"The structured framework suggested in this paper reveals the gaps and sets out the orderly sequence of decisions yet to be taken."

The Planning of LRT for Metro Manila*

by
Rene S. Santiago

Abstract

This paper reviews the issues and activities that characterized the planning of the Light Rail Transit system of Metropolitan Manila. A structured approach consisting of five major decision stages is postulated, then applied in discussing the current question: where is the next LRT line?

Circumstances and planning methods differed for the two lines. The first one, Taft-Rizal, went ahead somewhat so hurriedly that the normal sequences in the planning process were either compressed or skipped. As a result, some advantages were foregone and unnecessary problems encountered during construction. On the other hand, the planning and feasibility study for Line 2 were conducted on more firmer grounds such as: use of more up-to-date origin-destination data, examination of alternative alignments, and more comprehensive treatment of a wider range of issues. A radial (Aurora Blvd.) and a circumferential (EDSA) line emerged as having the highest potentials. These two options were then subjected to closer scrutiny, with the Aurora Line coming out on top.

However, information gaps still remain to cast doubts on the advisability of pursuing the project at an early date. A decision in favor of the Aurora Line will entail a government investment of US$220 million. The project's magnitude and impact are such that further studies can be justified – if only to address the affordability issue, the preparation of detailed engineering works, and the sourcing of subsidy, among others.

INTRODUCTION

Transportation planners now consider, with the benefit of hindsight, the disappearance of the street cars in many cities of the world as a big mistake. It is no mere nostalgia when people now view the fate of Manila's pre-war *Tranvia* in the same light. For at one time, it boasted of a network spanning 83.7 kms. Paradoxical as it may seem, its modern revival in the form of the Light Rail Transit (LRT) system had not received the expected unqualified support. A mere shadow of its predecessor with a 15 kms. line, the LRT was dubbed by its critics as another "white elephant in the City of Man". Not as colorful, but equally negative, was an internal working paper of the World Bank who saw it as an expensive project with doubtful impact on the city's traffic congestion. Whether present day skeptics will be proven right or wrong, only history can tell.

The controversies served to highlight the difficulties of planning and decision-making about problems confronting a Third World conurbation like Metro Manila. The issues and the analyses that went into the planning of LRT are the stuff of which urban planners and policy-makers could learn from. Besides, the literature on the subject is either scanty, outdated, or premised on developed country conditions as to have minor practical value to those responsible for major public transport undertakings in a developing country setting.

*One of the planning papers presented during the Philippine Institute of Environmental Planners (PIEP) Annual Congress, December 1986. The author is Managing Director of Trans/Pro Resources Corporation and has worked with the project team that prepared the Metrorail Network Options Feasibility Study.

THE GENESIS OF MANILA'S LRT

Serious consideration of rail-based mass transit systems began sometime in 1972 with a Japanese-funded study called "Urban Transport Strategy for Metro Manila Area". Its salient recommendation was for a heavy rail transit system operating mostly in underground radial network. At first blush, the proposal seemed to have emanated from a planner gone berserk or enamored about Tokyo's labyrinthine subways. Certainly, it was a planner's dream on how traffic congestion could be banished from the streets of Metro Manila. Unfortunately, the Philippines was not that "wealthy" to be able to afford it. The proposals might have been defensible and sound based on a Japanese transport planning philosophy that placed a premium on elegant and neat engineering solutions to the problems of urban mobility.

The pendulum swang a little too far in favor of economics with MMETROPLAN, a 14-month study conducted in 1976 with funding from the World Bank. Labelled after similar catchwords in other developed cities, it claimed to be the first comprehensive planning attempt to deal with the joint interactions of land use and transportation developments. Employing a more elaborate version of the UPTS-descended computer simulation models, the study could rightly claim sophistication in its methodology. Nevertheless, it did not accommodate feedback. The alleged relationship between land use and transport demand was more of a linear one-way causation, rather than interactive. MMETROPLAN's most controversial recommendation was for the adoption of cordon pricing around the CBD of Manila defined by C-2 (Quirino to Gov. Forbes Avenues). Justified mainly on economic grounds, it was supposed to precede a street-level light railway operating along four (4) radial roads. Rizal Avenue was conceived to be the first line, followed by Quezon, Shaw and Taft in that order. Significantly, the study found "no case for any fully segregated public transport system" and dismissed the metro alternative on economic grounds — arguing that "passenger flows were not large enough to exploit its full capacity."

The LRT-option gained momentum after 1977, propelled by the giants of LRT technology who smelled a potential sales in the making. The resulting attention relegated the priority (and low cost) recommendations of MMETROPLAN into side issues. Without a champion in the bureaucracy nor a likely reward to external proponent, cordon pricing fell on the wayside. The LRT, on the other hand, could count on powerful supporters — from contractors, equipment suppliers, financial syndicators, and foreign consultants. It can be said, therefore, that commercial interests created the impetus for the early adoption and implementation of an LRT system for MetroManila. The then political leadership, predisposed as it was to visible edifices, was only too glad to oblige.

The absence of a detailed feasibility study notwithstanding, a consensus emerged within government to go ahead with Line No. 1 along Rizal and Taft. The Belgian consortium edged out four other bidders on the strength of its financing package and proven quality of equipment. The absence of a Terms of Reference, or standard bid documents, led to technical differences among the bids so wide as to preclude direct comparison. Experimental technologies were frowned upon and with good reasons. The technical evaluation subsequently relied on the advice of the same foreign consulting firm involved in the MMETROPLAN study. The LRT Cabinet committee did consider other non-technical factors, but it was not clear how these factors (if they were itemized at all) eventually influenced the final choice.

FEASIBILITY AFTER THE FACT

One of the first tasks of the then newly-created Ministry of Transportation (circa 1979) was to review the LRT project and to produce a detailed feasibility study, even if only on hindsight. One wonders whether the project would have been cancelled if the numbers turned out to be unfavorable. Among the issues addressed in that 1979 study were:

- o The traffic rerouting problem that was expected to occur during construction.
- o Recalculation of the benefit-cost (B-C) ratio based on updated cost estimates (B-C ratio of 1.4 was derived).

- Comparison of an LRT option with an improved bus configuration (assumed as 250 articulated buses with 180 crush capacity). The bus option was later dismissed on grounds of capacity limitations.
- Evaluation of an elevated track, as a way of avoiding the complications of numerous LRT intersections with road-based vehicles.

