

# Urban Traffic Congestion: The Problem & its Solutions

To many people, traffic congestion is an irritant because it throws their personal schedules in to chaos. To others conscious of the value of time in their economic pursuit, it is a financial loss. Yet to some others, it is an easy excuse for being habitually late for appointments and for some others it is a convenient conversation starter. But most often, all these people tend to shrug their shoulders and appear to accept that this is part and parcel of the travails of urban living.

This article examines the proposition if traffic congestion is something we just have to learn to live with or if there are indeed initiatives that could be taken to reduce and manage it within tolerable levels. But ahead of answering that, we need to ask some basic questions:

- \* Why is there congestion?
- \* What are the effects of congestion?

Put simply, traffic congestion means there are more vehicles trying to use a given road facility than it can handle- without exceeding acceptable levels of delay or inconvenience. In Colombo and other major cities, this occurs mostly during certain times of the day- we call peak periods or rush hours. There are two clear parameters within a single equation that causes congestion, which is the balance between the demand and the supply of road space.

The demand for road space arises from the universally observed desire of individuals to own and use a motor vehicle. As incomes increase and technological advancements reduce the real cost of producing a motor vehicle, more and more persons find the financial means for owning and using a motor vehicle. However, motor vehicles do not come without their share of physical and environmental limitations. A motor vehicle in the first instance requires road space to operate freely, parking spaces at residences and work places. Increase of motor vehicles (the demand) often outstrips the provision of road space (the supply) in many countries. The result is traffic congestion..

According to the TransPlan Model (UoM, 1999) average traffic speeds within the Colombo Metropolitan Region (CMR) have dropped to around 20 kms/hr today. The typical corridor (major artery) speed is around 10-15 kms/hr within Colombo City. Traffic congestion may be considered a problem, by many, they often fail to see the extent of its impact on the com-

munity and country. These impacts could be further discussed as -

**Economic Growth:** A good transportation system is an important selling point to communities that desire to attract development that provides for employment and growth of a city. If transport costs

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due to congestion increase, goods and services produced within that city tend to increase in costs thus losing competitiveness in international markets. Efficient transportation access is therefore a very important consideration as it has a direct impact on sound and sustainable economic growth and productivity. The cost of congestion in the Western Province of Sri Lanka is over Rs 20,000 million per year (around 3 percent of Regional GDP). This includes the cost of productive time and wastage of fuel.

**Quality-of-Life:** To some people, congested highways are a symptom of deteriorating quality-of-life-in a community. The amount of time that is spent on commuting to and from work is also in reality, time that is taken away from social interactions or pursuit of activities that have a personal value and satisfaction.

**Environmental Quality:** Congested road conditions can have a detrimental effect on the environ-

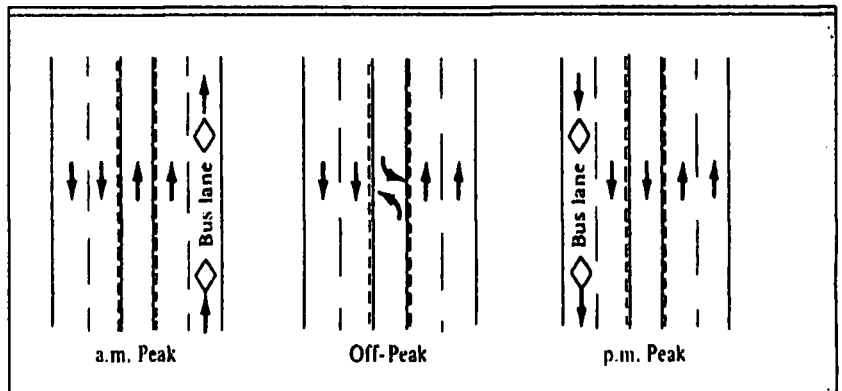
**Anti- Social Behavior:** Increasing social problems referred to as Highway Rage (or Road Rage) experienced in many countries where drivers show hostility to each other most often due to the frustration of slow moving traffic is also becoming a serious social problem.

## STRATEGIES FOR MANAGING TRAFFIC CONGESTION

Road users and political leaders need to be appraised what options there are for Colombo or any other city to manage traffic congestion. These management strategies could be discussed under short term and long term options. Most successful approach for Sri Lanka would be to adopt a dual strategy so that immediate respite and permanent solutions are initiated together.

