AN EVALUATION OF THE TRAFFIC AND FINANCIAL PERFORMANCE OF THE MRT-3 LIGHT-RAIL/METRO LINE IN MANILA, PHILIPPINES

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Abstract

This paper documents the performance of the MRT-3 light rail line in Manila.

- Capacity utilisation is around 100% in the peak, 60% during day-time and 30% in evening hours.
- MRT-3 has not attracted car-*drivers*. Of MRT-3 passengers, 99% have no own car available for the trip. However, 27% made their trip as car-*passenger* before.
- The dominant user is 25-40 years (73%), middle income (66%), 52% female and 48% male. Most trips are for work, school or business (82%).
- Travellers are very satisfied with the level of service.
- Utilisation was highly sensitive to the tariff. Full capacity utilisation was only reached after fare reduction to just above the bus fare.
- Fare revenue is structurally insufficient to recover costs (2002: 20%).
- Profit on real estate development linked to MRT stations is high, due to their good accessibility. This, plus value increase of other real estate along the MRT (for the same reason) outweighs the total cost of line construction and operation.
- MRT-3 is financially attractive for the MRTC consortium. The Philippine government carries all operational risk and receives a modest share of real estate revenues. Subsidy up to 2023 will probably be around 50%.

Keywords: Light-rail; Modal choice; Land value around light-rail stations; Public transport performance
Topic Area: G04 Transport cost, investments and economic development

1. Introduction

1.1. Aim of the paper

The paper documents the performance of the recently completed MRT-3 light rail/metro line in the Manila metropolitan area. It does so from the technical performance and the passenger point of view as well as from the financial point of view. Its aim is to investigate whether in the Manila case new metro lines, such as the MRT-3, can be constructed, that are successful in transport terms (attractive for travellers, highly utilised) and also financially successful, for private investors and operators as well as for the public interest (represented by the government –in this case the national Department of Transport and Communications, DOTC).

1.2. Method

In 2002/2003 a study was carried out to evaluate the performance of the MRT-3 line (Alzate, 2003). The study was based on a survey carried out among MRT passengers in November and December 2002 (504 respondents), data about traffic in the EDSA corridor in the 1997-2002 period (source MMURTRIP (1996) and DPWH-TEC), and rider-ship data and financial data concerning the actual MRT operation (source: DOTC).

1.3. The MRT-3 light rail/metro line in the Manila metropolitan area

Like most mega-cities around the world, Metro Manila[1] suffers from serious traffic congestion and the associated accessibility and environmental problems. According to the Metro Manila Urban Transport Integration Study (MMUTIS, 1999), roads in the city have become more congested, commuting time and distance have grown further, in-vehicle congestion in public transport increased and comfort level decreased, air pollution worsened (largely attributed to transport), and accidents increased. The general urban transport situation is characterised by a shortage of infrastructure, poor road maintenance, inadequate traffic and vehicle management, undisciplined drivers and pedestrians, and uncontrolled roadside activities and land use.

Among Metro Manila's major roads, Epifanio de los Santos Avenue, known as "EDSA", carries the highest traffic volume. It is the backbone of Metro Manila's road transportation system and a very high volume road. Daily (14-hour) 2-way traffic flows exceed 100,000 pcu (2x5 lanes) over the whole section between the South Super Highway and East Avenue, rising to almost 150,000 in the Ortigas/Shaw area. Depending on the section, around 10-13 % of the vehicles (25-30% of pcu's) are buses (standard large bus), carrying around 70% of all persons travelling in the corridor (car: 70% of pcu's, 30% of persons; average car occupancy: 2.5) (MMURTRIP, 1998). Jeepneys (smaller public transport vehicles) are not allowed on this road (which is enforced effectively). On most sections, buses utilise 2 out of the 5 traffic lanes. Reliable records of the maximum hourly number of bus passengers in one direction are not available. Existing data suggest a peak hourly capacity of up to 6-700 buses in one direction, with over 60,000 passengers. Compared to dedicated bus-lane capacities reported from other cities around the world, this is a remarkable performance, despite the seemingly chaotic appearance of the bus traffic (20,000 passengers per hour in the peak direction is generally considered an efficient performance for a single dedicated bus-lane).

By comparison: the current maximum capacity of the MRT line is 24,000 pass/hour in one direction (20 trains/hr, 1200 pass/train), which can still be increased to 36,000 pass/hr by running more trains/vehicles per train.

The Metro Rail Transit Line 3 (MRT-3) was constructed with the objective to alleviate the worsening traffic conditions and air pollution problem along EDSA. The report on which the decision to construct the line was based (J.P.Morgan) estimates that it could initially carry more than 450,000 passengers per day, expandable to a maximum of 900,000 passengers per day by expanding the train vehicle fleet (data presented later in the paper demonstrate that the actual maximum possible number of daily passengers is around 25-40% lower).

