PROCEEDINGS OF THE 42ND

ANNUAL MEETING OF THE

TRANSPORTATION RESEARCH FORUM

Annapolis, MD
November 29 - December 1, 2000

TRANSPORTATION RESEARCH FORUM
42ND ANNUAL RESEARCH AND POLICY FORUM Nov 28 - 1 Dec 2000
INTERMODAL ISSUES

INTERMODAL PASSENGER TRANSPORT INTERFACES by J Diandas, Sri Lanka

CONTENTS

ABSTRACT

Passenger intermodality includes the relative merits, benefits and costs of different modes and many other facets of journeys taken on more than one mode. This paper concentrates on one such facet, namely interfaces between public transport modes but omits interfaces involving bicycle, motorcycle, automobile, chartered van, taxi, para-transit etc. It does include the Walk Mode which is an inevitable leg (or legs) of most travel, yet is often omitted from the inventory of transport modes. The recently enhanced consideration for disadvantaged persons has stimulated interest in seamless or near-seamless travel. Private cars are profligate and public transport frugal in use of valuable urban travel-space. To discourage private car travel and encourage people to use public transport, minimal impedance at points of change from one mode to another is needed as a component of comfortable journeys. *Intramodal* change (e.g. bus/bus or train/train) is as much a feature of multi-vehicle journeys as is strictly intermodal change. It is therefore included in the discussion. Aspects of modal interface include proximity in place and time, ease of boarding and alighting, information about the next journey component, etc. New technology (e.g. low-floor trams and buses, platform screen doors, smart cards, next vehicle count-down display, etc.) may mitigate interchange impediments. Yet the biggest problem is bureaucratic inertia and even opposition to the need for improved interfaces, or, for that matter, improved public transport. Based on personal observation in a hundred cities and descriptions in the literature, the discussion cites many good and bad examples. The conclusion highlights a need for continuous strong propaganda on the civic, economic, spatial and environmental advantages (per passenger-mile) of public transport together with propaganda on improved intermodal interfaces as an important means of persuading people to use public rather than private transport.

1. INTRODUCTION AND METHODOLOGY

1.1 This paper addresses intermodality in travel by public transport. For this purpose public transport covers mainly travel by bus, tram, light rail (LRT), and heavy rail which includes Metro (variously called rapid transit, underground, subway etc.), suburban rail (often called commuter rail when service is confined to peak work related travel periods) and longer distance trains. For the purpose of this paper public transport also includes walking but does not embrace interchange with private modes such as car, motor cycle, pedal cycle and hired modes such as taxi, chartered vans etc even though .private/public modal interface is common and is the subject of substantial literature for example on park and ride schemes.

1.2 The walk mode, often overlooked in intermodal discussion, is the most prevalent mode interfacing with public transport because most public transport journeys start with walk-on access and end with walk-away to ultimate destination.

1.3 Intermodality in public passenger transport has risen in importance in recent years under the influence of two predominant factors, namely: -

.1 an increasing proportion of disabled or disadvantaged persons in the demand for public transport, and

.2 enhanced perception of the need to transfer travel from private to public modes as an economic means of reducing traffic congestion, and increasing the efficiency of road space use etc.

1.4 Obviously, to induce such transfer from private transport, public transport must be made much more attractive and comfortable. One way of doing this is to make interchange between modes or vehicles in the course of a journey proximate (in place and time), sheltered (from sun, wind and rain), level and unimpeded. This paper will address various aspects of this endeavor in relation to the modes between which such interchange is either inevitable or not easily or economically avoided.

1.5 The paper is not grounded on structured surveys or systematic literature review. The methodology is simply that of recalling:

.1 cases of intermodal interchange observed in the course of visits to a hundred or so cities in Asia, Europe, Australia, South America:

.2 cases described in trade, news and scientific journals:

.3 cases in Sri Lanka where attempts to improve the interfaces have been largely a failure because decision makers in the administrative, political and police communities generally prefer schemes to ameliorate conditions for general (private) vehicular traffic.

1.6 These recalled experiences have been backed by reference to extensive material in journals, specialist books and research papers on my bookshelf.

2. ASPECTS OF INTERMODALISM: ACCESS, PROXIMITY, INTERFACE

2.1 The ideal seamless journey would mean changing from one mode to another without being aware of the activity needed to effect the change. Such a journey is rare but does exist when a bus load of people drives on to a flat wagon of the Cross Channel Shuttle Train at Folkestone, England or Calais, France. Likewise when a train or bus drives on to a ferry, or a bus on to a transporter bridge. However these are rare cases and the ferry is only an intermediary in what is really an unimodal journey or part of a journey.

2.2 The normal case of intermodal transport requires physical movement by the passenger from one vehicle to another. It is the minimization of time and impediment in the process of interchange, in order to make the total journey seem near seamless, and therefore attractive, that occupies this paper. The components of interchange effort are addressed under access, proximity and interface.

ACCESS

2.3 The issue of access here is primarily concerned with boarding the vehicle and later alighting from it. In Europe low-floor trams and buses are common place and almost mandatory. The desirable practical level for a vehicle's platform and deck is 300 mm (11.8 inches) or less above the rail or roadway surface. This dimension can be provided over the whole length of the vehicle or at least over the sections of it that have an entrance or exit. Some buses have an additive or alternative of a kneeling mechanism that lowers the front end (at bus stops) to about 150 mm.

