

NINTH INTERNATIONAL CONFERENCE ON AUTOMATED PEOPLE MOVERS 2003



Connecting People and Places



2 - 5 SEPTEMBER 2003

KEYNOTE LECTURE *

CONNECTING PEOPLE AND PLACES : FROM AUTOMATED PEOPLE MOVERS TO AUTOMATED RAPID TRANSIT NETWORKS

Pierre Laconte

Honorary Secretary General, International Association of Public Transport (UITP) ; President, Foundation for the Urban Environment, Abdijndreef 19, 3070 Kortenberg, Belgium, +322 759 61 88, Pierre.laconte@euronet.be

ABSTRACT

This keynote lecture addresses the following items:

- Present trends in urban transport
- Limits to motorised individual transport modes, as indicated by the UK SACTRA Report, and need to improve modal split in favour of non motorised and public transport
- Improving modal split by making existing public transport more attractive, taking advantage of information technology
- Automated People Movers: general advantages and pioneering experiences 1982-2002
- The leap forward: the revolutionary Singapore heavy rail North East Line, opened in June 2003 and to be followed by others in Singapore and in Barcelona
- Future markets for Automated Transit: from single automated lines to automated rail networks, serving urban corridors, retrofitting conventional metros, using the opportunities offered by deep tunnelling.

The accounts of cases are based as much as possible on the experience of UITP members and personal visits and interviews with actors involved.

INTRODUCTION

Mobility is a key societal value of today. Modes of transportation utilised to achieve that mobility reflect society.

Automobility goes beyond mobility. The automobile, in a way like the individual detached home, reflects a change in social values sometimes referred to as "Me culture" or "mass individualism" (GAUCHET, 1985).

In line with Locke's philosophy, the emphasis is put on individual values rather than social values and on the rights of the individuals, rather than on their duties. Gender complementarity gives way to equal access. Producers of consumer goods or services and their marketing advisers have multiplied the socio-cultural typologies and market segmentation. In particular the automobile industry has diversified its products to suit individual tastes, status aspirations and quest for recognition as well as convenience and comfort. Only by having these social values in mind can public transport authorities and operators hope to get more customers than the captive users.

Against this background the UITP initiated in 1991 a survey on the attitudes of Europeans about urban mobility (not about public transport). In collaboration with the EC (Directorates of Transport, of Energy and of Environment) 20 questions were added to the Eurobarometer. The Eurobarometer is a Europe-wide half-yearly opinion survey consisting of 1000 face to face interviews per country.

Simultaneously Socialdata (Munich) interviewed a sample of 157 elected transport officials on the same items.

The findings indicated that notwithstanding the fact that 65% of the sample were car users the negative effects of congestion, of accidents and of pollution were clearly perceived by the citizens. They also perceived the need for measures to reduce traffic and to give priority on streets to public and non-motorised transport (UITP/SOCIALDATA, 1993).

By contrast elected officials were strongly underestimating public opinion, expecting the citizens to prefer car oriented policies. While 84% of the citizens were in favour of giving a priority to public transport the officials, independently from their own opinion, thought that only 49% were in favour of public transport priority. The reasons for the officials' overestimation of the opinions in favour of the car seem to be that officials themselves all have access to the car, that they actually use it for their political activity and that they read the media, usually favourable to the car, with particular attention.

LIMITS TO GROWTH OF INDIVIDUAL MOTORIZED TRANSPORTATION IN URBAN AREAS.

The success story of the car is still in full bloom. According to the OCDE countries statistics during the last fifteen years (1980 to 1995) the vehicle-kilometres travelled increased by 65% while the car ownership increased by 50% and the population by 13%. There are four times more new cars than new babies. Vehicle-kilometres travelled have increased five times faster than the population.

On the contrary the Singapore transport policy is to deliberately limit automobile traffic to a sub-congestion level through price mechanisms (auction of "certificates of entitlement", taxation on car ownership, user charges on roads and parking) and to maximise the market for mobility by public and non motorised transport and by taxis. To ensure a maximum competition within the market of public transport, franchises for groups of lines are attributed to multimodal operators (rail and buses). All of them participate in the " enhanced integrated fare system" (TAN HUP FOI, 2000).

In the UK the Standing Advisory Committee on Trunk Road Assessment (SACTRA)ⁱ has shown that the traffic induced by new roads and its congestion effect (in cities) can be worse than in the existing situation. It has led during several years to a notable reduction of road programmes in that country (1).

ⁱ Standing Advisory Committee on Trunk Road Assessment (SACTRA), Great Minster House, 76 Marsham Street, London SW1P 4DR, UK; Fax: +44 171 271 50 26), Trunk Roads and the Generation of traffic, London: HMSO, 1995.

