THE ROLE OF TRAMWAYS IN THE FUTURE BUDAPEST TRANSPORT SYSTEM

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Abstract

This paper reviews the exciting plans for the construction of a Metro Network and the reduction in the roll of tramways, against the background of the anticipated grouth in car ownership. The construction of the Metro will be too slow to meet the competition for passenger traffic from private cars. With no measwes to car traffic, public transport will experience a reduction of demand and the road network increasing congestion. The paper argues that the best policy may be to invest the capital finds available, after Metro line 3 reaches the Újpest District centre, in the gradual upgrading of the tramway network to an "Express" standard, with at greating speed of 25 km/W, stops about 0.5 km tramlines separate from other road traffic, and the pre-emption of traffic signals to remove the effects of general traffic congestion. Such a policy could be completed by 2000 giving a fast rail network including Metro of over 150 km, providing a competitive alternative to the private car.

Introduction

This article discusses the present role and future prospects for the tramway system in Budapest, and has been written as a result of working for 5 months at the Technical University in Budapest, using published Hungarian sources, and numerous meetings with officials, planners and transport operators.

Budapest's population has risen consistantly since the end of the war, standing today at just over 2 million, representing 19% of Hungary's population. The city also contains a concentration of industry (37% of national production), cultural, administrative, research and similar high level functions. The city is bisected by the River Danube with a 29% of the population and 33% of the land area in Buda on the west bank. The river is a major barrier to movement, as in Newcastle upon Tyne. This is worsened by there being no other bridges on the Danube for 80 km north or south, which concentrates major national and international traffic flows through Budapest, creating Paris style traffic congestion most of the day, even though car ownership (16 cars per 100 pop.) is low by western standards. Therefore national transport investment has aimed, until recently, at increasing the number and capacity of crossing points in Budapest.

The development of the city and its economy is guided by regular five year plans, with the 1985 just published.

Table 1

Size and Use of Tramway System By Tram

Year	Tramway Km	(%)	Tramcars	(%)	No. of journeys M	(%)	Journeys per Cap. p. a	(%)
1970	246.0	(30%)	1707	(42%)	894	(55%)	441	(55%)
1975	202.7	(21%)	1554	(40%)	710	(44%)	350	(44%)
1980	177.9	(18%)	1242	(32%)	572	(36%)	278	(36%)
1983	175.1	(17%)	936	(26%)	525	(33%)	255	(33%)

(Source Budapesti Statisztikai zsebkönyve 1983 & K. S. H. Budapest 1983)

Tramway traffic has fallen from over half the total, to a third of the total since 1970. The principal reason for this decline has been a firm policy to construct a metro network, replacing the most heavily used tramway lines and increasing the number of river crossing points.

Present Role of Tramways

The tramway network in Budapest has contracted in size and in importance, see table below (with its percentage of the total system for comparison).

There are now officially 3 metro lines, to which should be added 4 lines of the local surburban railway (HÉV) extending beyond the city limits to large towns in the hinterland. Two of these HÉV lines have been altered to interchange with new metro lines. The No. 1 metro line is the original "underground tramway" built in 1896 from the city centre to the town park (Városliget) to carry visitors to the 1000 year of Hungary celebrations. This line was closed in 1972 for extension, refurbishment and conversion to right hand running, and reopened in 1974 with new articulated Ganz trains. The other two metro lines are built on the Moscow model, using Soviet trains and equipment. The No. 2 (E—W) line opened first with a new tunnel across the Danube, and the No. 3 (N—S) line is still in construction (Fig. 1).

Some of the trunk tram lines have been cut back to act as suburban feeders to Metro terminals.

In terms of the public transport traffic, buses carry the largest proportion traffic, with 40% of the total (634 M pa 1983), while the Metro has the heaviest flows (13.5 M journey pa per km line, compared to tram 3 M, bus 1 M and HÉV 0.9 M). Although to western visitors Budapest fares are low, in comparison to local incomes they lie between those of S.Y.P.T.E. and Merseyside P.T.E. (1985 levels). About 60% of citizens and 85% of passengers have monthly passes of one sort or another, either the full price 180 Ft/month (about £ 3) or at reduced price for students, pensioners or soldiers.

The ticket use breaks down as follows

The fare system is based on honesty, and though officials guess that there is about 20% fare evasion, from a five month survey by the author, the evasion figure is below 1%.

