

Sustainable transport and the modernisation of urban transport in Delhi and Stockholm

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ABSTRACT

This article addresses issues of the development of transport systems taking its examples from Delhi and Stockholm. The introduction of the first bus rapid transport corridor in Delhi and the congestion tax in Stockholm is presented and discussed in terms of modernisation and sustainable transport. This paper explores the perceptions of politicians and examines some transport plans in the search for the driving forces for transport policies. The continuing presence of a high proportion of non-motorised modes of transport and use of public transport in Delhi over the past 50 years gives it a greater political opportunity for creating a more inclusive city than Stockholm. Whereas, in Stockholm, awareness of the influence of emissions on climate change makes the inhabitants more inclined to accept fees for the use of city streets where sustainable transport and modernisation of transport systems are seen as key activities, but are perceived and operationalised differently in Delhi and Stockholm. Despite all the differences, some similarities in the development of their urban transport projects have been found. This paper inquires into the planning and operationalisation of transport modernisation and the politics of sustainable transport.

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Introduction

The role of transport in urban areas has become an ever more important part of city life. Economic growth and a modern lifestyle make inhabitants travel more frequently and for longer distances. Accordingly, the pressure for efficient and sustainable transport leads cities to invest in new transport technology and management of urban traffic. The profiling of a modern city is of huge importance for its competitiveness in the national and international context. For example, politicians are led to develop plans to generate an aura about their cities: in Beijing for the Olympic Games in 2008,² or in Delhi in time for the Commonwealth Games in 2010.³ Their plans aim to increase the attractiveness and the transport efficiency of their cities for visitors to the games, and, more importantly, to make the cities attractive for international investments by multinational corporations.

The purpose of this paper is to explore the perceptions of politicians and examine some transport plans in two capital cities in the search for the driving forces that influence the urban transport plans and infrastructure development. The intention is to review the background and the outcome of one important transport initia-

tive in each city. The processes of motorisation in a well-planned and affluent city like Stockholm, and in an urbanising developing city, Delhi, are completely different. In both cities the present transport policies have had a long and messy history before being implemented. Of interest in this paper is also the process leading to new ways of handling urban transport. Were agreements about new transport an initiative based on a short and rapid process, or was a lengthy and stumbling process needed to reach a consensus? Politicians take the final decision. They in turn depend on the opinions of the voters and their preferences. The question of preferences is highly relevant in finding out whose preferences and needs will set the agenda for sustainable transport. Politicians walk a tightrope, balancing various kinds of interests. For instance, looking back in history we find that in many cities it was the car-dependent middle class whose needs shaped the use of the street space, and the use of cars has transformed the urban areas.

The selection of these two different cities is motivated by the assumption that though the two cities have very different historic and economic contexts, the preferences of the middle class are decisive for the way in which transport policies materialise. Of crucial importance for the outcome of these initiatives is how transportation systems are perceived by dominant actors, and the ways in which politicians negotiate the process of motorisation in these two cities. In Stockholm, the needs and preferences of the middle class (a majority in the population) has shaped urban transport by means of established ways of influencing the decision

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Table 1
Demographic and household income information of Delhi and Stockholm. Source: Stockholm (Munich-Stockholm – Comparison of the two regions' planning systems and contents, 2003) and Delhi (Economic Survey of New Delhi 2003–2004, 2005).

	Population	Area (sq km)	Population density (pers/sq km)	Household size (pers/hh)	Gross income (per capita)	
					Euro	PPP Euro
Delhi	14,400,000	1483	9710	5	950	5300
Stockholm County	1850,467	6490	285	2	24,246	20,400
City of Stockholm	758,148	187	4048	2	22,277	18,700

Table 2
Vehicle ownership in Delhi and Stockholm.

	Cars per 1000 persons	Motorcycle per 1000 persons	Total personal vehicles per 1000 persons	Households with one or more cars (%)	Percent HH with one or more personal vehicle (%)
Delhi	50 ^a	74 ^a	124	13	42
Stockholm County	373	20	393	64	66 ^b

^a Number based on estimated number of vehicles on the road in Delhi in 2002 (Report of the Expert Committee on Auto Fuel Policy, 2002).

^b Estimate based on motorcycle ownership.

making, whereas, in Delhi the middle class which is a numerical minority dominates. Despite having modernised their transport systems, both Stockholm and Delhi need to develop in the same direction, namely to move toward sustainable transport systems. The exploration of ways toward sustainable transport is carried out by means of two different examples: the Bus Rapid Transit (BRT) in Delhi, India, and the introduction of a congestion tax in Stockholm, Sweden.

In Stockholm, mass motorisation proceeded in tandem with the modernisation and development of a welfare state. Already in the 1930s, automobility was a mature technological system and some decades later mass automobility spread in Sweden (Falkemark, 2006). In Delhi, however, mass motorisation was introduced spontaneously as a consequence of rapid economic liberalisation over the past two decades within the framework of a low income country. Stockholm had a relatively homogenous population and a small-scale, homogenous motorisation process. In Delhi the population is much more heterogeneous in composition (socio-economic background and income) and this mix is reflected in the heterogeneous use of the street space. Delhi's roads have to cater to all the modes present in Stockholm plus hand carts, cycle rickshaws, a very high proportion of motorcycles and three-wheeled scooter taxis.