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[1] Metro Manila is the political, financial and educational center of the Philippines. It has a total land area of 636 sq km, and consists of 13 cities and 4 municipalities. In the year 2000 its population reached 10.9 million.

Aimed at providing an economical, efficient and comfortable mass transport system, the MRT-3 was envisioned to eventually replace buses as the dominant mode of public transport along EDSA. In retrospect this appears to have been an unrealistic vision, taking into account the actual passenger carrying capacities of both modes and the increase of traffic in the corridor after MRT-3 completion, due to both diverted and generated traffic.

Car users were also expected to shift to the MRT-3 due to shorter travel time. Traffic flow conditions along EDSA were expected to improve in correspondence with the reduction in the number of vehicles thus predicted.

2. Details of the MRT-3 line

The MRT-3 is located, generally, within the existing median of EDSA and is constructed in two phases. Phase 1, which started operations in December 1999, has a total length of 16.9 km's extending from North Avenue in Quezon City to Taft Avenue in Pasay City, with 13 stations. Phase 2 (still under negotiation, start of construction expected in 2005) will provide a 5.1 km extension of the MRT line from North Avenue toward Monumento Circle in Caloocan City. Most of the line is elevated, almost 2 km and two stations are underground and around 2 km and two stations are at grade. All road crossings are grade separated.

The line is part of the envisioned Mass Rapid Transit network for Metro Manila (LRT, light rail on fully grade separated infrastructure). This network consists of radial lines (LRT Line 1, 2, and 4) and a circumferential line (LRT Line 3) (see map, annex 1). Line 1 (14 km, 18 stations) is in operation since 1985. The average daily number of passengers grew from around 200,000 in 1985 to around 400,000 now. Line 2 has partially opened April 2003 (4 stations). Completion is expected by October 2004 (14 km, 11 stations, planned maximum peak capacity per direction 40,000 passengers/hour).

The initial intention of the government of the Philippines was that a private consortium would build and operate the line as a BOT. However, during contract negotiations this was changed into a build-lease-transfer (BLT) contract in which the national government (DOTC) is the operating party and takes the risk of insufficient revenues. The reason is that the consortium building the line was unwilling to take the risk that the fare revenue would be too low to recover the costs. They did probably not trust the study report in its prediction of the number of passengers and the fare these would be willing to pay. In retrospect this was a correct judgement, as the evaluation findings show. The evaluation findings also suggest that the financial importance of one element was not fully recognised by the government at the moment of contract negotiations, i.e. that of the revenue generated by real estate development and exploitation of the MRT-3 station sites.

Under the BLT Agreement, Metro Rail Transit Corporation (MRTC), a private sector consortium composed of seven Filipino-owned companies, is responsible for the design, construction, testing, commissioning and maintaining the system. Upon completion, MRTC leases the system for 25 years to the Department of Transportation and Communications, who will operate the system, with MRTC (through Sumitomo / Mitsubishi) providing the maintenance. The rolling stock was purchased from the Czech republic. At the end of the 25-year lease period, the ownership of the system will be transferred to the government.

The initial project investment in construction and rolling stock (of USD 655 million; out of which rolling stock 88) was financed through 29% "equity" (held by MRTC) and 71% debt financing. Payment by DOTC to MRTC is by means of an annual lease amount, covering

all costs including those of train and track maintenance. The lease amount includes a fixed 15% annual return (after tax) on equity capital. The Net Present Value of the lease up to 2023 (in 1999 costs, at 10% interest) amounts to around 1,030 million USD.

DOTC's (government) revenues will come from two sources: (i) MRT fare revenues, and (ii) the payments the BLT contractor (MRTC) for development rights at the stations and at the depot. In the report underpinning project approval, fare revenue was heavily overestimated, as the combined result of a high estimate of the number of passengers and an assumed high fare. The contract signed in 1997 between DOTC and MRTC appears to be quite one-sided in its allocation of project risk. Market risk with respect to passenger fare revenue is taken completely by DOTC (government). On the other hand, the commercial development revenues that DOTC collects appear to be variable, in proportion to the magnitude of development pursued by the BLT contractor, but limited to a maximum value (unrelated to the actual commercial success of the development). Detailed analysis of the financial arrangements of the project was outside the scope of this study.

3. Technical performance evaluation

3.1 Summary of passenger survey results

Profile of MRT Users

The survey results indicate that most of the MRT users (73%) are between 20 and 40 years of age. Only 9% are below 20 years old while 16% are between 41 and 60 years old. There is no significant difference in the age of users during the AM and PM peaks and the non-peak period. The exception is during the PM peak wherein more people between 41-60 years old (24%) use the MRT compared to the other periods of the day. The MRT travellers are a very stable group, the large majority of them travels by MRT 5 days per week.