2.4 There are several beneficiaries of low floors and genuflection. These are passengers (including ordinary unimpaired passengers as well disabled or disadvantaged persons, parents with children in prams, shoppers with small trolleys etc.), operators (who can cut down dwell time and running time thereby saving cost), and other road users who grumble about congestion attributed to bus loading delay.

2.5 Manchester (England) offers high semi-platforms to overcome the effect of its high-floor trams. This clutters the streetscape, causes stop-spacing and stop-location to be dictated by street layout rather than demand, and pre-empts future investment in low floor trams. Increasingly the need to start raising their station platform levels or lowering the floor level of their trains is being recognized by all Railways (heavy and wholly segregated light). When achieved this will contribute to the goal of achieving near seamless journeys for their patrons.

PROXIMITY IN TIME AND PLACE

2.6 Proximity in time is not necessary where one of the modes involved operates at close frequency, which may be defined as service at intervals of 10 minutes or less. Even 5 minutes may be felt as an inconvenient impediment to a smooth journey but is nevertheless a light one if the ongoing mode is assured. Where intervals of more than 10 minutes in both modes is involved it is desirable to co-ordinate the time schedules and/or provide a means for holding the ongoing vehicle at least for a limited pause, provided it does not unduly delay other patrons who are not interchanging.

2.7 Proximity in place requires conscious design. Many railways have cross-platform interchange between lines and some (notably Karlsruhe) have the same facility for trams. A few have it for buses (e.g. Toronto Lawrence subway station) but many railways are reluctant to have buses outside the station door. Airports in developing countries are even worse in their treatment of buses. However busy airports world wide are incurring problems in providing space for car parks and roadways for cars to approach and depart the porch. Moreover parking patrons or greeters are finding walking distance to the porch excessive as car parks are stretching farther and farther away. In any case the number of airports with trains directly underneath are increasing year by year.

2.8 However eager or reluctant the host authority may be, the modes must be brought as close as possible to each other for smooth interchange. For interface with pedestrians it is also important to locate bus and tram stops, and where possible train stations, as close as possible to activity centers and road intersections, in other words the destinations and origins that generate demand.

INTERFACE

2.9 Apart from the physical measures of access and proximity, good and smooth interchange involves matters of comfort, assurance, and information.

2.10 Comfort itself has many components: Protection in exposed places from rain, road-splash, wind, cold and sun by means of covered and/or enclosed shelters and pathways, including pathways between passenger generating buildings and the closest bus and tram stops: Lighting after dark: Temperature control in warm or cold climates; Seats for waiting or resting. Public toilets: Public Telephones: etc..

2.11 Assurance is needed about the walk path between modes and safety from miscreants. Especially at airports and complex train stations, many passengers suffer anxiety as to the path they should follow (an information issue) and whether there is need to hurry, for which well located readable clocks are useful. Assurance about harassment and assault requires visible staff, straight well-lit corridors and waiting places, and confidence in the security systems in place. Double crewed trains, trams and buses increase that confidence. Platform screen doors, introduced on subway lines in Leningrad, Singapore and more recently the Jubilee line in London, also improve safety and eliminate the "one under" problem.

2.12 Good information systems are needed not only to inform interchanging passengers about where and when their next journey component can be taken, but also to make more efficient use of available space at the interchange center. The more people are kept moving and boarding the ongoing vehicles, the easier it is to manage the center and cope with minute by minute incidents. Information systems include arrival and departure boards displaying scheduled and expected times and locations, directional indicators, next vehicle count-down displays etc. Such systems are needed for passenger and crowd volume indicators and CCTV displays to assist management to control crowds and miscreants.

2.13 The above inventory of features required for easy intermodal transfer is by no means exhaustive, but nor is it mandatory for every situation. Obviously a sense of proportion and good insight is necessary in designing, installing and maintaining appropriate features which lead to near seamless interchange.

3. WALK MODE INTERFACE WITH BUS, TRAM, SUBWAY, TRAIN, AIR.

3.1 The concerns of pedestrians interfacing with public transport are mainly the walk distance from origin to boarding point and alighting point to destination, the likely or average wait (dependent on both service frequency and reliability) and comfort at the boarding point.

3.2 WALK DISTANCE: Many operators seek to increase the distance between stops or stations in order to reduce cost of tires, brake linings etc and reduce the journey time for longer distance travelers. This is counter productive because it inhibits short distance, casual and spontaneous travelers, who, under any fare regime, pay the most per km traveled and in fact yield marginal income at near zero marginal cost.

3.3 The Canadian Transit Handbook (ed Soberman & Hazard 1980) sets down recommended bus stop spacing ranging from minimum 182m to maximum 600m. This would set the maximum walk along the bus route from 91m to 300m. But a paper by Brouwer et al (UITP Revue 3/74) reports practice in several European cities ranging from mean 286m to 418m. It also cites an ECMT Resolution defining "acceptable walking distances as 250m to 400m." These are distances from origin to boarding point and from alighting point to destination. Using the Canadian minimum measure, 250m would imply 159m from origin to the bus or tram route and 91m along the route, or other configurations of these two segments aggregating to 250m. Obviously the distance at points of interchange from the alighting stop to the ongoing boarding stop, or indeed to a rail station should be less than this.

3.4 Placement of stops should also be as close as possible to demand generating points. This includes road intersections. In Sydney (Australia) such bus stops have been observed at (not near) the traffic stop line. This suits passengers interchanging from buses plying on the cross road and passengers emerging on foot from the cross road. It also gives the bus a kick-start when the traffic signal turns green. However in Colombo (Sri Lanka) such bus stops are pushed upstream from the intersection on the argument (proposed or supported by Police, Municipal engineers, legislators and others) that "traffic" rather than people must be facilitated.