The key findings and conclusions that had influenced the final shape of the LRT system were as follows:

- Absolute LRT signal pre-emptions were judged infeasible in many of the at-grade intersections. This led to the final decision to elevate the system throughout most of its length, contrary to MMETROPLAN. Cost naturally went up. Retention of the at-grade option would have severely restricted the passenger capacity of the system, which was its principal attraction.
- With no basis for the assumption that 80 percent of public transport passengers will shift to LRT, the feasibility study proposed the banning and/or rerouting of the buses and jeepneys along the corridor – as a kind of insurance. The jeepney interests naturally balked at the idea, and government was unable to muster the political will to implement the rerouting plans. (The first year results of operations proved that banning jeepneys was unnecessary).
- It anticipated cash flow deficits up to the 15th year of operations, despite a favorable assumption of soft term loans. Thus, the project went ahead with the full knowledge that it would be financially unviable.
- Management of the system was recommended to be privatized, on the tacit admission of the inherent inefficiencies of public corporations. This radical concept paved the way for the re-entry of Meralco (the pre-war operator of *tranvia*) into the transportation business.

LESSONS IN IMPLEMENTATION

The construction of Line 1 took about five years, one more year than originally envisioned although half-line operation started middle of December 1984. A major factor in the delay could be attributed to the professional inexperience and corporate troubles of the Construction Development Corporation of the Philippines (CDCP) – the civil work contractor imposed by the Government on the Belgian consortium. A full discussion of the construction management phase is not within the scope of this paper. Some lessons from that experience, however, are worth mentioning, viz:

- Actual construction proceeded without the benefit of advance detailed engineering designs. In such a case, estimates of costs and itemized breakdowns were not sufficiently accurate as to allow a fixed cost contract award. This tentative amount led to subsequent problems of financing. Moreover, relocation of utilities along the route and the rights-of-way acquisitions had to be rushed. The rush, in turn, precluded any value engineering search for cheaper alternatives to reinforced concrete columns and girders, or to foundation piles, among others. Adverse effects on road traffic and adjoining businesses could have been minimized during construction had there been adequate preparation.
- The use of an independent private construction management outfit proved to be a blessing. Although the service entailed a bill of about 4 percent of project cost, the sheer magnitude and complexity of the project would have swamped the bureaucracy. More importantly, it provided a credible counterfoil to the contractor who utilized its access to the presidential palace for every conceivable advantage. The effectiveness of contract supervision became all the more remarkable when compared to other government projects, e.g., the $10 M parcel processing plant of the Bureau of Post or the $2.3 B nuclear plant which had no equivalent third party project management set up.

WHERE'S THE NEXT LINE?

The question of expansion began to emerge as the construction of LRT's Line 1 (Rizal and Taft Avenues) headed for completion. Where would the next LRT line be? The impetus for such a feasibility study could be traced to several factors, e.g., confidence that the first line would be a roaring success, availability of funding for the study which was raised by Electrowatt Engineering Services, Inc., the Swiss company that also provided the construction management for Line 1, and natural attraction to policy-makers of hardware-intensive solutions to urban transport problems (and a corollary aversion to messy institutional solutions, no matter how inexpensive the latter may be). Contrary to expectations, the study sparked an agonizing search for a more relevant methodology in planning an LRT system. The healthy debates highlighted the imperfections of current planning approaches; it also suggested that foreign consulting firms may be using the Metro Manila case as their testing ground, if not their guinea pig.

The experimentation alluded to earlier was apparent in the simulation model used. Called Transport Strategic Evaluation Package (TRANSTEP), it was claimed to be a new generation planning model with feedbacks. Its development consumed a lot of time and effort which eventually subtracted from the overall analytical and creative phases of the planning exercise. As a result, an incomplete, albeit hurriedly-done, report was produced in 1982 which recommended Epifanio delos Santos Avenue (EDSA or C-4) as the next best line for LRT. Instead of appeasing many skeptics, the report stirred a hornet's nest which could only be resolved thru an explicit consideration of non-economic factors. After all, metropolitan growth is more complicated than what economists and engineers have thought it to be. This was, so to speak, comprehensive planning in practice.

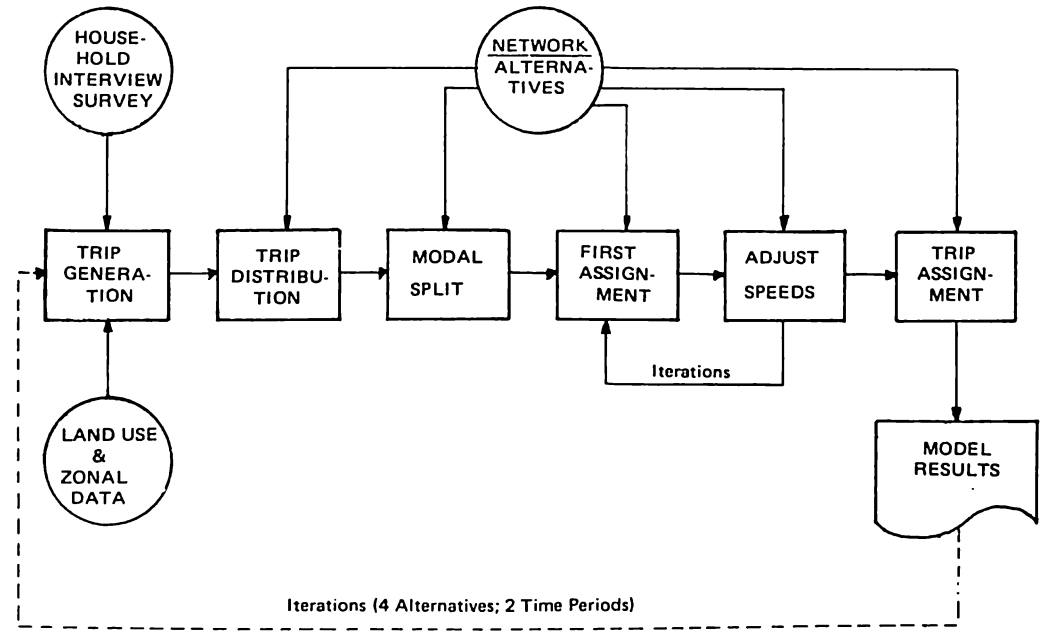
Three things conspired to make the planning of the LRT network expansion follow a different, if not a novel, track. These were: the availability of O-D data from home interview surveys of 1981, the confidence gained from successive refinements of the TRANSTEP Model, and the absence of pressure to rush the study. Figure 1 illustrates the modelling concept. Sets of assumptions are progressively inputed — from the more general to the more specific. Land use forecasts drive subsequent modules of the simulation model; choices converge to fewer and more detailed schemes as one proceeds to the back-end modules. Variations of the basic options entail computer runs, not of the entire model, but only of the appropriate intermediate modules.