Various policies to regulate mass motorisation and to shape the character of the systems of transport have developed differently in these two cities. Stockholm is a modern and planned city, whereas Delhi has developed as a multi-centric city by plan and serendipity. Stockholm is developing less rapidly, making it possible to plan within a relatively stable situation, while the rapid economic growth and urbanisation of Delhi are going to be quite heady.

The role of urban politics is increasingly important internationally, as some important or global cities have been politically strengthened due to their economic influence (Sassen, 2001). In some countries, the politics of the capital city is influencing politics in other capitals by means of global networks and economic relations even at the cost of traditional national politics.⁴

The experiences of modernisation of transport in the Stockholm and Delhi urban areas highlight different developmental trajectories, and thereby reveal different societal challenges and ways to cope with the problems of urban transport. Although, the imperative to achieve sustainability is present in both cities, the pertinent question is how do they become more sustainable? Despite their

differences in political practice, the elected politicians in both cities hold the responsibility and take the decisions balancing perceived public pressure and personal preferences.

Methodology

This paper highlights the role of politicians in influencing the urban transport. The text analysis of secondary sources such as official documents, statements, plans and evaluations, has been made. Some examples stressing the perceptions of the politicians and their influence on the process are presented. This paper will not present a chronological account of the historical processes. The perceptions of politicians together with some key issues of sustainability – city density, means of mobility, injuries and fatalities – are scrutinised below, since these factors can be important in determining the road leading towards sustainability.

Stockholm and Delhi in 2002

For the sake of the topic of this paper, the process of motorisation in Delhi and Stockholm will be divided in two major phases: background and some transport initiatives. To begin with, an account is provided of the urban characteristics of Stockholm and Delhi.

Stockholm County is four times larger than Delhi in area, but has a population density 34 times less than Delhi. However, the population density of Delhi is only twice that of Stockholm City, which is the central portion of the urban area of Stockholm. The average income in Stockholm is about 25 times that of Delhi in absolute terms, and 4 times in terms of purchasing power parity (see Table 1).

Car ownership rate in Stockholm is 7.5 times greater than that in Delhi (see Table 2), which is about double the purchasing power parity (PPP) income ratio but one-third the absolute income ratio.

Table 3
The transport modal shares in the two cities.

	Modal share, percent of trips				Taxis per 1000 persons
	Car	Motorcycle	Public transport	Bicycling and walk	
Delhi	8	14	38	40	6 ^a
Stockholm County	52	NA	45	4	3

NA – not available.

^a Including three-wheeled scooter taxis.

⁴ For further information see the works of Sassen about the role of politics of global cities 1982, 1991, 2001, 2006.

Table 4

Traffic fatalities in Stockholm and Delhi, 2002. Source: Delhi (*Road Accidents in New Delhi 2002 (2003)*) and Stockholm (Tegner, 2003).

	Fatalities per million population	Fatalities by road user type, percent				
		Car	Motorcycle	Bicycle	Pedestrian	Other
Delhi	118	3	21	10	53	13
Stockholm County	33	66	4	17	13	0

Table 5

Air pollution in Stockholm, 2000 and Delhi, 2002. Source: Delhi (National Environmental Engineering Research Institute, 2003), Stockholm (2005 World Development Indicators – Environment: Air pollution. The World Bank, Washington DC http://devdata.worldbank.org/wdi2005/Table3_13.htm (accessed 01.09.06)).

	Annual mean, 24 h average values ($\mu\text{g}/\text{m}^3$)			
	SPM	RPM	SO ₂	NO ₂
Delhi	476	179	9	48
Stockholm County		15	3	20

One fifth of the numbers of families own a car as compared to Stockholm. However, when one includes motorcycle ownership in the two cities, the gap in vehicle ownership per family decreases significantly – per capita ownership in Stockholm is three times that in Delhi, and the percentage of families owning a personal motorised vehicle is only 1.5 times in spite of the huge gap in per capita incomes. The availability of scooters and motorcycles has given 50% of Delhi families a personal vehicle at incomes 25 times lower than in Stockholm, while the per capita ownership is only three times lower.

The proportion of personal motor vehicle use (including motorcycles) in Stockholm is 2.4 times that of Delhi. The proportion of public transport trips in Delhi is just 15% less than in Stockholm, but non-motorised modes are 10 times more prevalent (see Table 3). In addition, the availability of taxis per capita is 2 times greater in Delhi than Stockholm.

The above figures would indicate that the transportation situation in Delhi is more desirable than in Stockholm because of low share of personal vehicles (cars and motorcycles) and 78% share of walking, bicycling and public transport trips compared to 49% in Stockholm. However, this is not borne out by the road safety and air pollution data shown in Tables 4 and 5.

These data show that the threat to life due to road traffic injuries and pollution in Delhi is much greater than in Stockholm. This shows the complexity of transport planning for a sustainable future. It is clear that having the right modal mix and low use of personal transport is a necessary but not sufficient condition for the provision of clean air, safe roads and optimal access conditions in cities.

Stockholm⁵

The first Swedish regulation on automobile usage was passed in 1906: Automobile Ordinance.⁶ Some decades later, in the 1930s, mass motorisation was introduced when the importance of the national railway was in steady decline. Already in the 1930s, the car was perceived by economists as bringing economic prosperity and supporting the process of democratisation in Sweden. Sweden was

⁵ From now on and throughout of the article Stockholm refers to the City of Stockholm.