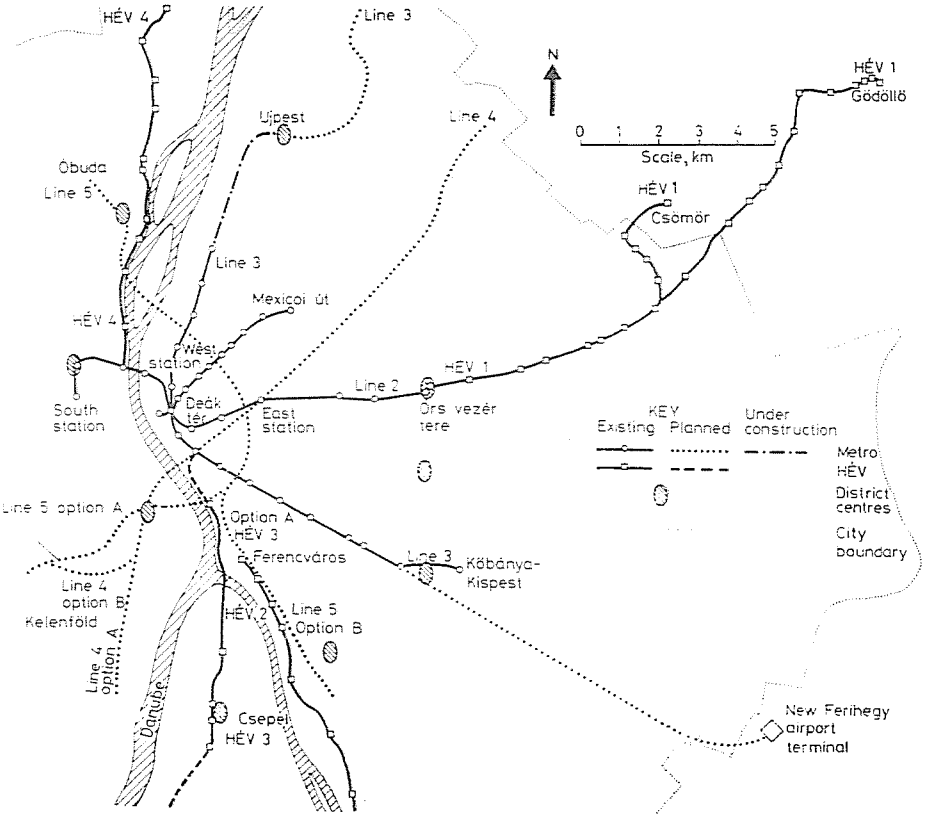

Fig. 1. Present and Planned Metro

Table 2

Travel tickets used in Budapest

Monthly Passes	All System	60%
	Tram, Metro Trolleybus	21%
	HÉV	1.1%
	Rack Railway	0.1%
	Other	2.6%
		84.8%
Single Tickets	Bus (universal)	6.6%
	Tram, Trolleybus	6.5%
	Metro Line 1.	1.1%
	Metro Lines 2, 3,	0.7%
	HÉV	0.1%
	Rack Railway	
		15.0%

The present tramway network is shown in Fig. 2. Although there has been a contraction in the total network, there also have been investment, particularly in the upgrading and partial segregation of routes 4 and 6 on the Nagy Körút which forms an important distributor around the inner city, with the segregation of routes 12 and 14 along Béke Út, the extension of route 69 to Újpalota and the construction of a "fast tram" line across the rebuilt Árpád Bridge (route 1) from Óbuda to Lehel Út, the first stage of a proposed line

