundabout line focused in the city (around 8.5 km). There were 56 bus stops, each with a distance of 300 to 500 meters, but only eight of them had seating and shelters. On-street parking was prohibited and two-wheelers were prohibited at certain bus route segments in order to make bus operations easier. 103,329 people used the bus during the trial period, with Route 1 carrying 60,276 and Route 2 carrying 42,963 people. Because of the significant public backings, the public transport administration was broadened and worked by Branch of Public Work and Transport (DPWT) with a fleet of 17 buses and two flat fare levels. During the first five days and the last eight days of the trial period, the flat fare of 500 KHR, or 0.13 US$ per trip, was implemented. The 800 KHR fare went into effect from June 6 to June 22, 2001. However, after a month-long extension, the public bus service was terminated, primarily due to the financial shortfall.

Table 1. Outline of the public bus experiments in Phnom Penh

Items	First bus experiment	Second bus experiment
Experiment period	1-30 June 2001	5 February-4 March 2014
Bus routes (length)	Route 1 (8.5 km), Route 2 (8.5 km)	Line 1 (7.5 km)
Operation hours	5:30-19:30	5:30-20:30
Bus fleet (capacity)	23 air-conditioned minibuses (29 seats)	10 air-conditioned buses (35 seats)
Bus stops and space	56 stops and every 300-500 m	36 stops and every 250-660 m
Number of shelters	8	5
Bus frequency	Every 6-10 minutes	Every 10-15 minutes
Average speed	Route 1: 13.9 km/h, Route 2: 13.1 km/h	9.9 km/h
Total passengers	Route 1: 60276, Route 2: 42963	43278
Bus fares and daily	500 KHR 800 KHR Average	1500 KHR
average passengers per day:	Route 1: 2668 2019 2344 Route 2: 1661 1077 1369	Line 1: 1546
Service extension	1 month (17 buses and 2 routes)	Till 2017 (43 buses and 3 lines)

Note: Information in this table was extracted from JICA (2001) and Phnom Penh Capital Hall The term “Route” or “Line” here has equivalent meaning. Each term simply represents the bus operating route for the different timing of bus experiments.

With a conviction that public vehicle is the most productive method for tackling the ongoing traffic issues in Phnom Penh, the municipality and JICA again got back the public bus transport experiment early February 2014, with three purposes: 1) to offer a chance for residents to encounter the solace and wellbeing travel, 2) to make way for a persistent transport activity in light of the gathering of transport activity skill, and 3) to thoroughly foster the metropolitan vehicle framework in the city (JICA, 2013). During the time of second public bus transport experiment, ten air-conditioned buses (non-standard transport with one entryway) were sent along the Monivong Avenue (Line 1), from Old Stadium Roundabout to Chbar Ampov market (around 7.5 km). To make it easier for buses to move around, the bus priority signal system was put into place at three major intersections. With a compact GPS gadget we prepared installed, the normal transport working pace was estimated to be 9.9 km/h, which was moderately sluggish. The increase in the number of motorized vehicles in the city, particularly along the bus route, was primarily to blame for the slow bus operating speed. According to JICA, 2001 and 2013, the average travel speed decreased from 22.1 km/h in 2001 to 15.0 km/h in 2012 as a result of an increase in general traffic volume from 99,389 in 2000 to 133,328 in 2012 (approximately 34.0%).

3.2 Result of the bus experiment

The bus service is still relatively new, and the flat fare of 1,500 KHR (or 0.37 USD) per trip is fairly affordable. The majority of bus stops are on roadsides marked "Bus stop" with lane markings and station poles. Phnom Penh's public bus services along major roads (Line 1 is 19.0 km, Line 2 is 19.0 km, and Line 3 is 13.5 km) would only make up a small portion of the city's existing road network and likely won't appeal to the general public because many commuters still prefer to travel door-to-door. The activity of the public transport was subsequently moved to a Phnom Penh City Bus Authority, which is briefly settled to deal with the transport activity. In order to make it easier for buses to operate, additional shelters along bus lines are built, and regulations like those regarding on-street parking are updated. In light of Phnom Penh Capital Lobby, the interest pattern is seen to be slowly vertically. Prior to October 10, 2014, Line 1 had an average of 1,148 passengers per day, Line 2 had an average of 609, and Line 3 had an average of 763 (totaling 2,521 passengers per day). The government appeared to be more supportive of the public bus service in Phnom Penh, despite the relatively low daily passenger demand.

