



Policy Brief



MEASURING THE ACCESSIBILITY BENEFITS OF PUBLIC TRANSPORT: AN EVIDENCE FROM LAHORE ORANGE LINE METRO TRAIN (OLMT)

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CONTEXT OF THE STUDY

Rapid urbanization and migration towards Lahore are causing inadequacy in the public service delivery, most notably the public transport. The Lahore Orange Line Metro Train (OLMT) is the first light rail mass transit project of Pakistan to cater the need of growing population of the city. The goal of any public transport planning is to increase accessibility in terms of proximity, affordability, mobility, convenience, and connectivity, social acceptability as well as social inclusion. However, each of these goals cannot be achieved simultaneously and policy outcomes face a trade-off. Similarly, affordability and financial sustainability of a transport system are the two aspects that cannot be met together. The transport service either end up relying on high levels of subsidies or charging transit fares that are too expensive for the city's poor. In the current scenario, the OLMT ridership is not being observed up to its full capacity which is resulting into a deficit and further cut in transit fee is not an appropriate solution to incentivize its usage. Therefore, a balanced financial sustainability approach is required to limit the fiscal burden and to generate revenue streams. The Lahore Orange Line Metro Train is the first mass transit project of Pakistan. Its ex-post evaluation might provide an appropriate case for policy makers regarding its suitability and replication in other major metropolitan cities of Pakistan. In addition, the analysis can also be useful for identifying the policy gaps for furthering the accessibility improvement as well as to promote passenger ridership. The study also develops a case for accessibility improvement by identifying the gaps that may create hurdle for non-users or discourage users. Another key concern is heavy subsidization which is an undue burden on government resources. In this study, some viable policy options are suggested to make this project financially sustainable.

INTRODUCTION

Pakistan is facing rapid expansion of cities due to increased population, rural-urban migration, and investment in real estate. As a result, cities are facing two major challenges i.e., housing and transport infrastructure. An integrated urban development strategy for capacity building and upgradation of urban management is also reflected in Pakistan's vision 2030 that targets a set of strategic areas for sustainable development. The urban population accounts for approximately 37% of the total population which is expected to reach around 60% by 2025. Therefore, investment in transport infrastructure is the need of time. Transport itself contributes to 22.3% of the services sector GDP



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and accounts for approximately 6% of the nation's total employment.¹ Lahore city is more prone to traffic issues as being the second largest city of Pakistan. The motor vehicles in Lahore are estimated to be around 6.2 million and makes 32% of the total vehicles in the Punjab. Government of Punjab is focusing on providing solutions within the realm of public sector, private sector as well as the public-private partnerships. The main objective of Lahore Urban Transport Policy is to reduce traffic congestion, increase accessibility, modernization, and capacity building through a well-integrated sustainable transportation system.

This study undertakes a post-completion performance assessment by exploring the impact of OLMT ridership on consumers' accessibility benefits. The main accessibility aspects taken into consideration include proximity, affordability, mobility, convenience, connectivity, social acceptability, and inclusion. The OLMT project is heavily subsidized and the estimated cost per passenger is approximately Rs. 130 against the per passenger fare of Rs. 40. On the other hand, the transit service is experiencing 60% less usage. To encourage its use, the Lahore Mass Transit Authority also suggested to reduce the OLMT fare by Rs. 10, but this is not the sustainable solution as it is already running a deficit. So, there is need to achieve financial sustainability of this project via generating additional revenue streams. This can be attained by improving the accessibility benefits that can incentivize the OLMT usage along with adopting a systematic approach for generating additional revenue streams.