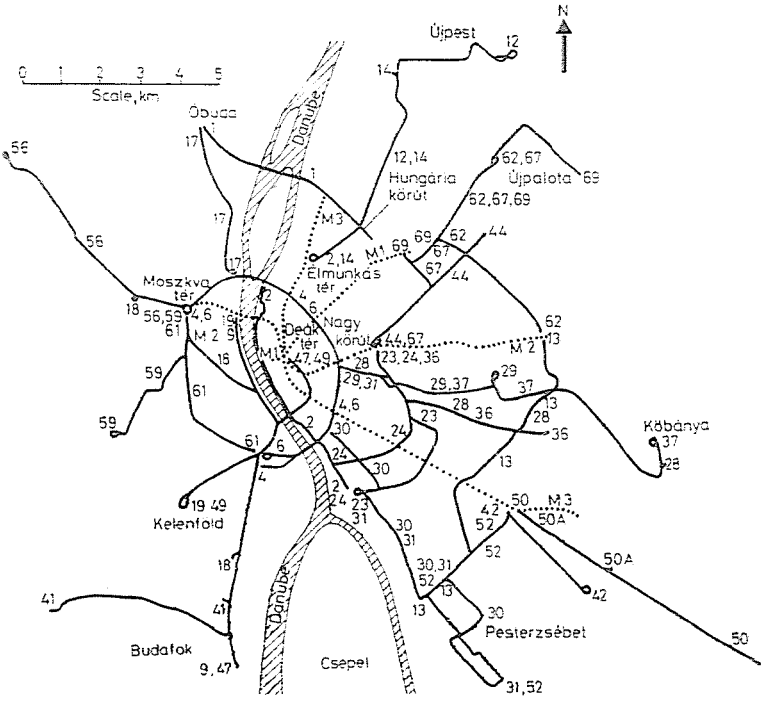

Fig. 2. Present Tramway Network

around Budapest on the Hungaria Körút. Also 172 new Tatra T5C5 tramcars have been bought to work in M.U. of 2 or 3 car trains on routes: 1, 12, 14, 18, 25, 37, 56 and 61, although officials of the Budapest Transport Company (BKV) expressed reservations on the Tatra Cars, as being too heavy and energy inefficient. Their preference for new trams would be for an up dated version of the 1960's 151 three section articulated Ganz trams, which operate notably on routes 2, 4, 6, 13, 23, 24, 30, 31 and 36. However, this may also be a reflection of nationalism. This debate is likely to become more critical as the ageing "UV" cars come to the end of their life. The 371 UV cars form the backbone of the present fleet and date from 1948 to 1965. These bring the age fleet age to 23 years, compared to $5^1/_2$ years for the bus fleet.

Table 3

Public Transport waiting times (mins.)

MODE	PEAK		OFF PEAK	
	Average	Longest	Average	Longest
Bus	2.8	19	3.9	17
Tram	2.2	13	2.8	16
Trolleybus	no data	—	4.1	11
Metro	1.2	3.0	2.0	5.0

Ganz-Mávag after a period out of the tram business, is currently building 4 axle single ended bogie cars for Alexandria, Egypt, which will operate in permanent back to back pairs, like the T5C5. N/P Over a five month period a survey of public transport travel times was made by the author which showed that operating speed (Fig. 3) and frequencies (Table 3) were very high (Fig. 3), though reliability was low for on-street services, but that over half the journeys made required an interchange (58%). With the added walk and wait,