Table 1. Profile of MRT Users

	Total		**AM Peak**		**PM Peak**		**Non-peak**	
MRT Users by Age								
1) < 20	45	9%	17	13%	15	7%	14	8%
2) 21-40	370	73%	98	75%	142	69%	130	77%
3) 41-60	89	18%	16	12%	49	24%	25	15%
	504	100%	130	100%	205	100%	169	100%
MRT Users by Gender								
1) Male	240	48%	65	50%	96	47%	79	47%
2) Female	264	52%	65	50%	109	53%	90	53%
Total	504	100%	130	100%	205	100%	169	100%
MRT Users by Family Income (PhP/month)								
1) Under 15,000	161	32%	41	32%	62	30%	58	34%
2) 15,000-59,999	331	66%	87	67%	138	67%	106	63%
3) 60,000 or greater	12	2%	2	2%	5	2%	5	3%
Total	504	100%	130	100%	205	100%	169	100%

The percentage of female MRT users is slightly higher than that of male (52% are females and 48% are males). The male to female ratio is almost the same during the AM, PM, and non-peak periods.

The trip production rate for males is higher (2.50 vehicular trips per day) than that of females (2.00) (based on the MMUTIS data). However, it is expected that there are more male car owners/drivers than female, so the percentage of trips males make by public transport can be expected to be lower than that of females. Hence, taking into account that public transport accounts for about 70% of the total daily vehicular trips in Metro Manila, the survey finding about the percentages of male and female travellers is in line with expectations.

Most of the MRT users (about 66%) belong to the middle-income group, with a family income between PhP 15,000 to PhP 60,000 per month (around 300-1,200 USD per month). 32% belong to the lower income group (less than PhP 15,000 family income per month) and only 2% belong to the high-income group (family monthly income greater than PhP 60,000). (Note: the exchange rate in January 2002: 51 Ph.Pesos = 1.0 USD; The GDP per capita of the Philippines (2003) is 4,000 USD; the 10% highest income category consumes 40% of the GDP).

Car Ownership among MRT users

41% of the respondents report that their household owns a car (95% confidence interval: 37-45%). This is in line with the finding that MRT users are mostly middle-class (in Metro Manila as a whole only 19% of the households own a car). The percentage is almost the same during the different periods of the day.

However, of all those that indicated that their household owns a car, only 2% say that this car was actually available to them to make their trip, but that they preferred to travel by MRT (95% confidence interval: 0-4%). The overwhelming majority of all MRT travellers (99%) are public transport captives, that didn't have a car available (that they could use at their own discretion) as an alternative mode of travel for their trip. In most cases respondents indicate that other family members were utilizing the car. In a few cases cars were undergoing repairs/maintenance, or did respondents indicate that the car was not available due to the "Unified Vehicular Volume Reduction Program" (UVVRP, also known as the colour-coding scheme), which bans cars from all roads once a week, based on the vehicle's plate number.

The finding that almost all MRT passengers are public transport captive means that no significant reduction in car use along EDSA corridor can be expected in relation to the MRT becoming available. This is consistent with traffic volume counts along the corridor, which although sometimes influenced by changes in traffic management on certain sections and intersections related to physical changes related to MRT-3, show no clear overall reduction in the volume of traffic after MRT-3 became fully operational.

Modal shift related to the MRT-3

Bus-to-MRT. The main modal shift created by the MRT-3 is from other public transport to MRT-3, mainly from bus. 67% (+/- 6%) of the respondents indicate that previously their main mode of travel was by bus, 4% by taxi and 2% by jeepney. It is interesting to note that the large modal shift from bus to MRT-3 did not lead to a strong reduction in the number of buses plying in the EDSA corridor. Reliable systematic traffic counts on key sections along the EDSA corridor during a range of years could not be retraced within the period available for this study (they may not exist at all). Sparse data that are available are inconclusive, but suggest a reduction by less than 10%. Reliable data on bus occupancy could also not be found (they may not exist at all), but casual observation of the bus traffic in November and December 2002 did not suggest a drastic reduction in bus

occupancy. It is also unlikely that a significant reduction in bus occupancy would not have led the operators to reduce the number of buses.

The most probable explanation therefore is that a significant part of the MRT-3 trips are either diverted or generated traffic. This is consistent with the answers given by the respondents about their travel routes in the past. 62 % indicated that they did not travel along the same route in the EDSA corridor before the MRT line was opened. Unfortunately, a more detailed analysis of the change in route patterns after MRT opening was not possible within the limited scope of this research.

