

An Integrated Approach to Public Transport, Tehran, Islamic Republic of Iran

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Introduction

As Tehran is the largest city in Iran by far, the transport challenges it faces therefore differ considerably from those faced by other Iranian cities. There are about 7 other major cities in Iran such as Tabriz and Isfahan (once one of the largest cities of the ancient world) but the difference between them and Tehran today is quite dramatic. This can be seen easily just by comparing their populations. They are all under 2 million while Tehran is four times their size. Thus, Tehran is the most densely populated urban area, and what goes on in Tehran will have an impact on transport nationally.

Over the past ten years, the worsening traffic congestion has become more than a nuisance and turned into a major challenge for the Tehran city authorities. The metropolitan region is growing at a rate of about one per cent so any new transportation system for Tehran needed to cater for not only the growing demand but also be adapted to the development and expansion of the city. In addition, the transportation system also had to satisfy the general public's rising expectations in terms of quality of life and environmental friendliness.

As the last traffic studies were done in the 1970s, the imperative to address urban transport was clear. Demographic changes, increased motorization and urban sprawl due to new urban developments as well as improved transport links (four urban rail lines and significant new road infrastructure were built in this period) made it essential to update the urban public transport development strategy.

As part of its historical legacy, even in the late nineties, Tehran still had a reasonably dense but aging network of rail based suburban and intercity transport services. This once good suburban and national rail system was still quite heavily used although quality was poor at this time.

Motorized vehicles are still rather expensive to buy. Until 2009 fuel was heavily subsidized, when new measures were put in place to realign the price of fuel and to reduce its use. There has been a noticeable growth in private car travel but as vehicles themselves remain expensive, many vehicles are 'multi-purpose'. Despite this, motorized transport is expected to grow about sixty per cent over the next twenty years as more people are able to afford a truck, light duty vehicle, car or motorbike.

The expense of owning a vehicle has meant that informal transport has not developed as quickly as in many other low income countries across Asia and market forces have not yet managed to fill the gap between poor quality, formal,¹ cheap public bus and rail services and higher quality, more expensive, informal transport. But this is changing fast and there is also a strong growth in the numbers of private cars being registered.

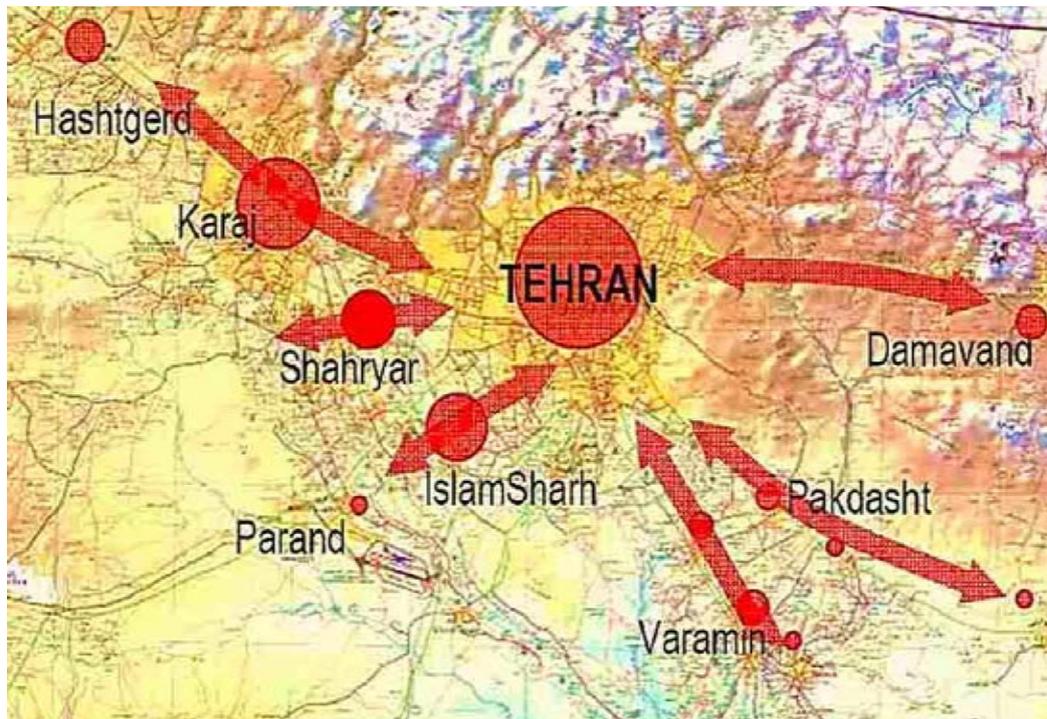
1. Formal public transport services are those with a scheduled, published timetable with a set payment structure.

Background

Tehran, the capital of Iran, is a growing metropolitan city with a population of just over 8 million and covering nearly 800 square kilometres. It is the seat of central government and is the most important political and economic city in the country.

The city has grown in population and size over the past thirty years from being a relatively small city with a population of 0.7 million in 1941 to being one of the leading megacities of the region. The Imam Khomeini International Airport, the Mehrabad Airport, the central railway station and four intercity bus terminals located there makes Tehran an important local and international transit hub.

Figure 1. The greater Tehran area as shown here is set to grow to 19 million by 2030



Source: Hashemi, 2011.