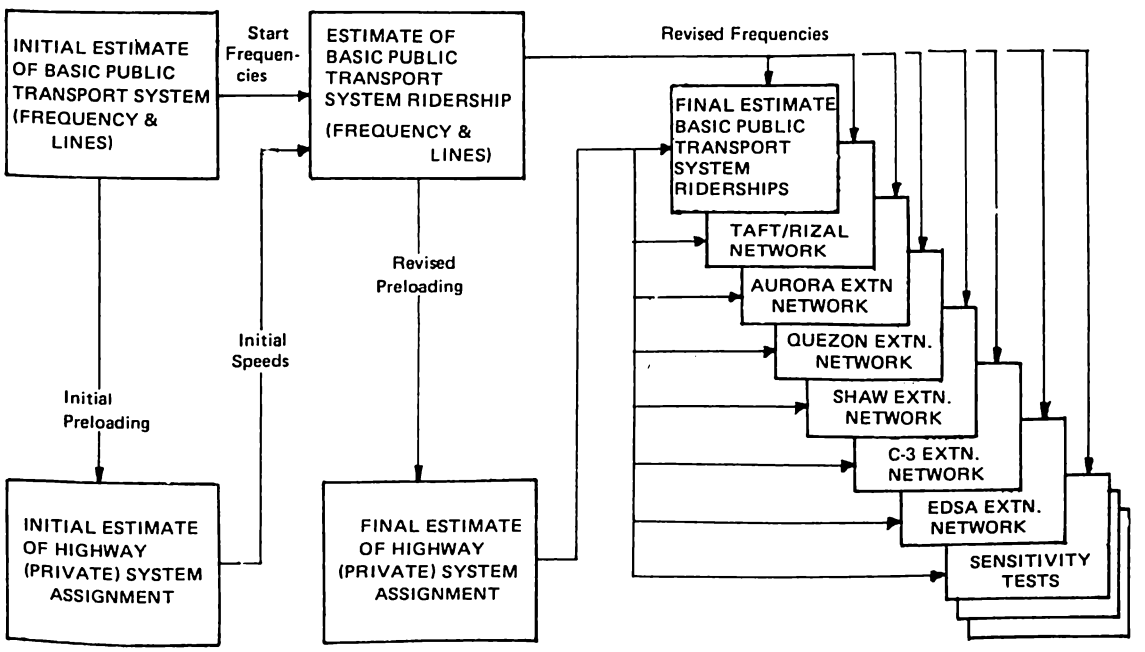
A STRUCTURED APPROACH

As a consequence of that model-based planning effort, a structured approach can be surmised. It allows the systematic consideration of economic and non-technical variables and plugs other participants into the planning process. Table 1 summarizes the hierarchical issues to be addressed — from the "fuzzy" to the more deterministic parameters. It is postulated that the technical issues (whose resolution are within the planner's responsibility) are embedded in a larger system (which are more in the realm of the public and policy makers). The implication of this structured paradigm is that planning and decision-making should proceed in sequence, from the general to the specific, rather than a non-ordered attempt at questions of differing levels of importance.

URBAN CONTEXT

That a project like LRT requires a conscious review of the desired urban development pattern can be deduced in Figure 2. If society's vision of a desirable city is closer to the sprawl development (typified by Los Angeles), then LRT is probably the wrong strategic investment decision to consider. At the other end of the spectrum is a more compact metropolis, a form that results in increasing densification thru time and one which rail-based transport reinforces and favors. Such an option did not enter the equation for Line 1; while it has been raised for the Line 2 study, the level of assessment was more academic and technical rather than political where it properly belongs.





Source: METRORAIL Network Options Feasibility Study, Vol. 2, Dec. 1985.

Figure 1. Simulation Model Runs for LRT Study

Table 1. Structured Planning for LRT

DECISION PHASE	KEY QUESTIONS	EXIT CRITERIA
1. *Urban development and land use pattern* LRT favors a central and dense development, rather than a dispersed or sprawl pattern.	* Is the forecasted growth of the city inevitable or non-controllable? * Is the land use and development pattern implied by the forecast desirable? Can it be avoided or altered?	* Population growth forecast looks reasonable & supportable during the planning period. * Development pattern is a realistic balance between what is desired and projected, i.e., realizable.
2. *Corridor Capacity* A chosen development requires a level of accessibility that may be beyond the maximum capacity of roads.	* Is the LRT the least-cost mode that can provide the additional capacity? * Have all low-cost measures (e.g., traffic management) been tried? Will these still be inadequate?	* Existing roads cannot be widened & surface modes (jeepneys & buses) have reached their limits. * Low-cost measures will only buy time but not a long-term solution to capacity deficiency.
3. *Economic criteria* Traditional benefit cost analyses.	* Is the B/C ratio $\rangle$ 1.0 or the IRR higher than prevailing opportunity cost of capital? * Is the composition of benefits acceptable and defensible?	* Project is provisionally viable in an economic sense, if answer to the question is yes. * Benefits normally consist of vehicle-hrs, passenger-hrs, and fleet savings.
4. *Financial Criteria* Projected revenues exceed operating costs; the capital need is of scale that can be afforded.	* Is the project self-liquidating? If not, can the subsidy be accommodated? * Can the investment be absorbed now, or can it be deferred? * Can a financing package be secured that can make the cash flow picture manageable?	* A project that can cover its full cost justifies itself. Subsidy maybe OK, w/in limits. * Capital budget has not been fully committed to higher ranking projects. * Interest cost on loans are low, repayment terms and conditions are very attractive.
5. *Risks and other considerations.*	* Will the project be still viable under a worst-case scenario? * Should the government pay for the investment or can the private sector be tapped instead? * How lumpy is the project compared to the overall investment program of government?	* Sensitivity analyses under various combinations of possible events (downside risks) do not produce B/C ratio $\langle$ 1.0. * Private sector is unable to invest in additional transport capacity. * Execution of the project does not pre-empt other small but worthy investments; LRT cost represents only a minor fraction of the overall capital budget.