3.5 Whatever the argument, seamlessness diminishes with every meter of distance between passenger generation and transit stop or station and with it the attraction to public transport of travelers by car and other private travel modes.

3.6 WAITING COMFORT AND ANXIETY: Shelter from sun, rain, wind, splash and cold is important at open bus/tram stops and railway platforms. Anxiety as to arrival of the vehicle to be boarded and whether the arriving vehicle is the right one also needs alleviation. The recently developed "count-down and destination indicators at bus stops (Southampton) and subway stations (London) give some relief. Airports engender most anxiety, but have long experience in visual indication.

3.7 Subway and other train stations and airports cannot, obviously, be moved from time to time to locations convenient to pedestrians. However at conception and planning stages effort should be made to fix stations at locations close to demand generation, taking account of future locations foreseen in urban structure plans and forward vision. Subway stations are generally well placed for pedestrians. Many are underneath road intersections and have prominent entrances on all four corners of the quadrant, a good practice saving pedestrians from having to cross roads. Some have direct entrance into large shops and office buildings. Only older ones are less pedestrian-friendly.

3.8 Suburban Railways have been slovenly in advertising their locations, and are sited (almost hidden from the public eye) poorly. In the London Suburb of Hornsey the Turnpike Lane subway station is active with trains every few minutes from early morning until late at night. The nearby Hornsey suburban railway Station is accessed by a dark stairway, offers trains with frequency ranging from 15 to 60 minutes. There is no bright name-board outside nor any information board listing train departures. In consequence, except for daily commuters, there is little custom. This is a bad case which could be remedied. This railway, (like ours in Sri Lanka) behaves as if it was still in the sellers' market that existed100 years ago.

3.9 Because of their comparative remoteness few people walk to and from airports. Colombo, Chennai and Sydney have rare airports close to the main road. Colombo has lined it one km approach road with shady trees which is boon for those few who walk to the airport. (hundreds walk the same stretch to a nearby industrial estate). Airports once built are there forever so relocating to help pedestrian approach is out of the question. But influence should be pressed on airport authorities to take account of potential pedestrian (air passenger, meeter/greeter, other visitor and staff) access in planning the total layout. However airport anxiety applies to all air travelers from all interchange sources and will be discussed later.

4. BUS MODE INTERFACE WITH BUS, TRAM, TRAIN, AIR.

4.1 BUS TO BUS: Interchange between bus and bus or other modes has already been discussed in the pedestrian section because almost all intermodal interchange involves some pedestrian linkage. Other important planning influences on convenience of bus interchanges are route network design and stop placement.

4.2 BUS ROUTE PLANNING: In 1962 the Ceylon Transport Board (the government monopoly operator of all bus services in Sri Lanka) drew up a set of guidelines to be followed in planning bus routes in Greater Colombo. The full set will be available on request. One such guideline proposed operating routes through the city center from a suburb on one side of the city to a suburb on the other side. This guideline was implemented gradually from 1863 to 1970 under a "route linking" program whereby radial routes terminating in the city core were linked to form through routes. For the operator this captured terminal dwell time and enabled the total service at the same frequency to be provided with fewer buses than were used by the two separate radial services. For those passengers travelling from any point on one such radial to any point on the other, interchange was completely eliminated.

4.3 Where significant residual interchanges would still be needed, guidelines pointed to special route layouts whereby suitable bus routes were made to merged upstream of common (or adjacent) stops or diverge downstream of such stops. This enabled most residual interchange to take place without pedestrians needing to cross roads. The relevant bus stops were located on the same sidewalk, alongside or just round the corner.

4.4 Historically some cities, especially those which had double ended trams, had all tram routes terminating at one or two central on-street points. In other cities, mainly those with single ended trams, most tram routes were linked across the city. Those cities (mostly in English and French speaking countries) which abandoned tramway systems, replaced then with electric trolley buses or motor buses, which followed, and mostly still follow the old tram route pattern.

4.5 Birmingham (England) is an unusual case where almost all radial bus routes circle the city center calling at several stops, and get back to their suburban origin without delay. Hence there is no need for a central bus station for suburban buses. This retains the advantage of not demanding a lot of valuable inner city land for terminals. However, passengers, especially those traveling a short distance beyond the city's core have not only to change vehicle but also, probably a premium fare for that short distance.

4.6 BUS STOP PLACEMENT: This issue has already been discussed under pedestrians and also under bus route planning. It remains only to emphasize that *user-friendly location should take precedence over "traffic" (i.e. private motoring).* However bus operators must attain propaganda skill and clout to meet that of the police, administrative, political and motoring communities.

BUS INTERFACE WITH TRAM OR LIGHT RAIL

4.7 A fine example is found at Lahe, Hannover where a custom design of Light Rail (an upgraded tramway, known in Germany as "Stadtbahn") provides for cross platform change from tram to bus and bus to train along the same two faced shallow platform. This is backed by coordinated timetables and electronic communication to hold back a bus if a tram is up to 2 minutes behind schedule.

BUS INTERFACE WITH SUBWAY, METRO etc.

4.8 Many metro stations have bus-stops or bus stations just outside their door. Good examples include Tiete Rodoviarios in Sao Paulo (where the large bus station arrived first), Wuerzburg in Germany and Golders Green, Morden and Harrow in London. Other less bus-friendly metro stations are nevertheless located adjacent to main roads and ordinary bus-stops are not far away.