The Greater Tehran region includes several small and medium sized surrounding cities namely Karaj, Varamin, Eslamshahr, Shahriar, whose populations have also increased but most of the jobs, commercial centres and much of the industry are still centred in Tehran itself. This generates large numbers of commuting trips both within the city and also to and from these nearby cities.

Today the population of greater Tehran is estimated to be around 14 million, making it one of the regions' megacities (Montazeri, 2010). The daily influx of people, mainly commuters, brings the 'daylight' population of Tehran up to more than 15 million (Hashemi, 2010a), more than a fifth of the whole country's population. The organic expansion of the city and its urban sprawl and wide catchment area has increased demand for transport; resulting in a complex and inefficient transport system. Since the late nineties, the extreme traffic congestion has gradually become a major challenge for the city authorities, and the city is also suffering from high levels of air pollution. This becomes worse at certain times of the year as Tehran is surrounded by mountains causing temperature inversions that trap the pollution over the city.

By the end of the 1990s, despite having a public bus company and reasonable rail system, the lack of investment and inefficient organisation of public transport was not delivering acceptable levels of service to an increasingly mobile public. As more people found better alternatives to public transport, the number of motorised trips went up, exacerbating congestion and air pollution problems and by beginning of the twenty first century the travelling public had become increasingly dissatisfied.

National government started work on a transport master plan for Iran at about this time, using outside consultants, looking at the investment needed to satisfy the growing demand and to try plan better for the future. With Tehran as the capital city and also the main urban centre for generating wealth, it was important to develop a transport master plan for Tehran that would also support the national transport plan.

The approach of the Tehran Municipality is noteworthy as they have tried to create a transport solution that will deliver a strategic vision for the city for 2025 and beyond. The focus is on high capacity mass transport. The backbone of this plan is a strong commitment to rail (supported at national level) but this is complemented with Bus Rapid Transport (BRT), improved regular bus services, as well as cycling and walking improvements. City authorities have tried to develop a comprehensive strategic plan which illustrates ‘Tehran in 2025’, based on the higher level strategic plan, ‘Tehran Comprehensive Strategic Development Plan – 2025 Outlook’.

The architecture of the ‘Transport and Traffic Network Plan’ designed for Tehran is based on mass public transport systems as the primary mode of choice with a semi public system as a complementary mode to this and private transit mode as the least priority. This is being put in place with a special emphasis on private sector partnership and investment.

This case study illustrates how the plan is being implemented and highlights some of the successes and challenges to date, especially in terms of expanding the rail network, the introduction of the BRT and some of the practical, operations hazards being faced with the introduction of compressed natural gas buses.

The Urban Context

Tehran Municipality is presently organized as a mono-centric city with a major CBD (districts 6, 7, 11 and 12) where most commercial activities are concentrated. This is surrounded by several residential areas. Most of the future urban development is expected to take place in the north and eastern parts of the city with lower levels of development in the south of the city (and districts 21 and 22).

Bus based public transport has been organized in Tehran since the 1920s. Urban Bus Company Tehran started operations in 1955 with 246 buses and 5 lines of 30.6 kilometres. Typically in that period, they carried 150,000 passengers daily but by the end of the twentieth century the quality of the both the services and the vehicles themselves were poor. The market became more fragmented, with many smaller bus operators entering the market in a haphazard fashion.

Modal share

It is estimated that more than 3.5 million vehicles travel on Tehran’s road network and today the municipality estimates that some nineteen million daily trips are made in Tehran (Hashemi, 2010a).

Twenty two per cent of trips are made by bus, twenty three per cent by shared taxi, ten per cent by metro, ten per cent by minibus, seven per cent walking and cycling (NMT) and the rest by private car (twenty eight per cent). These vehicles were responsible for eighty eight per cent of local air pollution annually (Hashemi, 2010b).

Affordability of transport in Tehran

Today, people are still relatively poor and so the price they are willing to pay for all collective public transport, including regular or shared taxis, is quite low. The average spend on housing is 45 per cent of disposable income with transport representing 8–12 per cent. Formal public transport fares (both rail and bus) remain extremely low, even compared to Latin America (where the average is around US\$0.25).

Table 1: Prices for tickets, Tehran Metro

Ticket type	Price €
Single trip ticket	0.18
Return trip ticket	0.33
10 trip ticket	1.02
One day travel pass (unlimited travel)	0.33
3 day travel pass (unlimited travel)	0.66
Weekly or 7 day travel pass (unlimited travel)	9.55
Monthly or 30 day travel pass (unlimited travel)	23.52

Source: Tehran Metro, 2009.

In Tehran, a bus trip costs between US\$0.02–US\$0.10 and US\$0.20 for the metro. In comparison, single ticket prices in Europe (on mainly subsidized services) are often over US\$2 (€1.5) for a single trip and monthly tickets €50 and upwards.

A problem with air quality

The following table summarises the relative and absolute (tonne/year) contribution for each emission source in 2005. Mobile sources include light duty vehicles and private cars (LDV), motorcycles, buses (public and private), trucks, minibuses and motor-vans. According to the study performed by an Air Quality Control Company in Tehran, the contribution of light duty vehicle to air pollution has been considered to be close to 50 per cent of the mobile sources.