In the light of current debate, this research addresses some viable policy questions, such as, who is benefiting the most from Lahore OLMT in terms of demographics and the employment profile? To what extent the OLMT has brought accessibility benefits to its passengers and how further improvement can be made to incentivize its use? Does mass transit system such as Lahore OLMT play a role in increasing social inclusion? What are the contributing factors that have influenced the rider's decision in favour of OLMT against other competing modes of public/private transport? What systematic approach can be devised to generate additional revenue streams by introducing targeted demand-side subsidies i.e., who to subsidize and by how much? Is there a connectivity gap among non-users of OLMT or discouraged users? Does the transport policy instrument, such as mass transit, plays a role in overcoming the gender mobility gaps? What aspects of a transport accessibility must be given more weights in terms of priority to develop feasible study plans for similar projects in Lahore or other metropolitan cities of Pakistan?

DATA COLLECTION/METHODOLOGY

The data is collected in two rounds. In first round, the on-site ridership survey of Lahore OLMT commuters is conducted through researcher administered questionnaire from 1st September 2021 to 28th October 2021. The scale of analysis is the complete OLMT route (Dera Gujran-Ali Town). For round 1, multi-stage sampling is adopted. The first step involves cluster sampling and convenient random sampling is applied in second step. For a particular day, the OLMT ridership is divided the into three clusters. The day is divided into clusters to cover the peak and off-peak hours among three parts of the day i.e., morning (07:00am to 12:00pm), afternoon (12:00pm to 05:00pm) and evening (05:00pm to 10:00pm). After clustering the population based on timings, one cluster (for instance,

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¹ Government of Pakistan, (2018). National Transport Policy of Pakistan 2018. Planning Commission, Ministry of Planning, Development & Reform. Government of Pakistan.



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morning) is randomly selected by choosing one train at a time and the passengers in that cluster are surveyed along the complete route of OLMT irrespective of his/her destination route. Similarly, for second cluster (for instance, afternoon) again one train will be randomly selected for survey and the same process will be repeated for the third cluster (the evening timings). Henceforth, the three clusters are surveyed in a day. In this way, both the peak and off-peak hours are included for OLMT ridership. The train sets for each cluster will be based on random selection. This process is repeated each day. The convenient random sampling approach is applied to select respondents in each cluster. The total sample size of OLMT users is 4900.

A separate questionnaire is designed for non-users and a sample of 500 non-users is collected to find out the mobility gap that discourages the non-users and to undertake a comparative analysis with users. The target population for this survey round are the commuters who travel along the roads parallel to the route of OLMT and the mode of these commuters is rickshaw or minivans. The simple random sampling is adopted for data collection of non-users. Out of 500 non-users, 68% were the ex-users of OLMT, and 32% have never travelled via OLMT. The field survey was conducted from 30th November 2021 to 13th of January 2022. To undertake comparative analysis of users and non-users, a subset of 500 respondents is extracted from the total sampled dataset of 4900 OLMT commuters. The systematic sampling was used to select every sixth case after further narrowing down the sample of OLMT users to 3000. The analysis is undertaken by using descriptive statistics, frequency distribution, multiple charts, stacked bar charts, pie charts, contingency table/cross-tabulations. A comparison between users and non-users is also undertaken by employing non-parametric approach². In addition, the multinomial logistic regression is also applied to determine the travel demand and travel behaviour of users and non-users with respect to connectivity and willingness to pay.

RESEARCH FINDINGS

- The survey shows that the past policy interventions in Lahore transportation system have brought improvements to larger extent in overcoming the discomforts for the proportion of citizens who experienced increased accessibility³. 78% OLMT users found transportation options in Lahore to be adequate in terms of ease to reach destinations whereas 17% revealed dissatisfaction. The non-users found less ease at travelling via alternative modes as 59% non-users responded to face large traffic congestion on road on daily basis. The users of OLMT were majorly satisfied with Lahore transportation system (68%) and found the transport options adequate (81%) followed by only 24% who found discomfort and restrictions during travelling. Regarding the traffic congestion on roads, 59% non-users always faced road congestion and 35% faced traffic congestion occasionally. This shows that non-users of OLMT experienced immobility and inconvenience in competing modes of travelling as compared to the regular users of OLMT.
- Further exploration as to why the non-users have not changed their travel behaviour in favor of OLMT, over their current mode, revealed that the lack of awareness about connectivity networks and 'information gap' regarding routes, timings, nearest OLMT stations and the used of OLMT were the major contributory factors. It is found that 68% non-users were unaware and did not have complete information on Lahore transportation network whereas 99% OLMT users were confident about being well equipped with travel information within Lahore.

