

Traffic congestion in Indian cities: Challenges of a rising power

Azeem Uddin

Draft, 23 March 2009

Growth of Indian Economy:

Until as recently as 1990, India was essentially insulated from the world markets. With foreign trade and foreign investment amounting to a tiny proportion of the GDP, ups and downs in the world economy mattered little. Movements in the Indian economy were even less consequential for the world economy — India accounted for negligible proportions of world trade and investment.

But the reforms undertaken during the last two decades have dramatically transformed the policy regime with the result that the fate of the Indian economy is now intimately linked to that of the world economy. In the reverse, the world economy has also come to depend on the Indian economy, though to a lesser extent. This is because India is still small relative to the world. But this too is changing rapidly.

To grasp the transformation that has taken place, consider just a few facts:

- Trade in goods and services as a proportion of the GDP has risen from 15.9% in 1990-91¹ to 55% in 2007².
- Direct foreign investment has risen from less than \$100 million in 1990-91³ to \$21.16 billion in 2008-09⁴ (upto Dec 2008). Alongside, portfolio investment has risen from \$6 million in 1990-91⁵ to \$29.3 billion in 2007-08⁶. However, during the April-December period of 2008-09, due to a slump in the global markets, there was a net outflow of Foreign Institutional Investments of \$13 billion⁷.
- Remittances have risen from \$2.8 billion in 1990-91⁸ to \$43.5 billion in 2007-08⁹.
- Acquisitions by Indian companies abroad, which have included such steel giants as Arcelor and Corus, Tata and Jaguar amounted to almost \$26 billion from January till September 2008¹⁰.
- India had a dream run of five years during 2003-08 as the GDP growth averaged nearly 9 per cent annually for five years, the best ever run over five years!¹¹ In its latest report, IMF has predicted that, owing to the prevailing economic slowdown globally, India's gross domestic product growth may slow to 6.3 per cent in the fiscal year 2008-2009, ending in March, and to 5.3 per cent the following year.¹²

These statistics testify to the rapidly growing importance of the world economy to India and vice-versa.

Impact of Economic Growth on Urban Traffic:

As incomes rise, car loans proliferate and the auto industry churns out low-cost cars to nudge them off their motorcycles, Indians are rushing headlong to get behind the wheel. Indians bought 1.5 million cars in 2007, more than double of that in 2003. The cumulative growth of the Passenger Vehicles segment during April 2007 – March 2008 was 12.17 percent. In 2007-08 alone, 9.6 million motorized vehicles were sold in India.¹³ By some estimates, India is expected to soar past China this year as the fastest growing car market.

India's population and its traffic are concentrated within its cities. The contrast between urban and rural India is far more pronounced than in most Western nations. The migration of rural population to urban areas in search of better job prospects has made cities densely populated. About 27 per cent the population live in urban areas. There are 4,000 cities and towns in India. About 400 cities have population over 1,00,000. Eight cities have population more than 3 million.¹⁴

Other reasons of Traffic Congestion in Indian Cities:

India has more truly congested cities than any other nation, which is not surprising, since it is also the world's second-most populous country, after China. Vehicles in India are distributed somewhat unevenly. Delhi, Mumbai, Kolkata and Bangalore have 5% of India's population¹⁴ but 14% of its registered vehicles.¹⁵ Traffic is growing four times faster than the population in six cities: Mumbai, Delhi, Ahmedabad, Bangalore, Chennai and Hyderabad. Indeed, Delhi is now said to have as many cars as Mumbai, Kolkata and Chennai combined.

Traffic is well known for moving at the pace of its slowest component. Most countries have automobiles, buses, trucks, trains, motorcycles, motor scooters and bicycles. But in India, in addition to this routine urban transportation, and contributing substantially to the congestion, are networks of auto-rickshaws and two-wheelers, as well as bullock carts and hand-pulled rickshaws (disappearing from some urban areas).

There has been a staggering 100 fold increase in the population of motorized vehicles, however, the expansion in the road network has not been commensurate with this increase. While the motor vehicle population has grown from 0.3 million in 1951 to over 30 million in 2004, the road network has expanded from 0.4 million km to 3.32 million km, only a 8 fold increase in terms of length during the same period.¹⁶ However, upgrading of roads by way of widening of carriage- ways, improved surface quality, strengthening/ reconstruction of old/ weak bridges and culverts, etc. has been carried out.