Table 2: Mobile and stationary sources of pollution

Emission	Mobile		Stationary	
	Tonnes per year	%	Tonnes per year	%
CO	1,354,652	99	18,222	1
SO ₂	6,142	10	57,173	90
NO _x	109,917	70	46,253	30
THC	155,609	71	64,761	29
PM	18,777	69	8,444	31

Source: <http://www.ess.co.at/WEBAIR/TEHRAN/tehran.html>, last accessed 16 June 2011.

Developing Tehran's Urban Mobility and the Mobility Master Plan

The planned population of Tehran City Municipality is estimated to grow to around 9 million inhabitants in 2030 and the total population of greater Tehran is estimated to reach as much as 19 million in the same period. Six axes of development were taken into consideration linking the major surrounding cities (as shown in Figure 1) and how these might be linked to Tehran by creating 6 main rail corridors.

The Tehran Master Plan especially highlights the need to create a poly centric city, with several centres of urban activities, rather than the present mono-centric configuration. These new and existing centres are to be well served by the future urban rail network. The first 5 year phase of implementation of the master plan started in 2008.

Developing a vision and strategy

Tehran Municipality worked hard to develop a visionary strategic plan for transport 'Tehran in 2025' during a five year period (2003–2008). This comprehensive plan is based on the wider 'Tehran's Comprehensive Strategic Development Plan – 2025 Outlook'.

Box 1: Tehran's vision 2025

In 2025, Tehran should have an integrated, available, safe, easy, comfortable and clean transportation system considering the limitation of resources and other relevant conditions for improvement of life quality.

From eleven draft scenarios, four possible network scenarios were selected on the basis of a simplified multi-criteria comparison. These were refined, detailed and tested through the multi-criteria analysis using a traffic forecast model. The objective was to select the one which best fitted with the objectives. It was felt that this type of analysis offered the best possibility of ranking the network scenarios according to different indicators and weighting, reflecting the different points of view of the major interest groups while still keeping to the different and overall objective as stated above.

By 2025 Tehran's road would be handling some 25,388,000 daily trips. However, if this was to be achieved, it was perfectly obvious that the mass transit options had to be seriously improved. Indeed, in the chosen scenario, public and semi public actors provided the variety of collective transport needed for a 75 per cent modal share. The backbone of this system would require a dense, high capacity multimodal public transport network.

Table 3: Number of trips required if the ambitious target of 70 per cent modal share of trips made by mass transit (excluding taxis) would be achieved by 2025

System	Mode	Trips	Percentage
Private	Cars and lorries (LDV and HDV)	3,960,000	22
	Motorcycles	540,000	3
Public	Urban railway	8,100,000	30
	Urban bus	9,036,000	32
	Minibus and vans	2,402,000	8
Semi-public	Taxis all types	1,350,000	5
TOTAL		25,388,000	100

Source: Hashemi, 2010a.

Public transport organisation in Tehran

Stimulated by a strong interest in rail at the national level since around 1997, the plan for improving mass transit in Tehran was developed setting the framework with suburban and metropolitan rail at its heart. However, as the plan evolved it became clear that a strong bus network would be needed to complement this. The final plan catered to provide for just over 19 million daily trips by mass transit (rail and bus services) aiming for a 42 per cent market share by 2030.

A systematic approach for designing the public transport network was taken based on:

- Bus and Railway being the primary, high capacity modes of the public transport network (with both public and private sector involvement);
- Vans and Taxis as the second level providing complementary services to the above (mainly with the involvement of the private sector);
- Priority would be given to public services in the design of the road network.

Box 2: The infrastructure needed to be built to deliver the mass transport network

Greater Tehran Strategic Plan for Mass Transit and Urban and Suburban lines 2030 includes the construction of:

Metropolitan Rail

4 Express Lines	179 km
8 Urban lines	251 km
Total	430 km

Road based

5 BRT, Tramway or LRT lines	60 km (integrated with heavy rail)
1 Monorail (integrated)	12 km (to Tehran Exhibition Centre)

Integration and transfer hubs

- 13 main interchange stations
- 54 Transfer stations
- 19 Park and Rides with 25,000 parking spaces
- 10 public transport interchange hubs with connections to bus railway and /or airport services

To serve 19 million daily trips by public transport

Sources: Systra Consulting, 2005; and Author 2011.

Institutional organization

Public Transport is mainly organized by the municipality in Tehran and the Traffic and Public Transport Office reports directly to the Mayor. There is, however, a growing proportion of operations (and maintenance) being outsourced to the private sector. As much as 40 per cent of public transport operations (excluding taxis) are run by the private sector.

Role of the private sector

In recent years, and especially in order to improve the quality of service, accessibility and efficiency of the public transport services, Tehran Municipality has taken important steps to attract private sector partnership into operating public transport services in Tehran. This has been especially applied to bus services. This partnership provides the system with newer vehicles provided by private companies and a higher quality of services than might have been

achieved in the same timeframe by public only operators. In 2006, there were only 724 privately operated buses compared to some 6,676 public ones.

The high capacity, high speed BRT lines are mainly operated by the public sector while the regional and local bus services increasingly by the private sector. The privatization trend in bus services is illustrated in Table 4.

Table 4: Governmental and private sector shares in bus service operation in Tehran showing the evolution of private and publically owned buses and line operations in Tehran since 2007

Year	Number of government owned and operated buses	Number of privately owned and operated buses	Number of lines operated by public (government)	Number of lines operated by private operators	Total	% of lines operated privately compared to total number of lines
2007	6071	1319	294	107	401	26
2008	5644	2209	249	127	376	33
2009	4490	2675	200	159	359	45
2010	3919	3102	178	165	343	48

Source: Tehran Municipality.