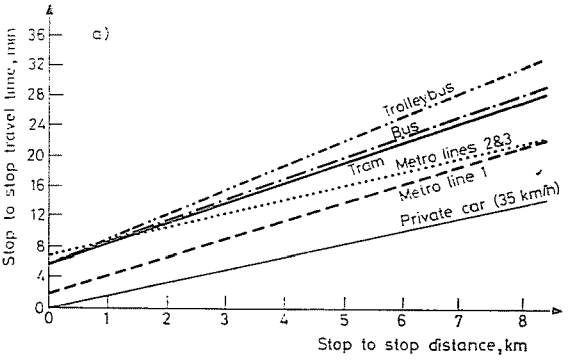

Fig. 3.a. Comparison of OFF-Peak Operating Speed

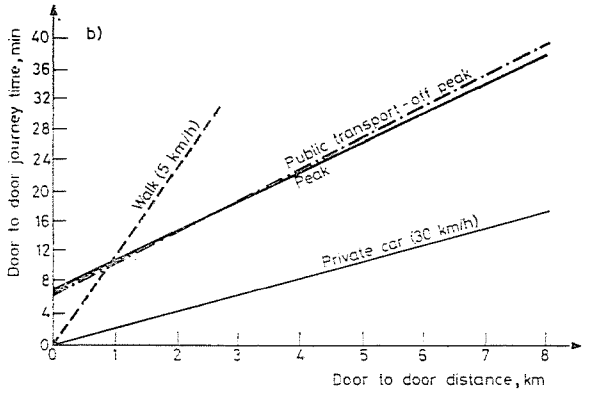

Fig. 3.b. Comparison of Door to Door Journey Speeds

this made overall journey speeds rather low (peak 11.7 km/hr, off-peak 10.4 km/hr). Most surprisingly, even though the new Metro (lines 2 and 3) had high operating speeds (32 kph) because of an average 4 minute access time by escalator, slower surface routes were actually faster for quite long journeys, and that the original sub surface Metro (line 1.) was faster for journeys up to 8 km in length even though the operating speed is only 24 km/hr. The characteristics of this line have been assumed for new segregated "Express" tramways. Lastly, the tram system has a further use for the movement of rail freight wagons, between exchange sidings at many stations (including the South (Deli) Station), and industrial and other premises in Budapest. This freight is normally moved at night or Sunday in trains of up to 10 wagons, with one or two grey painted electric tram engines, fitted with both tramway and railway draw and buffer gear. Since Budapest is very important for national industrial production and a high proportion of freight traffic is by rail (56% in 1983), this freight movement function is likely to continue to be important, and may lead to some tracks being retained, after Metro Construction, to enable the traffic to continue.

Five-Year Plan

The Budapest five-year plans have addressed several important problems:

(a) Severe housing shortage (average flat = 1.42 rooms and 1.14 families 1980).
(b) Congestion of city centre (inside Nagy Körút).
(c) Congestion of Danube crossings and separation of through goods road traffic, increasing the number of traffic lanes across the Danube from 10 to 28 by 2000 AD.
(d) Construction of 9 major suburban district centres.
(e) Construction of 5 Metro lines.

These are shown in Fig. 4. The construction of new flats, both to meet the existing housing shortage and to cope with declining household size, has been about 16 000 per annum over the last decade, with a target for the next decade of 11 000 pa. These have been built around the existing nineteenth century city, and form a distinctive "white wall" of 11 storey prefabricated concrete flats. By 1990 the population distribution of the city will be reversed with over half the people living outside the Hungaria körút (Ring Road). These new flats have car parking, which is impossible in the inner city, and a local district shopping centre where many of the City Centre Functions will be available. Added to this there is a national policy to meet the very high demand for private car ownership, which by 1990 will be approaching British levels. By that time not only will there be significantly more traffic congestion

since road building cannot keep pace, but most people will have a choice of a car and public transport will offer an even poorer quality of service by comparison.

The economic recession has also affected Hungary but in a different way from the west, since there is still full employment. However, there has been a sharp drop in funds available for capital investment, and transport has been badly hit. This has meant that Metro Construction on line 3 has reduced