⁶ It regulated an early kind of driving license. The stipulated age for driving a car was 18 years, and speed was limited to 20 km/h in denser areas and 30 km/h in rural areas, etc. (Falkemark, 2006, p. 191).

governed by the Social Democrats and the use of private cars was appropriated and regulated in accordance with traditional local social and political values.⁷ In the 1950s politicians were convinced that increased physical mobility by means of modern cars would improve democracy, stimulate economic growth and spur the progress of modernisation. The establishment of a welfare state was highly prioritised and the spread of mass motorisation became one important part of that vision. Furthermore all the main political parties voiced the supportive view on motorisation and only fragmented voices were raised against from some communists.⁸ One of the key issues during the electoral campaign (year 1956) was the pursuit of policies that strengthened the role of the automobile in the Swedish transport system. In 1956, the understanding of the potential of the car was expressed as:

Both as a toy and as a useful thing [the car] is difficult to replace with something else. Only some decades ago the ownership of a motorcar was the privilege of the few, a class distinction. It is not like that any longer. Development has been very fast. Now there are car owners in all layers of society, and we shall soon eliminate the remaining barriers. It is reasonable to say that the development of motorisation is the most manifest aspect of democratisation of our time (quoted from *Can we afford the motorcar?* authors' translation, Andersson, 1956, p. 3).⁹

In Sweden, in the 1950s, the position of the car in societal development was very strong. It was perceived as a vehicle for modernisation and deepening democratic relations.¹⁰ In the late 1980s the Swedish Prime Minister (a Social Democrat), Mr. Ingvar Carlsson went even further in defining the role of the car. He stated that 'the car is a human right'.¹¹ The content of this message was that everyone, everywhere in the world, should be able to own a car. The idea of general motorisation and an extensive use of automobiles embody the first modern era's belief that societal development lacked frontiers and was 'extending into a limitless future' (Thynell, 2003; Hughes, 1989). Consequently, the world would be completely motorised alongside general democratisation and the global spread and realization of human rights. However, the debate on 'Limits to Growth' was initiated in the early 1970s by the Club of Rome, and critics of the extensive use of automobiles appeared.¹² But at that time no strategies to confront the side effects of general motorisation were formulated.

Some years later, in 1992, the Swedish Prime Minister (a Conservative leader), Mr. Carl Bildt, was interviewed at the UNCED summit in Rio de Janeiro about his attitude towards the negative consequences of the rapidly expanding automobile society. Mr. Bildt expressed the belief that technical development would solve the problems of global car use. He also stated, however, that the Chinese should consider developing public transport rather than mass motorisation.¹³ About incorporating driving into the charter of human rights he seemed to have a more sceptical view.

⁷ Since 1936, Sweden has been governed by the Social Democrats except between 1976–1982 and 1991–1994, 2006–ongoing when the Conservative Party or coalitions like the Alliance for Sweden has been in power.

⁸ During large parts of the 20th century, there were no political conflicts regarding the role of mass motorisation in the Swedish strategy of national development. Such conflicts regarding future investments and costs became more frequent towards the end 21st century when the environmental aspects entered on the transport agenda (Falkemark, 2006).

⁹ Quoted in Tengstöm, 1991, p. 104.

¹⁰ One of the Swedish lead politicians during the 1950, Minister of Communications, Mr. Sven Andersson, pointed out "that development of mass automobility is probably one of the most evident expressions of democracy in our times (Tengstöm, 1991, p. 3).

¹¹ *Bilen tillhör de mänskliga rättigheterna* (interview published in *Dagens Nyheter*, 21 August 1989).

¹² Meadows et al., 1972.

¹³ *Dagens Nyheter*, 1992.

Congestion tax

In Stockholm various ways of modernising urban transport have been adopted. In 1950, the underground train system began to run, and the city received its modern urban plan. Thirty years ago, a county bill was laid before the council for economical steering of the car traffic. A number of years later, in 1992, an agreement was reached by the Conservative government stating that road investments were to be partly funded by a road toll. However, in 1997 the Government led by the social Democrats, which initiated the agreement, withdrew its support because of the growing political difficulties caused by the agreement.

In 2002, the process leading towards introducing a congestion fee began. The charge was then considered a tax, which meant that the Swedish parliament had to decide the level of the charge and how the collected revenue should be allocated (recycled) to different purposes. One of the latest and most powerful initiatives was the introduction of a congestion tax in the city centre. Since 1 August 2007, a permanent congestion tax has been imposed on Swedish-registered vehicles driving into and out of the Stockholm city centre zone on weekdays (Monday–Friday) between 6:30 and 18:29.¹⁴ The final part of the process by which this occurred is now described.