In less than 3 years, the total share of private sector in annual trips reached to more than forty per cent. It is hoped that with the implementation of the master plan and other transport improvements this share will reach to 60 per cent in period 2011–2013.

In addition, there are some 80,000² taxis in Tehran and over the past few years around half have changed ownership to be privately owned. These are differentiated by colour (green for those owned by private companies and yellow for those privately owned, by the driver).

Developing Tehran's rail system

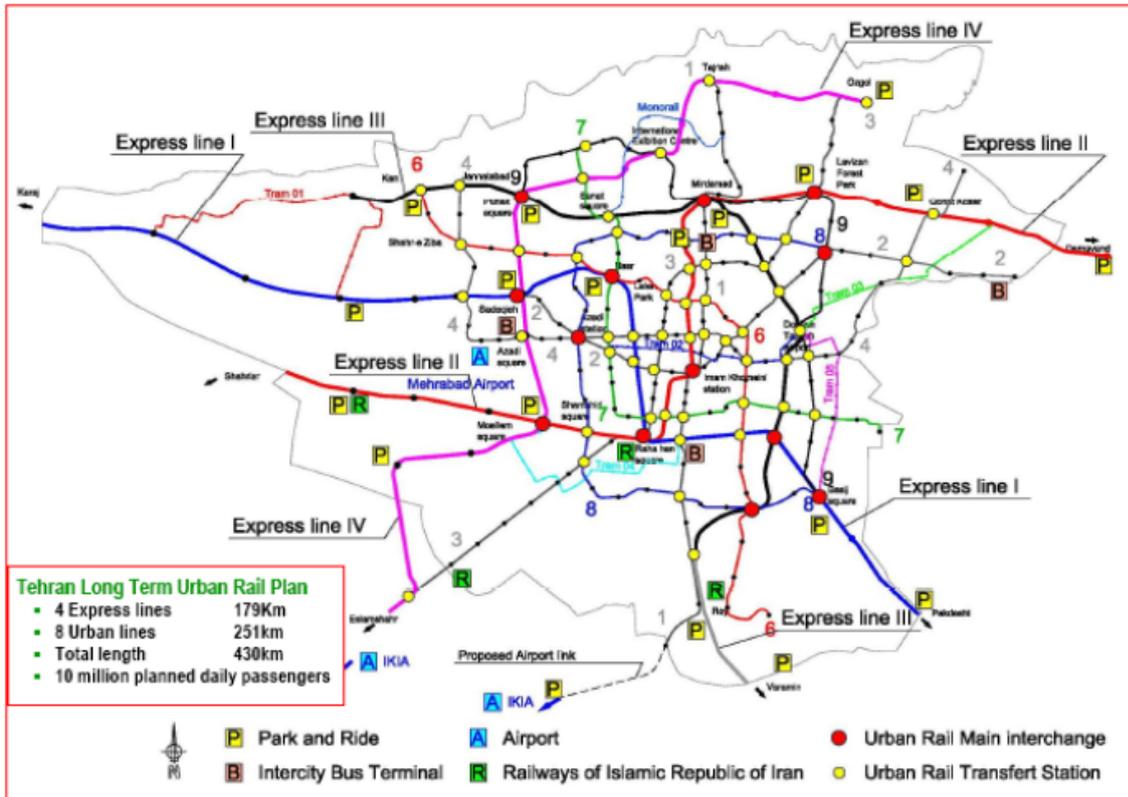
A national law passed by the Iranian Parliament states that the share of rail-based public transport in Tehran should be not less than 5 per cent (2008) and national legislation encourages all cities over 500, 000 population to have a rail based mass transit system. Tehran already has a metro, and metros or a Light Rail (LRT) systems are planned (8–10 systems in total) in the other 9 leading cities.

Rail based systems can cope with high passenger numbers but they are also expensive to build. The backbone of Tehran's mass transit is strongly rail based but it is complemented by high capacity bus lines that function like a metro called Bus Rapid Transit (BRT), as well as city bus networks, shared and regular taxis.

Tehran's long term urban rail network serving some 276 stations will have a total length of 430 kilometres, of which more than 300 kilometres are new alignments. The master plan increases overall capacity by adding four express lines and eight urban lines between the East and the West of the city, complemented with five express high capacity bus lines (Bus Rapid Transit).

2. It has been difficult to verify the exact number of taxis but this is an unofficial estimate from UITP Liaison.

Figure 2: Caption Tehran’s long term rail plan showing the main transport hubs



Source: Montazeri, 2009.

All the lines are planned to integrate with other modes via fifty four transfer and thirteen main interchange stations, to achieve an excellent level of connectivity across and into Tehran and the gateways linking the surrounding cities. The connectivity is strengthened by the existence of Express lines I and II crossing the city and by the loop around the CBD formed by the Express lines III and IV.

