Infrastructure Investment – Vital for Quality Public Transport

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a report by
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Public transport should not be visualised simply as a collection of separate routes. At its best, public transport can also be a 'seamless' network, meaning that travel throughout the region is convenient to customers. Although this is not easy to achieve in nations with weak administrative institutions, if accomplished it can do more than provide good transport – it will support other goals of developing urban regions. Investment in key infrastructure is almost always going to be a necessary factor in forming a successful network.

Integrated networks are often criticised because they require many users to transfer. However, these critics' underlying assumption is one of constant frequency of service. If more than one route can be altered at the same time, as is usually the case in real networks, a more relevant assumption is one of equal operating budgets for several alternative groups of services within the same area. In actuality, the frequency of service that can be offered could be much higher, depending upon route structure and the fare revenue it attracts, as well as the modes of transport used on the various routes. There are analogies from other transport sectors.

Freight rail companies in the US have succeeded in reducing costs and improving service by enlarging and improving the co-ordination of their networks.

Robert Krebs, Chairman of the Board, Burlington Northern Santa Fe Railway (BNSF), said at the 2001 Transportation Research Board annual meeting in Washington, DC:

> *"Mergers allow railroads to create broader, seamless, more productive networks that offer customers better transit time and more value for their transportation dollar. Capital investments allow acquisition of more efficient equipment (locomotives, maintenance-of-way equipment, etc.), and the ability to remove bottlenecks from the rail network that makes our employees and our infrastructure more productive."*

Similarly, the US's large airlines have been either enlarged further through mergers, or through joint fares and schedules. They work together with commuter airlines for short trips and with international airlines for long trips. The benefits that rail companies and airlines claim also apply to urban public passenger transport.

At this point, it is useful to define different categories of rights-of-way, using definitions from Vukan Vuchic[1]. Public transport modes using right-of-way C operate in mixed traffic of all vehicle types. Modes using right-of-way B have lateral separation from general traffic, but still have at-grade crossings. This is typical of light rail transit (LRT) and bus services. Right-of-way A modes use total separation on a private right-of-way. This is typical of underground trains and mandatory for automated systems (examples are given in *Table 1).*

Table 1: Categorisation by Public Transport by Right-of-way Standard

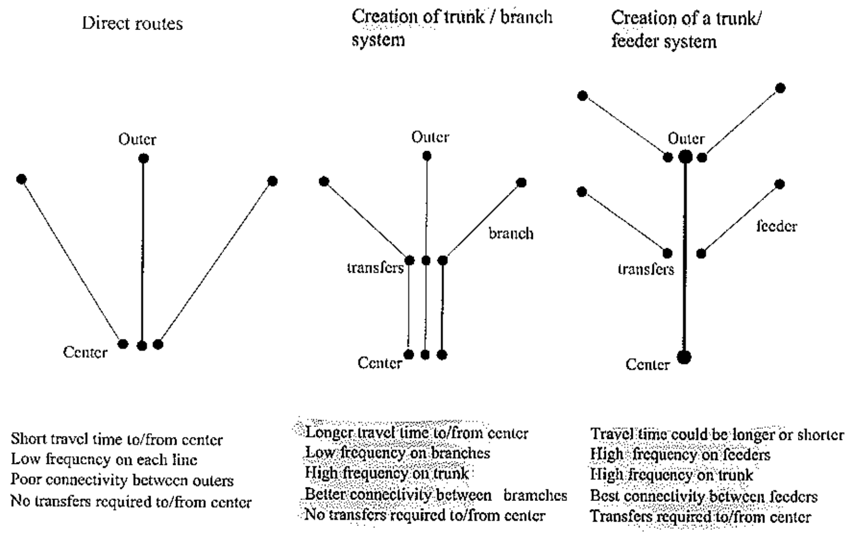
Definition	*Examples*
A grade separation	*Mexico City and Sao Paulo underground trains, Kuala Lumpur automated trains*
B lateral separation	*Strasbourg France and Sacramento US LRTs, Curitiba bus services*
C mixed traffic	*All 'jitneys' and vast majority of bus services*

A co-ordinated network involving services using modes with different right-of-way standards can, on balance, provide better service to the bulk of users than a multitude of overlapping routes. In the case of cities with large populations and long travel distances, it is the only method that can provide both sufficient capacity and reasonable travel times. An example of a hypothetical corridor and conversion of separate routes into two different types of co-ordinated systems will help explain the trade-offs.