IMPROVING MODAL SPLIT BY MAKING CONVENTIONAL RAIL MODES MORE ATTRACTIVE: THE MANCHESTER METRORAIL AND THE KARLSRUHE TRAM-TRAIN

The Manchester Metrorail

In 1989 the public transport authorities decided to link two underused commuter lines, one ending north and other ending south of the centre. This new north-south line was to be operated by a tramway, which would run on streets between the two stations and use old BR track for the rest.

To implement this idea the authorities launched a European call for consortia ready to design, build, and operate the new network during 15 years. The winning consortium committed itself to:

- take the full industrial risk of the investment while providing itself 5% of the total cost (ca 200 million \$) and to
- take the full commercial risk of operation (no subsidy). The system opened in 1992.

The niche effect was obtained through several operating innovations, among others:

- The fares structure was extremely simple
- The timetable was equally simple: one tram every 6 minutes (later every 5 minutes) from 7 AM to 7 PM, 12 minutes at other times
- A 50% rebate was introduced at non peak hours, targeted at the housewives shopping and leisure trips, in particular mobile older people
- The operating staff was hired according to service criteria (no previous transport experience was wanted) and trained to fill all the operating jobs.

In 1995, after 3 years of operation the annual operating profit was 5 million \$. The system length has been doubled since and a third extension is at the planning stage. The part of the investment financed by the private sector rose to about 50%. The part not financed by the private consortium could in the future be financed by a parking levy on work-place parking provided by employers.

The Karlsruhe Tram-Train

Among the various passenger rail interfaces the most important one seems to be "interoperability" between heavy and light rail sharing the same track. It means that the vehicle moves from one track to another rather than the passenger having to move from one train to another.

To attract new passengers track sharing, i.e. high and low speed trains, heavy and light rail sharing the same electrified tracks has demonstrated its attractiveness in the case of the Karlsruhe urban and suburban tram-train network. It started in 1995, three years after Manchester. The operator succeeded in convincing DB, the mainline operator to let heavy rail and light rail vehicles use the same tracks. The same vehicles are safely running alternatively on the central city streets and on traditional railway track (in Manchester the track was completely taken over from British Rail).

For the passenger, remaining on the same train for the whole trip takes away the negative perception of having to change mode and wait twice.

The Karlsruhe experience presents a realistic case for encouraging an organisation in charge of both track and operations to safely open it up to a third party. In Karlsruhe it happened by persuasion. In Japan it happened by regulation.

Track opening to third parties should not be confused with total separation of track from operations. A useful comparison could be made between on the one hand the reportedly successful Japan Railways 4

privatisation with regional split-up (SUMITA, 2000) and on the other hand the somewhat less successful British Rail privatisation with national split-up between a monopoly track owner and the various franchised operators (WOLMAR, 2001).

The regulatory obligation for a main operator to accept third parties on its track is compatible with service development and new investments in track. By contrast the UK Railtrack experience confirms the suggestion that a monopolistic track owner has all interest to create scarcity in order to maximise his position, rather than expand. If track-only monopolies were to be generalised in Europe one may wonder who may have a market-led interest in developing new rail links.

AUTOMATED PEOPLE MOVERS: GENERAL ADVANTAGES AND PIONEERING EXPERIENCES

As soon as 1900 at the Exposition of Paris the advantages of automated travelators or moving walkways were clearly demonstrated. A three-speed moving walkway allowed people to step smoothly from the low speed belt to a faster one and from there to a still faster one. The system functioned during the whole time of the exhibition without reported incidents.

Still today hectometric walkways have an essential role to play in order to increase the attractiveness of a system made of several components by making the people move effortlessly from one mode to another. One was just installed at the Montparnasse Station, to reduce the inconvenience of long walks, another one in Tokyo. Hectometric walkways can also link stations with neighbouring developments. A case in point is the successful Ebizu multifunctional complex along Tokyo's Yamanote Line developed jointly by Sapporo Beer and Japan Railways East on the site of a disused brewery located 700 m from the Ebizu railway station. The creatively designed pedestrian travelator has been the key mode of access and the key to success.

Beyond hectometric pedestrian walkways more than hundred automated people movers are in operation around the world: they link airport terminals and parking lots, theme parks, hospital complexes, selected points of downtowns (Downtown People Movers), campus buildings, etc. (Table in FABIAN 2002)..