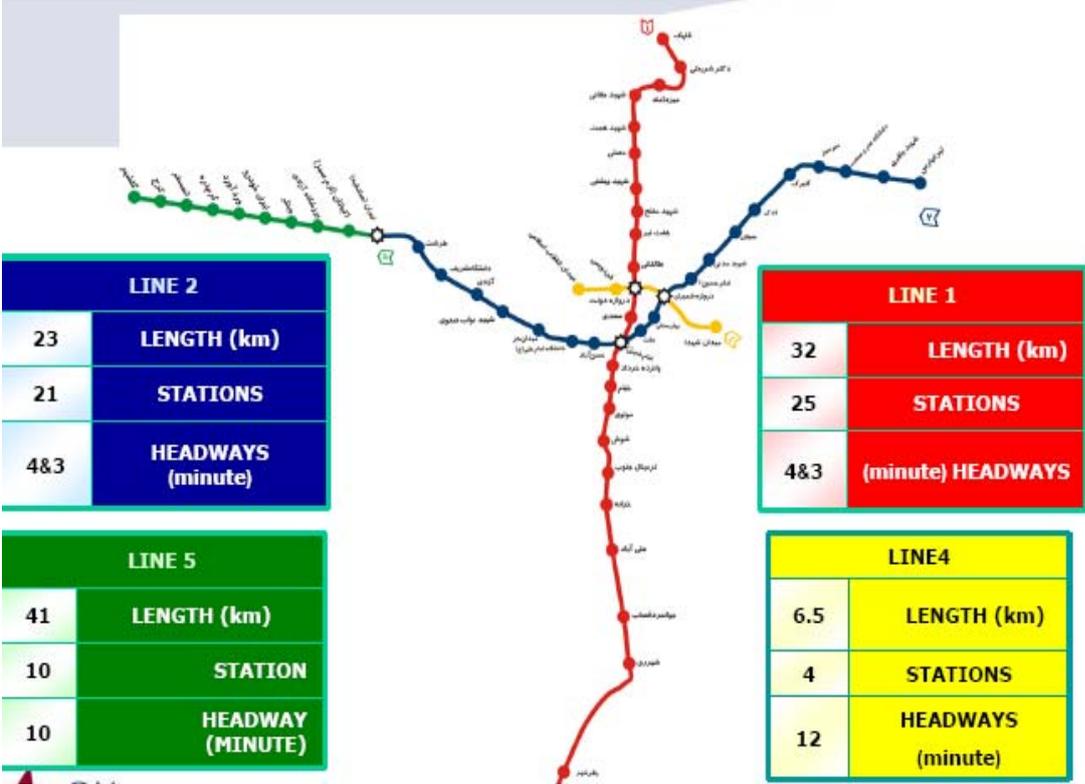
Creating a world class metro

The metro (underground) has enjoyed some considerable success and has been in operation for the past 12–13 years. It now carries nearly 2 million passengers/trips a day, representing 12 per cent of the total number of trips made in Tehran. Metro development and operations are split into two wholly owned public companies – one for operations and one for capital investment. The operations company has subcontracted the maintenance (complete system) to the private sector in a contract of five years.

The development of the metro network has accelerated recently, as the Tehran municipality as well as the city council has allocated more of its budget to it. Metro projects have a high priority as part of developing and promoting Public transportation in Tehran.

Construction was initially funded with support from Central Government and a private public partnership also has significant interest. The first phase cost about US\$45 million per kilometres (while Light Rail was US\$25 million and the suburban rail lines were costing around US\$20 million). In the first phase of Tehran Metro, national banks and foreign loans

Figure 3: Tehran’s metro



Source: Tehran Metro, 2009.

provided much of the finance. During this phase, some financial challenges were experienced. Since putting the Tehran Urban & Suburban Railway Operation Company (TUSRC) under new management, the budget required for capital investment is now partly covered by Central Government and partly by the municipality. The government has now sanctioned TUSRC to raise long term financing facilities from other sources and until now US\$1.6 billion (inclusive of interest raised by 2008) has been raised.

Today there are 125 kilometres of metro lines serving 70 stations. 15–20 kilometres of new lines are currently under construction but it has proved to be quite difficult to achieve the full master plan. The shortfalls in the funding mainly from a lack of financial support at national level has meant that construction and operations have not gone according to plan and due to the intermittent and lack of financial flows from central government, the municipality has been obliged to pay 75 per cent of the costs of infrastructure, which poses serious management problems.

By 2010 lines 1, 2, 4 and 5 are operational and 125 kilometres have been built. Balancing capital investment and operational finance flows is still a struggle. The metro is at present (2010) operating at ten per cent lower than capacity as there are less train sets and rolling stock operational and available than planned (partly because municipal funds have had to be channelled into infrastructure investment). The metro is only running at 4 instead of 2 minute headways on lines 1, 2 and 4 and the 42 kilometres long line 5 suffers from even longer headways (between 9 and 15 minutes). The high demand and the present crowded conditions require efforts to be made to ensure these passengers do not switch to other less environmentally sustainable modes.

Iran has also tried to become self sufficient in manufacturing trains, metro cars and tramways. 96 trains including 74 seven-car metro train sets and 12 eight-double-decker car trains with 24 locomotives are operating on the metro and suburban rail network. In order to cope with the increase passenger demand, a further 65 trains have been ordered with the affiliated group of companies responsible for the manufacture of wagons and locomotives.