The introduction of the tax in Sweden was anticipated by a pilot test, the so-called Stockholm Trial, from January to August 2006. The official evaluation of the trial stated that the congestion tax had achieved the three goals, namely to reduce congestion, increase accessibility and create a better environment. According to the evaluation:

The trial cut traffic flows – even more than expected – and the reduction was surprisingly stable if normal seasonal variations are taken into account. In addition, the effects were noticeable further away from the congestion-charge zone than we first anticipated. This also means that several of the feared ‘side effects’ did not materialise. Access was improved, which had a major positive impact on travel times and also meant that you could be more certain that your journey would take a specific amount of time.¹⁵

According to the official evaluation of the Trial, called *Facts and Results from the Stockholm Trial*, the Swedish national goal of reducing emissions of greenhouse gases was reached as follows:

The Stockholm Trial reduced emissions of both carbon dioxide and particles. This reduction is substantial, to have been achieved through one single measure. As the reduction in traffic took place in densely populated areas, the reduction – mainly of particles – brought a major health benefit to the county as a whole. The health benefit is about three times higher than the benefit that would have been gained had the reduction occurred through an increase in fuel prices. As expected and in general terms, the Stockholm Trial only had a marginal impact on noise levels.¹⁶

As stated above, one of the purposes the congestion tax was to improve the city environment. Interviews with citizens and cyclists in the city centre showed that these user groups experienced improvements in traffic flow, air quality and vehicle accessibility

(Brundell-Freij and Winslott Hiselius, 2007, p. 5). A minor survey showed that inner-city children experienced improvements of the urban environment (Facts and Results, 2006, p. 104).

Fig. 1 shows the reduction of traffic flow at the various toll stations. Automobile traffic into the area was reduced by 22%, light lorries by 21%, and lorries by 13%. Emissions of carbon dioxide, nitrogen oxides and particles from road traffic were reduced by 8% to 14% in the inner-city (Facts and Results from the Stockholm Trial, 2006, p. 5).

For public finances the congestion tax is an excellent affair, with a calculated profit of 1050 million USD/year. This means that when the trial was made permanent, investments, operating and maintenance costs would be paid off in 4 years. But the extensions of public transport were a less profitable affair for the various surrounding municipalities in greater Stockholm. Moreover, public transport was augmented with 197 new buses and 16 new bus lines.

User reactions

The official evaluation concludes that public transport passengers appear very satisfied with the direct bus lines. Residents of Stockholm and owners of businesses have changed from being predominantly negative to having a positive attitude towards the trial as such, and to the congestion tax as a permanent measure.

Essentially, changes in acceptance normally look like this: Before you’ve experienced something yourself, you mostly see obstacles and expenses, but after you’ve made your own experiences, you begin to see the advantages and benefits you’re getting for your money. There is still great uncertainty however as to how fast these changes in attitudes take place (Facts and Results, 2006, p. 17).

The agreement on congestion charges at the national level was made under the condition that an agreement was also to be made at the local level. Initially, there was no support from the Social Democratic party at the local level. The Social Democrats found themselves somewhat forced into an agreement at the local level as well as at the national level although at the national level they enjoyed support from the Green party. Most actors perceived traffic congestion in Stockholm as a problem, though to different extents. The perceived scope of the problem was nevertheless not a cause of disagreement. The major disagreement was instead over the policy measure to solve the congestion problem.

The importance of political agreements

In advance of the 2002 national election, the local Social Democrats promised that they would not impose congestion charges if they won power in the council. However, as mentioned earlier, there was agreement at the national level on a congestion charges trial in Stockholm. This agreement was finally accepted by the Social Democrats at the local level. As a result, the Social Democrats were accused of betrayal based on their earlier promises (ibid).

The time series data provided by the polls in Stockholm indicate that the rather dramatic change in public preferences that occurred in connection with the introduction of the trial was not a consequence of increased information about the program design or its congestion-reducing effects. Evidence indicates that what the public may not have correctly predicted was how much they would appreciate the objective effects that occurred. There is reason to assume that the political decision to include a referendum during the mandate period in the package was at least partly influenced by the fact that (some) politicians anticipated the public’s change of attitude (ibid).

¹⁴ No tax is charged on Saturdays, Sundays, public holidays, the day before a public holiday or during the month of July, <http://www.vv.se/>.

¹⁵ *Facts and Results from the Stockholm Trial – Final version – December 2006* Congestion Charge Secretariat, City of Stockholm, Muriel Beser Hugosson, Ann Sjöberg and Camilla Byström, p II.

¹⁶ Ibid.