BUS INTERFACE WITH TRAIN

4.9 There are many examples of buses calling under cover and very close to railway stations. These include Belapur in New Bombay, Harrow and Golders Green in suburban London, Victoria and London Bridge in Central London, and some Washington Metro stations. to name a few. The finest case is Lawrence, Toronto where buses descend ramps to subway train platforms. After delivering or collecting passengers for onward journey they regain street level by other ramps.

4.10 There are adverse examples. Edinburgh Waverley has access and egress driveways for taxis on to the key platform for long distance trains. But passengers interchanging from train to bus have to climb a stiff flight of stairs or a long tedious ramp to reach street level. London Paddington has a similar driveway for taxis and private cars, but not for buses.

4.11 Even the central Colombo Fort (Sri Lanka) station had such a driveway for cars and taxis, demolished later to make room for two more platforms. Later a series of bus-stops placed under the canopy of the main station entrance were abolished because Railway managers perceived buses as a nuisance to railway customers or as competitors trying to snatch train passengers into buses. Later still the station forecourt was transformed into a bus station for longer distance private buses. This, too, was ejected by the railway on the same arguments when a new Minister of Transport supported the Railway.

4.11 Such attitudes were swept away in Germany by the formation of urban transport federations (e.g. Hamburg Verkehr Verbundt (HVV)) in which all operators of train, subway, tram and bus present a single face to the public and offer single ticket journeys irrespective of mode or operator. Such transformations are unlikely in developing countries. A worst case is Bangalore. A new train station emulating the architectural splendors of Buffalo, Kansas City and New York Grand Central but defeats public transport integration by allotting space outside the station frontal first for cars, second for taxis and finally for buses across a busy public roadway to a sunken bus station of modern design.

BUS INTERFACE WITH AIR

4.11 Only a few airports are bus-friendly. Kuala Lumpur's now replaced Subang airport had an arriving bus-stop just outside the air departure concourse and a bus-stop with ample seats for buses to the city just outside the air arrival concourse. Hong Kong's in town airport and Singapore Changi have bus terminals just below the arrival lounge with elevators accommodating luggage to move down or up. But Colombo International Airport banishes buses (but not cars and taxis) today on security grounds and before security became an issue banned them on passenger convenience grounds. While, as will be discussed later, airports with direct easily accessible train stations under their concourses are multiplying, buses are not so welcome even when train connections cannot provided.

4.12 Many airports have "shuttle" bus between train station and airport, between car park and porch, between terminals and, on the air side, special buses connecting aircraft on the apron with departure lounges and arrival halls. These will be treated as internal airport systems and discussed under train/air interface.

5. TRAM AND LIGHT RAIL INTERFACE WITH TRAM, SUBWAY, TRAIN, AIR

5.1 TRAM/TRAM INTERCHANGE: Trams were treated in the past on a biased perception that trams caused congestion. Hence tram interchange stops, like similar bus stops were pushed away in the interest of "traffic". However many new tramways constructed in recent years in Strasbourg, Rouen, Nantes, San Diego, Sacramento, Manchester (England), Sheffield, Stuttgart Pragsattel, etc. have taken care to juxtapose stops for interconnecting tramlines as near to adjacent as possible.

5.2 TRAM OR LIGHT RAIL INTERFACE WITH SUBWAY: Trams have very good cross platform interchange with subway lines where trams (Stadtbahn) lines are also taken underground, as illustrated in Frankfurt and Stuttgart. Diverting trams and LRT under the surface inhibits casual and spontaneous riders, but sub-surface interchanges at Frankfurt and Stuttgart provide significant encouragement to car users to transfer to public transport. This is especially so during winter weather and where core areas have been totally pedestrianized.

5.3 TRAM OR LIGHT RAIL INTERFACE WITH RAILWAY: Many Swiss towns have the terminals of local light (some on-street) railways placed in the courtyard of the main railway station. Bremen, many other German cities, Ghent and Amsterdam have tramlines, and even multi-track tram interchange layouts, in the main railway station forecourt. However these are not always as close to the station concourse as they could be. Sheffield (England) has a special pedestrian bridge linking a tram stop at higher elevation with the main railway station. Unfortunately this bridge is in a windy location and not sheltered from the elements.

5.4 Sydney's original extensive tramway system (abandoned long ago) had a special line ramped up the to main railway station level, then running perpendicular to 15 or 16 train terminal tracks with several stops just outside station concourse, down another ramp to rejoin the main tramway system. However the new recently opened LRT line terminates at the same station but on the lower level.

5.5 Melbourne has a large thriving recently privatized tramway system. Several tram routes pass alongside the main Flinders Street railway station. However, no special facilities such as a covered path have been provided for tram passengers changing to or from train.

5.6 Milan pre-empted its extensive tramways from close interface with the grandiose Central Station. It is a huge architectural monument approached by elegant but strenuous flights of stairs which trams cannot negotiate.

5.7 In Karlsruhe dual voltage tramcars run out to the hinterland on main and branch railway lines. Thus hinterland passengers no longer need to interchange between train and tram at the inner city's perimeter. The technology needed for track sharing has been copied in Saarbruecken and is likely to be copied soon in Nottingham (England) and probably several other cities world-wide. This system presents real seamless rather than near-seamless travel.