The bus rapid transit (BRT) system

By the end of the latter part of the twentieth century, the city bus service had deteriorated, ridership was falling and service levels were poor. This was partly due to:

- Severe competition on routes and violation of agreements so the public bus service could not compete with emerging unregulated services from the private sector;
- Fares set too low for profitability and fleet renewal;
- Partial privatisation of operations but this was an unhappy arrangement as the government set the fares (and kept them at an unprofitable, low level) while the private sector took all the financial risk;
- Poor service levels and declining patronage;
- On board cash payment allowed fraudulent behaviour;
- No reliable data on patronage/ ridership;
- Weak supervision and monitoring;
- Problems with security both on the vehicles and at terminals;
- No service or fare integration with other companies or service offers.

Buses struggled in dense mixed traffic and the bus service was viewed as a poor quality service for the poor (Hashemi 2008).

Photo 1: A view of the Tehran bus based rapid transit system with one of the highest ridership levels in the world showing the median position of the bus lanes



Source: Tehran Municipality (via UITP Liaison office).

This chaotic situation led to a renewed interest in the introduction of the metro. However it was also clear that the metro could not be built quickly enough, and other options were explored. Bus Rapid Transit (capacity bus services that runs on similar lines to a metro) was seen to be a way of providing high capacity, mass transit at an affordable price. Although it required some new infrastructure, it had the added advantage of maximizing existing infrastructure.

The first BRT line was introduced into Tehran in 2007 after a municipality visit to Bogotá, Columbia to see the famous TransMilenio BRT in operation. However, despite the success of this trip, the Mayor was not entirely convinced that this system would exactly suit the needs of Tehran. By adapting the most important design features and finding the right solution for the dedicated right-of-ways and pre-boarding payment and adapting them to the local requirements, a high capacity, well adapted and affordable system was achieved. The study for adapting the design of the final BRT network was carried out by Amirkabir University of Technology in Tehran.

An increase of 77 per cent passengers per day was achieved in the first year of operation. Passengers grew from 214,000 passengers to 380,000 daily in the period between May 2007 and May 2008.

Two further lines were introduced in 2008 and at present 5 lines, 176 kilometres of BRT are in operation, and a further 5 are planned. They carry 1.8 million passengers daily, probably the highest in the world (the metro lines combined in Tehran carry 1,700,000 and the regular buses some 4,000,000 passengers daily).

Operational details

The main specifications of Tehran BRT lines are as follows:

- Exclusive two way median right-of-way for line 1;
- Bus priority at intersections;
- Several doors for facilitating more speedy boarding and alighting of passengers;
- Average length of bus stop: 36–44 metres;
- Sufficient protective cover against sun heat, wind etc at stops and stations...;
- Air conditioning system (cold and warm);
- Special ramps for full wheel chair accessibility;
- System of advance announcement of bus arrival (real time passenger information);
- Information and advertising displays;
- Electronic ticketing system;
- Operations managed by intelligent control centres; and
- All stations equipped with video monitoring cameras.

This highlights the high quality of the BRT both in terms of speed of service but also in terms of comfort and passenger levels that it has attracted compared to the previous low quality regular bus service.

Recent analysis shows that in addition to total improvement in transport corridors' performance, the efficiency of each fleet is also improved by more than 90 per cent based on a single cabin 13 meter public bus with 36 seats (i.e. a regular bus not a high capacity vehicle). The active fleet serving this route has been reduced from 320 to 240 vehicles bringing considerable operational gains.

The results are as follows:

- Along BRT 1 line a 46 per cent decrease in total amount of air pollutants and emissions in the Azadi Square – Tehranpars corridor.
- Analysis in BRT 2 line shows that more than 1,495,000 litres of fuel saving a day by reducing daily trips by private cars and motorcycles in this corridor.
- Studies on the Ghods Square – Rahahan Square BRT line shows that more than 27 per cent of trips by private cars have been transferred to BRT fleet and as a result the total emission production has been decreased by 140 tonnes a year including NOx, CO, SO2, particulate matter and hydrocarbons (Hashemi 2010a).

Privatisation of operations

In order to improve the quality of service, accessibility and efficiency of public transport, Tehran Municipality has taken important steps to attract private sector partnerships to operate its bus services. These partnerships have provided the system with new fleets paid for by private companies as part of their contract and right to operate and a higher quality of services has been delivered quicker than the municipality would have been able to provide. However, experience has shown that successful contracts usually require some level of risk sharing and need careful management (see Table 1).

In less than 3 years, the total share of private sector in annual trips reached to more than 40 per cent. The target is to reach 60 per cent in 2011.

In addition, the introduction of new BRT lines can also catalyse a change of old habits – such as rerouting, closing some bus services or to introduce other reorganizational aspects. This can bring greater efficiency across the whole transport system. Benefits include

The Technical improvement of fleet

A major breakthrough in fleet management in recent years has resulted in the renovation of the fleet, decreasing the average age of fleet to 5.3 years and converting 50 per cent of the active fleet to CNG. When the average age of the bus fleet in Europe is 7.7 years, this should be seen as quite an achievement (IUTP, 2007).

An Electronic Fare Collection System

In 2010 an integrated electronic fare collection system was introduced on metro and bus services. It is currently in use on all bus fleets directly under operation of the Municipality equipped with e-card readers. The first experience of e-ticketing private bus services is now on trial in the Qods-Rahahan BRT line fully under operation of a private company.

Some Useful Learning Experiences

Attracting a new class of client

BRT is seen as being able to attract a new clientele to use bus services. Prior to 2007, bus transport was seen as being ‘poor transit for the poor’ but the success of the BRT and market research surveys show that BRT is an attractive service to the middle and professional classes. As these are the people that are more likely to also own a car this is just the target group that is the most important to convince to use public transport but it can be difficult to attract them onto regular bus services.