**The Short-Term Strategy:** This strategy has two distinct approaches. The relative merits of each and the suitability of them, for Colombo and other cities in Sri Lanka are discussed below-

**Managing the Transport Supply:** Managing the transportation system by adding new facilities or by making operational changes to improve system performance is the most common response by engineers and even politicians and administrators to solve congestion problems. These measures can be better un-



ment, in particular air quality and noise pollution. Congestion arises due to increase vehicles on the road. Ironically this is the time when there are the most number of people on the roads as well. This means that many more people become vulnerable to respiratory diseases such as asthma - widely prevalent today.

derstood by classifying such attempts as follows:

1. **Adding new transport infrastructure capacity:** This means *new roads, expressways and railways* that can carry more vehicles. Even though this is almost always the 'first-option' suggested by road engineers and police alike, this is usually very expensive

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and often socially prohibitive in urban areas. However the bigger limitation in this approach is that road construction in urban areas is often considered to generate more traffic in the long term, and the idiom that 'traffic fills whatever road space provided' is a well-established fact. For example, the author has shown elsewhere (Kumarage, 1999) how the proposed Katunayake Expressway could very well increase congestion within the city, even though there might be some respite for a period of time on the existing A3 highway.

**2. Improving existing infrastructure for increasing capacity:** A less expensive approach is to identify *bottlenecks and increase capacity* at these places. Signalizing an uncontrolled intersection (e.g. Katubedda Junction) or street widening of bottlenecks (e.g. Kadawatha town) or providing for a grade-separated intersection (e.g. Ragama fly over) would fall within this category. However many such attempts are also unlikely to solve traffic problems in the long term, as these bottlenecks often control the flow of traffic beyond them and when they are eased, the problem shifts further down stream- a problem identified as 'migration of congestion'.

**3. Redesigning existing infrastructure for increasing capacity:** Converting existing road space for high occupancy vehicles either by introducing *bus lanes* or providing *bus ways* (experimentally tried in Sri Lanka last October, but widely used in many European cities- de Silva et al, 2002). In some cities, entire roads have also been converted to *pedestrian only streets*. *Removal of on-street parking* is another successful method used (tried successfully in 1997 but later lapsed due to Police disinterest- Kumarage, 1999) especially in the peak period in the peak direction. This is a successful approach increasingly used in cities throughout the world, that have correctly identified that carrying more people in to a city is more important than merely allowing for more vehicles to come.

**4. Operational improvements to existing infrastructure to increase capacity:** These include operational changes to increase the capacity of a transport system. These measures include introducing *reversible lanes during peak periods*, (for example, the Galle Road between Maliban and Kalubowila Road, has five lanes. The middle lane can be made into a reversible lane, with the outer lane in the peak period turned in to a bus lane); introducing a *right-turn phase* in a traffic signal, ensuring better *police enforcement, one-way systems* that reduce traffic conflicts and expanding the public transport network are some common approaches. The use of Information Technology

has also allowed the development of *Intelligent Transport Systems* where incident detection programs, motorist information systems, and towing/enforcement efforts that can be used to minimize the effects of accidents and other non-recurring incidents and increase the capacity and reliability of the network.

**Managing the Transportation Demand:** In its broadest sense, demand management is any action or set of actions intended to influence the intensity, timing, and spatial distribution of transportation demand for the purpose of reducing the impact of traffic flow. These can be categorized under the headings.

**a) Re-distribution of the spatial form of the demand for transport:** These include the urban re-planning and the *relocation* of certain land uses that may cause traffic congestion. For example, there has been a plan for many years to relocate the wholesale trade activities in Pettah to

higher than off peak so that some demand is spread to other hours. *Prohibiting delivery vehicles* during working hours in a city, is another method of designating goods transport to night times when road capacity exists.

**c) Re-distributions of demand between the modes of transport:** This is done in order to move persons from modes of transport more likely to cause congestion to more space efficient modes of transport. This can be done by say increasing the *quantity and quality of public transport*. Financial penalties may also be used for this purpose. *Imposing Road Tolls* (where cars are taxed and buses allowed free as in Singapore) and increasing *Parking Charges* to commercial values (most European & U.S. cities) is another method. In some cities reducing parking availability and imposing time limits for parking is an established strategy (e.g. London). Generally re-distribution is favourable when passengers are induced to move from high space utilizing vehicles (e.g. cars and motor cycles) to lower space utilizing vehicles (such as buses and other modes of public transport).

*Park and Ride* facilities are also encouraged, which enable people who would be travelling by private cars to park their vehicles away from a city and take a bus or train from there (a proposal for this has been made in Kumarage, 1997).

#### Long-term Strategy

Solving traffic congestion in the long-term however requires even wider strategies and policies. These can be identified in to four categories. These are also discussed in brief.

- (a) A land-use strategy compatible with transport capacity,
- (b) A Vehicle Ownership strategy compatible with road capacity,
- (c) A strategy for public transport compatible with population density,
- (d) A strategy for new modes of public transport compatible with personal incomes.