And where is India heading? A case of Tata Nano:

Tata Nano, the world's cheapest car, priced at US \$2000 is a marvel of engineering and ruthless cost-cutting sure to bring greater mobility to people throughout the developing world. And that is what makes it so troubling. Economists says the Nano potentially could expand the country's auto market by 65 percent and spur a 20 percent increase in auto sales in its first year. Honda, Toyota and Fiat are among the companies developing competitors to the Nano. The proliferation of cheap vehicles could prompt as much as 25 percent of the 50 million people who ride scooters to buy cars.

Strategies to Mitigate Congestion:

Traffic congestion is a serious problem in most Indian metros. The scorching pace of economic growth and the growing incomes of India's burgeoning middle class are only likely to make the

situation worse. Public transport systems are overloaded, and there is a limit on how much additional infrastructure such as roads and rail lines a city can add.

Of course, city planners are doing the best they can to cope with the increasing stress on the transportation infrastructure. For instance, in Mumbai, tens of flyovers have been – and continue to be – constructed, and existing roads are being widened.

But creating more infrastructure is not a solution by itself. The improvements in infrastructure will always lag behind the increase in traffic. Its benefits are only short-term; what's needed is a more imaginative, holistic and integrated approach to the problem.

A piece of statistic from the Mumbai Traffic Police web site illustrates the magnitude of the problem: While length of roads in Mumbai increased two times between 1951 and 2007, the population increased 5.4 times and the number of vehicles a whopping 43 times.

	1951	2007	Increase No.Times
Road Length (Kms.)	837	1900	2.27
Population (lacs)	29.9	160	5.35
No. of Vehicles	35000	15.03 lacs	42.94

The improving-infrastructure approach seeks to accommodate the future. What is also needed is a preventive approach to actually reduce the traffic on the roads. This can be achieved in two ways.

Build better public transport systems: Transport experts at the second Urban Age conference on mega cities in Sao Paulo, Brazil - a city with 18 million people and 9 million cars - were unanimous in pointing out that throughout the world, whether in industrial or developing countries, public transport had to be promoted at the expense of private, motorized transport which, in effect, implies traffic restraint, among a slew of other measures. The demand so often raised by car owners for more roadways, by way of highways, fly overs and the like. India which is the second largest producer of buses, accounting for 16 percent of world's total bus production has a bus penetration ratio anywhere between 0.4 to six buses per 1000 people¹⁷. An efficient public transport system can effectively reduce the traffic on city roads. There's considerable evidence to suggest vehicle owners will use a mass transit system, if a good one is available. In fact, because of traffic snarls and the problem of finding parking space, many commuters in cities like New York and London choose to travel by the metro rail network.

Many cities in India are already taking steps in this direction. Prime Minister Manmohan Singh recently laid the foundation for a metro rail network in Mumbai. City authorities are also exploring providing public transport on sea routes that connect important hubs of Mumbai.

But building such alternative transportation systems requires huge investments. That is where we come to the second approach.

Reduce traffic through congestion charging schemes, Car-pooling etc.: Cities around the world such as Singapore and London have introduced congestion charging schemes to reduce traffic. For instance, in London, drivers are charged a fee for entering the Central London zone. The idea was to ensure that those using the road infrastructure made a financial contribution towards it, discourage vehicle owners from making unnecessary journeys and encourage the use of public transport systems. The results were impressive indeed: traffic in central London went down

by about 21 per cent, and traffic speeds went up by about 10%.¹⁸

Congestion charging brings with it a dual advantage: it reduces traffic on the roads and generates funds that can go towards improving alternative systems of transport.

But congestion charging can be a politically loaded issue. In London, too, it was not an easy decision to introduce a fee for private vehicles to use certain roads. But London Mayor Ken Livingstone remained committed to his vision, and Londoners today enjoy the fruits of the LCC. Introducing such schemes in India will require political consensus and strong political will.

