

Technological Evolution of Manila Light Rail Transit System

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Abstract

This study focuses on the different elements of Manila Light Rail Transit System Line 1 in Metro Manila with the aim of characterizing its technological evolution and putting in context its impact in terms of what it is best designed for and what it can deliver. The study provides the concept of understanding the recent operation and developmental resolutions that the management of LRTA line 1 is providing as a preparation to uplift the socio-economic conditions of the commuters. Through the application of technology and scientific principles by means of transportation engineering for managing the facilities of the LRTA line 1 system, the system can provide safer, more rapid, more convenient, economic and environmental friendly way of transportation for the increasing demand of commuters. However, LRT 1 is best designed to substitute conventional railway services on routes where much higher capacity is required and to reduce travel time, further improving the railway service, also against other modes, therefore leading to mode substitution.

Keywords: *Highway engineering, railway transit, road engineering, transportation engineering*

1. Introduction

The traffic jams in Manila are staggering. Only a few traffic lights often disregarded separate the combatants. Every one force his way across the junctions, thus blocking everyone else and so the government decided to find a solution. In 1986, it granted franchise to the Philippines Monorail Transit systems Inc. to plan and build, and operate a monorail system. Before, the feasibility study was completed, the Japan International Cooperation Agency (JICA) was asked to do a transport study. This was undertaken between 1971 and 1973, and then proposed a system of radial and circumferential roadways, an intercity rapid transit system, a commuter railway service and an expressway with three branches. A further study was commissioned to find ways of implementing the conclusions and recommendations were carried out but some concerning rapid transit.

It was only in October 1981 that the Light Railway Transit came to light and later on constructed the CDCP which was a government agency responsible for any government construction project in the present year the continuous uncontrolled growth of population leads to a problem in transportation due to sudden increase on commuters.

The employees of the public and private sectors, the students of the institution, devotees of religious groups such as churches located in the metropolis and all the commuters depend to the case of accessibility to the transportation of the LRT-1 line from Monumento to North Avenue uncontrollably increases.

2. Technological Evolution of Manila Light Rail Transit System Line 1

LRT 1 has been the main mode of transportation of commuters with destinations along Taft and Rizal Avenue, being in existence for around a quarter-century already. Latest statistics from the LRT Authority show that there are 13-14 million passengers every month, with almost 400,000 on a daily average [1], [6]. The LRT 1 originally had 19 stations from Baclaran in Paranaque to Monumento in Caloocan. Recently, the LRT 1 Yellow Line was extended to link to the MRT. Three more stations were added to the LRT 1 to "connect" the Monumento Station to MRT's North Avenue. These stations are: Balintawak, Roosevelt, and SM North.

In 1980, the Government awarded the project implementation to a Belgian consortium consisting of ACEC (Ateliers de Constructions Electriques de Charleroi), BN (Constructions Ferroviaires et Métalliques, formerly Brugeoise et Nivelles), TEI (Tractionnel Engineering International) and TC (Transurb Consult). The Light Rail Transit Authority (LRTA) was then created to be responsible for the construction, operation, maintenance, and/or lease of LRT systems in the Philippines.

The project was constructed at the cost of Philippine Pesos (PhP) 1 billion where a soft and interest-free loan amounting to PhP 300 million was provided by the Belgian Government and the remainder was financed by the Consortium.

The LRT Line 1 was placed in revenue service in December 1984. From a mere 12,000 passengers average per day during its opening month, ridership was at its all time high at 450,000 passengers per day in August 1994. In 2004, ridership is averaging 270-300.000 passengers per day [6].

The operation and maintenance of the LRT Line 1 was contracted by the LRTA to METRO, a private operator that operated Manila's street railway system during the pre-war period. The LRTA, however, retained the Authority to prescribe the fares and plan for network expansion and extension.