² Mann-Whitney U test is used to test the hypothesis whether the two independent groups are significantly different.

³ Accessibility refers to people's ability to reach the desired destinations.



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So, information gap is also one of the reasons that have restricted the non-users to substitute from present travelling mode towards OLMT despite facing discomfort and inconvenience. Therefore, overcoming this 'information asymmetry' might increase the OLMT ridership and raise revenues.

- Lahore OLMT has contributed towards 'gender inclusive' transportation mode by improving the transportation access to female students (17%) passenger share compared to male students (15.8%) along with 'locational efficiency' through easy access to destinations. The greater proportion were those commuters whose ultimate destinations were workplace (51%) and education (33%). Regarding reach to local community services and hospital, the regular passengers were only 7% whereas 80% passengers never used it for this purpose. Hence, 'targeted demand-side subsidies' can be offered to office workers and students in the form of special 'smart cards' which might induce more people to shift towards OLMT use, causing an increase in revenues.
- The major shift factor in favor of OLMT was the past daily travel expenses as 36% commuters were previously experiencing more than Rs. 200 followed by 21% between the daily expenses of Rs. 150 to Rs. 200. Only a small proportion of commuters (5%) were facing the per day travel cost of Rs. 40 or less which is equivalent to the OLMT fare. Further breakdown revealed that 32% passengers were previously spending daily expenditure of more the Rs. 70 on rickshaw but now shifted to OLMT usage. Moreover, 22% OLMT commuters who were previously using personal vehicle were the bikers with average cost of less than Rs. 200 and 13% were the car users with travel expense of more than Rs. 200.
- It is also found that the previous mode of transportation of majority commuters was rickshaw and two-wheelers. Such a switch may also contribute to reducing the space footprint, carbon footprint and road congestion.
- Among the OLMT users, 12% owned personal cars and 33% had ownership of two-wheelers which reflects the proportion of 'choice riders' i.e., the availability of personal vehicle at the time of ridership. Although OLMT is benefiting those who ride it by choice, but larger proportion are those who have shifted from non-availability of the alternatives. 48% OLMT commuters with no personal or household ownership of vehicles were previously using rickshaw and 7% were using the private taxi service. This segment of the passengers also faced higher travelling costs. Thus, the mass transit has proved crucial for a large segment of the society by providing 'basic mobility'. It was also found that most of the motor-less commuters but belonging to vehicle-owning households were the females who faced 'forced immobility' in terms of dependency on a family member for shared transport. Thus, the transit service has contributed considerably to overcoming this barrier by providing safer and convenient transports.
- The users of OLMT were spending an average daily expense of Rs. 138 and Rs. 356 while using additional public transport and private vehicle, respectively. Whereas the non-users faced an average daily travel cost of Rs. 91 and Rs. 141, respectively. Even though users are experiencing greater daily average travel cost as compared to the non-users, but the users responded to bear lesser burden as compared to non-users in terms of relative share of travel expenses in total income.
- The major reason of greater average travelling cost for OLMT users was the connectivity gap with mass transit service due to which the travellers required additional transport. 40% passengers required additional transport at both ends of OLMT service i.e., entry and exit stations and 73% of these OLMT users were those who used either rickshaw or taxi services. However, 10% passengers reached directly to OLMT entry station but used additional public transport from exit station to reach destination. 6% percent riders used personal vehicle