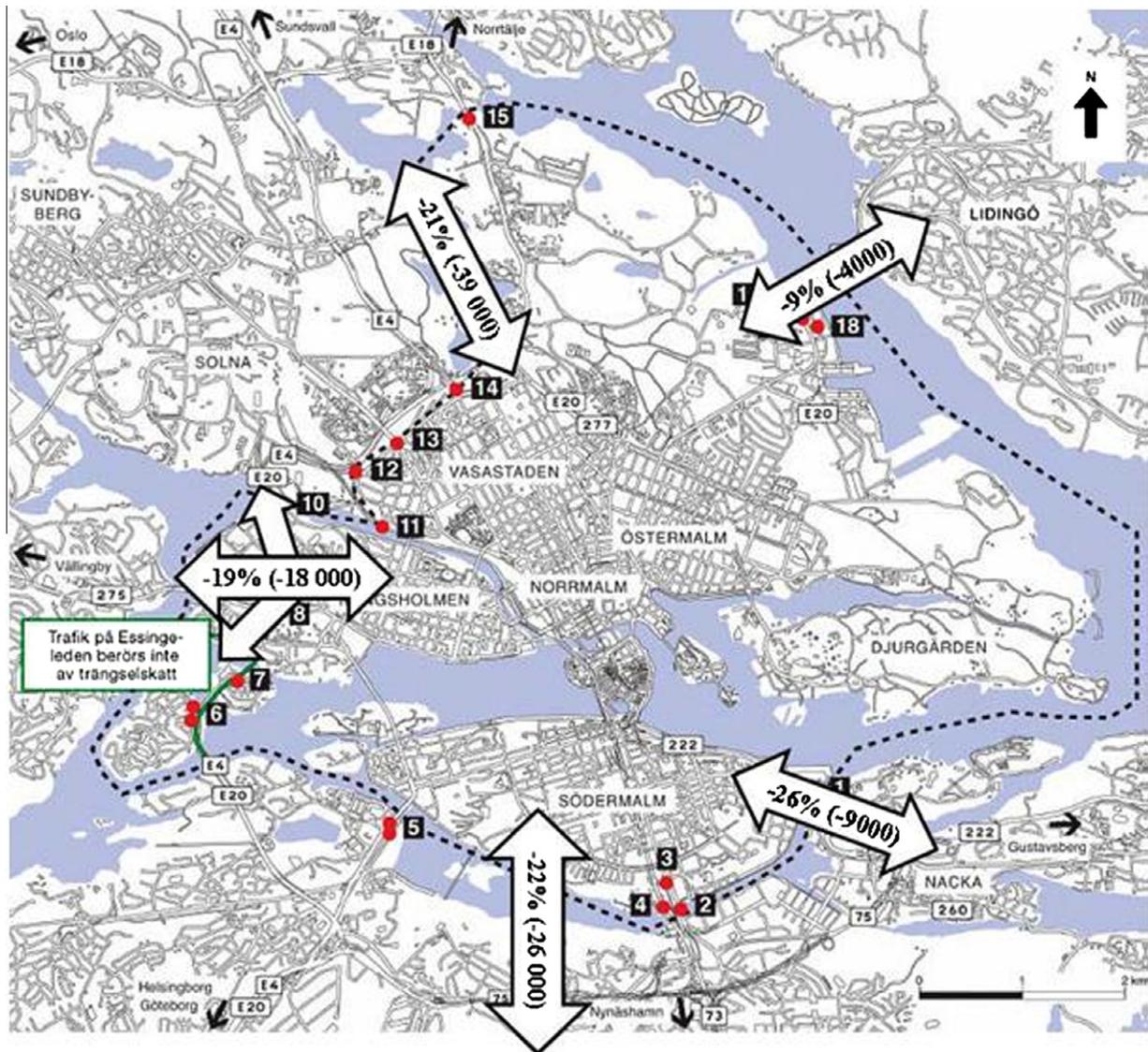


Fig. 1. Reduction in traffic flow at the toll stations during paying hours (6:30–18:30). <http://www.stockholmsforsoket.se/upload/Trangselkarta1000x707.gif>, p. 11).

What were the plans for the new tax revenues? According to the municipality of Stockholm in 2006: 'The leaders of the four parties¹⁷ forming the governing coalition said in a debate article in the Swedish morning newspaper *Dagens Nyheter* (1 October 2006), that congestion tax in Stockholm could possibly help finance a new by-pass road'. Accordingly the surplus from the congestion tax would be used to build a 20 km new highway. This could possibly improve the short-term efficiency of the traffic system, but it will not contribute to its long-term sustainability. Political experience shows that whenever the Swedish business community unites with the liberal parties they become powerful and capable of making valid political agreements (Falkemark, 2006, p. 265). This turned out to be the case once again and the by-pass motorway link west of the city centre was decided on in 2009. The tax revenues will be used to cover some of the estimated costs of the road: 4 billion US Dollars according to the Swedish Road Administration (<http://www.vv.se/>).

¹⁷ The government (2006–present) is called the Alliance for Sweden and consists of four liberal parties; the Centre Party, the Liberal Party of Sweden, the Christian Democrats and the Moderaterna (formerly the Conservative Party). The Prime Minister is from the Moderaterna.

Delhi

Between 1951 and 1961, the population of Delhi increased from 1.7 to 2.7 million, and the city was characterised by a combination of very high population density in relatively small areas, and low population density in large areas. This trend in urbanisation and its associated problems were intended to be tackled by the development of a Regional Master Plan for Delhi. This effort was assisted by a Ford Foundation consulting team of seven persons coordinated by Gerald Breese, and the first *Master Plan for Delhi* was published in 1962.¹⁸

The main concern of this plan was to deal with the growth in the urban population, and the planners proposed to restrict it by building a 1.6 km wide green belt around the city and diverting the surplus population to the adjacent 'ring towns'. The city was segregated into zones that kept residential and working areas apart. Public transport networks and land-use patterns were designed to complement the plan. Though the issues of public transport and bicycle paths are mentioned in the plan, the main

¹⁸ Master Plan for New Delhi (1961–1981). New Delhi Development Authority, New Delhi, 1962.

Table 6

Salient features of the transportation situation Delhi 1957 (adapted from Breese, 1963).

Mode soft modes, motorised public and private	Trips, number	Trips (%)	Vehicles, number
<i>Soft modes</i>			
Bicycles	400,000	36	146,966
Cycle rickshaws	42,400	4	700
Tongas (two-wheeled horse carts)	136,000	13	3034
<i>Motorised public</i>			
Bus	252,500	22	1307
Tramways	14,000	2	
<i>Motorised private</i>			
Motorcycles and scooters	12,500	1	5715
Scooter and motorcycle rickshaw	87,400	8	1005
Taxis	60,000	4	1391
Private cars	110,500	10	10,281

attention was on the provision of wide roads to enable faster motorised transport.