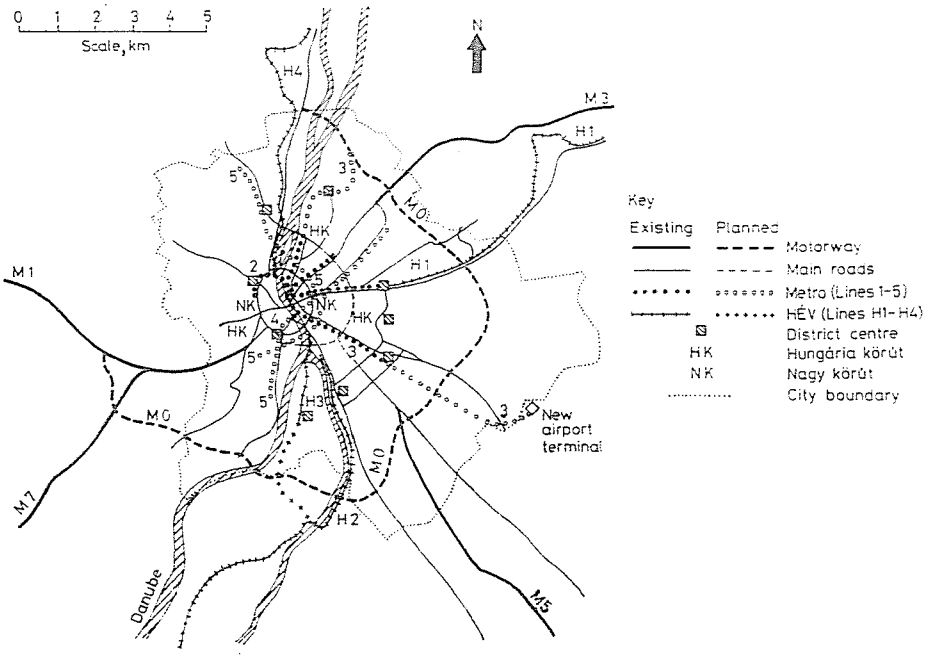

Fig. 4. Five-Year Plan Proposals

to less than one km per year, and means that the full system could not be completed until the second half of the next century. Also ambitious road proposals have led to a clash between the city and the state. The city would prefer to see the cheaper Hungária Körút dual carriageway completed around the city (about 5 km from the centre) with a new bridge across the Danube in the south near the top of Csepel Island. While the state wants to build a more expensive Motorway (M.O.) (about 15 km from the centre) around the outer area (akin to the British M 25) with new bridges in the north at Újpest, and in the south across Csepel Island. The city argues that its proposal will reduce severe traffic congestion on the Nagy Körút and Petőfi Bridge, the state argues that M.O. is needed to meet the new national motorways M1. M3, M5 and M7.

Planned Retrenchment of Tramways

The present Five-Year Plan proposals resolve around the planned extension and completion of a 5 line Metro. In this case the role of tramways will be further significantly reduced, as the busiest routes are replaced or paralled by new Metro lines and the remaining tramways merely become feeders to the Metro.

At present there are two options being considered, for Metro lines 4 and 5, which affect the remaining tramway network. These options relate to the best method of serving Kelenföld in the south west and linking the Metro to the HÉV line to Ráckeve. These options are shown in Fig. 1. The consequent changes to the tramway involve expansion or consolidation in the suburban areas. In particular the 'fast tram' route 1 is planned to be built right around the new Hungária Körút, in stages to reach the Danube in the south by 2000. In the east a new tramway is planned to replace bus routes 58, 61, 62, 68 through Kőbánya to Rákoskeresztur. There will be a short eastwards extension of route 42 in Pestlőrinc, a diversion of routes 31 and 52 through Pesterzsébet and a short lived extension to route 12 northwards in Újpest to serve a new

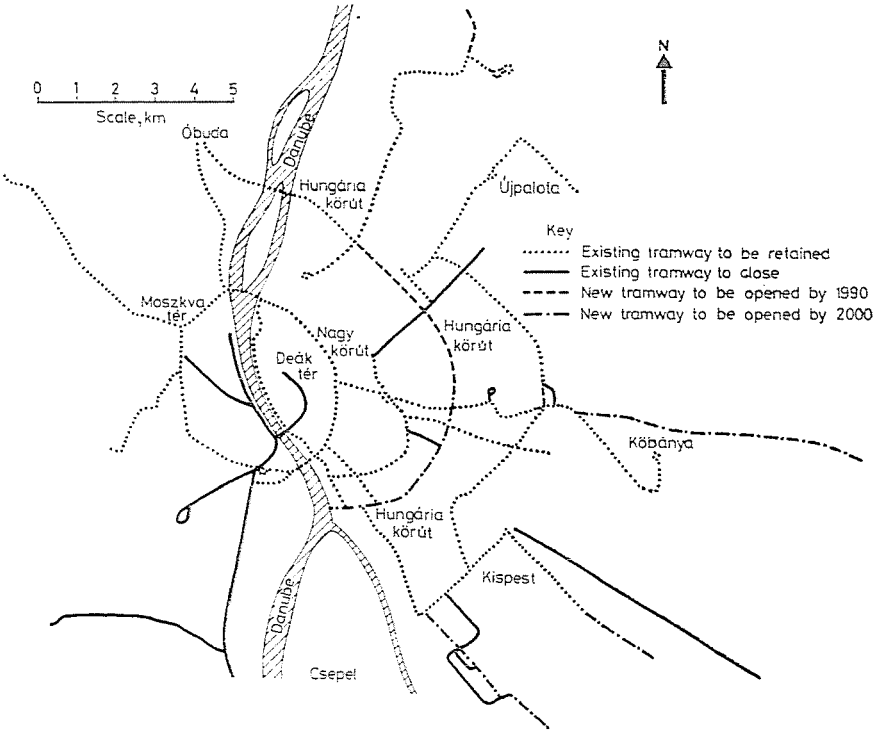

Fig. 5. Five-Year Plan Tramway Proposals

housing district of 50 000 in construction. However, these will be more than balanced by the closures in the wake of Metro construction, viz. 9, 18, 19, 23, 41, 44, 47, 49, 50, 62 and 67 leaving the tramway network a mere shadow of its former self. These are shown in Fig. 5. Of the routes left the following would be developed by extension or diversion onto new rights of way: 1, 12 28 or 37, 30, 31 and 52.