5.8 A reverse version of Karlsruhe is recently reported from the Zwickau-Plauen region of Germany. Diesel railcars will run into Zwickau city center on tri-rail tramway track. This, too, represents real seamless travel. Moreover the Vogtlandbahn has taken over 240 km of local railways on which "measures have been taken at many stations to guarantee a flawless transition between rail and bus services for the benefit of ongoing passengers, including integrated tariffs." *(Tramways & Urban Transit. Feb 2000).*

5.9 TRAM OR LIGHT RAIL INTERFACE WITH AIR: Most important airports are sited beyond the distance normally served by tram or light rail. Hence only a few tram/airport links are known to the author. Bremen had a tram line with a tram-stop labeled "Flughaven" but with intervening walking distance over 200 yards. Recently the track was re-aligned into the airport premises. At the time of writing the author is about to fly to Bremen and will take tram line 6 to the chief railway station (Hauptbahnhof or Hbf), thence tram 4 to the conference center. He will then be able to report on both the air/tram link and the tram/tram link at the Hbf.

5.10 Newcastle (England) light rail system (fully segregated and functionally akin to a heavy metro railway) was extended to the small and simple airport about 10 years ago. But there is an intervening 150 yard uphill walk from station to airport concourse. Since the light rail station is at a lower elevation it could have been extended under the concourse.

5.11 London's Docklands Light Railway is also fully segregated but classifed as light rail) It is belatedly planning an short branch into London's short runway (STOL) City Airport with a station under the cramped air terminal buildings. There are also said to be several cities in Russia and Ukraine with plans to extend conventional tramway lines into the airport wherever it is fairly close.

6. SUBWAY (METRO, U-BAHN ETC.) INTERFACE WITH SUBWAY, TRAIN, AIR

6.1 SUBWAY TO SUBWAY INTERCHANGE has on the whole been well designed and operated. The Victoria Line in London was built 1963-1969 as planned with cross-platform interchange at the 5 out of 7 connections with other underground lines. Earlier cross platform examples were Finchley Rd (Metropolitan and Jubilee) and Acton Town (District and Piccadilly)

6.2 Se station, the focal center of the Sao Paulo Metro is a remarkable case of subway/subway interchange. Two lines cross at right angles, one over the other. Both lines have each track sandwiched between two platform faces one for alighting, the other for boarding. Interchanging passengers are fed by escalator from the alighting platform of one line to the boarding platform of the other. Segregation of boarding from alighting passengers is achieved by opening the alighting side train doors 10-20 seconds before the boarding side doors. This system avoids confusion and jostling among passengers. At the same time it reduces train dwell time, a key limitation in attaining 90-100 second headways or 36 to 40 trains per hour.

6.3 Hong Kong MTR also has interesting carefully pre-planned arrangements for interchange between the two lines which run parallel under Nathan Road. At Prince Edward, the first station where they meet, cross platform interchange on the upper level is between outbound Tsuen Wan trains and inbound Kwun Tong trains. On the lower level it is between inbound Tsuen Wan trains and outbound Kwun Tong trains. At the next station, Mong Kok, upper level cross platform interchange is between inbound trains of both lines and on the lower level outbound trains of both lines. At Yau Ma Tei, the third station, the lines revert to normal running with Kwun Tong trains above and Tsuen Wan trains below. Similar arrangements are found at Central and Admiralty stations for interchange between the Tsuen Wan and Island lines. Singapore MRT has adopted similar arrangements at Raffles and City Hall.

SUBWAY INTERFACE WITH COMMUTER, SUBURBAN AND MAIN LINE TRAIN.

6.3 The different classification of urban railway types is blurred. In Sydney (Australia) the underground and suburban railways are one and the same. In Seoul, Madrid and London some underground lines are really extensions into the city center by suburban railways. RER lines in Paris are similar. Some deep level small profile "tube" lines are extended quite far along suburban railway lines. Whatever the definitions, easy interchange is provided in many places in many countries.

SUBWAY INTERFACE WITH AIR

6.4 There are several examples of subway systems serving airports. They include O'Hare, Heathrow, Atlanta, and Cleveland. The trend is continuing. Chicago CTA already serves O'Hare and a new line is planned for the revived Midway Airport. Singapore's MRT system did not go to Changi airport when the system was inaugurated, but a branch line is now planned.

7. TRAIN (COMMUTER, SUBURBAN, MAINLINE) INTERFACE WITH TRAIN, AIR

7.1 TRAIN/TRAIN INTERCHANGE: As with subway/train interface there are many favorable cases of cross platform interchange and other forms of assistance when transfer is necessary to farther away platforms.

7.2 However there are difficult cases where stairs must be ascended and descended more than once and murky paths traversed on foot. Two such cases can be cited. In Mumbai (Bombay) changing at Kurla to the Mankhurd branch used to be very unpleasant until the branch was extended across the creek to New Bombay. At Watford in outer NW London reaching the platform of the branch line to St Albans is also awkward and lonely at night. Improvement in all such cases will be an important contribution towards attracting motoring people to travel by train.

7.3 TRAIN INTERFACE WITH AIR: Air travel continues to grow. Most air travelers, meeters, employees and others come and go by car or taxi. Land space required for approach roads and parking lots is inadequate. Intra- and extra-airport traffic congestion threatens to stifle airport functions. In this scenario many large airports have come to the realization that cars are too profligate in the use of space and therefore look for the assistance of railways. In consequence in addition to metros already discussed many heavy rail systems are now serving airports. They include Heathrow (supplementing the Piccadilly "tube" line), Gatwick, and Stansted in London, Manchester Ringway, Philadelphia, Frankfurt, Paris Charles de Galle, Duesseldorf, Hong Kong's new airport and Amsterdam Schiphol.