As to the conventional metros almost all of them rely to a certain extent on automation, mainly through:

- Automatic Train protection (ATP): prevention of erratic actions by human drivers
- Automatic Train Operation (ATO): substitution to human drivers who only remain in charge of commanding door operation and activating the start signal on the driver's console.

The specific place of the Automated People movers lays between the conventional metros and the short line circulators.

Driverless metros completely dispense from a driver's console. Trains must be able to function without any human attendance.

Indeed the first driverless metros (Kobe Portliner and Lille VAL (Véhicule Automatique Léger), 1982) dispensed not only from the driver but also from the human attendance and the social control and passenger safety feeling coming with it.

In cities riddled by violence and vandalism, unattended places become a choice for "incivility". Remote monitoring admittedly allows observation but not immediate intervention in case of

undesirable passenger behaviour. As Professor Gabillard, inventor of Lille's VAL, once told the author: "We had thought about any single technical failure that could occur, but not about creative human malevolence". Cases of this abound, for example triggering the alarm signal and running away, what is likely to stop the train until the staff arrives. These problems also raised complex responsibility issues: was it the task of the operator or the task of the urban police forces to invest in hiring, training and protecting security staff?

Very soon operators started to put roving stewards in the trains and on platforms, who were able to act in case of incident as well as to observe and satisfy the passengers quest for security. The London Docklands automated system introduced them from its first day of operation.

What was a challenge became an asset. Instead of having human beings perform the minimal and boring tasks left to them by the Automatic Train Operation, the staff was no longer left in the driver's cabin but used for more rewarding customer-related tasks. Moreover the roving character of the attendance staff does not limit the number of trains in circulation to the number of staff available at the same moment. This gave the operator a tremendous capacity of flexible response to a sudden increase of demand, at no extra cost.

The full use of this potential has been made by the Copenhagen driverless "minimetro", which was put in service in October 2002 and was well accepted by the public, notwithstanding some teething problems. It provides an unattended round-the-clock service. Unattended service does of course not dispense the system from having stewards. A similar system is planned for Brescia.

In parallel with increased frequency of trains allowed by the independence of APM systems from the number of drivers available, the capacity of trains has been gradually increasing. In France the RATP automatic Meteor Line, opened in 1999, has the capacity per train of some conventional metro lines. Tunnels are extra large, in order to provide an evacuation path along the track, accessible to wheelchairs.

In 1997 already UITP 's International Metropolitan Railways Committee (UITP 1997) concluded "Automated systems constitute one of the major development routes for metropolitan transport systems and can make an effective contribution to the functioning of major urban areas".

THE LEAP FORWARD: SINGAPORE'S REVOLUTIONARY HIGH CAPACITY AUTOMATIC METRO

In June 2003, about seven years after the initial decision, the Land Transport Authority (LTA) of Singapore, in charge of all surface transport infrastructure, opened its 20 km long driverless North East heavy rail line (NEL), with a capacity of 75.000 passengers/h in each direction.

LTA justified its decision in favour of automatic operation by safety considerations, the human behaviour of drivers being considered as less reliable than automation (KNUTTON 2003). It was built by Alstom and is operated under a 30 year license by SBS, the island's largest private bus operator, at its own risk, without subsidies. Smaller automatic people movers are connecting several of its stations to neighbourhoods and shopping centres.

Optimised staff efficiency is achieved by ensuring the same training to the stewards (Customer Service Assistants) and the station managing staff (Assistant Station Managers). The entire staff is thus deployed in the public eye instead of buried in a cabin.

Fares are fixed by an independent body, which includes all the main stakeholders.

A remarkable feature of Singapore's transport policy is its continuity and its long term goal to balance investments in the public and in the individual modes, knowing that the space consumption of the automobile, including parking provision, is up to 100 times the space consumption of a public transport user. Ownership and use of the car are subject to marginal social cost pricing. This is achieved by setting quotas on car ownership: each month the certificates of entitlement, i.e. license plates, are auctioned and the unsuccessful bidders have to try again later. The use of the car is subject to a congestion charge applicable in the Central part of the city and on the congested parts of the motorways network. The level of the charge effectively varies with the level of congestion.

The opening of the first automated heavy rail transit line, to be followed by two others, is the latest achievement of the Singapore transport policy, twenty years after the decision was made to in favour of building a mass rail transit system, against the opinion of the World Bank, confirmed by a team of Harvard economists (PHANG 2003). By 2006 the rail network length will reach 145 km.

Moving the Airport to Changi and have it linked to the city by rail was equally visionary and contested by American consultants. It has saved the City from air and noise pollution, as the main traffic, the noise footprint and the concentration of gases are above the sea.

The creation of the Land Transport Authority in 1996 has been the institutional consolidation of Singapore's transport policy.