Car passenger-to-MRT. One very interesting other modal shift took place. 27% (+/- 6%)of the respondents indicate that they used to make their trip by car, as a passenger in the households car. The implication of this is that the average car occupancy in the corridor must have gone down, because more family members, the MRT option being available, opted for using the MRT instead of travelling along in the family car. The advantage of this probably being that the others in the car (driver, other passengers) no longer had to make a detour to drop someone, and that the freedom in choosing the desired time of the day for making the trip increased for both parties. Unfortunately this possible outcome had not been anticipated in the survey design, so no questions were asked about the reasons for changing from being a household-car passenger to travelling by MRT.

Apparently, the MRT effect on car travel in practice was not the hoped-for modal shift car-to-MRT that would reduce the number of cars on the road, but a shift of car passengers to MRT, that only reduced car occupancy. One should add that, although no effect on the number of car trips appears to have occurred, it is possible that for those cars in which the number of passengers went down the trip became shorter, which might create a (very modest) reduction in total car traffic volume.

Assessment of the Level of Service

Generally, MRT users are satisfied with the level of service of the MRT and its facilities.

⇒ Fare. Almost all respondents (99%) indicated that the current price level is fair. The remaining 1% said that the price is low (implies that they would be willing to pay more for the use of the MRT). However, one should be very careful with the interpretation of this finding. It has to be realised that the MRT fare has been reduced very significantly twice. The first reduction was by 35%, two month after the line opened, in reaction to the dramatically low number of passengers in the first month (the initial fare was around twice the bus fare). The second reduction was by another 15%, 5 months later (July 2000), but also included a change in fare structure, making longer distance trips very significantly cheaper. The MRT-fare at that moment became almost the same as the bus fare in the EDSA corridor. After the first price reduction the number of passengers doubled (but remained far below the expected number), after the second price reduction the number of passengers grew more than 3x (to almost 200,000/day). Further growth of the number of passengers, to 300,000 end of 2002, was gradual, and also relates to the last stations becoming available during that period.

⇒ Waiting time at stations. The large majority of the respondents (93%, +/- 2%) said that the waiting time at MRT stations is fair, 7% consider it low. Less then 1% is dissatisfied, saying that waiting time is too long.

⇒ Travel time. MRT users are generally satisfied with the travel time compared to other modes (e.g., bus, car or taxi). About 53% of the respondents rate the travel time using MRT as very good, 46% as good, 1% as fair. The high level of satisfaction with the travel time reflects reality: travelling along EDSA by car or bus takes far more time. For example, travel by bus or by car from North Avenue to Taft Avenue (17 km) on average takes 1.0 to 1.5 hours or even more, while it is less than 30 minutes by MRT. Apparently the need for additional transfers (usually 2) when using the MRT does not significantly diminish the attractiveness of the speed of travel by MRT, probably because of the high train frequency.

⇒ Comfort. 7% of the respondents indicated that MRT comfort is very good, 75% said that it is good, 15% said that it is fair, while 3% said that it is bad. Those rating comfort as bad or fair almost all travelled during peak hours, when trains are full and it is hotter inside the trains, and there also are queues at the ticket booths. The short travel time itself appears to contribute strongly to the perception of the trip as comfortable, compared to travel by bus or by car, caught in heavy traffic jam during peak hours.

⇒ Reliability. 4% of the respondents rate MRT reliability as very good, 91% said it is good, and 5% fair. Reliability includes factors such as the timely arrival of trains, regularity of arrivals and low probability of delay due to engine/technical troubles.

3.2. MRT-3 utilisation

It is interesting to compare the actual number of MRT passengers with the predicted number of passengers. Figure 7.1 shows the average daily number of MRT passengers from December 1999 onwards. The large gap between the predicted and the actual volume of passengers is obvious. The effects of the reduction in ticket price in February and July 2000 can be seen clearly.