Table 6 shows the salient features of the transportation situation in Delhi in 1957. Between 1957 and 2002, the population of Delhi increased by about seven times, the car population about 60 times, motorcycles about 200, and buses 10. It is fascinating that though there has been a huge increase in personal vehicles, the proportion of trips by cars has not even doubled. However, this large increase in cars and motorcycles has preoccupied the concerns of planners ever since, and the main concern has been to provide for more road space and reduce 'congestion'.

The Master Plan for Delhi 2021 is still focussed on widening roads, providing expressways and grade-separated junctions, and a metro system for the city.¹⁹ The Plan has no specific provisions for expenditure on pedestrian infrastructure, and restricts bicycle use to collector roads and access streets. The focus remains the car, and the car-and-road system would appear to be the winning technology.

In 2002, the Government of India announced a new *Auto Policy* with the objective to 'Exalt the sector (automotive) as a lever of industrial growth and employment and to achieve a high degree of value addition in the country' because the 'Indian auto sector needs to grow collaterally and in harmony with world industry. India has the potential to be a global automotive power.'²⁰ This has obvious implications for the forming of Indian transport and traffic policies.

Over the past few years, the economy of Delhi has been growing by about 10% per year, and vehicle ownership (cars and motorcycles) by about 15%.²¹ In Delhi today, the most modern high-speed cars and motorcycles have to share the roads with slow vehicles and non-motorised modes. Accordingly, the consciousness about global risks associated with chaotic urban transport is being recognised also by the administration. The National Urban Transport Policy stated that 'Travel in the city has become more risky ... This again has tended to impact the poor more severely as many of those killed or injured tend to be cyclists, pedestrians or pavement dwellers.'²²

In December 2005, 65 km of a rail-based metro system were completed in Delhi with the expectations of carrying 2.2 million passengers per day. Built at a cost of 2.5 billion US Dollars, it attracted only 0.4 million passengers per day. However, high-profile metro systems easily find political support, and though they fail to

satisfy the transport needs of a city, they continue to be funded.²³ Delhi is no different; the construction of the second phase of the metro is well underway.

Introduction of bus rapid transport (BRT)

This story begins in 1996. At that time Delhi was abuzz with new plans for a mass rapid transit system (MRTS). The MRTS, it was claimed, would alleviate the congestion problems of Delhi and reduce pollution dramatically. The Central Pollution Control Board of India was interested in the latter claim, and asked researchers at the Transportation Research and Injury Prevention Programme of the Indian Institute of Technology Delhi to study the issue and provide them with a comprehensive plan for sustainable transport policies for Delhi. The team spent about a year on the project and produced a report titled *Delhi on the Move 2005 – Future Traffic Management Scenarios* in May 1997.²⁴ There were three main ideas in the report: (a) the non-viability of metro systems in many locations and evidence that such systems do not reduce vehicular traffic on the surface, and hence do not result in pollution reduction either; (b) the success of high capacity bus systems initiated in Curitiba (Brazil) and the reasons why such systems would be ideal for Delhi; (c) The need to establish dedicated bicycle lanes on all arterial roads in Delhi as a pre-condition for efficient traffic flow.

First phase

The study was widely reported in the press. The newly appointed Minister for Transport for Delhi took notice of the press reports and commissioned a study to prepare a Bicycle Master Plan for Delhi, which included detailed designs for dedicated bus and bicycle lanes for two corridors. This was the early opening of a window, or the beginning of a process that could have had far reaching consequences on urban road designs and planning. This Bicycle Master Plan was submitted in 1998.²⁵ Detailed designs and drawings were submitted to the Government of Delhi along with the rationale for using central or curb-side lanes for buses. However, before any progress could be made at the ground level, the Minister and then the government changed. This delayed any further progress and the usual muddling through resulted in the loss of a process that might have developed into a formative moment.

Second phase

A new Minister of Transport and the Chairman of Delhi Transport Corporation showed renewed interest in the BRT in 2001, and it was decided to organise an international conference on the subject in January 2002. The conference was attended by many professionals associated with BRTS around the world including Enrique Peñalosa, ex-Mayor of Bogotá, Colombia. At the end of the conference, the Government of Delhi announced that it would initiate plans for establishing BRT corridors in Delhi.

Third phase

Several meetings and presentations later, the Government of Delhi appointed a high level committee to prepare plans for sustainable transport in Delhi. The Committee submitted its report in September 2002 and recommended that seven corridors of BRTS should be built. By September 2003, detailed engineering drawings

¹⁹ Draft Master Plan for New Delhi, 2021. New Delhi Development Authority, New Delhi, http://www.NewDelhi.com/planning/draft_master_plans.htm (accessed 22 October 2006).

²⁰ *Auto Policy, 2002.*

²¹ Economic Survey of New Delhi 2002. Government of the National Capital Territory of New Delhi, New Delhi.

²² The National Urban Transport Policy of the Government of India, May 2005.

²³ Siemiatycki (2006).

²⁴ Mohan et al. (1996). Transportation Research and Injury Prevention Programme, Indian Institute of Technology, New Delhi.