Mumbai's Regional Transport Authority has also recommended car pooling. Mumbai Environmental Social Network has promoted a web- and sms-based pooling system (www.mykoolpool.com). Bangalore Transport Information System has a group-SMS version (www.btis.in/carpool). Because regulations prevent a private motorist from charging for lifts, Koolpool has ingeniously circumvented the problem by enlisting the help of Hindustan Petroleum which permits pick-ups at its petrol pumps. In return, each driver receives a petrol voucher worth Rs.25 for giving a lift, irrespective of the distance. Even if the commuters get to pool their cars, the broader environmental objective is met, even if commercial considerations suffer.

Traffic restraint schemes envisage eliminating at least a fifth of the cars on the road on any given day. Athens and Mexico City have implemented such schemes successfully. One way to do this is to permit cars with number plates ending with an odd number on alternate days into the city centre. The fear, however, is that rich residents may only buy a second car - or, as has been feared, may actually fraudulently change their number plates every day!

In the absence of traffic restraint schemes in India, including the controversial Bus Rapid Transit which has run the gauntlet of motorists' ire in Delhi but is adopted in 83 of the world's cities, public transport is suffering. From 1994 to 2007, the share of public transport has declined from 69 per cent to just 38 per cent in cities with more than 4 million people.¹⁹ The answers are staring us the face, but we have the car lobby to contend with, and its powerful backers among politicians and the bureaucracy.

What made the London Congestion Charging Project such a success was technology.

Using technology to solve traffic woes:

The aim of the LCC project was to reduce traffic in the centre of London during peak hours by charging vehicle owners a fee to drive through the area at certain times. What was unique about the project was that there were no toll gates or barriers to collect charges from vehicle owners.

Instead, a network of cameras records the number plates of vehicles entering the city centre. An automatic number plate recognition (ANPR) system grabs the live video stream of vehicles, converts them to still images, uses certain in-built business logic to identify the number plate from the image, then applies OCR (Optical Character Recognition) tools and converts the number plates into text. These numbers are stored in a database. This database is then used to charge vehicle owners. Hence, charges could be collected without slowing down traffic in any way.

Singapore too has had a lot of success with its Electronic Road Pricing Scheme. Technology plays a big role in the success of the scheme, albeit in a slightly different way than in London. In Singapore, gantries are located at all entrances to the central business district and on roads with heavy traffic. Cars are equipped with an in-vehicle unit that contains a pre-paid cash card. Every time a car passes under a gantry, a toll is automatically deducted from the cash card.

In the recent past, Delhi Traffic Police has introduced a number of technological innovations like Online Prosecution System, the Area Traffic Control System, and SMS facility for information dissemination and GIS based Accident Information System - to mention just a few. The most satisfying aspect of these changes is that they have proved to be very relevant to the needs of the people of Delhi.

Technology can be very efficiently used to curtail the traffic woes. No one can dispute the importance of intelligent traffic signals. As per additional commissioner of traffic police, Bangalore city, out of 300 traffic signals, 163 have already been connected to the traffic management centre of which 120 are vehicle actuated- i.e. if there are no vehicles waiting for four seconds, the signal would turn red automatically. Most arterial roads in the city are in the supersaturated category. In such a scenario, intelligent signals along with junction capacity augmentation can provide long-term solution to traffic jams.

State government has promised to spend Rs 79 crore (15.8 million US dollars) to improve traffic management in Bangalore. Around 100 enforcement cameras and 800 vehicle-actuated, solar-operated traffic signals will be operated from the centralized Traffic Management Centre. Variable Message Signs (VMS) will be put up and operated from the centre, conveying live information to road users about diversions, road accidents or rallies. The centre will have an information cell which will provide real-time information about traffic conditions through SMS and FM radio channels. The centre will also have other commuter-friendly services like traffic helpline and parking information.

And now, further efforts are on to solve traffic congestion problems in the core areas of metropolitan cities, by the resorting to such innovating Intelligent Traffic Management Systems (ITMS) and installing intelligent traffic signals, which are networked into the Area Traffic Control. These have massive benefits from the traffic flow, safety and pollution points of view. This ATC system is an integral part of the intelligent Transportation System (ITS). The ITS includes many state-of-the-art sub systems like - incident Monitoring System (IMS), the Variable Messaging System (VMS), electronic Toll System (ETS), Weight-in-Motion System (WMS), the Camera Based Enforcement Systems (CBES) and also the Intelligent Public Transportation systems (IPTS), among many more.

If we try to solve the problem of traffic management piece-meal in one or two locations, it will simply re-surface elsewhere. What is needed, instead, is network analysis and design that allows the entire complexity of relationships between various points to be understood.