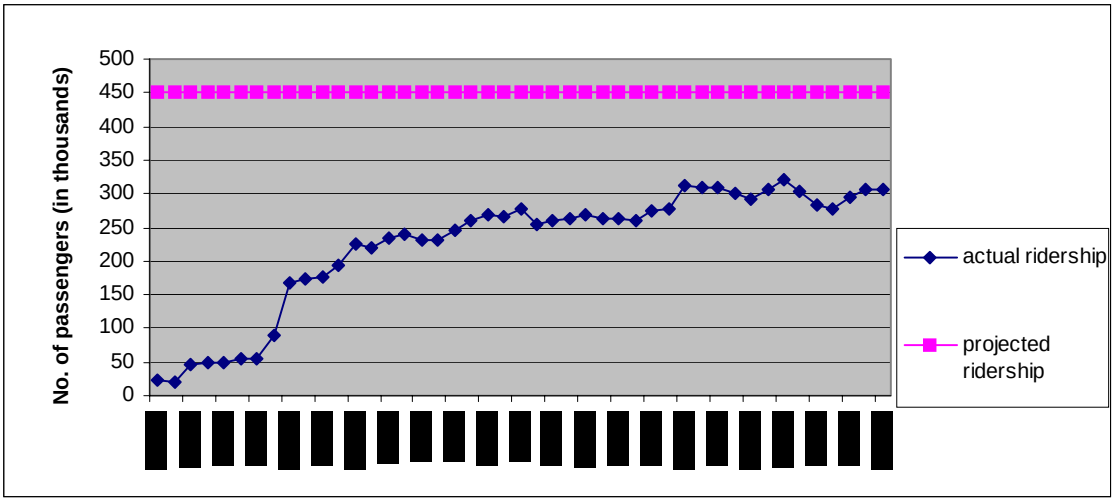

Figure 1. MRT-3 Average daily number of passengers (Actual vs. Predicted)

There are several reasons apart from the initial fare level that explain the gradual growth of the number of passengers, such as the fact that the construction of the last section (3 stations up to Taft Avenue) was only completed towards end 2000, access to the stations (i.e.,

escalators) was completed gradually, train arrival time signalling was initially inaccurate, and getting a ticket took a long time in the peak (automated fare collection system not yet operational).

The high initial MRT-3 fare had a strong effect on the number of passengers. Apparently, the price elasticity was very high. DOTC, the operator, started charging PhP 17 flag-down rate (39 USD cents at the exchange rate of that moment) and PhP 2 per additional station, as proposed in the project report (i.e. around 75 USD cent for a 9-10n km long trip). This rate was way above the bus fares. The minimum regular bus fare was PhP 3 with an additional PhP 1 for every extra kilometre. For air-conditioned buses, the entry fare was PhP 8, and PhP 2 for every extra kilometre. Most travellers therefore initially continued to use the buses.

To attract more passengers, the fare was reduced to PhP 11 flag down rate on February 2000. There was further reduction in fare on July 2000 (minimum fare of PhP 9.50 and maximum of PhP 15 (any trip length) (i.e. around 31 USD for a 10 (or more) km trip, at the exchange rate of mid 2000). The fare remained in that level since then. This means that at that moment the fare for a 10 km long trip along EDSA by MRT was 15 PhP, by ordinary bus 12 and by air-co bus 26. For a 15 km long trip the MRT was even cheaper than the ordinary bus. The number of passengers jumped from around 50,000 per day in June to 175,000 in August.

Table 2. MRT3 Fare History

Fare Level (PhP)	Date Implemented
17.00 (min.) – 34 (max.)	15 Dec. 1999 – 25 Feb. 2000
11.00 (min.) – 20 (max.)	26 Feb. 2000 – 20 July 2000
9.50 (min.) – 15 (max.)	21 July 2000 – Jan. 2003

(Source: Martinez, 2002)

With the wisdom of hindsight, the commercial soundness of the fare policy is dubious. Immediately starting with a much lower fare, and increasing this as the line was completed and facilities improved might have produced better results. It is in fact unclear whether the travellers would in the current situation not be willing to pay substantially more for the MRT than they are actually paying.

The number of MRT travellers predicted in the project appraisal report was 450,000 passengers per day (week- average) during the opening year, and even a further growth of 5% per annum to a maximum of 600,000 was suggested (with the same vehicle fleet). However, from an analysis of the current number of passengers and their average trip length it is clear that the current level of around an average of 300-320,000 per day (week, 7-day, average) is in fact the maximum number that the line can handle. The maximum number of passengers that the line can at the moment handle on a single day is around 425,000/day (maximum of the passenger counts on the busiest days during 2003; due to variations between days and Saturdays and Sunday in particular, the daily average per week is much lower).

During the peak periods the capacity utilisation of the line along the central sections is almost 100 % in the peak direction, but becomes lower towards the end stations of the line – which is unavoidable- while in the opposite direction, the capacity utilisation is lower (for example, north- and southbound load factors on the three most central sections of 54% and 93% during the PM peak were reported (Martinez, 2002)). The average utilisation during the rest of the day is at best 60%, and during evening hours 30%. It is difficult to see how these

percentages could go up significantly, in particular because the biggest competitive advantage of the MRT is in the peak.

The other factor that determines the ratio between the number of passenger-km's that the line can handle and the actual number of trips is the average trip-length. Based on entry and exit stations reported by passengers in the survey, the average MRT trip length is around 9 km. Taking into account the maximum occupancy percentages and the average trip-length, the maximum number of passengers (trips) that MRT-3 can handle in the current situation (phase I vehicle fleet and track length) is to be estimated at between 320 and 360,000.