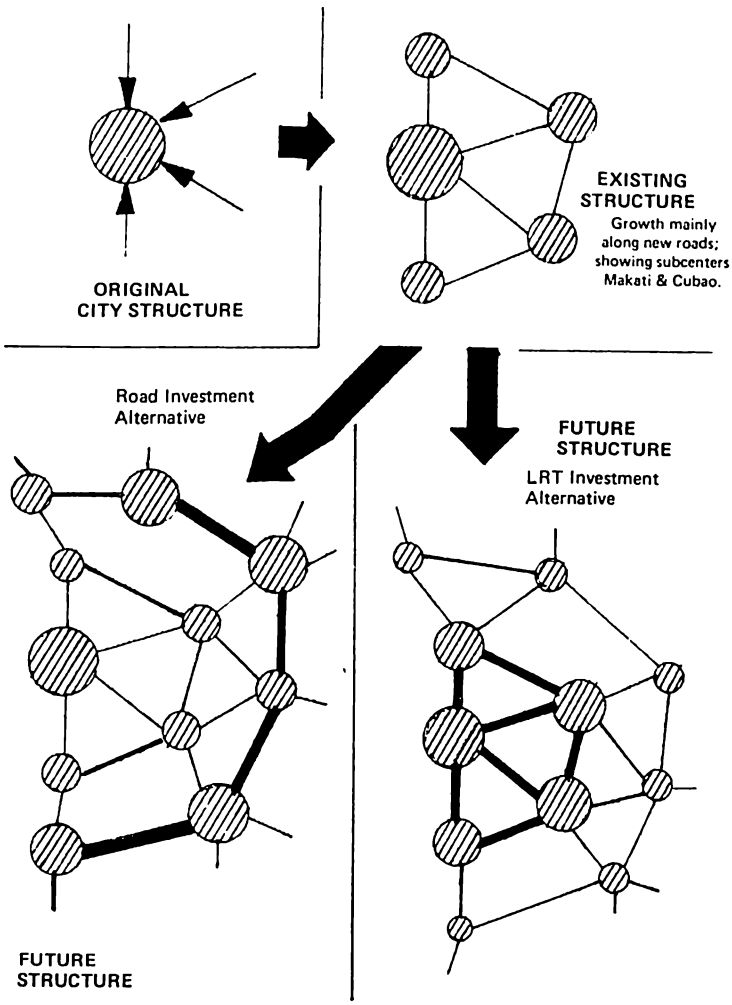


Figure 2. Urban Structure and Transport Development

The question of route or alignment is central when it comes to a fixed mode of mass transit system. Necessarily, the alternatives must be generated from a forecast of the shape and the size of the urban area. The MetroManila scenario falls between a continuation of past trends and a partial success in controlling the sprawl. This was operationalized in the three base case (corresponding to years 1980, 1990 and 2000) simulation runs.

Six possible network options (see Figure 3) were identified as a result. These corresponded with the broad alignments of high travel demand corridors. The evaluation of options against several criteria (growth potentials, capacity constraints, major destination points and social impacts) is summarized in Table 2. The process narrowed down the choices to two promising routes: Aurora and EDSA. The first happens to be the best radial route (Aurora line) and connects three areas with the strongest transport attractions, viz., Binondo, Quiapo, and Cubao. EDSA, on the other hand, emerged as the preferred circumferential network. It, too connects major centers but is tempered by long intervening stretches of low land use activity. Regeneration of the old city center is associated with the Aurora option, while EDSA, with increased accessibility to the outer areas. Public transport dependent population, i.e., the lower-income families, are highest along Aurora and relatively less dense along EDSA.

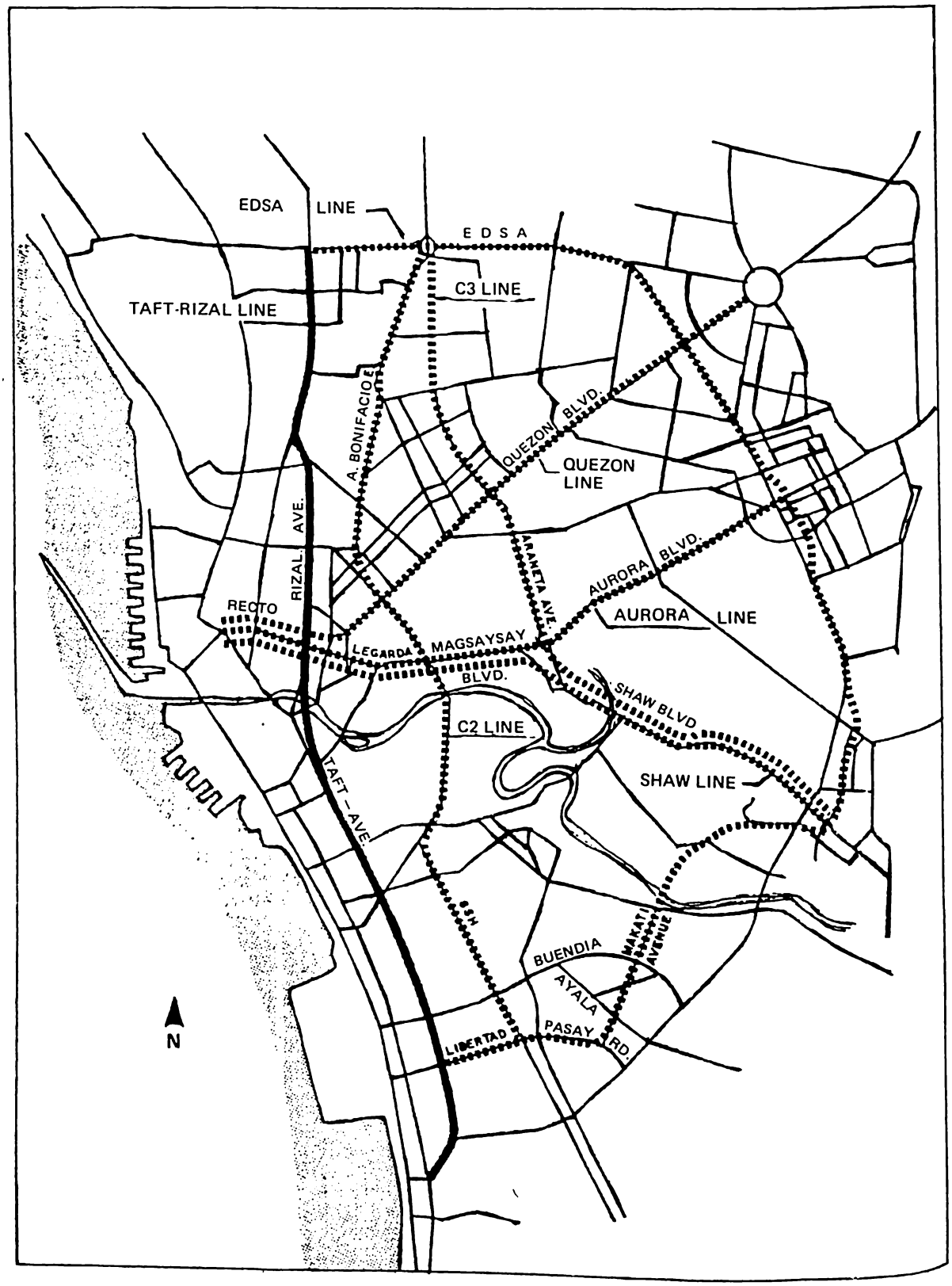


Figure 3. Alternative Lines for LRT.