Figure 1 shows three different ways of providing

1. *Vukan Vuchic (1981),* Urban Public Transportation: Systems and Technology, *Prentice Hall.*

Figure 1: Comparison of Three Service Configurations with Similar Operating Budgets



service. Assume that an equal operating budget is available in each case. The first way, 'direct routes', provides direct routing towards the centre. It provides the shortest travel time and direct service to the centre, but it requires travellers going to destinations on other routes to transfer in the centre. Thus, for destinations not on the same route, the trip is circuitous and travel time is long.

The second way, creating a 'trunk route with branches' configuration reroutes travellers to and from the outer branches to a common trunk section. It improves connectivity because it opens up the possibility of transfers between outer points on the branches without going all the way to the centre first. Focusing only on one route highlights the negatives of a more circuitous trip for those going to the centre, while neglecting the positive features. One positive is the very existence of connections between outer origins and destinations without going all the way to the centre. With unco-ordinated services, there may never be a more direct route between them when there is low demand. Another potential positive is that a trunk can increase the frequency of service and capacity along the corridor into which all of the routes have been funnelled.

Now the logic of the third way, creating a 'trunk/feeder system' becomes clear. If connectivity between outer points is important, then traffic needs to be collected to a common point closer to the outer end. If this is to be done in any case, a co-ordinated use of modes can improve frequency on the branches as well as the trunk. By operating fewer but higher capacity vehicles on the trunk section, the saved vehicle-hours from the smaller vehicles that otherwise would have operated on this section can be reinvested into increasing the frequency on the feeder routes. Such shorter routes also allow services more closely tailored to the specific needs of specific communities. Thus, even better service can be offered to all points. The negative attribute of the separate trunk configuration is that transfers are now mandatory for all travellers between the trunk and what were formerly branches, but the wait will be short in high-demand periods. In low periods, connections can be timed for minimal waits. In summary, the benefits to using feeders are substantial while the negative impact of requiring transfers can be minimised.

An increasing accumulation of passengers is an argument that can strengthen the merits of a separate trunk configuration further. Removal of private vehicles and upgrading of trunk lines to a higher standard is much easier to justify and implement when there are very high volumes of passengers. This is, in fact, the principle of the highly acclaimed system in Curitiba, Brazil – extraordinarily large buses running on right-of-way B, with connecting radial and tangential routes that use buses of several sizes. Many of the world's public transport networks with heavy usage use this configuration and witness a large volume of transfers.

Yet another advantage of using trunk lines when rail technology is used is that daily peak demands and growth in demand over time can be accommodated on this trunk at low marginal cost, through the lengthening of train size. Furthermore, progressive investment strategies are possible as demand and finances dictate. Curitiba is now looking at conversion to rail as demand taxes the capacity of some of its bus lanes. Whether further upgrading to right-of-way A can occur will depend on the investment resources available.

Most analyses performed by lending institutions emphasise short-term monetary costs, but downplay benefits, especially when they are long term. Most large cities are located where they are because of their historical close proximity to high-quality agricultural land and natural resources. Yet, this same valuable land is coming under intense pressure over time from population growth and/or motorisation. Meanwhile, freight mobility is increasingly being hampered by chaotic development and traffic conditions.

Due consideration must be given to denser development patterns that can be achieved around high-capacity infrastructure. With supporting policies, there is hope of restraining growth in motorisation and sprawl. Air pollution too is not only an immediate health hazard; CO_2 is warming the atmosphere, bringing climate instability and future problems. Cities with high-capacity infrastructure can be dense enough for effective use of large electrically powered or fast-maturing fossil fuel/electric hybrid vehicles and for convenient non-motorised trips.