METRO operated and maintained the LRT 1 System until the end of July 2000 when LRTA terminated its contract. A 2-year Maintenance Contract was then awarded to Transurb-Technirail, beginning in 2001. When the latter's services ended in April 2003, LRTA chose to conduct a bidding for the new maintenance contractor. After a long bidding process, the Maintenance Contract, that would be valid for 2 years until May 2006, was awarded to the Genials-SKI-SPI Joint Venture (composition of SYSTRA Philippines, Inc, Genials Trading & Contracting Company, Inc and Summa Kumagai, Inc., now SKI Construction Group, Inc) [6].

2.1. History of LRT line 1

As shown in Figure 1, actual construction in Manila started in September 1981 at Taft Avenue between EDSA and Libertad. By the end of 1983, the construction had risen out of the streets over most of the route; and the shape of the new transit facility was taking shape for all to see. The first Light Rail Vehicles (LRVs) arrived in Manila in November 1982 and construction of the Pasay Depot became the most vital task of the whole project [2, 3].

Power was turned on in the Depot and became operational in December 1983. The LRVs began trial runs on the Taft Line in March 1984 and by September 1984 the Taft Line gave the public a view of what was to come by providing free public passenger rides for a one week period.

After September, there was a strong coordinated effort to finish all the remaining Taft Line work and finally, on December 1, 1984, the Taft Line was officially opened to public service.



Figure 1. Construction of LRT 1

Work on the Pasig River Bridge started in November 1984 with the superstructure floated out and put into place. By the end of January 1985, the bridge was completed and track laid across to join up with the track on the other side

Previous to this, there had already been a major effort on the Rizal Line side, and with the Pasig River Bridge complete, speed trials began in February 1985. By April 1985, passenger service was extended into Carriedo, the downtown station, and one month later, on May 12, 1985, the Rizal Line was put into service.



Figure 2. LRT in 1984

To operate the System, a contract was entered into between the LRTA and a specially created new company METRO INC. - a wholly owned subsidiary of the Manila Electric Company. METRO's task would be to acquire the know-how of the new technology and develop an efficient, well-trained organization to operate the System and manage its day to day affairs and be responsible for all technical matters in the future [3], [7].

The LRTA took over all System operations after the rank-and-file employees of METRO INC. staged a wildcat strike, destroyed some of LRTA's properties and paralyzed the entire operation of LRT Line 1 system from July 25 to August 2 of 2000. In view of the adverse consequences brought about by the said strike on the financial position of LRTA and on the efficient provision of LRT services to the public, the LRTA decided not to renew the 16-year Operating and Maintenance Agreement with METRO, Inc. which coincidentally expired on July 31, 2000.

2.2. LRT Trains

The elevated concrete superstructure was designed and built to withstand Richter magnitude 8 earthquakes. Special provisions were made to dissipate seismic energy at the bridge supports (restraining bars, shear keys) and at the column bases (plastic hinges). MERALCO supplies the 35-kV power for the system to nine substations, which convert the supply to 750V dc using two air cooled silicon rectifiers. Communications with trains uses a semi-duplex or duplex UHF radio system. Relay-type trackside signals with fail safe technology are used throughout the line [3, 4].

The LRT Line 1 at various stages in its history has used a two-car, three-car, and four-car trainsets. The two-car trains are the original first-generation ACEC trains (railway cars numbered from 1000). Most were transformed into three-car trains, although some two-car trains remain in service. The four-car trains are the more modern second-generation Hyundai Precision and Adtranz (numbered from 1100) and third-generation Kinki Sharyo / Nippon Sharyo (1200) trains.[5][6] There are 139 railway cars grouped into 40 trains serving the line: 63 of these are first-generation cars, 28 second-generation, and 48 third-generation. One train car (1037) was severely damaged in the Rizal Day bombings and was subsequently decommissioned.[7] The maximum speed of these cars is 80 kilometers per hour (50 mph) [5, 7].

The LRT Line 1 fleet is being modernized to cope with increasing numbers of passengers. In the initial phase of its capacity expansion program completed in 1999, the line's seven four-car second-generation trains were commissioned providing an increased train capacity of 1,350 passengers while the original two-car trains capable of holding 748 passengers were transformed into three-car trains with room for 1,122 [6].