Table 2. First-Stage Evaluation of LRT Network Options

OBJECTIVES	ACHIEVEMENT INDICATORS Primary	Secondary	VALUATION	WEIGHT	LINE OPTIONS Shaw	Aurora	Quezon	C-2	C-3	EDSA
IMPROVE CONDITIONS FOR TRANSPORT USERS		Improved accessibility of city	Qualitative	Medium	"High", removes existing bottle necks and relieves restriction on movement.	"High", same as Shaw	"Medium-High", similar impact as Shaw & Aurora but only in Manila CEO & end of line.	"Medium to Low" provides only marginal improvement in accessibility.	" Medium", provides missing links along C-3 section.	"Low", provides only marginal accessibility improvement, lesser than C-2.
LOWER TRANSPORT SYSTEM COSTS	Low costs of Metrorail	Improved corridor transit capacity	Qualitative	High	"High," no spare capacity or potential for widening to accommodate more road traffic.	"High", same as Shaw.	"Medium", some potential left for capacity increase of road-based transport.	"Medium": C-2 still has some potential for improvement; "Low": Superhighway section.	"Low": C3 can precede the Metrorail w/capacity for future needs; "H" along Shaw.	"Medium" still has potential for improvement constraints to Shaw first at bus stations.
IMPROVE ENVIRONMENTAL AND URBAN CONDITIONS.	Improved traffic safety		Vehicle-km for road-based traffic	Medium	"Medium": reduction of vehicle-km by 2.5%.	"Medium": By 2.5%	"Medium": By 3.1%	No information available.	"Low": By 1.2%	"High": By 6.0%
	Improved Urban Development	Improved accessibility to major centers	Number of trip generation along Metrorail lines	High	"High": in Cent Manila area; "M L" at Shaw & EDSA crossing (High employment forecast for year 2000.	"High": Existing main centers at each end, commercial areas in Binondo & Cubao, plus school sites.	"High": Central Manila area "Low": Outer end of the line.	"Medium to Low" Transport attractions are medium to low magnitude distributed equally on the line.	"Medium to Low" Line is considered strong at the ends but weak in between.	"M to High": connects 4 distinct locations between stretches of low activity.
		Reduced urban sprawl effects	Qualitative	Medium	Metrorail in general tends to reduce urban sprawl, whilst road-based solutions encourage sprawl. Differences between network options in reducing urban sprawl are marginal. However, all circumferential options tend to favor North-South axis of development; radial options, an East-West orientation.					
		Regeneration of CEO	Qualitative	Medium	"High": Metrorail serves areas suffering from urban decay.	"High": same as Shaw.	"High": same as Shaw.	"Medium": Metrorail bypasses main center but touches fringe of decay.	"Low": Bypasses old city center entirely.	"Low": same as C-3.
	Reinforcement of Existing Centers		Quallitative	Medium	"Medium": high reliability in terms of land use prediction in the center; "L to M" in the outer less developed areas.	"High": Metrorail connects 2 existing major centers & has therefore reliable ridership predictions.	"Medium to Low": High in the central area but weak in the outer areas.	"Medium to Low" Chances for substantial redevelopment are lower than those along established corridors.	"Low": existing activity pattern on lowside & based almost entirely on development expectations.	"Low": Metrorail w/least effect on land use because of existing high level of accessibility.
	Improved Access for Public Transport "Captive" Population		Length of sections differentiated into heavy or moderate use of public transport	High	"Medium": High public transport dependency along Magsaysay Blvd., slightly higher car ownership along other sections of the line.	"M to High": except for a small area in middle of the line, majority of population public transport dependent.	"Medium": Half of Quezon line strongly dependent on public transport; outer half with high car ownership level.	"High": Residents along C-2 have a high public transport dependency.	"Medium": Along C-3 population depends less on public transport.	"Medium to Low" Car ownership levels are medium to low, hence public transport dependency is not too strong.
OVERALL RANK					"HIGH-MEDIUM"	"HIGH"	"MEDIUM"	"MEDIUM-LOW"	"MEDIUM-LOW"	"MEDIUM"

CORRIDOR CAPACITY

Unlike in cities of developed countries, the principal advantage of a Metrorail line in developing country cities is high public transport capacity in the chosen corridor. Diverting or attracting ridership from cars and other modes is as less important as the goal of meeting the anticipated needs of a future urban populace in a proposed urban development. Paramount in the case of MetroManila's LRT is a satisfactory means to relieve existing bottlenecks in corridors where expansion of the road system is either too difficult or expensive. This principle is illustrated in Figure 4.

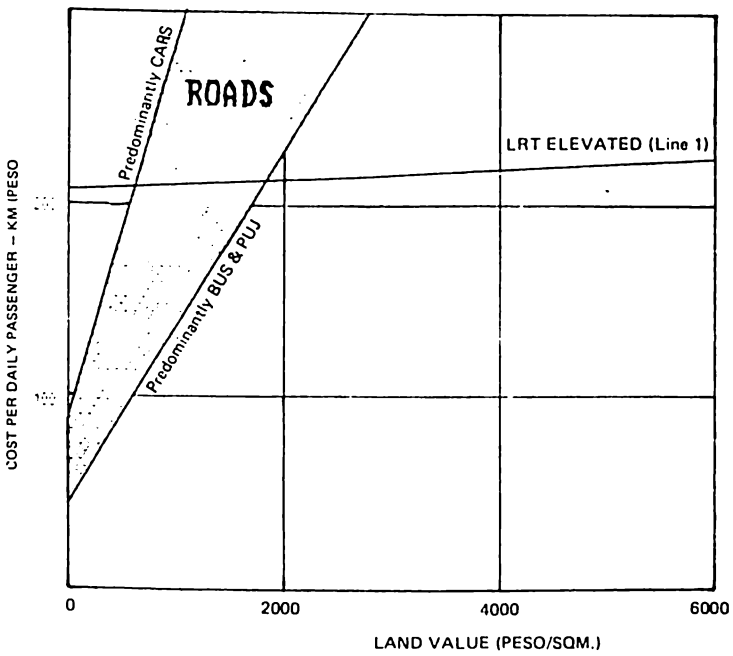


Figure 4. Cost of LRT vs. Road

Future road improvement plans, including traffic management measures, are unlikely to improve substantially the capacities of the radial corridors in MetroManila. Thus, if no other treatments are undertaken, there will be further worsening of congestion which are already manifest along most radial roads with high public transport demands. This scenario applies to Aurora, particularly. The congestion outlook is not as grim for EDSA, since proposed road constructions along C-3 and C-5 will alleviate the existing bottlenecks at some of its segments.

