

Financing Issues Of Public Transport Seen From The Perspective of Karnataka State Government Agency

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KARNATAKA STATE ROAD TRANSPORT CORPORATION

TRANSPORTATION ACTIVITIES

Supports mobility
demands for passengers

Freight

Results in growing
levels of motorization

Congestion

Harmful Emissions



STATISTICS OF KARNATAKA STATE

- Population → 52.73 million (2001 Census)
- Area → 1,92,000 sq km
- Inhabitation → 27573 villages, 270 towns
- Connectivity → 1.34 lakh kilometres of road
- Road Length → 10801 km maintained by
Panchayats & Municipalities

Source: State of the Environment Report and Action Plan-2003

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TRANSPORTATION ISSUES

Increased vehicular emissions due to traffic congestion

- ✦ increase in vehicle pollution load
- ✦ preference for personalised mode of transport
- ✦ increase in commuting hours
- ✦ lack of efficient traffic management
- ✦ longer travel times
- ✦ extra fuel consumption
- ✦ high-level of pollution
- ✦ discomfort to road users
- ✦ degradation of the environment

Vehicular Distribution in Bangalore (%)	
Two Wheelers	39.58
Cars	57.55
Cabs	31.36
Three Wheelers	39.48
Buses	34.75
Goods Vehicle	30.75

Number of vehicles in Karnataka increased from 14.33 lakhs in 1990-91 to 39.96 lakhs in 2001-02.

Among the various types of vehicles plying on the roads two wheelers constitute 71.81% followed by cars 9.50% and other vehicles 9.57%

Source: State of the Environment Report and Action Plan-2003

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Problems of Automobile Technology

- ✦ Improvements have been made by manufacturing adhering to stricter emission norms with improvements such as combustion processes, treatment of exhaust gases (with catalytic converter) and use of cleaner burning fuels
- ✦ Number of 4 stroke vehicle is increasing but the two wheelers form a sizeable amount of total vehicle population
- ✦ Two stroke vehicles consume more fuel when compared to the four stroke ones and also cause relatively higher pollutant emissions
- ✦ Introduction of battery driven cars have failed to garner a sizeable proportion of the automobile market in India
- ✦ Vehicles run on a blend of ethanol and petrol, however for vehicles on 10% blend the engine needs to be modified
- ✦ Automobile technology in India still needs to evolve in order to develop more energy efficient, eco-friendly and cost efficient vehicles
- ✦ These above factors have to be addressed long before clean technologies become popular



Age of Vehicles

- ✦ Age of vehicle fleet is important, old vehicles require more maintain and consume more fuel per unit travelled
- ✦ The Mashelkar Committee estimated 9.49% of 2 wheelers, 90.93% of cars, 6.94% of three wheelers and 35.97% of commercial vehicle in Bangalore are aged vehicles



Vehicle mix on roads

- ✦ Traffic mix in the State consists of motorized and non-motorized vehicles and they fight for the same road space
- ✦ These are vehicles with different space occupancy, ridership characteristics, acceleration and cruising speeds, coupled with insufficient road space, drastically reduce the average speed on the roads
- ✦ Reduction in speed increases the travel time and leads to increase in consumption of fuel and emission of carbon dioxide, hydro-carbons and oxides of nitrogen



Insufficient Road width and lack of medians

- ✦ Carriage way width are very important from the view point of road carrying capacity
- ✦ Carriage width is classified into three categories
 - Single Lane 3.75 mts
 - Intermediate Lane 5.5 mts
 - Two lanes 7 – 7.5 mts
- ✦ A large part of the road network in Karnataka is made up of single lane roads or narrower and much of the network is in poor condition
- ✦ 71% of the state highway are single lane, 22% are intermediate lane and only 7% are two lane width
- ✦ Among the major districts, 98% are single lane while 2% are wider than single lane
- ✦ Almost all village and rural roads are single lane widths
- ✦ Narrow carriage width leads to more congestion and reduced speed
- ✦ A study in Bangalore on volume-capacity ratio reveals that 8 roads in the city are congested. These roads handle more traffic than they are designed to handle*.