7.4 Heathrow presents the interesting case of two railways plying to central London. The older Piccadilly line is a standard metro line with trains every 3 to 4 minutes stopping at 19 stations up to Piccadilly Circus in London's West End, 24 to Kings Cross (an important main line station) and a further 12 to its terminus in the far north suburbs. It takes nearly an hour to reach the center, but if you can manage your luggage in exiting underground stations, there is a wide range of places to alight, and still more by interchanging on to other lines. More recently Heathrow Airport itself sponsored and partly funded Heathrow Express. The high quality premium fare Heathrow Express plies at 15-minute intervals non-stop in 25 minutes to Paddington main line station. This station is on a somewhat lonely fringe of the West End, but plentiful taxis are available to complete your journey. My experience has seen the Piccadilly "tube" trains well patronized, but the Heathrow Express under-loaded. However neither train can compete in overall convenience with more expensive limousines which take you from airport straight to your final destination in an hour or so depending on the level of traffic congestion.

7.5 Narita, 60 km from Central Tokyo, is another example with two railways. When Narita opened, the Keisei Electric Railway provided "Sky Liner" non-stop service to/from a point short of the airport (linked by shuttle bus), to the Keisei underground Ueno terminal, on the fringe of Central Tokyo. Patronage was poor until it was extended at both ends: - at Narita to a terminal under the airport (as had been originally proposed), - at Tokyo to run through on the Toei Asakusa Metro Line to Shinagawa on the far side of Greater Tokyo, and later to Hanedo Domestic Airport hitherto served only by the Hanedo-Hamamatsu Monorail

7.6 More recently the fragmented and privatized East Japan JR built a line to Narita and also planned express service through Tokyo to Yokohama with less central and suburban station stops than Keisei.

7.7 Colombo's Katunayake International Airport is a perverse example of antagonism towards public transport in general and railways in particular. There was a sparsely used single-track railway branch with a station adjacent to the air passenger terminal. When this terminal was completely rebuilt to enlarge and modernize it, the rail line and station were pushed back half a kilometer. The Dutch design consultant said that, (based on current usage of poor train service) there was no demand for rail transport. When reminded that rail transport at Schiphol Airport was frequent and popular, he said the client did not want railway facilities. Later, after an aircraft on the apron was bombed, rigid security measures still in force excluded buses (but not private cars and taxis) from the land side porches and allowed only petroleum supply trains on the railway branch. Railway and bus operators urged modification of the restrictions if agreed security checks could be made. This was refused.

8. AIR TO AIR INTERCHANGE

8.1 Changing planes, or interlining as it is called is a common, experience of air travelers. Ticketing and luggage systems are indeed seamless, but not the physical movements and the waiting, especially at big hub airports. Travelers' problems are compounded when planes arrive late.

8.2 Big airports are large complex places that breed anxiety in inexperienced passengers. Signage and Information are generally good but too few and too small. Huge destination flap board displays are excellent but are replicated in the various lounges by small monitors that are difficult to read. There are few help desks. Loud speaker announcements, if any, are often drowned by ambient noise.

8.3 There are also several transport systems within most airports. These include travelators (moving walkways) to help move along long corridors, elevators and escalators to change levels, shuttle buses and toy-like people movers.

8.4 Buses are used for car park to porch (an indicator that parking lots stretch quite far), for train station to porch and between air side lounges and planes on the apron. The latter are usually extra wide specially designed vehicles that go out of use once mobile piers and fingers are provided.

8.5 People movers come with various shapes, sizes and propulsion technologies. Mag-lev was used for connecting Birmingham (England) rail station to the air terminal but was too expensive and was replaced by buses. The multi-route "Airtrans" at Dallas-Fort Worth provides connections between different airline terminals. Gatwick has a rubber tired unit for access to its terminal 2. However all of these can be considered internal airport systems and will not be discussed further.

8.6 The fact that airports have initiated high-tech transfer and information systems shows that airports are striving to meet the problems of interline and originating and final leg passengers. However sometimes are sometimes overwhelmed , especially when things go wrong. The fact that high security has to be enforced adds to the travaios of airport and passenger.

8,7 However, unlike surface transport modes, most air travelers have little opportunity to choose alternative mode of travel. In this sense their striving to improve facilities for interlining passengers will not help the intense urban problem of extracting travelers from their cars and putting them on public transport.

9. WATER INTERFACE WITH LAND TRANSPORT

9.1 Until recent years ferries were an important link across rivers and international seas. However many cross water ferries have been rendered redundant by great engineering achievements. These include the Channel Tunnel, the Bangabandhu Bridge over the Jamuna River, the link between Kobenhavn and Malmo and other bridge/tunnel links in Denmark, the 54 km Seikan Tunnel joining Hokkaido to Honshu, the Lincoln and railway tunnels between New Jersey and Manhattan. They also include many other lesser splendid engineering projects. Some of the redundant ferries carried passenger trains and buses, as well as cars and lorries across the waters.

9.2 However many ferries remain in service and need easy connection with public transport on land. A classic example is Circular Quay in Sydney that links bus and train on land with the many cross harbor ferry services. The several piers are close walking distance from the bus terminals and the escalators linking the elevated station of Sydney's "underground" railway.