While not impossible, performing computer simulations in order to generate traffic forecasts for all of the six line options would have been too costly and time consuming, aside from being impractical. Model runs for the three time periods and with varying assumptions on fares, population levels, restrictions on competitions, and value of time were therefore produced only for the Aurora and EDSA options. The base case of "without LRT" assumed the completion of roads in the future according to plans.

ECONOMIC ASPECTS

Table 3 presents the results of economic analysis for the two preferred lines. Although moot and academic, the economic viability of Line 1 was also recalculated. By all economic indicators, the Taft-Rizal line scored highest. As a system, the addition of either Aurora or EDSA results in a lowering of B-C ratios and Internal Rates of Returns (IRRs). Calculated incremental internal rates of return is 22.2 percent for the Aurora line and 20.3 percent for the EDSA line, based on the assumption of distance dependent fares and free transfers between Metrorail lines. From an econo-

Table 3. Benefit Cost Evaluation of LRT

		Taft-Rizal Line Network	Taft-Rizal/ Aurora Network	Taft-Rizal/ EDSA Network
Distance-Dependent Fare w/Free Transfer				
○ B-C Ratio	–		1.57	1.49
○ IRR	–		20.70	20.30
○ Incremental IRR	–		22.10	20.30
Flat Fare				
○ B-C Ratio	–	1.59	1.27	1.25
○ IRR	–	20.30	.18	17.80
○ Incremental IRR	–	Base Case	Base –.02	11.10

Notes: a) Opportunity cost of capital = 15%
b) Assumes no bus competition along EDSA
c) Value of time constant at P1.70 in 1980 prices
d) Value of unit benefits by type, as follows:

Passenger time = P1.93/hour
Vehicle time = P10.716/hour for PUJ
= P51.735/hour for PUB
Vehicle time = P48,750 for PUJ
= P315,450 for PUB

mic viewpoint, a new system should prove its feasibility under equal competition from street modes, hence, the variable fare.

The streams of benefits consisted of three kinds, viz: passenger-hours saved, bus and jeepney vehicle-hours saved, and purchase costs of future bus and jeepney vehicles which would otherwise be acquired without LRT to meet peak hour travel demands. In addition, some consumer surplus are derived by other vehicles which move into the space vacated thereby. Capital and operating costs were taken as they are, i.e., without shadow pricing. In schematic form, the aggregation of benefits and costs is shown in Figure 5. The economic methodology is as conventional as you can get, but doubts linger about the non-inclusion of annual subsidy on the cost side. It can be argued that it represents a real cash outflow. On the other hand, if such amounts are due to debt servicing, a double counting may happen. Fortunately, the B-C analyses were not very sensitive to cost variations.

FINANCIAL ASPECTS

It is posited in Table 1 that passing the economic hurdle is a necessary but insufficient condition. Public sector decision-making has to consider also the possible financial implications of the project. Can the Philippines or MetroManila afford the capital cost and the anticipated yearly subsidies? It is a question that rarely bothers traditional politicians or bureaucrats, since the headaches will be on their successors. Taxpayers ought to raise it, since it is they who will ultimately foot the bill. The fact is that fare-box revenues invariably fail to cover operating costs — by as much as 50 percent to 20 percent — if the experiences of other countries are any gauge, and these are at fares five times the level of Manila's.

Construction of Line 1 (Taft-Rizal) amounted to P3.5 billion, 85 percent of which was funded out of borrowings. Historically, public investment in transportation projects in MetroManila constituted less than three percent of the national total infrastructure expenditures. During the construction of LRT Line 1, this ratio jumped to seven percent and ate up more than 60 percent of the capital outlays for the metropolitan region. It only meant that other sectors and regions had to be sacrificed in favor of LRT.

The Aurora line would need P4.4 billion in capital cost for about 9 kms. distance from Divisoria to Cubao. On the other hand, EDSA line would cost P7.4 billion for the 22 kms. stretch. If built