Source: Bangalore Traffic Police, 2004



Poor road surfaces

- ✦ 99.9% of State Highways are surfaced while 65% of major district roads are surfaced
- ✦ Majority of village and rural roads are not surfaced
- ✦ Urban roads and highways have unexpected road humps deliberately and unauthorizedly placed due to some accident in the past
- ✦ Pot holes and wavy road features (resulting from faulty construction and maintenance) rutting due to movement of iron hooped carts, contribute to poor road quality.
- ✦ Bad roads put extra stress on engine, cause more fuel consumption and result in wear and tear
- ✦ Engines produce higher emissions while accelerating and deaccelerating
- ✦ 70% of accidents are due to poor road quality and bad driving
- ✦ Condition of roads tend to deteriorate after monsoon which again leads to increased wear and tear and eventual mechanical failure
- ✦ Mixed nature of traffic speed differences between heterogeneous traffic causes more accidents, severity of the accidents also increases.

Source: Press Trust of India, 2002



Poor Network Geometry

- ✦ Bad intersection geometry is the main cause for low speeds
- ✦ When Traffic volume in geometry are considered together, the degree of saturation becomes a key factor in determining congestion level

For eg: According to Karnataka Road Development Corporation Ltd., 19 intersections were over saturated. Grade separation would offer economical and optimal solution for transportation problems.

Out of these 19 intersections, construction of flyovers in the priority 10 selected would provide 16% to 44.29% relief in terms of delay, which also will contribute to air pollution and noise Pollution.

According to a study conducted by Rail Indian Technical and Economical Services, A proposal for a one-way system would lead to an estimated fuel saving of 3 million litre per year and one-way system would also results in improvements in speed of vehicles.



Volume to capacity ratio on major roads in Bangalore

Name of Road	Volume – Capacity Ratio
Nrupatunga Road	3.62
District Office Road	2.51
K.G. Road	2.51
Lalbagh Fort Road	2.67
Puttanna Chetty Road	2.45
Richmond Road	2.26
M.G. Road	2.76
Chord Road	2.51
Tumkur Road	2.62
Sankey Road	1.52

Source: Bangalore Traffic Police, 2004

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Location of vehicle stops

- ✦ Location of centralized bus terminal at the heart of the city contribute to congestion of traffic on the roads leading to bus terminal
- ✦ However, the inability to provide separate space for private vehicles is still causing the congestion
- ✦ Bus stops in the middle of the roads hinders flow of traffic
- ✦ Location of Auto rickshaw stands, taxi stands and bus stops near intersection is causing problem
- ✦ Absence of parking control near intersections has added to the problem

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Land use and transportation planning deficiencies along road and railways

- ✦ Air pollution to building, offices and shopping areas on both side of the road. These roads act as both local areas roads as well as regional arterials, hence a lot of criss-crossing movement due to pedestrians and local traffic
- ✦ Land use and transport system have not developed in an integrated mannerism urban areas in Karnataka. No consideration was given to provision of land for bus stand, bus terminus location, wider roads for bus route and land reservation at junctions
- ✦ Lack of multi-nodal city development to minimise travel
- ✦ Junction treatment is bad with insufficient space for traffic movements and is further aggravated by location of petrol bunks, bus stands and taxi/auto stands and roads humps



- ✦ By-passes have been planned to be located close to the city and development begins around the bypass
- ✦ Inadequate land use control and regulation is found more near railway lines where slums develop long the Railway lines. The impact of these types of land use development result in congestion, higher air and noise pollution
- ✦ Other land use relate deficiencies are:
 - a) No specific areas reserved for bus terminus, parking of buses on roads
 - b) Multiple approaches to intersections
 - c) Road designations are unrelated to road importance, road width and plying of public transport
 - e) Insufficient parking space compared to the demand generated by public places such as temples, shopping centres, cinema halls, function halls etc.



Public Transport and mass transit inadequacies

- ✦ Public transport represents low energy use per passenger kilometre, low emissions per passenger kilometre, consumers low road space per passenger kilometre
- ✦ Efficient and reliable public transit would provide an incentive to people to avoid private transportation alternatives
- ✦ The benefits of mass transport system become apparent with the economics of transporting people across distances.
- ✦ In Bangalore, people are options for personalised mode of transit inspite of fuel costs
- ✦ Rail based mass transport systems are highly efficient both in terms of energy efficiency per passenger kilometre and pollution emitted per passenger kilometre compared to any other road based petrol or diesel transport system. However, there is a high initial capital cost involved.