Figure 3. LRT Tracks

The track shown in Figure 3 has a standard gauge of 1,435 mm is utilized. The track comprises of flat bottom rails of EB 50T that are fastened on twin block reinforced concrete sleepers. The minimum curve radius is 170 m on the main line LRV and 25 m in the depot.

2.3. LRT Stations

Originally, Line 1 has a length of about 13.95 km and runs from Baclaran in Pasay City to Monumento in Caloocan City. Pasay City lies in the south-west section of Metro Manila, close to the airport. From there, the line runs in a north-western direction, parallel to the Bay but at some distance from it along Taft Avenue to the Manila City Hall, where the central terminal is located, then through

Arroceros Street, across the Pasig River, entering the Santa Cruz district at FEATI University. From there, it follows Rizal Avenue and Rizal Avenue Extension in a northerly direction to Monumento in Caloocan City [3], [8].

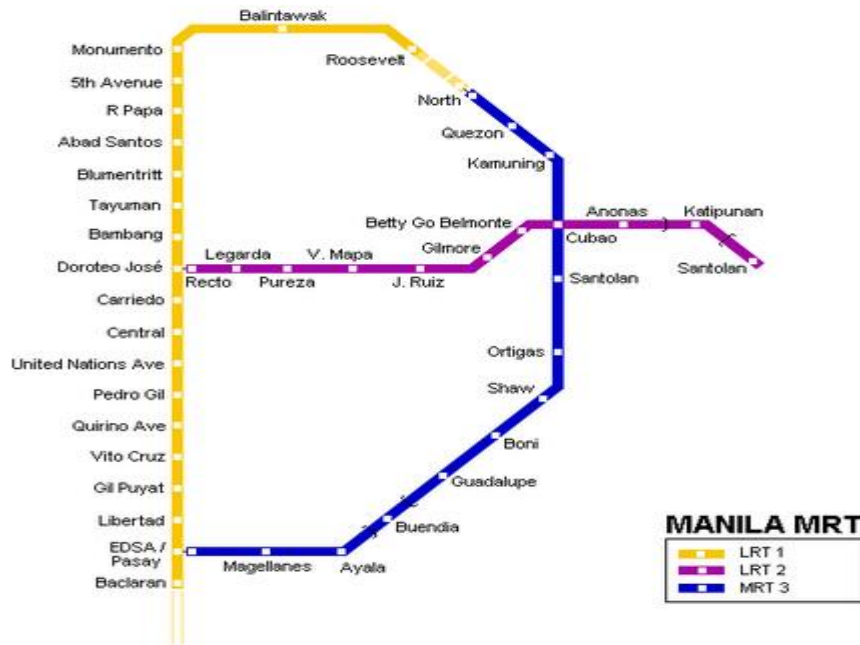


Figure 3. LRT Stations

Under the LRT North Extension Project, a further 5.7 km elevated line has been constructed from Monumento Station of Line 1 to North Avenue of Line 3, with 3 additional stations namely: Balintawak, Roosevelt and a Common Station. The opening of Balintawak Station and Roosevelt Station on March 22, 2010 and October 22, 2010 respectively has brought closer to the goal of "closing the loop", connecting LRT Line 1 from Baclaran to Roosevelt to the Metro Rail Transit that runs along EDSA. From there, it runs in an east-west direction from Monumento to North Avenue, linking the cities of Quezon City, Caloocan, Manila, Pasay, and Parañaque. Passengers can transfer to the Line 2 at Doroteo Jose station, while passengers can transfer to the Line 3 at EDSA and North Avenue stations [8].

3. Research Design and Instrumentation

3.1. Research Design

The study used the interviews, inferential and descriptive methods of research with questionnaires as the main data-gathering instrument. The subjects of the study were passengers of jeepers and buses, commuters of MRT, MRT staff and government agencies such as the Department of Public and Highways that has been involved in railway transport strategies. The target population had to be within the catchment of MRT station. A reconnaissance survey was first conducted on July 15, 2015, the period when questionnaires and interview schedules were also formulated, units of observation and analysis identified and sampling procedures designed.

3.2. Instrumentation

Direct field observation and recording by the researcher was done by the use of a filed notebook, base map and a camera. To verify all the information provided, the researcher

made field observations. Some of the issues that were observed directly include the LRT lines and also the conditions of the existing coaches and engines.