²⁵ Tiwari, 1999.

for the first six km of the first corridor were ready and an Indian manufacturer was selected to produce the first set of urban buses. In September 2003, elections were announced for the state of Delhi (National Capital Territory of Delhi). The Congress Party included the establishment of the BRTS in Delhi in its election platform. The Chief Minister announced that the construction and establishment of the BRT corridors in Delhi would be the government's top priority item in the transport sector: 'High capacity buses from April.'²⁶ Laying to rest all speculation about the implementation of the BRT, the Chief Minister said that putting together the dedicated roads would require more time, as it involved many complexities including coordination between various agencies. In the meantime, officials manning the relevant departments were changed, causing further delays in the implementation of the project. Doubts were again raised about the efficiency of BRT versus light rail, monorail and metro systems. Tenders were invited for construction of the corridor, but the prices quoted were found to be too high, as a 6 km length did not provide economies of scale for the contractors. The government then decided to start a re-tendering process for the full 16 km of the corridor.

Final phase

Work continued with detailed plans for the corridor and getting approval from all the stakeholders before awarding the contract for construction. This is when the objections to the project became more intransigent. The main objection came from the police department, who claimed that taking away road space from cars for use by buses would make efficient traffic flow impossible in Delhi. In the meantime, the Environmental Pollution and Control Authority of Delhi (EPCA) demanded that the government give time specific plans for expanding the public transport system in Delhi as a means of controlling atmospheric pollution. This put the delay in the execution of the BRT project under the purview of the EPCA, and hearings were held to work out the disagreements among the various parties. This process took a few months and all details of the BRT project had to be reviewed again. Finally, under pressure from the EPCA deadlines, the project was approved and tenders invited for the project. A special purpose company was incorporated for the execution of the project and a contractor was selected for implementation in September 2006. The work on the first corridor was flagged off by the Chief Minister of Delhi on 4 October 2006. In parallel, the Delhi Government invited proposals for six more BRT corridors in Delhi. The decision in Delhi to opt for the BRTS, as well as the announcement the Government of India's policies on transport planning and urban renewal have resulted in another seven cities in India opting for BRT systems.

Construction of the first phase of BRT corridor continued with detailed designs for exclusive bicycles lanes and pedestrian friendly raised crossings and tactile markings on the road for the first time in Delhi. Design details had to be revised several times to accommodate the constraints posed by other services and stakeholders. Several rounds of meetings were held with the public works department engineers explaining why the existing road guidelines and standards had to be modified as per the international guidelines to construct the BRT corridor.

After two fatal accidents on the corridor under construction, media started a discussion on how exclusive bus and bicycle lanes were going to take space away from car traffic. They said that such designs had no place in a city like Delhi which has been experiencing increase in car and motorcycle traffic. The media reports were selective in highlighting the accidents and slow traffic at the time of construction. The actual design details and facts about expected benefits to the majority of the commuters by experts did not make

any difference to the media reporting style. The first six km of the corridor were opened to operations in April 2008 amongst media reports of "Big Road Trauma" and corridor of chaos. In the first week of operations, there were instances of hardware and software failure in signal operations, bus drivers not stopping at the designated stops and car drivers using the bus corridor to avoid traffic delays in the car lanes. By second week, operations improved and the traffic survey reports showed 200 buses moving in the exclusive corridor carrying 15,000 persons per hour at an average speed of 20 km/h in peak hour. Average speed of buses and ambulance had been improved to 20 km/h compared to 10 km/h on other arterial roads in Delhi. Survey of bus commuters and bicycle users shows that majority of them (~80%) are satisfied with the new corridor design and would want the corridor to be extended (CSE, 2008 and NDTV poll). However, the government announced that they will evaluate the designs carefully for their impact on car traffic and slowed down the expansion of the corridor.

Though the implementation of the BRT has commenced in Delhi, at times it seems that accommodating the primary demands of the major stakeholders of the 'Transport Industry' – the Delhi Metro Rail Corporation (DMRC), the public works department, light rail and monorail industry in the planning and investment agenda is the primary focus. The first phase of the metro is carrying 20% of the projected trips and facing operating cost losses, yet extensions of metro lines are being actively pursued by the government – both by the bureaucracy and the politicians. Providing efficient and safe transport to the masses and using public money in the most efficient way is not the driving force for implementing BRT in Delhi. The company which has been instituted to implement the project called Delhi Integrated Multimodal Transport System (DIMTS) is also preparing plans for light rail transit and monorail. BRT road designs have been modified to 'improve' car flow, so that after the construction of the BRT lanes, car users will not be inconvenienced, even at the cost of safety and access for pedestrians and bicycle facilities. The segregation of bus lanes is seen as increasing space for cars since the buses will not interfere with the cars.

Concluding discussion

The importance of modernisation is recognised by the authorities and the same goes for sustainable transport. In 2007, Stockholm introduced congestion taxes, while Delhi is balancing its needs for the provision of safe walking and bicycling infrastructure, the augmentation of efficient and affordable public transport systems, and becoming a modern 'world class city'. The domination of the upper-class car-based worldview is supported by the middle-class dream of owning one's first car. While in Stockholm, the extensive middle class, having satisfied its desires for car ownership, is gingerly stepping into worries about sustainability and global warming, in Delhi the demand of the motorists for removing congestion irrespective of efficient bus operations might halt the modernisation of public transport and soft modes. In that case, the process of urban renewal will suffer a setback. On the other hand, if the integrated concept of BRT, walkable cities and bicycling becomes more politically attractive in the face of global warming, there might be a chance to counteract the growing risks associated with the globalised use of private cars.