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To Transport 10,000 people for 1 kilometre

Parameters	Car	Minibus	Regular	Heavy	Articulated	Biarticulated
Persons/ Vehicles	3	25	80	105	180	270
Vehicles Needed	3333	400	125	95	55	37
Area Occupied (m ²)	48000	8800	3200	3260	2600	2370
Fuel Consumption (L)	400	120	40	38	31	34

Source: State of the Environment Report and Action Plan-2003

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Fuel adulteration

- ✦ Fuel adulteration engine performance & leads to higher emissions
- ✦ Adulteration of fuels especially in diesel vehicles is directly related to the price difference between diesel & kerosene



Air Ports & Sea Ports

- ✦ Bangalore airport is another source of noise pollution particularly in the nights
- ✦ One study reveals noise levels of 86 –102 decibels (A) at the air port which exceeds the level permitted by the Environment Protection Act in industrial area which is 75 DB in the day and 70 decibels at night
- ✦ With the growth of the city, a lot of localities have sprung up near the airports
- ✦ Sea ports require maintenance through dredging. Due to severe siltation, the New Mangalore port requires annual dredging of the order 2.87 Mm³/year from the lagoon.
- ✦ Unscientific dredging can have adverse impacts on the local ecosystem in the form of re-suspension of bottom sediments, accumulation/dispersion of toxic substances oxygen depletion, reduction primary production, temporary alternations, increased nutrient level and bed load movement.



Road Network in Karnataka

- 11% of State Road Network constitute National and State Highways which carry the bulk of road traffic
- 71% of State Highways and 93% of major district roads are single lane (3.75 m)
- 32% of the road length constitute National Highways, State Highways and major district roads which are maintained by the State Public Work Department

contd...



- Remaining roads are maintained by Zilla Panchayat
- Few Districts viz: Gulbarga, Raichur and Kodagu have no highways passing through them
- On an average, about 69 kms of road exists per 100 sq km of geographical area and 250 km of per lakh population in the State
- In terms of length, National highways account for about 2.8% of the total road-length in the State. National Highways account for total traffic volume in the State.



Road Length in Karnataka

Road Type	Length in km
National Highways	3,728
State Highways	9,829
Major Districts roads	28,247
Other district roads, village roads, irrigation & forest roads	92,258

Source: State of the Environment Report and Action Plan-2003

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Percentage of Villages connected

Types of Road	% of Villages connected
All weather roads	60.3
Fair weather roads	23.7
Kucha roads	15.7
No Roads	0.3
Total Roads	100.0

Source: Public Works Dept.2003

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Initiatives of Government of Karnataka

- ⌚ Upgradation of the 259 kms Tumkur – Haveri section of the Western Transport Corridor (WTC) from a two lane, single carriage highway to a four-lane, divided highway
- ⌚ National initiative to improve the highway system, particularly through the construction of the Golden Quadrilateral and North-South Corridor benefiting Karnataka
- ⌚ Karnataka State Highway Improvement Project (KHSIP) to upgrade and improve road transportation infrastructure with assistance from the world bank
- ⌚ Bangalore-Mysore Infrastructure Corridor is a major project proposed to be under taken on a Build-Own-Operate-Transfer basis to provide to fast road access between Bangalore – Mysore through an express way

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Trends

- ✓ The economic growth in the State is centered in and around Bangalore, Capital of Karnataka State & the Silicon Valley of India.
- ✓ 38.22% of the vehicles are in Bangalore and 90% of the growth in vehicles within Bangalore Urban Area already represents personalized modes of transport (two wheelers and cars)
- ✓ Annual growth rate in traffic on road system exceeded annual growth rate of road network in last two decades
- ✓ 20% increase in traffic each year and 25% annual growth on state highways but road network has expanded to an average rate of 2.6% per year only

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Projected Vehicle Kilometres and percentages by 2010

Vehicle Type	Vehicle Kilometres	Percentage
Cars/Jeeps	123.12	25.6
Taxis	4.06	0.8
Two Wheelers	231.63	48.3
Autos-Petrol	86.94	18.1
LCVs	11.42	2.4
HCVs	8.21	1.7
Bus-diesel	14.83	3.1
Total	480.2	100