In route length terms, the post-2000 tram system would be less than half the present day network. However, should it not be possible to construct the Metro as planned, and car ownership continues to grow at a rapid pace anticipated to reach 22.5 per 100 inhabitants by 2000, then Budapest will experience severe traffic congestion, for which one solution would be draconian traffic controls and car restraints. However, the city authorities at present are not prepared to restrain car use, witness the anarchic and illegal parking in the city. Severe road congestion will also slow down street based public transport services, so that cars would still be the faster mode, door to door, for an, increasing number of citizens with a choice. However, if the service characteristics of the No. 1 (Földalatti) Metro line could be achieved by all services, and private cars were slowed by congestion, then public transport would become competitive in travel time with cars. This may be possible if the city were prepared to invest in segregared rights of way, either on street, or off street, for which the tram route No. 1 is a model.

"FAST" and "EXPRESS" Tramways — Definitions

The new line No. 1 is being built as a "Fast" tramway, on exclusive rights of way with physical separation from other traffic and stops on average 0.7 km apart, more than twice as far apart as on other tramways in Budapest. This results in a service speed of 24 km/hr in spite of there being no special priority for trams at road crossings.

This paper proposes to extend that concept by the inclusion of priority at road crossings, with some form of pre-emption of traffic signals, such that trams do not need to slow down. The technology for this is well developed both for buses (Runcorn Busway) and trams (VETAG in Holland). By eliminating delays at road junctions high average speeds can be obtained with closer stop spacing, down to about 500 m. Closer stop spacing shortens both average passenger walking distance (and time) and vehicle stop times, still enabling an operating speed of 25 km/hr to be realised. This proposal will be called "Express" tramways, and does not rely on the full 120 km/hr capability of the Tatra T5C5 cars being used.

Express tramways can be constructed incrementally. On roads not wide enough for full physical separation and the exclusion of other road traffic,

Dutch style "trambaan's" can be used, incorporating a slightly raised surface on the tracks, with a humped kerb parallel to the tracks at the edge of the right of way.

An Express Tramway Network for Budapest

The cost of constructing the line No. 1 Fast tramway has been between one-third and one-tenth that of a full Metro. Where only up-grading rather than completely new construction is required then the cost will be even less. This proposal assumes that Metro line No. 3, will be constructed to the Újpest District Centre (Árpád út and Pozsonyi út by 1990 and thereafter capital funds equivalent to a kilometre of full Metro will be available per year. This investment should be used to create an Express Tramway Network to supplement the Metro and have the following objectives:

(1) to provide overall journey speeds competitive with private car travel;
(2) to serve the growing population outside the Hungária Körút ring road;
(3) to provide for the increasing tangential and cross city travel demands which will arise from (2);
(4) to improve operation, efficiency and journey speeds by combining routes to allow more journeys to be made without interchange.

By these approaches over half the existing tramway network could be upgraded to the Express standard by 2000, providing a rapid rail network (Express tram and Metro) of over 150 km. Indeed, an Express Tramway network is likely to provide on average a better standard of service, with faster journeys (42%) than a Metro, shorter walks at either end of the journey and easier access to the service. There would also be the psychological advantage, in the Express tram being seen to be faster than its competitor, the private car. Lastly, the capacity problem of the Danube bridges can be eased by the use of Express Tramways which attract travellers who would otherwise use a car. The Five-Year Plan envisages increasing the number of bridge lanes from 10 to 28, so raising the peak hour traffic capacity from 15 000 to 28 000 cars per hour (24 000 to 67 200 passengers per hour). However, converting a traffic lane to an Express Tramway increases the passenger capacity of that lane by over 10 000 per hour in the peak. So the proposed capacity expansion could be realised by 6 Express Tram lines, without the need to build any new bridges.

In some places curves will need to be relaid with gentler radii, superelevation and transitions to gain the maximum benefit from Express operation. But the cost of this is likely to be small compared to the benefits derived.