9.3 Hong Kong has still active ferries between Kowloon and Victoria Island despite the road and rail tunnels but these do not connect closely with trams or buses on the Island. The Hooghli River in Kolkata (Calcutta) has many very busy ferries competing with trams, buses, rickshaws, taxis and foot travel from Howrah station across the old but massive bridge. However none of these have such effective interface with train and tram as did the ferry terminals at Hoboken New Jersey, and the Transbay Ferry Terminals in San Francisco and Oakland.

9.4 So long as ferries play an important role in connecting land public transport systems across water bodies, and hope to restrain passengers from transferring to cars on longer diversionary routes, they must improve the layout of terminal piers to enable buses, trams or trains to draw up alongside the ferries that accept and discharge the passengers.

10. INTERCHANGE IMPEDANCE IN GENERALIZED TRAVEL COST

10.1 Generalized cost is a concept of planners for modeling how people will react to given circumstances. Generalized cost includes real money cost or perceived money cost (i.e. the components incurred at or near the point of travel), value of time and configured value of various hindrances. Perception is important because people act on what they perceive, not on reality. For example car users treat the cost of tires as a sunk cost not being part of the apparent marginal cost of any trip except the one just after or just before buying new tires. Even gasoline when the tank is quarter to three quarters full is not counted as a cost for any short trip or short diversion to visit a shop or a friend.

10.2 This aspect of perceived motoring cost places public transport at a disadvantage wherever its users are asked to pay at the point of use the full cost including even depreciation and return on investment. Fortunately most countries reward public transport operators for their environment-friendliness and economy in the use of surface space and thereby keep fares low. Even so, perceived nuisance in any process of interchange is a positive deterrence to travel by public transport and needs to be minimized.

10.3 For the purpose of transport modal choice comparison, generalized cost takes in the value of travel time and the assumed negative value of impedance anticipated or incurred in the course of the journey. The value of time is weighted so that waiting time is deemed to cost as much as three times the value of time actually traveling. These values are estimated on the basis of attitudinal studies to ascertain the factors that persuade people to choose or not choose a particular mode.

10.4 That interchange in the course of a journey will consume time is clear. It will also incur inconvenience. Journeys by car incur interchange impedance only when parking is difficult or is only possible at the cost of a long walk to the real destination. Hence, if significant travel is to be attracted from car to public transport, or retained on public transport, it is necessary to cut down interchange time and inconvenience as much as possible. In addition some comfort facilities introduced into the change-over process that is not available in a car journey will give a small premium value to the public transport journey. Comfort facilities like opportunities to buy a newspaper, food item or other odds and ends, or an opportunity to view attractive scenery, or observe human animation are however difficult to value. Nevertheless an effort to do so must be made.

10.5 The calculation of generalized cost may seem a complicated abstraction. But It is merely an attempt to quantify human behavior in choosing a travel mode. Inclusion of interchange impediment in generalized cost enables the planner to feel for the traveler's irritation when anticipating an unpleasant interchange that would dissuade him from using public transport.

10.6 This paper does not touch on the proportion of generalized cost attributable to interchange, but does attempt to show that it is a significant component of travel cost that can only be mitigated with careful thought and design.

11. CONCLUSIONS

11.1 It is generally accepted by planners that given sufficient patronage, all forms of public transport are more frugal with space, less harmful to the environment and more socially congenial than private motorized transport. On this basis it is also accepted planners and hesitantly by decision makers that the quality of urban life will be much improved and made sustainable if there is a reduction of private motoring with a matching increase in use of public transport. These changes can be progressed only by: -

physical restriction of private transport or by

fiscal measures to increase the perceived cost of travel by private transport, or by

substantial improvement in the quality of public transport and reduction of its generalized cost to socially acceptable levels, or by

a combination of these strategies.

11.2 In so doing, alleviation of the hindrance involved in interchange is a significant factor. Following from the earlier discussion on generalized cost of travel, it follows that elimination of interchange where possible and/or improvements in interchange facilities that mitigate its inconvenience can tip the balance in favor of choosing to travel by public transport instead of by car.

11.3 Therefore it behoves all public transport providers and all city authorities who wish to improve the quality of life and its environment-friendly sustainability must study methods to achieve improved interchange as well as their skill in carrying this message to the reluctant higher decision makers.

11.4 However there is a major hurdle to be overcome. This is a combination of the play-safe mind-set of bureaucrats and the power of the road lobby. The road lobby embraces more than the business interests of the petroleum, tires, car-making and road construction industries. It also includes the skilled professional civil engineers and the consumers of motoring.

11.5 The problem with the administrative community, also known as bureaucrats, is their innate conservatism and resistance to change and that the top decision-makers among them are mostly elders who have weathered the years and yearn for a peaceful retirement. They also fear to displease the political community above them and the technology experts below them. To blunt their resistance to change and overcome their inertia requires sustained, well documented, vigorous propaganda (without indulging in over-statement) on the civic, economic, spatial, and environmental benefits per passenger-mile that flow from well patronized public transport and on the importance of ameliorating the inconvenience of interchange as a small but important way of weaning motorists from their cars into public transport.

11.6 Without elaborating further in this paper on the agents resisting change, it is relevant to mention the recently launched BREMEN INITIATIVE. This is an attempt by concerned communities in Bremen to harness and conjoin the goodwill of municipal governments, local business leaders and physical planners to re-invent genuine mobility.