**(a) A land-use strategy compatible with transport capacity:** The Colombo Metropolitan Regional Structure Plan (UDA, 1999) provides a good case study on how a sustainable and balanced land-use strategy can be devel-

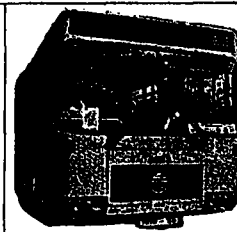


Table 1  
Proposed Work Hours

Sector	Proposed Start AM	Present Start AM	Proposed End PM	Present End PM
State Schools	8:00	8:00	14:00	14:00
Private Schools	8:15	7:30/8:00	14:15	13:30/14:00
Other Educational Institutions	8:30	8:00/8:30	Varies	Varies
Public Sector Offices	8:45	8:45/9:00	16:30	16:45/17:00
Private Sector Offices	9:00	9:00	17:30	17:30
Banking/Financial Sector	9:30	9:00	18:00	17:30
Retail Business	10:00	10:00	18:30	18:30

Orugodawatte (University of Moratuwa, 2000). This (long overdue project) would reduce the freight traffic to the Central Business District area and ease traffic congestion considerably. Similarly there is a proposal (Kumarage, 2002) to decentralize the Pettah Bus Terminal so that fewer buses would come to Pettah and Fort areas. Relocation of administrative functions that attract travel is a common strategy (e.g. relocation of passport office).

**b) Re-distribution of the temporal pattern of the demand for transport:** This is also known as demand spreading. There are many methods adopted in different countries to spread the traffic during peak hours. Since it is when large numbers of people travel at the same time to the same locality that cause traffic congestion, there is now an effort in other countries to *Stagger Work Hours* (see Table 1). This requires offices opening and closing over a longer time span (e.g. spread from say 8 am to 9.30 am). This also applies to separating school times from office time and even spreading school opening times between different areas or types of schools (e.g. private and state schools could start at different times). *Flexible Work Hours* is another method whereby workers are allowed to report for work over a period of time rather than at an exact time. *Electronic Road Pricing* is another method used in some cities, whereby peak period road use could be tolled



**Table 2: Vehicle Ownership Saturation Levels with Urban Parameters**

Population Density	Population Density (persons/ha)	Roads (m/person)	Share of Public Transport	Car Ownership Saturation (per 1000p)	Restrictions
Low	< 25	> 4	< 5%	600-700	Little or no restriction on ownership.
Moderate	25-75	1-4	15-35%	300-400	Some traffic and parking restrictions
High	> 75	< 1	50-80%	200-300	Traffic and Ownership Restrictions

oped based on the transport capacity that can be provided. The combined land use- transport strategy adopted in the CMRSP aims to provide for more space efficient modes of transport within the CMR together. The main radial arteries to the City are proposed to be developed as High Mobility Roads for fast commuter travel (by banning parking, right-turns, introducing signalisation etc). Furthermore, it proposes to develop the Colombo City as mixed high-density land use and to facilitate the planned formation of six satellite city centres. The proposed outer ring road in this case is intended to connect these satellite cities while simultaneously providing for an orbital route around Colombo and its suburbs for inter-regional traffic.

**(b) A vehicle ownership strategy compatible with road capacity:** Vehicle ownership is associated with increase in incomes. It is also represents an important feature of choice of travel. Increases in vehicle ownership however, requires more road space, parking space and measures to control air pollution etc. Therefore, to properly plan the land use in the CMR or in any city, the levels of vehicle ownership that can be sustained therein has to be understood.

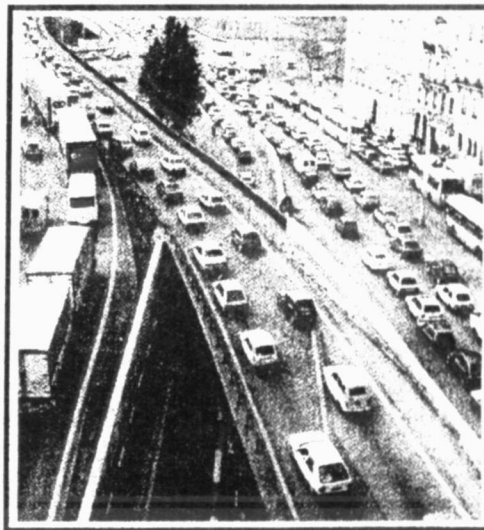
The present rates of vehicle ownership in Sri Lanka, is around 74 vehicles per 1000 persons. This increases to 97 per 1000 in the CMR. In Colombo District, this increases further to 141 per 1000. In Colombo City, this is even higher at 262 per 1000. The fact that within most parts of Colombo City and also in many parts of the Colombo District, traffic congestion is a regular feature indicates quite clearly that the present level of vehicle ownership therein, cannot be sustained. This as described before, is because the demand that these vehicles generate cannot be matched by the provision of increased road space. This means that the saturation levels for the present transport infrastructure appears to have been reached in these areas. This saturation level is based on three distinct parameters -

- Population Density,
- Performance of Public Transport,
- Road Length.