The researcher conducted personal interview of a selected sample respondents using standard structured questionnaires. This gave the researcher the socio-economic background of the study area. Questionnaires also captured that were informative about the modes affecting Metro Manila commuter rail system in the Metro Manila, the problems of potential train users in facing the LRT transport system.

4. Findings

4.1. Feedback as an Ease on Accessibility of Transportation by LRT line 1

As shown in Table 1, majority of the respondents which has 38% says that the system present status as an ease of accessibility to the transportation is just the same with its previous year of service, and with an average of 18% of the respondents says that the system is improving, followed by 17% of the respondents says that the system is sometimes just the same/sometimes not, followed by 15 of the respondents says that the system is not improving and the least says that sometimes improving, sometimes not.

Table 1. Frequency and Percentage Distributions as an Ease on Accessibility of Transportation by LRT Line 1

Feedbacks	Frequency	Percentage
1. No improvement	9	15
2. Sometimes improving, sometimes not	7	12
3. Just the same	23	38
4. Sometimes just the same, sometimes not	10	17
5. There is more improvement	11	18
Total	60	100

4.2. Reasons Ease on Accessibility of Transportation by LRT Line 1

Figure 4 implies that 45% of the respondents have no comment, 28% says better management and operation, 20% says too much commuters and least among them is service interruption.

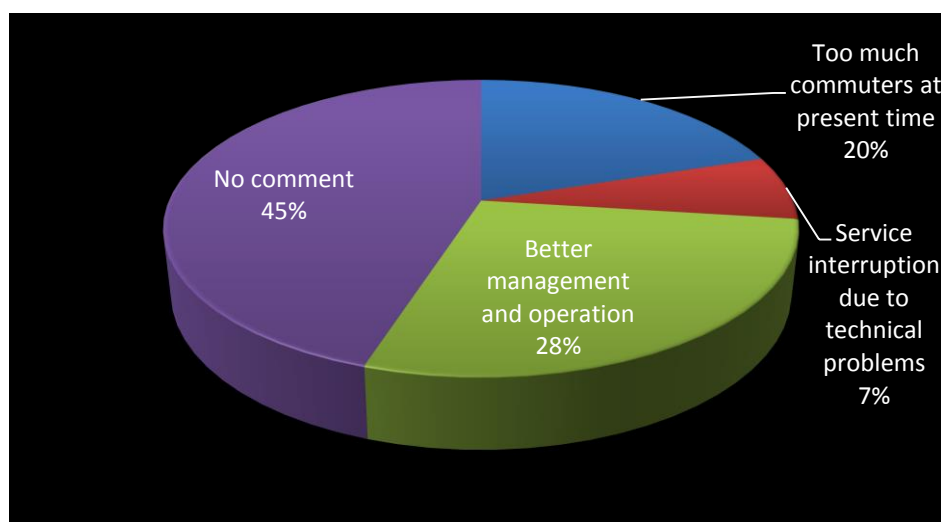


Figure 4. Reasons Ease on Accessibility of Transportation by LRT Line 1

5. Conclusions

The LRT system's performance as an ease of accessibility to the transportation does not change as compared with its previous year of service. The applications of technology and scientific principles brought out by the transportation engineering, for the planning, functional design, operation and management facilities of the LRTA line 1 system in order to provide a safe, rapid, comfortable, convenient, economical and environmentally compatible movement of people and the method brought out by the transportation planning process of the system seek to assess the short and long range transportation problems of the concerned route and to develop, select and implement plans and strategies for solving these problems. This is based on the satisfaction of the transportation system such as to accommodate volume of people which results to a successful operation of the LRTA line 1 to ease the transportation system for the increasing volume of commuters is presently considered by the system LRTA line 1 (Baclaran to North Avenue).

To meet increasing demand of commuters for a responsible mass transit service in the Philippines through the help of new technology and careful planning must be continued and the consideration of scientific process in resolving the increasing demand of commuters must be further developed in order to promote more effective transportation process.

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