(such as bike or car) and 5% passengers used public transport to reach OLMT station (both formal and informal such as public bus, rickshaw, or taxi service) but no additional transportation was used from exit station. On the other hand, 29% percent passengers did not require any additional transport with OLMT service (from both sides i.e., entry and exit station). Therefore, the overall cost of travelling increased due to additional burden of 'multi-modal' commuting to and from OLMT stations as compared to travelling via OLMT service only. Thus, even if these commuters pay a uniform fare of Rs. 40 per OLMT ride the additional travelling adds to their costs. On the other hand, OLMT ride was cheaper for those who did not require any additional transport, as the mass transit was within the walking distance of their place of residence and commuters' destinations. Thus, the transport policy of Lahore needs to be made more compatible with the mass transit by improving the connectivity to reduce the travel burden of additional travel cost and public provision of feeder buses can be cost effective in this regard. So, provision of affordable connectivity can greatly contribute to an increase in ridership and revenue generation.

- Similarly, missing connectivity is the reason for non-users not to substitute their present mode with OLMT usage. The non-users wanted to avoid 'time poverty' caused from delays in reaching the OLMT station first before being taken to their actual place of destination whereas they could take short-cuts by travelling directly to their destinations. However, these non-users have been experiencing discomfort and time cost by facing traffic congestion on roads. The traffic congestions, on the other hand, have been causing the implicit delays in comparisons to the delays that non-users expected to experience while connecting to OLMT stations from their residence or destinations.
- Majority of the OLMT passengers faced more than 2 km to connect to the OLMT stations in comparison to the non-users who faced 1 km or less if they need to reach the nearest OLMT station. This shows that rather than the proximity of OLMT, improved physical accessibility by means of convenience (cheap, safe, and comfortable) and mobility (speed, distance, and time) have been the contributing factors for derived demand of OLMT.
- On average, the daily expenses that non-users and users were willing to spend were Rs. 28 and Rs. 146, respectively. However, the median value of willingness for total sample, users and non-users was Rs. 40, Rs. 100 and Rs. 20, respectively. The current price of OLMT fare during the conduct of field survey is Rs. 40 and when the passengers were presented with a hypothetical situation of fare increase, 67% users revealed its acceptability.
- Majority of the passengers who revealed their willingness to pay additional Rs. 30 and Rs. 20 belonged to income group of above Rs. 60,000 (19% in the case of Rs. 30) or less than Rs. 20,000 (33% in the case of Rs. 30 as well as Rs. 20). On the other hand, majority of passengers who agreed to pay additional cost of Rs. 10 earned less than Rs. 30,000. It is interesting to note that low-income earners have shown greater willingness to bear extra burden of fare increase despite having limited income. This means that the service has contributed greatly toward social inclusiveness for low-income earners as they are more willing to bear an increase in fare. This is because these commuters either do not own private vehicles or belong to motor-less households and must bear higher alternative travel cost. Therefore, price discrimination on the concept of progressive taxation can be applied by issuing 'smart cards' for different income groups by further categorizing them into regular and non-regular commuters.
- The commuters who expected an increase in travel time as opposed to no change had 66.4% less chance to pay additional travel cost for feeder buses in comparison to no payment. On the other hand, the odds of paying additionally for feeder buses was 12.19 times higher than no payment for commuters who expected a decrease in travel time with the use of feeder buses

as opposed to no change in travel time. With reference to the observable connectivity gap, there was 60.3% and 58.9% less chances of paying additionally for feeder buses by those commuters who could either directly reach their destinations or walk without using additional transport as opposed to those who needed additional transportation. Similarly, those who can directly walk or use a motor bike to reach OLMT entry station has 60.3% and 50.5% less chances, respectively, to pay additionally for feeder buses in comparison to those who required taxi service to reach the OLMT entry station. The car users, bus passengers and rickshaw users showed insignificant results.