By contrast, a transport system without public transport infrastructure providing right-of-way A or B is likely to be based primarily on small-capacity, low-technology public transport vehicles operating in mixed traffic. When public transport is much slower and even more unreliable than private options, it will be all but impossible to restrain even further growth in motorisation.

Another result of a primary focus on monetary costs is that the value of travelling time by the underprivileged is considered low because their incomes are low. The implication is that it is acceptable to burden low income people in large and congested cities with extremely long travel times. This is debatable ethically, as the underprivileged population's travel time is equally important to that of the privileged.

There are also safety benefits from high-quality public transport. As income grows, people will find alternatives to poor service, such as motorcycles. These can be acceptable in small numbers, but the result when they proliferate is serious air and noise pollution and a terrible human toll in accidents. In Vietnam, 25 people per day die from motorcycle accidents and many more are maimed, and motorisation has just begun. In general, pedestrians are the biggest losers of all, as they are the most afflicted by private motor vehicle hazards but do not receive any mobility benefit.

Another example of a benefit comes from the Tren Urbano, the new rapid transit line in San Juan, Puerto Rico. The project was designed such that locals learned the operating, maintenance and planning skills in running a modern railway.

There is reason to be sceptical that private investment capital can replace public capital for public transport systems. Sky Train in Bangkok is an example of a privately financed, high-performance but high-cost line. To try to recover their investment, the fare had to be set so high that the people most needing it cannot afford it. It is made even less affordable by not offering joint fares with connecting services. Instead, it is most attractive to those who can already afford an automated vehicle. Meanwhile, much of its capacity goes unused.

Many of the potential benefits of a system like Sky Train do not accrue in ways that can be charged for by investors, going instead to the community-at-large. Therefore, the decision to build can not be based only upon profit considerations. Moreover, a vexing problem to attracting private investment is the uncertainty. The usage and fare levels of transport systems will depend possibly on urban policies and economic conditions that can change over the long life of transport infrastructure and rolling stock. In the same speech quoted earlier, Robert Krebs explained that despite his company's reputation as being the best-run railway in North America, Wall Street is now denying his company capital at reasonable rates. In fact, BNSF has spent US$2.2 billion over the last two years buying back their own stock. If a rail company with a proven solid record of profits no longer makes enough to satisfy investors, it seems unlikely that a speculative venture in a developing nation will do much better.

One alternative is to allow development rights around stations in return for financing the transport infrastructure. The recently completed Manila Mass Rail Transit line was built using this concept. However, it demonstrates that there must be careful negotiations, as the physical design for connections to buses, 'jeepneys' and non-motorised travellers did not receive proper attention. There is also the potential problem of displacement of lower-income people to the fringes if land values increase too much. Thus, this funding technique is problematic and can be used only in selected circumstances.

As World Bank publications emphasise continually, private operators can be used to reduce costs. Indeed, to encourage continual service expansion, any private operator that shows they have found a new niche could receive subsidy on the same terms as operators of existing routes. There are limits, however, to how much competition can improve service. A public transport system is also an engineering design problem. Operating efficiency comes, not just from management practices and market incentives, but from higher operating speed, higher capacity, higher reliability and a network that distributes its capacity wisely.

Small cities can have adequate service with public transport based on right-of-way C. Medium-sized cities will need upgrades to modes using at least right-of-way B, in order to create an attractive public transport system. Large cities will need modes on right-of-way A if large numbers of their population are to cross the city in a reasonable amount of time. Intelligent Transportation Systems technologies, such as traffic signal controllers, have to be adapted for less developed nations that favour public transportation over private vehicles (no matter how unpopular this might be with those who drive private vehicles). Electric power distribution systems will need to be installed, and so on.

The worldwide need for public transport infrastructure is enormous. It is an unfortunate reality that high-quality public transport often requires large investments, regardless of the income level of the city. If the world is serious about sustainable development and helping the underprivileged, the more privileged nations are simply going to have to provide financial assistance on a non-commercial basis. Nothing else is realistic. ■