With the growing numbers of cell phone users in the cities, it might be possible to use real-time data from cell phone service providers to track congestion. This is based on the idea that congestion is the presence of numerous people in a particular location, and if nearly everyone has a phone, then the presence of phones could be a useful proxy for the presence of people. Together, the traffic police, Mapunity (a private company) and Airtel, (India's largest telecom operator) conducted a pilot study, installing 11 towers at key intersections on two arterial roads leading to the Bangalore HAL airport. Airtel also created the infrastructure to download and host its entire Bangalore data, and Mapunity created the analytical and predictive algorithms for traffic based on this data. The pilot project demonstrated the potential to create a city-wide real-time traffic information system, and this was shown to city officials.

Learnings from the Ants; an interesting experiment:

Ants seem to have cracked a problem we humans haven't. While our cars get clogged in jams, ants

Kyoto of the Cities, Naples, Mar 26-28, 2009

help each other to move around their colony much more efficiently. Understanding how they do this could inspire more effective routing of road traffic.

Collective intelligence expert Dirk Helbing from the Dresden University of Technology in Germany and his team investigated how ants move around their colony. They set up an ant highway with two routes of different widths from the nest to some sugar syrup. Unsurprisingly, the narrower route soon became congested. But when an ant returning along the congested route to the nest collided with another ant just starting out, the returning ant pushed the newcomer onto the other path. However, if the returning ant had enjoyed a trouble-free journey, it did not redirect the newcomer.

The researchers created a computer model of more complex ant networks with routes of different lengths. The team found that even though ants being rerouted sometimes took a longer route, they still got to the food quickly and efficiently.

If human drivers travelling in opposite directions could pass congestion information to each other in this way, we would all be better off.

From a technology and project implementation stand point, India has no dearth of talent. After all, our IT talent is exported across the world to solve some of the most complex challenges. It's time we harness it to solve domestic problems as well. Indian companies have enormous experience in successfully implementing large-scale, citizen-facing, mission-critical projects. And these are challenges the Indian IT industry will welcome with open arms.

Conclusion:

Among the strategies that address congestion, reduce unexpected delays, and make the most of the nation's existing investments, continued advancement of better transportation operations plays a critical role. It will not happen by one single act. The transportation community can accelerate the solution to congestion by being more aggressive in championing the need for transportation systems management and operations, more aggressive in showing the benefits of management and operations, and more aggressive in the deployment and use of traffic engineering, transportation management, and traveler information tools.

Azeem Uddin is the Lead Analysis Engineer at General Motors-India and works in the area of Engine Performance Simulations and Computational Fluid Dynamics.

REFERENCES:

1. India, The Emerging Giant by Arvind Panagariya
2. CIA-The World Factbook-India
3. An analysis of perception of foreign direct investment in India, Indian Journal of Economics and Business , June, 2008 by Janardhana A. Alse, Arun K. Srinivasan
4. Department of Industrial Policy and Promotion, India FDI Fact Sheet, December-2008
5. Impact of Globalization on Developing Countries (With Special Reference To India), International Research Journal of Finance and Economics, Issue 5, 2006
6. Reserve Bank of India, Press Release: 2007-2008/1681
7. U.S Department of State, 2009 Investment Climate Statement – India, February 2009

Kyoto of the Cities, Naples, Mar 26-28, 2009

8. The Economic Times, May, 25, 2005
9. Business Standard, Mumbai, March 17, 2009
10. Indian Economic and Business News Bulletin, Commercial Wing of the Indian Embassy in Israel, October 2008
11. Business Week, March 11, 2009
12. The Financial Express, March, 19, 2009
13. Website of Society of Indian Automobile Manufacturers, <http://www.siamindia.com>
14. Website of Ministry of Urban Development, Government of India <http://urbanindia.nic.in>
15. Forbes, India's Most Congested Cities, December 19, 2006
16. Press Information Bureau, Govt. Of India
<http://pib.nic.in/archieve/factsheet/fs2000/roads.html>
17. Business Standard, “State plans centralised vehicle testing centre”, March 13, 2009
18. <http://www.london.gov.uk>
19. The Economic Times, “Climate plan wants drastic curbs on private cars”, December, 15, 2008