Express Tramway Proposals

In order to show what an Express Tramway network might look like some proposals have been drawn up, which are shown in Fig. 6. These cannot be considered to be definitive but show some of the options which are available. Clearly some of these are going to be controversial, but possibly less so than the principle of giving Express Trams priority over other traffic at junctions

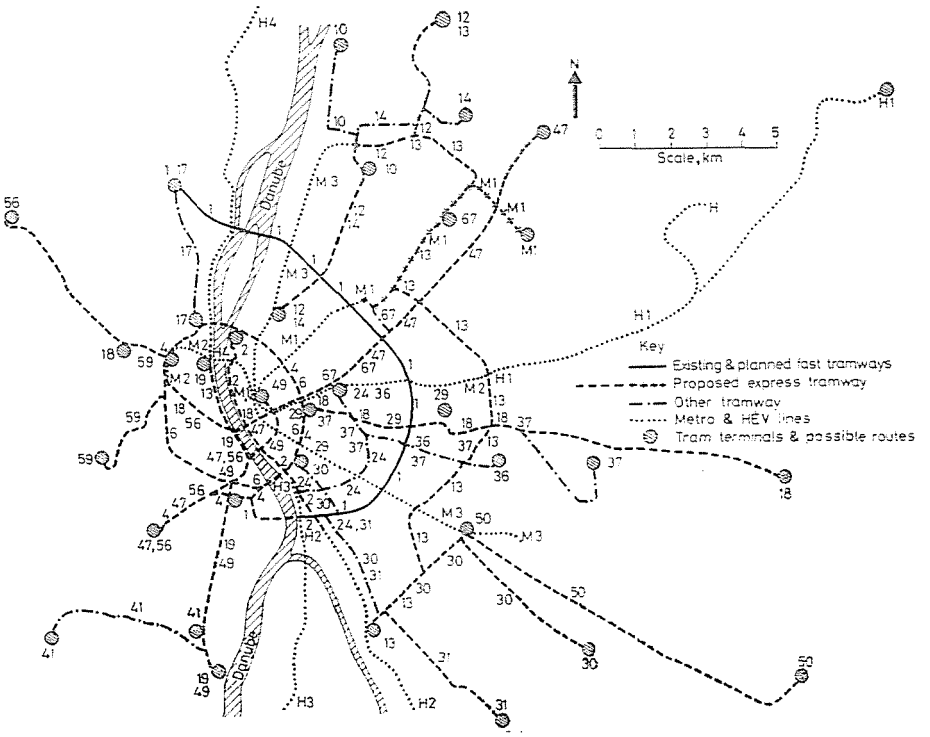

Fig. 6. Existing Planned "Fast", and Proposed "Express" Tramways

and in some cases would allow bus services to be reduced on particular routes, the buses being used to improve services in the suburbs, or withdrawn to provide operating savings.

The Express Tram route network is listed below together with the residual conventional tram routes, some of which post-2000 could also be upgraded.

Of these proposals, the two most controversial are likely to be

(a) extension of Metro line 1 from Mexikói út along Express tramways to
(b) reintroduction of tramway over Erzsébet bridge and Rákóczi u.

Table 4

Proposed express tramway network

Route No.	Terminii	Length (kms)	End to End time (mins)	Metro Interchange
Metro 1	Vörösmarty Tér—Újpalota	12.5	30	M2, M3
1	Óbuda—Lágymányos	18	43	M1, M2, M3, H3
2	Margit Híd—Ferencváros	7	17	H2, H3
4	Moszkva Tér—Kelenföldi pu.	13	31	M1, M2, M3, H3
6	Moszkva Tér—Nagy Körút (circular)	15	36	M1, M2, M3, H3
12	Élmunkás Tér—Újpest (new Town)	12	29	M3
13	Újpest (new Town)—Pesterzsébet	23.5	56	M1, M2, M3, H2, H3
18	János Kórház—Rákoskeresztúr	21.5	52	M2, M3
19	Batthyány Tér—Budafok	11	26	M2
29	Blaha Lujza Tér—BNV	5	12	
47	Rákospalota—Kelenföldi pu.	19	46	M2, M3
49	Deák Tér—Budafok	10	24	M1, M2, M3
50	Határ út—Ferihegyi Repülőtér	12	29	M3
56	Hűvösvölgy—Kelenföldi pu.	15	36	M2
59	Moszkva Tér—Farkasrét	5	12	M2