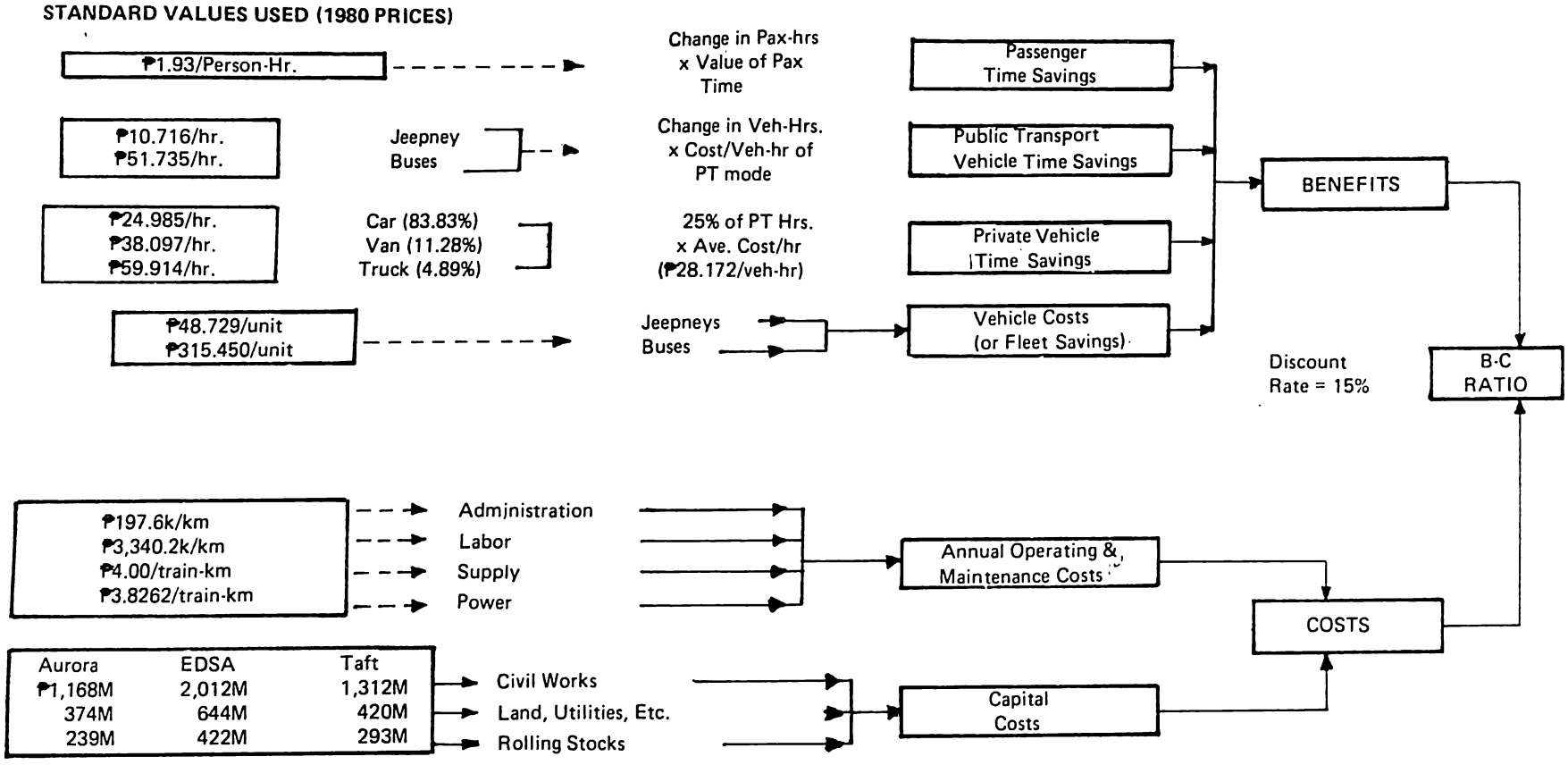


Figure 5. Composition of Benefits and Costs

over a three-year period, the investment outlay would range from P1.4B to P2.5B per year. It is interesting to note that transport investment in Metro Manila has not gone beyond P1.2 billion per year. With the economic downturn of the last years, the projection is even lower or a level of P0.5 billion per year up to 1990. Clearly, the LRT project is too lumpy as to be out of scale with available public funds. Unless government is prepared to divert resources from other projects and other regions of the country, Line 2 of the LRT system cannot be afforded earlier than 1990.

A graphical portrayal of the financial predicament of the Line 1 during its first 10 years of operation is shown in Figure 6. While positive operating margins are forecasted, the heavy debts will more than eat up the cash balances especially during the early years. Under such scenario, the survival of the LRT system will hinge on its ability to secure an annual subsidy (approximately P150 million per year up to year 1995), to reschedule its debts, and to profit from commercial rents on its stations. Unfortunately, the latter opportunity had been surrendered to the PGH Foundation under the behest of the MetroManila Governor.

The financial returns for Line 2 on either of the two options are also not attractive enough to deserve national priority. The income for the new line, will be no better than that for Line 1 (Taft-Rizal). In fact, the addition of Line 2 will increase the net losses of the system due to higher interest burdens. Combined operating profits would go up marginally with the Aurora option, but would skid downwards with the EDSA alternative. In other words, choosing the Aurora line means a lower subsidy (P342 M per year for the first five years of operation) than EDSA (P553 M).

A related policy question is the matter of equity and government participation. Extending the LRT network will boost its share of the trip market from less than five percent to about 11 percent by year 2000. Would it be fair to invest billions of pesos on a single public undertaking that would have a minimal impact on the overall travel market? Moreover, an LRT expansion (by its very nature, a public sector undertaking) contradicts the stated policy of leaving the transport business in the hands of the private sector. It implies a larger role for government.

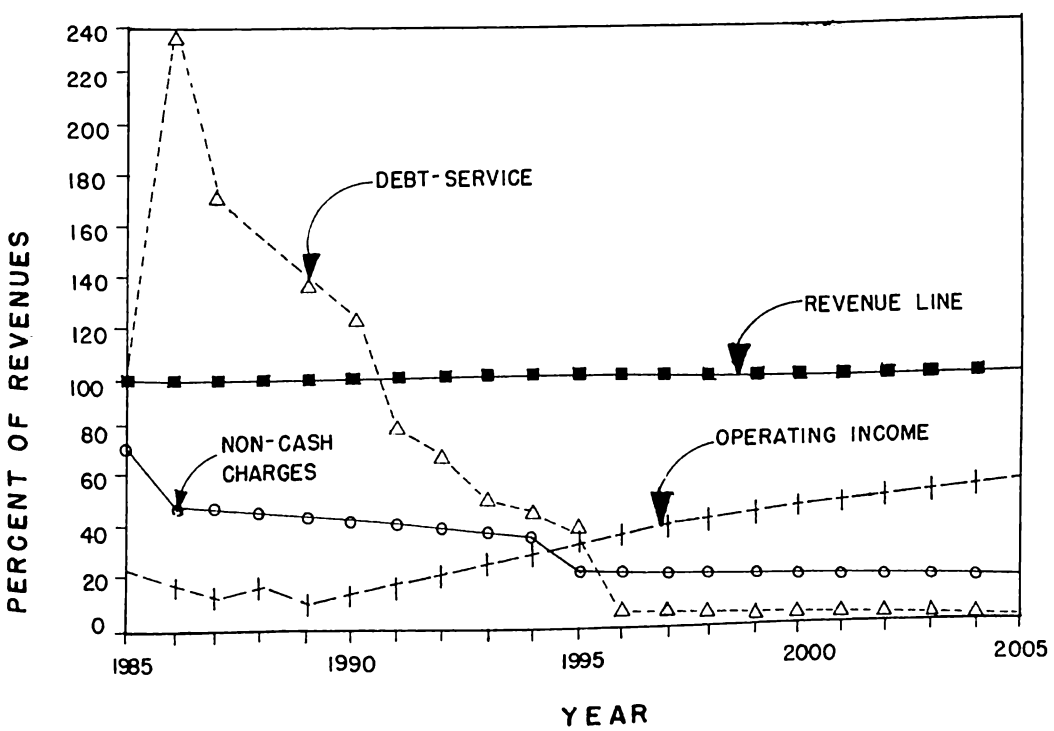


Figure 6. Financial Outlook for LRT Line 1

EVALUATING RISKS

The structured planning framework presented earlier requires the LRT project to pass another hurdle before a firm decision to implement can be justified. This final phase deals with risks and uncertainty, including the robustness of the assumptions used in the previous analyses. Their resolutions are judgemental in nature and may point out promising areas for sensitivity analysis.

One of the more nagging issues is about the ability of LRT to influence land development. Bold planners argue that the LRT line for Metro Manila should be towards the developing suburbs southward, instead of to the old built-up area of central Manila. This view is based on two risky, but theoretically appealing, assumptions:

- That an LRT is better used in serving low-density suburbs, which implicity accepts the North American model of rail systems attracting car-based trips;
- Patronage or riderships should come from future travel demands, which is in contradiction to the corridor-capacity constraint criterion mentioned earlier.