It is not clear on exactly what grounds the initial project report predicted 450,000 passengers per day. It could be that the actual average trip length was assumed to be significantly lower. The project report may also have been on the optimistic side. The MRTC consortium, accepting a BLT contract only, was probably aware of the uncertainty of the predicted number of travellers.

To increase the capacity of the line, the utilisation of the 73 available LRVs could be optimised (by running 4-car trains during peak hours instead of the 3-car trains currently being used). Assuming 90-95% vehicle availability in the peak period, this could increase the maximum number of passengers per day to around 390,000. When Phase 2 of the MRT-3 Project is completed, 24 additional LRVs will be provided. The number of passengers using the line per day can then be expected to go up to around 540,000 passengers (rather than 900,000 as predicted in the initial project report).

4. Financial performance evaluation

Financial results for DOTC and MRTC, expected actual results versus project prediction

As shown in the preceding section, there is a big gap between the passenger numbers predicted in the feasibility study and the actual number of passengers. This difference is caused by unrealistic initial projections, not by under-performance of the MRT-3 line. The current fare is also far below the fare assumed in the feasibility study for the line. The implications for the financial performance of the line for the operator (DOTC) are easy to grasp.

According to the project report, DOTC could expect to recover its costs. However, based on the current fare levels and current contractual rates for commercial development around MRT stations, the now predictable NPV of the line for DOTC is –568 million USD over the 2000-2024 period (see table 3, alternative 2; consisting of the NPV of a lease amount to be paid to MRTC of –1,037 million USD, the NPV of the net operational revenue on fares of +388m USD and a revenue from rent on real estate development by MRTC of +79m USD).

The MRTC consortium is not negatively affected by the above "gap", their annual lease income being independent of the fare revenue (NPV 1,037 million USD; guaranteed 15% return, after tax, on 190 million "equity" investment).

Table 3. Net Present Value of the MRT-3 for DOTC, for different fare level projections.

	AVERAGE FARE (PhP)			NPV (USD million)	Net cash flow remains negative until:
	present	2004	2010		
scenario 1 (current fare)	12.50	12.50	12.50	- 659	2024
scenario 2 (modest fare increase)	12.50	15	19	- 568	2016
scenario 3 (larger fare increase, real estate dev. rights increase to NPV +180)	12.50	16	22	- 427	2016

Note: all values in constant cost (prices) 1.1.2000. Interest rate for NPV calculation: 10%. In 2016 the annual lease to MRTC drops from 118 to 63 million USD/year because all loans on the initial investment have then been paid back.

The calculations summarised in Table 3 above indicate that the overall project NPV for DOTC will be severely negative, even if significant fare increases are implemented, and that the net MRT-3 cash flow for DOTC will be negative until at best 2016. In the year 2002, the estimated net MRT-3 cash flow paid by the government was -92 million USD (74% of the lease payment by DOTC to MRTC was "subsidy").

A closer look at the revenue from real estate development at MRT-3 station locations by MRTC/DOTC

In combination with the conclusion that the hoped-for positive indirect effects of the MRT-3 line hardly materialised (low –if at all significant- impact on car and bus traffic levels and hence on pollution and congestion levels), the preceding paragraph on the financial outcome of MRT-3 for the government of the Philippines might seem to lead to rather bleak conclusions about the soundness of the MRT-3 investment. However, a closer look at the financial details of the MRT-3 project shows that this is not necessarily the case.

Fare revenue is not the only revenue generated by the MRT-3 line. Revenue is also generated by commercial real-estate development at station locations (and at the-larger- MRT vehicle depot location). Part of this revenue is passed on to DOTC in the form of a rent for land development rights.

Linked to the MRT-3 construction, the MRTC consortium obtained development rights on a total of 335,000 m2 of government land, at/around station sites and at the depot site. In the first project documents the annual rent that the consortium would have to pay for the development rights for this land was set at 35 USD per m2. In the final contract signed in 1997 the amount was much lower, since the rates were specified in Pesos and the strong devaluation of the Pesos against the USD during that period was not corrected for. Should the initial rates have been maintained, the NPV of development rights revenue would have been around USD 180 million (scenario 3 in table 3).

A more detailed financial analysis, beyond the scope of the research reported on here, would be required to assess whether a contract for the MRT-3 would have been reasonable that distributed the potential real-estate development profits related more equally between the government and the development-consortium. Here we can only give some raw numbers. The total value of the land for which development rights were granted can be estimated at around 300 million USD (based on current land prices in this part of Manila), so a rent representing a NPV of that magnitude would in principle be reasonable (or even more, in view of the

exceptionally good accessibility of the locations and the large numbers of potential customers passing there -similar price differences can be observed in other countries at high-accessibility locations in congested cities).