The full consolidation with the land development policy remains a further step to achieve.

FUTURE MARKETS: FROM AUTOMATED PEOPLE MOVERS TO AUTOMATED RAIL TRANSIT NETWORKS

The leap forward provided by Singapore's NEL paves the way for a new generation of automated rail transit world wide. From now on it has become difficult to plan rail transit while ignoring the Singapore achievement, both in terms of reliability and reduction of operational costs.

Moreover instead of single automated lines within a conventional rail transit system time has come to consider fully automated rail transit networks. This implies retrofitting existing lines by adding sliding doors and, at a further stage, procuring open space rolling stock equipped with frontal evacuation doors where the drivers cabin used to be.

This new market will be complementary to the well established market for smaller APM's of capacities of around 10.000 passengers/hour in each direction. Their advantages are specific (FABIAN 2002):

- providing short distance links between high density nodes including heavy rail stations (Singapore itself provides examples of this at Sengkang and Punggol)
- allowing curvilinear alignments serving smaller stations, distant of some 500 metres, and easy to integrate in the urban landscape, sometimes through buildings
- catering for passenger flows which would not justify heavy rail but nevertheless more than street cars. This also opens up APM markets for conurbations below the conventional wisdom threshold of one million inhabitants, if demand for travel is concentrated along corridors.

The next battle will of course be to convince national and city political decision makers to leap forward too and to set modal split targets for public transport in accordance with the level of public transport investment. In Singapore that target has been fixed at 65%, through a political decision, supported by the means to achieve it. The 1996 LTA White Paper counts on convenience, comfort and speed to achieve the modal split objective (WILLOUGHY 2001).

In most other places winning the battle will require building a coalition of interested parties and setting up a well orchestrated campaign combining advertising, press information, public relations, public affairs towards the elected officials and their staff and, most of all, a direct communication with the public at large. A well known example of this has been the historic decision by the City Council of Atlanta to finance the rapid transit system. Witnesses remember it as similar to a mayoral campaign. In Europe the case of Strasbourg comes to mind. The new rail project and its striking rolling stock was presented day after day in public meetings as part of a general beautification of the public spaces. It was not a mayoral campaign but turned out to be a key asset for the election of the Mayor.

The land use intensity is equally one of the keys to achieve a modal split favourable to non motorised and public transport modes. In the case of Singapore this seems a sound political judgement, considering the space constraint of the island. In other places the coalition of interests will have to think developments as much as transit (DUNPHY 2003).

The environmental considerations plead for a “decoupling” of economic growth from growth in energy consumption and therefore favour modes of transportation requiring the lowest energy consumption by person transported. In the case of Singapore this policy clearly makes sense, taking into account the fact that all fossil fuel has to be imported. It forms an interesting contrast with other fuel importing countries. China’s policy of subsidising individual transport is leading that country to a growing dependency on imported fossil fuels and the need to pay for them..

FUNDING AUTOMATED TRANSIT AND URBAN DEVELOPMENT OPPORTUNITIES THROUGH THE UNCERTAINTY PRINCIPLE

In most countries elevated rapid transit, automated or not, raises objections. The visual impact, noise and dust are a limiting factor in the development of that form of rapid transit. On the other hand both elevated and underground rail pays the full cost of land expropriation as soon it has to trespass private land, even if the owners will be benefiting on the remaining of their land from later development allowed by the existence of the new infrastructure.

Literature speaks about ways to achieve “value capture” through special taxation, planning gains (the UK “Section 106”) and other techniques but it is recognised as not being significant, unless of course the rapid transit is developed by the landowners themselves. The case of the rail link built by Baron Empain between Cairo and the tract of desert land that was to become Heliopolis remains famous. Japanese private railways were financed through land development. More recently the Copenhagen APM was built on a large tract of public land, which it is helping to develop. But in most cases expropriation costs are a heavy burden on the development of rapid transit.

On the other hand the technical progress in deep tunnel boring techniques, including more efficient distance monitoring of shields, better adapting to terrain uncertainties and reduction of damage risks at the surface have lowered the cost of tunnelling.

Deep tunnelling also generally dispenses from expropriation if it does not affect the future use of the surface land. The alignments of deep tunnelled transit lines can therefore be fixed independently from the street pattern, horizontally linking the points of maximum future demand along a string of underground stations.

These underground stations can be linked to the surface both vertically, through lifts, and diagonally, through escalators. The points of exit can be freely located by the transit authority within the circle of exit opportunities above each station. This “circle of opportunities” is directly proportional to the depth of the tunnel.