- Similarly, the users of OLMT had 0.368 times the odds of fully supporting the feeder buses in comparison to non-users of OLMT, whereas 84.1% less chances that users might reveal demand for feeder buses as against no demand when compared with non-users' demand. The odds of fully or partially supporting the feeder buses by non-users was 2.717 times and 6.291 times higher, respectively, in comparison to OLMT users as against not supporting the government provision of feeder bus connectivity. These results indicate that provision of feeder services can induce the non-users to shift towards OLMT use which can play an important role in increasing the passenger ridership and generation of fair-return revenues.

POLICY RECOMMENDATIONS

The current study has some useful policy implications to devise strategies compatible with the OLMT mass transit service.

- One of the important policy mediations is to increase the transit coverage and catchment area through 'connectivity'. The future direction for policy makers is to conduct a survey for developing an optimal design of feeder-bus network system to improve connectivity with OLMT and supplementing it with mobile digital App to overcome information gap. The App can work on the similar pattern as ride hailing service by involving rickshaws (the name can be suggested as orange rickshaws) with information about routes, timings, and expenses per kilometer in connection with OLMT stations. Such measures can induce more people to shift towards OLMT and prevent the present users to discontinue by making the additional travel expenses cheaper and more affordable as compared to prevailing multimodal arrangements of connectivity. Furthermore, the App can make additional travel expenses more affordable for users by pooling the riders heading in same directions. This may further create a spillover benefit in terms of employment creation for those involved in providing the 'connectivity service'; especially compensating the rickshaw drivers as majority of the OLMT passengers' past mode of transport was rickshaw
- The burden of government subsidy can be reduced by replacing the uniform user charges with special targeted 'smartcards' for regular users by grouping them into different income profiles and as per the requirement of working class, students, and the females. In addition, the zoning of ridership fare between peak and off-peak hours and the coverage of distance along the OLMT route is another way of generating addition revenue streams.
- The government subsidy can be further eased through searching alternative sources of revenue generation rather than targeting the ridership only. The public-private partnerships (3Ps) can play an important role in this regard by promoting commercial activities on the OLMT. The OLMT stations are economically valuable for small businesses (such as food kiosks by selling on-the-go snacks) and revenue sharing through these business ventures can be a source of additional finance for mass transit. The mass transit rail can also be used as advertisement and marketing medium to generate additional revenue streams. The most immediate intervention is to use the train's display screens for advertisement purposes. This



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can generate considerable amount of non-commuter revenue source for the OLMT service. Similarly, the digital screens can also be installed at each OLMT station which can not only save the stations' own running costs of lightening but provide revenue through provision of platform for advertisements. Static ads can also be a source of additional revenue for this mass transit. Conversely, rather than just focusing on mobility in isolation, there is need to follow the global practice with strong collaboration of partnerships. The mass transit services in Shanghai and Tokyo has substituted the fare-setting strategy from affordability to service quality. Whereas in Hongkong and Singapore the provision of mass transit service is through private partnership and land development scheme is adopted to capture the land value to recover the costs.

- With respect to the feasibility of similar mass transit projects, it must be kept in mind that introducing a mass transit service without a support of well-knitted network and awareness cannot maximize the welfare gains. The 'accessibility-by-destinations' is also a necessary element for chalking out the routes for a mass transit service i.e., the location of employment and access to health and education institutions need be considered for penetration of full benefits of transit service. These factors must be given considerable weightage while devising the feasibility study and replication of similar mass transit in other locations and cities. Since transportation demand is 'derived demand' and ridership of mass transit cannot be increased without access to destinations.
- Moreover, such service provision is not financially viable in the long run if supported by government subsidies. Being a developing country and facing huge fiscal constraints, it will never be feasible for Pakistan to introduce such innovative public transport interventions solely based on government support. Pakistan needs to follow the footsteps of Singapore, China (Shanghai), Japan (Tokyo) and Hongkong where the mass transits are commercially operated rather than depending solely on fare revenue or transferring the burden on government resources. Therefore, public-private partnership is necessitated for generating additional revenue streams or further advancement in rail mass transit systems in Pakistan.