According to the Colombo Traffic Study, (UoM, 1995) the share of public transport within Colombo City is around 50%. Within the CMR it is estimated to be around 60%. The national average also appears to be around 60-65%. The population density in Colombo is 174 persons/ha and according to CMRSP projections,

set to increase to nearly 200 by the year 2010. According to the same projections, the population density, which is 30 persons/ha in Colombo District at present, is set to increase to 40 persons/ha. The road density in metres per person, which is an alarming 0.2 in the CMC, increases only up to 1.4 in Colombo District. **Table 2** shows the corresponding land use density, incomes and performance of public transport associated with the respective levels of sustainability in vehicle ownership.

On an international comparison, the ownership of vehicles in cities in the USA, Canada and Australia show that sustainability levels can be as high as between 600 to 700 vehicles per 1000 persons. These rates are associated with, high incomes and low levels of public transport use at less than 5%. The population density of these cities is generally low and below 25 persons per hectare. Most European Cities on the other hand,



maintain incomes comparable to the earlier group of cities, but have significantly higher public transport patronage of around 25%. In these instances, the vehicle ownership rate appears to saturate at around 300 to 400 vehicles per 1000 persons. In these cities however, population density is higher (25-75 persons/ha). Most cities also apply some degree of traffic restraint usually in the form of parking limitations. The third group refers mostly to Asian cities, where vehicle ownership levels seem to taper off at even lower levels. Public transport in these cities is between 50-80%. This is achieved by intensifying improvements to public transport and simultaneously applying equally intense traffic and even vehicle ownership restraint measures. These cities have much higher population densities at over 75 persons/ha.

Based on a comparison of the above cities in Sri Lanka, which in most cases have low road densities and high population densities and are presently public transport oriented, would only be able to sustain relatively lower levels of traffic and correspondingly lower vehicle ownership. In the case of the Colombo City saturation has already been reached, whereas in other parts of Colombo District, where on account of the fact that public transport has a good coverage, it would be most desirable to target for saturation levels of around 300 vehicles per 1000 persons. In this case, there is some growth possible before saturation occurs.

Such a situation can only be arrived through specific interventionist policies that bring about balanced transport growth (e.g. as the New Deal Transport Policy in the U.K.). It is clear that without any interventionist measures, vehicle ownership will continue to increase with incomes and traffic congestion will continue.

This should then influence all transport policy and infrastructure planning within the CMR and its sub regions. This would mean that policy directive should be aimed at controlling vehicle use starting from the CMC and then spreading to Colombo District before extending to all of the CMR. Such policy should take into account steps to maintain the public transport share, while planning for traffic restraint measures and measures to manage the ownership and use of private vehicles.

**(c) A strategy for public transport compatible with population density:** It was shown earlier that public transport becomes a necessary and appropriate mode of travel when population density is high and density of roads is low at the same time. In such a scenario when incomes

increase, it is public transport that can provide sustainable transport. Therefore it is evident that the backbone of an efficient and sustainable transport system in the CMR would essentially center around a good public transport system. Particularly for travel within the CMC and on the commuter arteries.

Such a strategy would require the following policy initiatives, projects and programs to give priority for public transport use and to restrain private vehicle use- a two pronged approach that has been successfully used in many cities throughout the world (e.g. Singapore, Tokyo, most European Cities).

- Implement a Parking Policy where parking

spaces are restricted & where parking fees are increased in keeping with the demand for the limited spaces.

- Implement an electronic tolling system for the roads within the CMC at peak periods so that inefficient use of road space by low occupancy vehicles during peak periods could be discouraged by a toll.
- Encourage the operation of road and rail based park and ride systems.
- Divert port-based freight traffic from road to rail.
- Set up regional distribution centres for agricultural produce to minimise travel related to internal trade.

**(d) A strategy for new modes of public transport compatible with personal incomes:** The CMRSP (UDA, 1999) has proposed a People Mover System for Colombo City as a means of improving public transport as well as introducing a higher level of service

in public transport. This is essential if public transport is to be a viable alternative for people whose incomes are increasing. They would look for quality in public transport. If passengers, whose incomes are increasing all the time, do not find adequate quality, then the need to own and then use a private vehicle would be unmanageable. Therefore, the need for a new public transit system has a wider connotation than its immediate financial viability. It should be a part of a strategic plan of managing mobility in the CMR. The Colombo Urban Transport Study (WS Atkins & University of Moratuwa, 1999) have recommended a Light Rapid Transit (LRT) – also known as the modern day trams for Colombo City and for two radial corridors. These systems are being introduced as alternatives for road building programs (e.g. Bangkok or Kuala Lumpur) and are investments that will most likely be most effective in managing the future demand for transport and the management of traffic congestion in our cities.

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