THE END

GENERAL BIBLIOGRAPHY

Bandi F, P Brouwer, M Conde Cabeza and J Nyst with F Lehner. Length of walking distances and distance between stops : their influence on the attractiveness of public transport. UITP Revue 3/74

Brouwer P. Position and design of bus stops in urban areas. UITP Revue 1/1983

Budillon, A et al. Les Ruptures de Charge dans les Villes de Province. Institut de Recherche des Transports, 1972

Chicago Transit Authority & Chicago & North Western Railroad. Northwest Passage Demonstration Project Final Report, UMTA, 1973

European Conference of Ministers of Transport. The Interface between Air and Land Transport in Europe. Proc. Seminar. 1983

Gray, George E & Lester A Hoel. Eds. Public Transportation: Planning, Operations and Management. Prentice Hall, 1979

Hoel, Lester A et al. Catalog of Transit Station Impact Case Studies. USDOT 1983

Horowitz, Alan J & Nick A Thompson. Evaluation of Intermodal Passenger Transfer Facilities. For FHWA & TSP, USDOT 1994

Hussein, Khalifa A. Bus Logistics for Developing Countries. Author, Dar es Salaam, 1980

Schneider, Louis M. Marketing Urban Mass Transit: A Comparative Study of Management Strategies. Harvard University, 1965

Soberman, Richard M & Heather A Hazard. Eds., Canadian Transit Handbook. University of Toronto - York University, 1980

Tatsujiro Ishikawa & Mitsuhide Imashiro. The Privatisation of Japanese National Railways. Athlone Press, 1998

Vuchic, Vukan et al. Timed Transfer System Planning, Design and Operation. USDOT, 1981

Vuchic, Vukan R. Urban Public Transportation: Systems and Technology. Prentice Hall, 1981

White, Peter R. Planning for Public Transport. Hutchinson, 1976

<u>BIBLIOGRAPHY OF AUTHOR'S OWN WORK</u>

Complexities in the Relationships between Railway Costing, Railway Marketing, Joint Development, Externalities and Transit Integration. World Bank Workshop Colombo Oct 96

A Professional Glance at Public Transport in India. in IJTM Aug 96

Best Cases and Worst Cases in Urban Public Transport in Sri Lanka at preparatory Workshop for Istanbul 1996 HABITAT II, UNCHS Singapore Jul 95.

The abject treatment of public transport in South Asia. invited article IJTM Feb 95

Transport Sector in Sri Lanka: new developments in different sub-sectors; totality of benefits, burdens and responsibilities. FES Conference Nov 94

Buses and their functions : to what extent do they fulfill their role? CITa Oct 94

A theory for bus and tram route development in urban situations of large scale systems under government or private ownership and dyssystems under one-bus private owners. WCTR5 Yokohama Jul 89. in Proc. WCTR5

Problems of traffic flow and their solution having regard to the traffic congestion and the preponderance of bus passengers among road users, at IESL Oct 88

Competition, cooperation and user friendliness of Public Transport in 16 Asian cities: a comparison. UITP City Transport Conference, Singapore Oct 88

A quality comparison of public transport in 12 Asian cities. CODATU IV Jakarta Jun 88 published in Transports Urbain dans les Pays en Development; nouvelles perceptions et nouvelles politiques, ed Prud` homme. CODATU. 1990

Railway station layout & facilities; monuments with management-care or interchanges with user-friendly customer-care. Proc. International Seminar on Transit Technology of Tomorrow. IREEA Bombay 1988

The need for a systems approach with spatial and temporal dimensions to conceptualising, planning, managing and operating public passenger transport in large cities, In "Transportation Systems Analysis and Policy Studies" ed Satsangi & Agarwal. Proc. ICOTSS. IIT Delhi Dec 86

Systems approach to planning, operating, managing and marketing urban public passenger transport: its changing status in Colombo, in "Urban Transport in Developing Countries: Constraints and Potential" Proc. CODATU III, Cairo Jan 86

The physical and institutional separateness or togetherness of urban railway types. Proc. International Seminar Metro Railway Problems & Prospects. Calcutta Nov 85

Some less recognized aspects of on-street tramways with special reference to accessibility, stop-spacing and urban form definition. In Proc. "Electrifying Urban Public Transport : Light Rail Transit" ed Lewis Lesley . Blackpool Nov 85

Information systems & technology for developing countries transport systems. CIT lecture series Oct 85

Some impressions of public passenger transport in Calcutta. CIT/SLAASF lecture series Apr 85

Three dimensional management of bus operation in urban conglomerations. at Times Research Foundation Seminar on Metropolitan Transport in India. Delhi Mar 85 and at 2nd SLTF UoM Aug 85

The Intertwinement of transport with shelter, energy and environment. SLIA Forum. Feb 84

Co-ordination, integration & proximate interchange facilities in public passenger transport. UoM Jun 83

Report on route and destination indication on buses, SLCTB Central Consultative Committee of Jul 80

Production and consumption of urban passenger transport. Seminar:Liberation of the City. CSR May 79

The interface between passengers and bus systems. Staff seminar NCRTB Jan 79

Concept of three dimensional management of urban public passenger transport. Seminar SRTB Nov 78

Some impacts of transport on the urban environment. UNEP seminar Colombo Jun 78

Some relativities in physical planning for transportation with emphasis on urban areas in Sri Lanka and other less developed countries. Internat. Conf. for Scientists of Non-Aligned Countries Colombo Jun 76

Reshaping Colombo urban bus services. Transport Management Vol 3 No 1 Jul 73

Priorities in the utilisation and development of roads. SLAAS Symposium on Roads Jun 64

Bus route network of Greater Colombo: general principles. adopted by Bus Route Replanning Committee of CTB. May 62