The actual location of the exits can therefore be made according to an analysis of the negotiated costs and advantages of any number of potential places. They can be either on public land or, preferably, on private land ready to be redeveloped and whose owners could see the advantage of incorporating a direct access to the underground rail network.

As within the “circle of opportunity” obviously more than one location presents a real estate interest, the respective owners can potentially be put in competition. This is where the principle of uncertainty comes in. In fact the “circle of opportunities” can be “elongated” thanks to the fact that the authority has possibility to locate the stations at any point within reasonable distance from the next one on the line.

In the case of automated transit the reduced costs of operation would therefore be combined with a reduced cost of expropriation and potentially the benefit of some value capture.

CONCLUSION

Some twenty years have passed since the first APM – automated people movers. The Singapore Land Transport Authority has now introduced high capacity ART – automated rapid transit. Its high capacity fully automated North East Line opens the way to extensive further developments of rail transit, in Singapore and elsewhere, putting less staff in the boring tasks replaced by automation and more staff in the rewarding tasks of making the passengers feel they are taken care of. Besides the two additional ART lines under construction in Singapore itself the Barcelona 42 km high capacity driverless Metro Line 9, also under construction, suggest a new paradigm in rapid transit investment.

These future developments do not mean only constructing more new lines but also retrofitting existing ones. The Hong Kong MRT has started installing platform screens and sliding doors on existing lines. Shanghai’s new metro has now decided to test them too, according to TP Plus. This should facilitate the shift to driverless operation, while increasing passenger safety by preventing them falling from the platforms. This means a further step towards achieving fully automated rapid transit networks – ARTN – made of heavy rail lines (up to 75.000 passengers/h in each direction) and connecting them to smaller people movers playing a feeder role, both being complemented by streetcars, buses and taxis.

Present advances towards large capacity does not take away the APM perspectives for smaller cities. Nuremberg has an interesting transitional system, mixing manned and driverless operation.

Finally it is suggested that the progress in deep tunnelling techniques also opens the way to a synergy between the cost savings in building deeply underground, the cost savings of automated operation and the additional income deriving capturing some of the added land values generated by the improved accessibility.

REFERENCES

- DUNPHY, R. et al. (2003), « Ten Principles for Successful Development Around Transit », Urban Land Institute, Washington D.C., 2003
- GAUCHET, M. (1985), « Le désenchantement du monde », Paris 1995
- FABIAN, L. (2002), « Planner's Guide to Automated People Movers : Trans.21 Transportation Systems for the Twenty-First Century », Boston 2002 and TP PLUS (Lfabian@airfront.us)
- GHIGGI, C. & TORRE, M., « The Copenhagen driverless metro : a steppingstone in urban mass transit systems », paper prepared for APM 2003 Singapore
- GHIGGI, C. & TORRE, M., « System Integration in the Copenhagen Driverless Metro », in : Copenhagen Metro Inauguration Seminar, COWI / COPENHAGEN, 2002
- KNUTTON, M. (2003), « Rapid Transit : Singapore », International Railway Journal, May 2003
- PHANG, S.-Y. (2003), « Strategic development of airport and rail infrastructure : the case of Singapore », Transport Policy 10, 2003
- TAN YUP FOI (2000), « Singapore : Successful Public Private Partnership for a High level Public Transport System », International Public Transport , 2000/5
- SUMITA, S. (2000), « Success Story : The Privatisation of Japanese National Railways », London 2000
- UITP/International Metropolitan Railways Committee-IMRC (1997), « A Better Quality at the Lowest Cost : Driverless Metros », Brussels 1997
- UITP/SOCIALDATA (1998), « Assessments of Mobility in Europe », Brussels 1992
- WILLOUGHY, C. (2001), « Singapore's motorization policies 1960-2000 », Transport Policy
- WOLMAR, C. (2001), « Broken rails : How Privatisation Wrecked Britain's Railways », London 2001

Pierre Laconte, President of the Foundation for the Urban Environment, is Honorary Secretary General of the International Association of Public Transport UITP, which he has been leading during some 15 years, and Vice President of the International Society of City and Regional Planners. He was one of the three planners in charge of the masterplan and the architectural coordination of Louvain-la-Neuve, a new town developed by the Catholic University of Louvain around a new railway station, 25 km south of Brussels, Louvain-la-Neuve presently has a population of 37.000. It has won the Abercrombie Award of the International Union of Architects in 1982.

-
- Keynote Lecture to the International Conference « Connecting People and Places », Singapore , 2-5 September 2003, organised by the Association of Consulting Engineers Singapore and the American Society of Civil Engineers ASCE