In the absence of empirical evidence, to locate an LRT line according to anticipated or assumed growth is an act of faith. It is very risky. Besides, the transport demand in suburban corridors exhibits directional and temporal peaking during the day — a phenomenon which would make a rail-mode of transport underutilized most of the day.

Another uncertainty factor is the predicted travel demand levels which is a function of population growth and their distribution as to residences and workplaces. The Metrorail study adopted a 13 million population forecast by the year 2000, which is about 20 percent higher than the medium estimates of National Census and Statistics Office (NCSO). Given the slowdown of urban growth in recent years, a lower estimate may be more reasonable. Computer model runs at lower values suggest a reduced viability for a second LRT Line. Prudence dictates a farther postponement of the LRT investment, if greater weight is given to the lower population and wider dispersal assumptions.

Another way of dealing with the uncertainties (attendant to a decision to go ahead with an LRT extension) is to examine possible combination of events that may favor (or disfavor) it. Factors that would raise the odds for an expansion are:

* increase in fuel prices,
* intensification of development within C-4,
* failure of regional developments outside Metro Manila,
* shift to a variable fare,
* acceleration of economic growth, and
* continued inefficiencies of road-based transport modes.

Judgements have to be made as to their likelihood. What can readily be conceded is a long term trend towards a higher value of time — a doubling of which produces a 26 percent jump in B-C ratio from 1.59 to 2.01 for the Taft-Rizal line. Too, incremental IRR for Aurora would flip from — .02 percent to +32.9 percent. Curtailment of street-level competition (i.e., from buses and jeepneys) would also favor an LRT investment, more so for the EDSA line than Aurora. On the other hand, the converse of these aforementioned factors plus continued peso devaluation represent the downside risks that militate against another LRT Line.

LOOKING AT OTHER SYSTEMS

There are something like 320 urban areas in the globe which now operate local rail systems in one form or another. A straight forward comparison among them may be misleading because of many differences — car capacity, propulsion, tracks, stations, headways, operating scheme, etc. Even their planning had to be site-specific. However, to the extent that they do provide a point of reference, Table 4 maybe useful.

Table 4. Comparison of Selected LRT Systems

	MManila	Vancouver	San Diego
Metro Population	7.0 M	1.2 M	1.9 M
Length in Kms.	15 Kms.	22 Kms.	25 Kms
Total System Cost	$212 M	$500 M	$86 M
Level of tracks	elevated	elevated	semi-elevated
No. of Stations	18	15	18
Cost/Km.	$14.1 M	$22.7 M	$3.4 M
Ave. Ridership/Day	250,000	100,000	14,000
No. of LRVs	64	114	25
Crush Capacity	375	100	400 (?)

One important observation is that in terms of service utilization (e.g. number of riders and cost/km.), the Manila LRT looked more defensible and cost-effective than its critics may concede. Another obvious conclusion, not just from the above table but from the experiences of 268 or so pure LRT systems in the world, is that Third World cities used them more intensively. They are also of far bigger population. A city of less than 4 million should probably not look at LRT, unless it is wealthy. Kuala Lumpur, with its population of about 1.2 million, would have been an exception had it proceeded with its LRT plans.

SOME CONCLUSIONS AND SUGGESTIONS

The planning tasks are far from finished for Manila's LRT. One line does not make a system. Other public transport modes need time to adjust to it and function in an integral manner. The structured framework suggested in this paper reveals the gaps and sets out the orderly sequence of decisions yet to be taken. It is patterned after the "building-block" approach.

On top of the list to be attended to is how to shift to variable fare, or some kind of staged fare. This may entail redesign of station exits/entries and change of gate pass from token coins to tickets. Total revenues are expected to improve considerably, but at the cost of the competing road-based public transport modes.

Acquiring additional railcars (above the present 64) to meet growing demand on Taft-Rizal is the next agenda. The forecasts indicate rail-car deficiency by the early 1990s. Careful monitoring of ridership levels will be needed to allow sufficient lead time (about three years is needed) for ordering, manufacturing and delivery. Local assembly could also be explored or tested during this period. A minor extension of Line 1 farther to the south appears promising, if only to decongest the Baclaran terminus and connect the Manila international airport.

Line 2 is the biggest item looming on the horizon. To implement or not to implement. This paper takes the view that government should not yet bite the bullet. If there are any lessons to be learned from Line 1, the engineering design should be completed first to arrive at "hard" cost estimates and before any construction award is made. This important phase was short circuited, with bad results in the case of Line 1. Early acquisition of rights of way can also be synchronized with the detailed engineering phase.

More critical and urgent than the engineering study is the conduct of additional sensitivity analyses for the Aurora option before an irrevocable commitment is made. *Make haste slowly is advisable, when it comes to an investment this huge.* Foreign mercantile interests will surely push for an early timetable. With the local availability for the computer simulation model, the planning exercise can be conducted by Filipino planners without resorting to expensive foreign consultants. The analyses should contribute to the sharpening of the capability of Filipino professionals, if not improve the quality of public decision-making.

The feasibility study for Line 2 did not investigate the options of exclusive busways or reserved buslanes. The projected average loadings on the Aurora line (about 10,000 passengers at AM peak) are not beyond the capacity of the bus mode. While this prospect is in the borderline because of the difficulty of enforcing Public Utility (PU)-only lanes and the extreme congestion that exists, nevertheless, it deserves a closer scrutiny because of the high costs of an LRT Metro.

Omitted in the planning process in the past was the public, or at the very least, the local governments of affected municipalities: Manila, Quezon City, and San Juan. It would also be advisable to bring private developers into the planning loop in order to realize the full potentials for land developments along the route. Commitments from these two groups may influence the eventual alignment and profile, if not the final decision and the construction costs.

An issue worthy of policy research is the matter of annual subsidy implicit in an LRT investment. Will it be more optimal to grant this amount (capital and operating subsidy) to commuters or to private transit operators, rather than in an LRT project? This question is not academic in the light of the privatization thrust. Consider, for example, the appropriateness of the Aurora Line. With the projected 296 thousand riders per day, the capital cost will be equivalent to $700 per rider for less than three percent of total daily urban trips. The subsidy translates to $0.19 (P3.84) per trip. For lesser amounts, the government may be able to procure the same service levels from private bus operators or induce the commuters to go elsewhere.

No one disputes the fact that many considerations — economic and otherwise — enter into the planning and decision-making for a mass transit system. More than simply rattling off these issues, however, is a pragmatic and systematic way of resolving them in the context of a third world city.

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