Source: State of the Environment Report and Action Plan-2003

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Vehicle use and travel patterns in Bangalore City

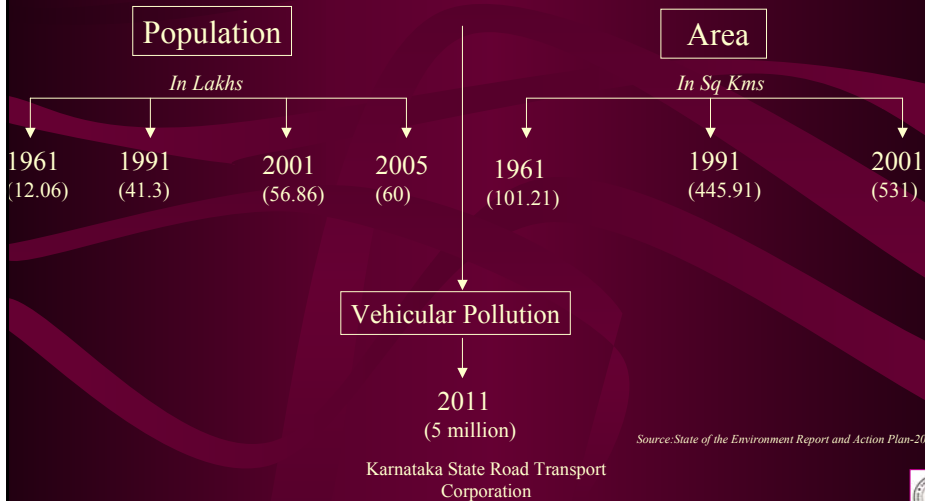
- ✔ 78% of households owned a motor-vehicle, with vehicle ownership at 1.5/household
- ✔ Trips per person/day were 0.89, and are expected to go upto 1.25 by 2011
- ✔ The average trip length is 7.1 km and average travel time is 30 mins
- ✔ Average car occupancy is 2.21, scooter occupancy is 1.41, and auto occupancy 2.1
- ✔ Average speed in the city is 13.33 kms/hr and is likely to go down to 10km/hr by 2011
- ✔ In terms of modal split, 8.4% of all trips are undertaken by car, 38.1% by two-wheelers, 40.9% by bus, 1.1% by bicycle and 11.5% on foot.

Source: Rail India Technical and Economic Services, 2001

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Bangalore City



Action Plan

- ★ Traffic police to adopt measures including traffic signals synchronization and display of diversion maps
- ★ Declare more roads as one-way: One ways reduce conflict points which in turn reduces the junction delays
- ★ Augmentation public transport: Introduce more biarticulated buses on peak routes
- ★ Parking restraints should be implemented to discourage personalized mode of transport. These include high parking fees, reduction in parking time, declare more no parking zones etc.
- ★ Coordinate land use and transport planning in order to encourage spatial settlement patterns that facilitate access to basic needs such as workshops, schools, healthcare, places of worship, goods, services, leisure thereby reducing the need to travel



- ✈ The Transport department should develop and maintain a credible database including inventORIZATION of vehicles and other attrition, vehicle utilization, speed, emission functions, continuous monitoring of air quality in critical areas, adulteration and safety aspects
- ✈ Alleviate construction of a few flyovers and grade separators
- ✈ Need for better traffic management and demand restraint measure: Traffic movement can be streamlined by implementing better traffic management measures like synchronized signals, grade separation of fast and slow traffic. Well designed arterial roads, intersections, pedestrian crossings and display of traffic diversion maps during peak hour of traffic flow. For ensuring sustainable transportation, a traffic count volume database should be prepared.
- ✈ Extra travel could be avoided by better directional signing including available car parking. Other strategies include: restricting access to sensitive areas, encouraging walking, cycling, public transport, generating awareness among people of the implications of their transport choices and improving alternate routes, promote car pooling, augmenting public transport and land use planning with regulations



- ✈ Requirement for a rapid transit system in Bangalore urban area
- ✈ Provision of a mass transport system like a bus system can definitely wean away a substantial number of private transport users to the bus system
- ✈ The bus system is the main public transport mode in urban transportation in Karnataka. There is no suburban railway system being operated anywhere in the State.



THANK YOU



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