Table 5

Remaining conventional tramways

Route	Terminii	Length (km)	End to End time (mins)	Metro Interchange
10	Pozsonyi u.—Megyeri Csárda	4.5	19	M3
14	Élmunkás Tér—Rákospalota	13	28	M3
17	Óbuda—Margit Híd	4	15	
24	Keleti pu.—Ferencváros	7	25	M2, M3, H2
30	Ferenc Krt.—Pestlőrinc	14	42	M3
31	Ferenc Krt.—Pesterzsébet	9	27	M3
36	Keleti pu.—Kápolna Tér	6	23	M2
37	Blaha Lujza Tér—Gránátos u.	12	40	
41	Budafok—Kamaraerdő	6	23	
67	Keleti pu.—MÁV Telep	7	19	M2

Taking these in order:

(a) the extension of Metro Line 1 would avoid the need for interchange by passengers who presently use tram line 69 to Mexikói út. There would need to be some realignment of curves, the Földalatti trains would have to be fitted with high reach pantographs to work both tunnel and open tracks, and four or five new trains would be needed. Against that will be the replacement of the ageing UV cars on line 69, the through journey at faster speed, and providing some of the service that Metro line 4 if built would provide. Added to this the low floor height of the Földalatti trains would make level access from platforms only 350 mm high, which would also improve access to the Express Trams on lines 13 & 67 which would run over part of the route.

(b) *Erzsébet bridge.* In order to increase the effectiveness of the existing Danube bridges, some travellers who would use their cars must be kept or attracted to public Transport. Converting two lanes of Erzsébet bridge to Express Tramway operation would provide an opportunity to reduce the number of buses using the bridge, and increase the overall effective capacity by at least 50%. A similar argument would also hold for Kossuth Lajos út and Rákóczi út. However, from Tanács krt Express Tram line 47 would parallel Metro line 2 to Keleti pu. But there are already examples of tramways paralleling Metros: Metro 2 and trams 18, 59 & 61, Metro 2 and trams 47 & 49. An Express Tramway along this road would provide an enforceable public transport priority, which the present bus lanes do not, either through illegal parking or bus drivers ignoring the bus lanes. This route might allow for an experiment of fixing the "Nagypaneles" (track slabs) on the road surface, providing a very effective barrier against interlopers. Trunk Express tram line 47 would then provide a better service to passengers than the proposed Metro line 4.

Other Options and Problems

Clearly there are many permutations for these proposals, e.g. conversion of HÉV line 3 from Könyves krt. to Határ út to Express Tram line 2, with the Ráckeve HÉV terminating at Borásos tér by using the Csepel HÉV. Some lines proposed for conversion to Express Tramway standard after 2000 could be converted before.

Ferihegy Airport provides another problem, which because of its status is likely to be critical. The plan to extend Metro line 3 from Határ út, would at present investment levels take from 1990 to 2002, without any other network improvements being possible. Workers at the airport will find the proposed Express Tram line 50 very convenient. Air passengers will almost certainly continue to use the Express Coaches to the Volán, Deák tér, bus station. However, should there be a strong need for a Metro link I would suggest extending from the present Kőbánya—Kispest Terminal along the MÁV tracks which parallel the airport motorway. With a single station at Steinmetz Kap. the journey would take 15 minutes to the airport. This could be operated at a 15 minutes frequency on a single track with a passing loop at the intermediate station, giving a journey time from the Airport to Deák tér of 35 minutes.

Lastly, with the outer population continuing to expand there will be gaps in the Express Tramway network which could be filled, for example, Rákosszentmihály, Rákoshegy, Rákoskert, Pestimre, Rákosliget, Királyerdő and Budaőrs. In some cases several bus routes could be redirected to provide better services overall.

Conclusion

Present transport plans for Budapest envisage a five line Metro being built and the role of the tramway being substantially reduced. However, the capital investment necessary for this is unlikely to be available in time to meet severe competition from the rapidly growing level of car ownership. Therefore plans for Metro lines 4 and 5 should be reviewed and possibly the available funds to upgrade some tramways to an Express standard (with an operating speed of at least 25 km/hr). By 2000, a high quality network could be built covering the whole of Budapest.

From the present service, tramways upgraded to an Express Standard would give a better level of service with on average faster journeys and shorter walks than a Metro. An Express tramway network could be built throughout Budapest in the time and for the price of just extending Metro line 3 to Ferihegy Airport.

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