The travel preferences made by families with growing incomes are today of decisive importance if new transport strategies to counteract the increasing global risks associated with the modern systems of transport are to become successful. At the same time, the ways of handling sustainable transport in affluent cities are seen as a way of implementing attractive solutions and setting the agenda for newly rich cities.

The notion of sustainability in Delhi is different from that in Stockholm, but in both cases it is articulated mostly by one

²⁶ By Staff Reporter, published Tuesday, December 23, 2003, *The Hindu*, New Delhi.

socio-economic group, the influential middle class. This is due to the role of transport and the middle class to support economic growth. It is not based on (or to a lesser degree based on) the fact that large groups of citizen's care about the environment. In Stockholm, the car-owning middle class is in the majority. Its influence on the politics of mobility is less conflict ridden due to the established political system. In Delhi, the democratic electoral process forces politicians to listen to the lower middle class and the poor majority at election time. However, after the elections, and during policy making, politicians are dominated by upper-middle-class technocrats and experts with different concerns. It is this battle that is leading politicians to examine alternatives to universal technological solutions, albeit very slowly. Politicians look for ways of satisfying their voters' demand for urban access. The way traffic issues are handled in richer cities might be attractive since lessons learned so far shows that behaviour in early modernised cities is being transferred to currently modernising cities. The notion of sustainable transport emerged during the last two decades when western cities had already been modernised (alt. were already modernising their systems of transport) and hence their process towards sustainable transport contains other elements. Furthermore, the concept of sustainable transport is often defined in general terms that seems to comprehend modernisation of systems of transport plus environmental and social concerns. From this perspective, the acceptance of city street tolls, congestion taxes and bicycle lanes in wealthier cities such as Stockholm, London, and Singapore could be an interesting source of information for the growing middle class in Delhi. One of the lessons from introducing the congestion tax in Stockholm is that politicians take the decision early in their mandate, and enjoy the positive results before the next election.

The social differences in Stockholm and Delhi stress the inherent conflict between ecological and social sustainability. The ways of handling this call for different approaches. The explicit goal of social sustainability is to improve quality of life through providing opportunities in terms of incomes, housing, health, equity, liveability and so on. Persons having a small ecological footprint need increased access, and for this reason raising taxes on vehicles and energy is not an alternative. Therefore, improved access in urban areas by means of sustainable transport is an essential goal.

The continuing high proportion of non-motorised modes and public transport use over the past 50 years in Delhi is due to low incomes and a lack of investments in modern transport technology. This provides another political lever for shaping the future of Delhi into a more inclusive city. In Stockholm, the heightened awareness about the role of CO₂ emissions in spurring climate change makes the Swedish road users inclined to accept a congestion tax.

In Delhi, where 13% of the households have a car (2005), the transport needs of a significant percentage of low-income families are creating social tensions. This socio-economic conflict manifests itself politically, with no easy or fast solutions. Perhaps the emergence of sustainable transport in a developing urban area will have to be based on the transport needs associated with the lower middle class. The needs and resources of such families could be the point of departure for the design of sustainable transport policies and regulations. For the rapidly growing middle class, structural conditions such as city form, land use and accessibility issues, will have to be addressed in order to increase sustainability. In Stockholm, some debate about the risk of excluding low-income families took place in the media at the time of the congestion tax trial. This discussion, however, did not influence the final form of the congestion tax.

Finally, in conclusion, the modernisation of urban traffic is not the same as building a sustainable transport system. To increase sustainability, a number of social and environmental aspects have to be developed and integrated as well. The lesson learned from reviewing the experiences in Stockholm and Delhi is as follows.

Planning for the BRT in Delhi shows that it will have to be mediated through the inclusion of 'modernisation' in transportation discourse. The builders of transport systems who are engaged in extending mass automobility in Stockholm and Delhi will try to maintain their influence. For instance, in modernising the systems of transport, new and costly technology is applied focusing on modifying (transitioning to CNG, ethanol) and maintaining the car-and-road system, and only to a lesser extent addressing the light-rail-based modes of transport. The BRT becomes more acceptable when it is shown to introduce modern sleek buses, the use of intelligent transport systems, and gentrification of bus corridors. BRTs are more acceptable when the interests of the transport and construction industry are safeguarded. The extension of the metro system and preparations for introducing a monorail and LRT are not questioned, and they are pursued with the required investments and policies. If BRT designs incorporate traffic safety and provision of non-motorised transport facilities and universal design concepts as integral to its functioning, it is possible that this new system will demonstrate that it can lead the city closer to the goal of a 'world class' and 'liveable' city.

In comparing the emergence of sustainable transport initiatives in a developed and in a developing city, the following can be concluded: Examples of strong government, efficiency or energetic action were not found. The need to improve the transport system was recognised decades earlier, more or less at about the time when mass motorisation was adopted. Then it became evident that major revisions of the infrastructure system were required to meet the growing demand for urban travelling. But, the decision-making remained slow, taking about 10–20 years, and was far from a linear process in the two cities. In Stockholm, despite lack of strong opposition, the decision was delayed. The initiatives that were finally decided on can be described as a modernisation of the systems of transport, and the process has been characterised by a lengthy muddling-through process. In a long term perspective, the emergence of the initiatives has been messy.

The experiences presented in this paper show that modernisation leads to sustainability only to a limited extent. It can be stated that the decisions about urban transport have favoured modernisation at the cost of sustainability although politicians have claimed to increase sustainability.

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