Research carried out by the municipality showed the level of qualifications of those riding the BRT was rather high. 44 per cent had university degrees (Bachelor or BSC equivalent); 24 per cent diploma level; 11 associated degree level; 13 per cent no diploma and 8 per cent had a higher degree (Phd, Doctorate or Masters). Attracting this class onto public transport services has helped to reinvigorate interest in bus transport and investing in its infrastructure by local transport departments. This sector of society is less sensitive to small increments in fares when compared to poorer members of society as they are usually also considered to be choice riders and take public transport for the convenience, travel times as well as affordability of fares.

Gaining support from the business community

Agreeing on new bus routes can be contentious and brings out the ‘NIMBY’ (not in my backyard) in most of us. Routing the BRT line 2 through a major shopping centre Molavi was no different and it experienced considerable resistance from local business. They argued that business would deteriorate if access by car was restricted and priority given to the bus. However, this opinion has been reversed as it has been found that women find the BRT a very convenient way to do their shopping and business has improved since the BRT was introduced.

BRT is also seen as a way of changing old habits – such as rerouting or close some bus services or to introduce other reorganizational aspects.

Gender balance in BRT drivers

An unintended consequence of high quality BRT was the interest and promotion of women as drivers for the new bus system.

It has been shown that women are not only attracted to the BRT to ride the system but they also make excellent BRT drivers! Recent experience has shown that they:

- respect the responsibility and understand the risks of being a bus driver;
- take more care and ‘look out’ when driving;
- comply with road and safety rules more completely;
- drive within speed limits and with safety in mind;

Photo 2: Women bus drivers in Tehran



Source: Tehran Urban Bus Company.

- are quick to take evasive action when needed; and
- respect the power of the vehicles.

Development of Other Sustainable Modes

Cycling plans

The promotion of cycling as a green, safe and cost effective mode of transportation especially for local access and short distance trips has been a major preoccupation of Tehran municipality in the last 2 years. Based on the Tehran Transportation and Traffic Master Plan and demand analysis for cycling, more than 368 kilometres of dedicated cycling routes have been put in place.

A new ambitious €40 million plan aims at fostering daily bike use and the final objective is to reach a 12 per cent bicycle modal share by 2030.

Among the major initiatives taken recently are:

- Safe access of students to schools, including safe zebra street crossings equipped with buttons to change the lights and traffic signals in front of schools;
- Improved accessibility of passengers to public transport services, for example the passenger bridges are equipped with escalators and the terminal design with pedestrians in mind
- Renovation and restructuring the passages and pavements for normal pedestrians and people with physical disability (see Photo 4).
- The construction of dedicated walkways, pedestrian areas and ‘No-Car’ passages especially in major amusement and shopping centres including Tehran’s traditional ‘Bazaar’.

The first dedicate cycling route has been established in Tehran’s Locale 8. This area was selected for a pilot project on dedicated cycling routes as it has the appropriate topography suitable for cycling; it’s proximity to Metro line 2 and line 3 of BRT system; it is close to major entertainment and amusement centres such as local parks, cultural centres and shopping malls and it has relatively difficult access of motorized vehicles to some areas within the zone.

Photo 3: Bike racks in Tehran



Source: Tehran Municipality.

Photo 4: The use of tactile surfaces on pavements and other infrastructure surfaces has helped improve accessibility for the visually impaired



Source: Tehran Municipality.

The major feature of this project is the involvement of private sector investment for the bicycles, the rental centres, and other facilities. The route and infrastructure is designed and established by the Municipality.

Challenges for Energy for Transport in Tehran

Iran is one of the countries where fuel (namely diesel and gasoline) are extremely highly subsidised (GTZ, 2009). Until last year (2010) pump prices were below the cost price for Brent crude and gasoline, for example, was only about US\$0.10 per litre. In 2007, a fuel card system was introduced allowing a minimum quantity to be bought for a set subsidised price. This was a huge undertaking across Tehran as some 12 million cards needed to be put into the system for car and motorcycle owners alone (Kamal, 2008). The new system introduced allowed the public to buy up to 50 litres per month for the US\$0.10 price but then people had to pay US\$0.40 per litre over and above this use. This has very recently been changed to allowing 65 litres to be bought at a higher fixed price of US\$0.40 equivalent and any more at a new price of US\$0.70 per litre.

These unpopular measures were introduced to curb the use of diesel and gasoline and to reduce the subsidies paid on these fuels. These measures have nonetheless curbed growth and reduced consumption of petrol by 5 million litters per day over the business as usual trend.

Changing from diesel to compressed natural gas

The present trend for road based public transport is to move away from diesel and gasoline towards natural gas. Iran has vast reserves of both oil and natural gas, but it imports 40 per cent of its gasoline for local consumption as it lacks sufficient oil refineries. Diesel (as used for heavy duty vehicles such as buses and lorries) still has high levels of sulphur. Since the mid nineties, much effort has been put into building the infrastructure needed for this and it now serves some 13,000,000 vehicles across the country (12 million private cars and 1 million heavy duty vehicles, e.g. buses, trucks).