Provided that DOTC operates the line in a proper manner and maintains the current levels of passenger satisfaction and security, the attractiveness of the MRT-3 station sites can be expected to increase further over time, since road traffic congestion levels are not going down and the competitive edge of MRT accessibility will increase as the MRT network grows from the addition of other lines.

Land value increase in the MRT-3 corridor

One other important element should be included in the analysis of the financial impact of the MRT line, the effect that the accessibility improvement created by the line has on the land value of the existing real estate in the EDSA corridor. The city has a property tax based on property (real estate) value. This means that a property value increase triggered by improved accessibility increases the tax base, and thus the tax revenue. Analysis of the financial implication of this requires detailed further analysis, including an assessment of valuation procedures and tariffs. However, giving a rough order of magnitude is possible here: the area affected covers around 20 km2

(20 million m2), so a 10% increase in land-value represents a value of around 1,500 million USD (land-value only, not the value of property built on the land).

5. Summary

The main findings of the traffic performance evaluation of the MRT-3 line are:

- ⇒ After completion of phase I and all its stations, the line shows an almost full capacity utilisation in the morning and afternoon peak hours, around 60% occupancy during the rest of the day and of around 30% in the evening hours (the line now operates from 6.00 AM until 21.00 PM).
- ⇒ The peak occupancy of the trains is 100% on the central part of the line and reduces towards 70% near the end-points.
- ⇒ This means that the present volume of daily travellers is around the maximum that the line can be expected to carry at this moment, given the length and frequency of the trains (maximum on a working day 425,000 passengers, maximum week average around 320,000 passengers/day). In terms of utilisation the line can therefore be said to be very successful. The impact of the tariff on utilisation will be discussed under financial performance evaluation.
- ⇒ The capacity of the rail track still enables significantly longer trains at higher frequencies. Further investment in more trains is planned for future years.
- ⇒ The current daily volume of MRT-3 travellers lies at around 75% of the volume predicted in the feasibility study that was carried out in preparation to the decision to build the line. The reason is that the feasibility study assumed unrealistic train occupancy factors throughout the day.
- ⇒ Almost all MRT-3 passengers (99%) say that they have no car available as an alternative mode of travel for the trip that they make by MRT-3. However, a significant number (27%) states that before the MRT-3 line was opened they made the same trip by car, apparently as a passenger in the car of another household member.

- ⇒ This leads to the conclusion that the MRT-3 does not so-far induce car-drivers to leave their car at home and travel by MRT-3, but may have the effect that the car occupancy reduces and that car trips become more direct (less detours to drop/pick other family members), i.e. not less car trips, but maybe slightly less car-km's.
- ⇒ The travel-time gain of the MRT-3 compared to the same distance travelled along the EDSA corridor in either car or bus is around 45 minutes for 10 km (including waiting for the train, excluding access/egress time and parking time requirement for cars).
- ⇒ The main modal shift created by MRT-3 is from buses to the MRT-3. However, this includes a significant amount of diverted and generated traffic, and the number of buses in the EDSA corridor has not gone down much after MRT-3 was fully operational (by less than 10%).
- ⇒ The profile of the dominant MRT-3 user is: 25-40 years old (73%), middle income (66%). The percentage of male (47%) and female (53%) travellers is almost equal. The large majority (%) of the trips is to work, school or for business and back (82%).
- ⇒ The satisfaction of the MRT-3 travellers with the level of service of the line is high. This regards all aspects: speed, cost, comfort, and reliability.

The main findings of the financial performance evaluation of the MRT-3 line are:

- ⇒ The utilisation of the line is highly sensitive to the tariff. When immediately after the opening of the first part of the line the tariff proposed in the earlier feasibility study was charged, the number of passengers remained low. Lowering the tariff to almost the same level as that of buses steeply increased the number of passengers, to full utilisation.
- ⇒ The fare revenue of the line is structurally insufficient to recover its capital and operational costs. The percentage of the total costs covered by the fare revenue can improve a bit over the current 20%, because an increase in train frequency and in vehicles per train can be implemented without further investment in the rail track. However, this will not make the line cost recovering on fare revenues.
- ⇒ The real-state revenue generated by exploitation of the MRT-3 stations (and depot site), plus the value increase of existing real estate in the EDSA corridor due to improved accessibility, outweighs the total cost of constructing and operating the line. However, this statement must be treated with caution: it is based on rough "order of magnitude" estimates only. A precise analysis of the real estate development aspects of MRT-3 was beyond the scope of this study. Further study is highly recommended.
- ⇒ The contracts for the MRT-3 line between the government of the Philippines and the private consortium that constructed the line and carries out maintenance of the track and the trains, leave the government with a large deficit as well as with the most tricky part of the deal, i.e. operating the trains and the stations (running the trains, fare collection, security). With the wisdom of hindsight, the overall profitability of the line (considering both fare revenue and real estate revenue) is such that the government could have negotiated a much better contract, from the public interest point of view.