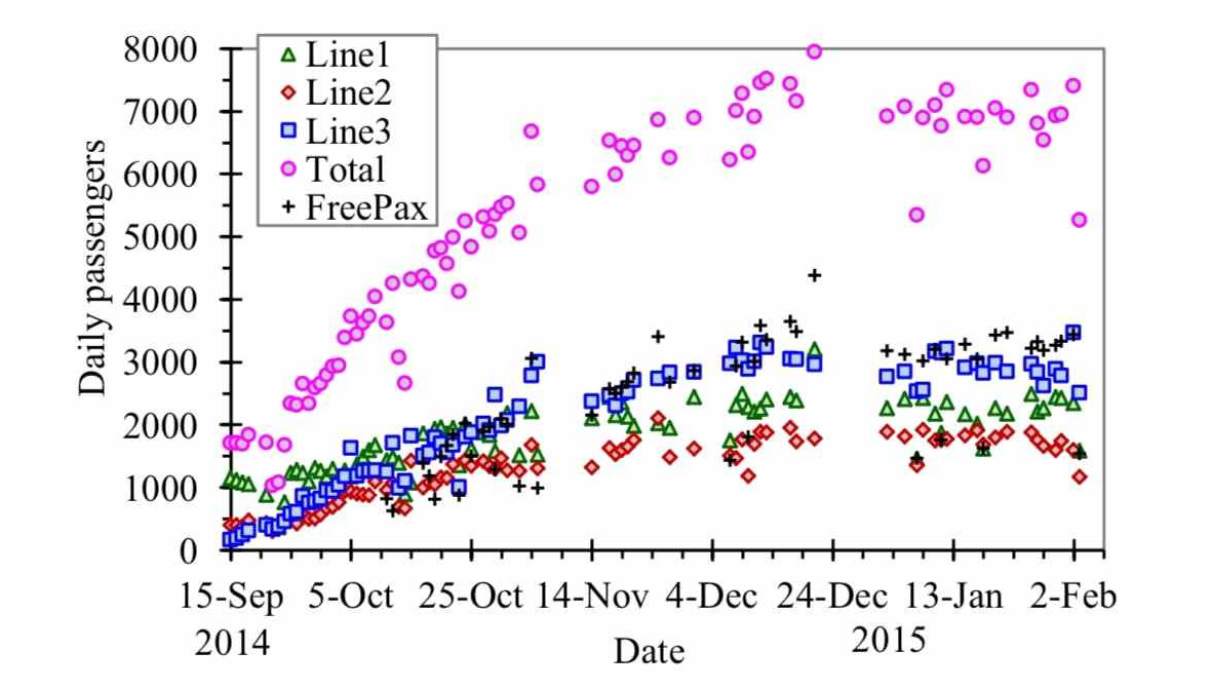

fig 1. Number of daily bus passengers from 15 Sep. 2014 to 3 Feb. 2015

The bus network grew from three lines (54 km) to eight lines (186 km) by November 2017. Activity speed keeps up with at 14 km/hour all things considered. From 6,300 kilometers per day in August 2017 to 18,500 kilometers per day in March 2018, bus mileage increased. As of March 2018, the bus service rate has increased from 67.5% in 2016 to 89.6%. As the network grows, the number of passengers keeps growing, reaching 21,000 per day all together. Between August and November 2017, the fleet grew from 57 buses to 155. Maintaining the fleet: contracted with Gui Wanda (98 buses) and JKI (57 buses); From July 2018, own the mechanics and workshop of CBA.

Table2. Increase in drivers and administration staffs, following route/fleet expansion.

	By August 2017 (57 buses/3 Lines)	By March 2018 (155 buses/8 Lines)
Management Officers	7	7
Office staffs	10	21
Drivers	92	310
Conductors	92	54
Other staffs	30	80
TOTAL	**231**	**472**

Ⅳ Results, Analysis and Discussion

Bus Rapid Transit system aims to improve punctuality, increase transportation capacity, improve convenience and promote the use of public transportation. This system does not cost as much as subways or railroads, and has more transport capacity than regular buses. Like railways, BRT runs on a dedicated roads that are not accessible to regular vehicles, thus shortening the time required compared to regular buses that only run on regular roads. There is no traffic congestion on the exclusive lane, and it is possible to operate at a time close to the prescribed schedule. This medthod helps ensuring proper operation time by shortening bus operation tim and improves bus service and increase of bus users which resulting in reduction of road capacity and traffic congestion.

Bus Only Lane's purpose is to improve bus service by securing on-time operation of buses as a public transportation system and convenience of buses. General vehicles are restricted from passing through this priority lane, but the restriction maybe applied only at certain times of the day, such as in the morning or evening when many people commute to work or school. General vehicles can use the priority lane, but not when it is expected to be difficult to exit the priority lane, such as in a traffic congestion. When a route bus comes from behind, it is necessary to go out of the priority lane immediately so as not

Case		Traffic Volume in Mixed Traffic Lane (pcu/day)	Average Travel Speed (Km/h)	Travel Speed during Peak (Km/h)	Average Travel Time during Peak (Km/h)
Without Project		88,000	25.1	6.0	25.0
With Project	Bus Lane + Parking Management	87,200	10.2 (mixed) 25-30 (bus)	6.0 (mixed) 25-30 (bus)	25.0 (mixed) 5.0-6.0 (bus)
	Bus Lane+ Parking Management+ Para-Transit Management	75,300	11.1 (mixed) 25-30 (bus)	6.0 (mixed) 25-30 (bus)	25.0 (mixed) 5.0-6.0 (bus)

From the case study above, we can see an increase in bus speed with the average bus speed in peak time has increased 4–5km/hour on average, that is, around 28%. The number of passengers has 4–7% increased after implementing the bus–only lane. The bus only lane has a significant impact on the estimated time of arrival, making the difference with estimation and real time within 1–2 minutes difference. The policy of the median bus only lane shows a significant reduction of PM10 concentration, however, the density of No2 does not have any significant tendency or reduction. Due to the median bus only–lane policy, the overall traffic volume declined, which led to a reduction of air pollution.

V Conclusion

From the data that we collected above, we can see clearyly that after the first experiment of public bus in 2001 failed because of the financial shortfall, citizens began to understand more about public transport where they can use for their daily travel within the city instead of their private vehicle. The data showed slow increase in number of bus users because of the lack of route that the bus travel and the punctuality of arriving the destinated place. With the recent improvement on public bus transport such as more routes, more buses and well-connected network of road, the number of bus users increases to about 21,000 per day in 2017. Bus only lane which is another improvement of public bus can futher give citizens a reliable and punctual time of arriving because the buses are having their own lane to run with stable speed even in rush hour. This means that by improving the number of routes, buses and implementing bus only lane, we can encourage citizen to change their mind set on using public transportation over their private one. When more citizens using public transport, the number of private vehicle will decrease and hence traffic congestion also decrease.

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