In terms of buses, the main public bus company in Tehran, Urban Bus Company Tehran now deploys some 3500 gas buses in the total fleet (1758 owned by the municipality and 1742 privately). They are used for regular services rather than the BRT (CNG buses are only used on BRT line 2). A further 6135 regular diesel buses are in operation and 66 trolley buses serving a total number of 459 routes (BRT is 92.6 kilometres).

Overcoming practical challenges of this transfer

However in practical terms there are still some fairly major challenges to using CNG for buses despite the long term benefits and reductions in local pollution. The vehicles themselves are more expensive to buy and as the energetic value of CNG is lower than diesel, more is needed to go the same distance, and as they need careful maintenance, they can end up being more costly to operate overall.

Present experience highlights the following:

- Delay and expense in the supply of vehicle spare parts.
- High cost of repair and maintenance as compared to that of diesel vehicle.
- Lack of proper hardware and software support from manufacturer (and availability of them in local languages).
- Danger of technical faults in gas burning engine buses.

- Reduction in the level of operational achievement among gas burning buses as compared to that of diesel vehicles particularly on gradient surfaces.
- Wearing effects of added equipments such as gas tanks on the bus structure.
- Failure on the part of manufacturing companies to issue ‘Type Approval’.
- Shortage of technically professional personnel in the field of deploying gas system.
- Failure on the part of authorities to carry out periodical test, of tanks and other equipments.

However, the most significant problems affecting the use of CNG gas for buses is also connected with the filling station infrastructure. This infrastructure is not owned or managed by the bus companies and so access and poor service levels have an impact on bus services. Problems include:

Insufficient number of existing stations and slow construction of new ones due to expense (so buses have to go a long way off route to fill up and this takes a long time).

- Poor quality equipment installed in the stations.
- State of repair of the stations (general maintenance and overhauls).
- Lack of capacity in the number of compressors and level of gas pressure (too low) during cold season creating scheduling problems for bus drivers.
- Oil leakage from greasing compressors gets into gas in the vehicles and tanks causing breakdowns or sometimes water and oil mix in the gas fuel.
- Shortages of supply due to lack of proper maintenance of the storage tanks at the CNG filling stations rendering some tanks unusable,(Iraq and Arabi, 2010).

Transport Demand Measures

Tehran’s congestion charging scheme

Tehran is one of the few cities in the region that has put in place comprehensive demand management measures to restrict vehicle access to inner Tehran with a RTZ (restricted traffic zone) sometimes called ‘Tehran Congestion Charging System. Access of all vehicles to the inner central business district (19 square kilometres) has been restricted since 1981. This has been extended to cover 31 square kilometres. An annual fee has to be paid to enter this area and an even and odd number plates enforcement is in place in a slightly larger zone. Trucks and lorries are restricted across an even larger area. At first, monitoring was done by the police via 65 gateway entrances but this was difficult to enforce and violations ran at over 30per cent. Today measures include the implementation of automatic speed cameras, and automatic control system.

This is quite progressive for the area but it can only be effectively implemented if quality alternatives are in place.

Car free and pedestrian zones

One of the major projects in promoting car free areas and pedestrian zones in Tehran was implemented in Tehran’s Traditional ‘Bazaar’ area. This historic building has been the most important commercial centre and shopping complex in the city for decades. In 2008, the Municipality planned to construct a pedestrian only zone in some of the heavily populated streets surrounding the Bazaar. This finally led to construction of a walkway ring around the monument and as a result the air pollution and traffic congestion in this area decreased to almost zero. As this walkway ring is in near to the ‘15 Khordad’ metro station, using public

transport to reach to this area became much more attractive for people and especially for business people.

Conclusions

Tehran should be commended for its integrated approach to finding affordable solutions to solving its urban mobility challenges. Few other mega cities in the region have attempted such an ambitious and visionary approach. It is unfortunate that the timely delivery of this visionary plan has been hampered due to avoidable financing issues. Despite national government's promotion of rail and the fact that they committed to pay 50 per cent of the capital costs for the Tehran metro and urban railway, this commitment has not been entirely honoured and only covers between 15 and 25 per cent obliging the municipality to cover the shortfall. In particular, this has slowed the expansion and the delivery of the metro cars and the metro is running longer headways than planned. Around 25 per cent more passengers could be carried if more metro cars were in operation as planned.

However, the imbalance between supply and demand is now causing problems and overcrowding, especially on the metro, is now a major problem due to lack of capacity. This is likely to get worse until the metro and BRT are able to properly expand.

In the short and medium term, BRT has proved to be able to provide mass transit at a more affordable price than rail and at 1.8 million daily passengers it also provides high capacity services. Prior to 2007, bus transport was seen as being 'poor transit for the poor' but the success of the BRT and the surveys show it is now an attractive service to the middle and professional classes, precisely the social classes that cause much of the congestion as the poor cannot themselves afford cars.

The contribution of organized mass transit to local economies should not be forgotten – and in this example, the business community is now convinced that metro and BRT services access to their business is a positive.

The opportunities created for women as BRT bus drivers go well beyond just a job, but bring them respect in the community as well as the fact that they seem to be able to effectively carry out their duties outperforming some of their male colleagues! This in turn helps provide social equity and clearly demonstrates that formal public transport not only provides sustainable transport choices in today's world but they also increase equal opportunity for the creation and retention of green jobs.

Recent policies on the price of fuel have increased the attractiveness of public transport over private transport. But despite the general promotion of mass transport, how to fund such ambitious plans remains a challenge.

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