Conclusion

The conclusion that can be drawn from the evaluation findings in this study is, that in a high-density mega-city such as metropolitan Manila a rail mass public transport system on a fully separated infrastructure network can be constructed and operated in profitable manner. The most important line network design parameters are (1) the strategic location of stations

with respect to land-use development, and (2) real estate development around stations and in the corridor that is synchronised and financially integrated with the rail network construction. Further confirmation by additional financial analysis of the Manila case is recommended.

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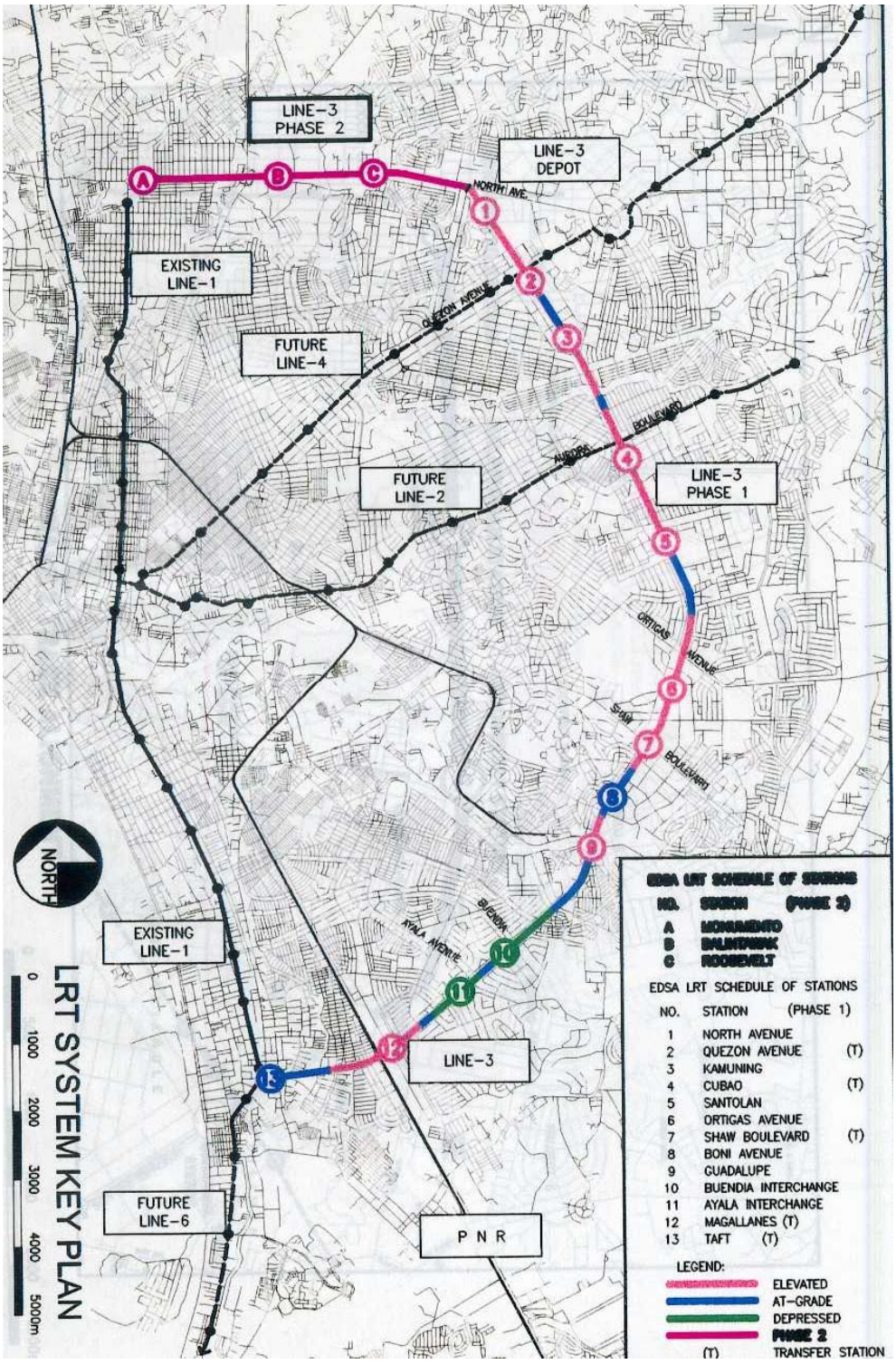
ANNEX 1

Mass Rapid rail Transit lines in the Manila Metropolitan Area, Philippines.



MTR-3 Line Manila, Philippines. View on the EDSA corridor from one of the stations.

Interior of one of the MRT-3 stations in Manila, Philippines