

INDEX

Sl No	Title	Chapter No.	Pg. No.
1.	Introduction	1.0	2
	a. Public Transport	1.2	2
	b. Traffic Congestion	1.4	3
	c. Perverse Incentives	1.5	3
	d. Class Divide Created By Public Transport Systems	1.6	3
	e. The Singapore Experiment	1.8	4
	f. Causal Factors To Traffic Congestion	1.9	4
2.	The Missing Link In Public Transportation	2.0	6
	a. Introduction	2.1	6
	b. Providing Last Mile Connectivity	2.2	6
	c. Last Mile Pavements And Road Networks	2.4	7
	d. Disincentives To Walking	2.5	6
	e. Other Disincentives To Walking	2.6	8
	f. Shared Vehicles As LMC For Metro	2.9	9
3.	Problem Statement	3.0	10
4.	Solution To Last Mile Connectivity(LMC)	4.0	11
	a. Introduction	4.1	11
	b. Air Conditioned Shared Cab As LMC For Metro	4.2	11
5.	Scientific Study	5.0	14
	a. Introduction	5.1	14
	b. Objective Of The Study	5.2	14
	c. Methodology Of The Study	5.3	14
	d. Data Collection	5.4	16
	e. Data Analysis	5.5	18
	f. Simulation Using Software	5.6	20
	g. Scenario Analysis	5.7	21
6.	Deliverables	6.0	22
7.	End Notes	--	23
8.	Appendices	--	26

Chapter 1.0

1.0 INTRODUCTION

1.1 INTRODUCTION

1.1 Bengaluru is experiencing explosive growth, and is currently the second fastest growing City in India, after Delhi-NCR. The Population is forecasted to have grown to 1.16 Crores (as of 2016), having grown from 96 Lakhs as in 2011¹ (And, Census of India, 2011). The decadal forecast undertaken expects the City to reach a population of 1.41 Crores, by 2021, showing a calculated steady 21 percent growth, from 2011 to 2021¹. The Total Vehicle Population in the City has also grown from 37 Lac (2010), to 62 Lac (2016) - a growth of 67.5 percent, even as infrastructure struggles to keep pace. Affluence is visible in the form of Private Car ownership, that has jumped 78 percent, from 7.03 to 12.5 Lac in six years (2010 to 2016). The relative increase of Private Cars with respect to total vehicle population growth of the City, for a similar period shows an alarmingly accelerating trend - Private Car growth has increased by 19 and 20 percent (2010 & 2016). (Appendix-1) As a result of this growth, Roads Infrastructure has come under heavy strain.

1.2 PUBLIC TRANSPORT

1.2 Rapid population growth of Bengaluru is attributable to a number of factors including IT and manufacturing industries that were setup, creating greater demand for products and services resulting in increased secondary economic activity and its consequent affluence for City Residents. The seasonal nature of agricultural work in a majority of Districts of Karnataka, and drought affecting large parts of the state, has caused unskilled migrant agricultural labor to pour into the City seeking a livelihood. The skill-based industries have also generated secondary job demand, increasing employment opportunities for skilled migrants from other states to settle in Bengaluru. The Public Transport available in the City to cater to growing needs of this increasing population has grown just 14 percent, from 6150 (2010) to approximately 7000 (Estimate : 2016)². A Public Transit system in the form of two alignments of Metro Service was planned and executed to cater to rapid growth, with various stretches being opened to the public in phases, since October 2011.

Last Mile Connectivity: A Viable Solution To Traffic Congestion

1.3 However, various studies have pointed out systemic deficiencies in infrastructure; Prominently, the lack of multi-modal connectivity³, that could result in poor ridership, contrary to forecast that should ideally have resulted from the greater capacity created for Public Transit, by constructing the Metro.

1.4 TRAFFIC CONGESTION

1.4 All Arterial Roads of the City are showing Volume to Capacity (V/C) ratios unacceptably higher than 1.1 indicating bursting-at-seams congestion⁴ approaching a state of grid-lock. A number of Comprehensive Traffic and Transportation and Mobility Indicator Studies have been undertaken from 2007 onwards⁵, to attribute causes and to suggest remedial measures to alleviate and redress congestion in the City. Common findings in almost all such studies pinpoint issues including inadequate planning, poor design, infrastructural issues, inadequacy of Public Transport, and increasing reliance on Private Cars for work-related trips. It has also been identified that a majority of these Private Cars trips are undertaken with a single occupant.

1.5 PERVERSE INCENTIVES

1.5 Perverse Incentives are defined as measures that have unintended and undesirable results, contrary to the incentive makers' interests. This may well be applicable to Bengaluru, as Cases Booked versus Towing Charges collected from Parking Regulation enforcement shows a decline during 2013,14 and 15 (Appendix-3,4). Towing Revenues collected per case, too, show a decrease during this period, from an average of Rs 204 (in 2011), to Rs 194(in 2016) (Appendix-5). A decrease in regulation of Parking Violations can only act as license for greater violations, which fuels the unintended consequence of increased Private Vehicle mobility.

1.6 CLASS DIVIDE CREATED BY PUBLIC TRANSPORT SYSTEMS

1.6 An additional factor exposed recently, in the Indian context, is the observation made by the Delhi High Court in October 2012 while dismissing a writ petition, to wit, 'We are sure we would like to live in a developed country and we remind ourselves that a developed country is not one where the poor own cars. It is one where the rich use public transport'⁶, extensively reported on by the world media⁷.

Last Mile Connectivity: A Viable Solution To Traffic Congestion

1.7 The case related to certain Private Car owners of NCR Region forming an interest group through an NGO, and petitioning the scrapping of a BRT (Bus Rapid Transit) Pilot being executed for Delhi. The Court's final orders, hailed as a Landmark Judgment, dismissed the petition in the larger Interest. Affluence of City Residents has resulted in greater acquisition of Private Cars as a means for Motorized Transport, as well as a status symbol. This has generated an unstated social divide by class, engendered by affluence, and while not adequately researched, has divided Travelling Public into economically weaker segments that adopt a Bus as a cheap Public Transport mode having no options, versus the more affluent who would rather adopt an air conditioned Metro (or a Volvo intra city Vajra Service) when available conveniently, than an ordinary Public Transport Bus subconsciously equated to that for the have-nots.

1.8 The Singapore Experiment

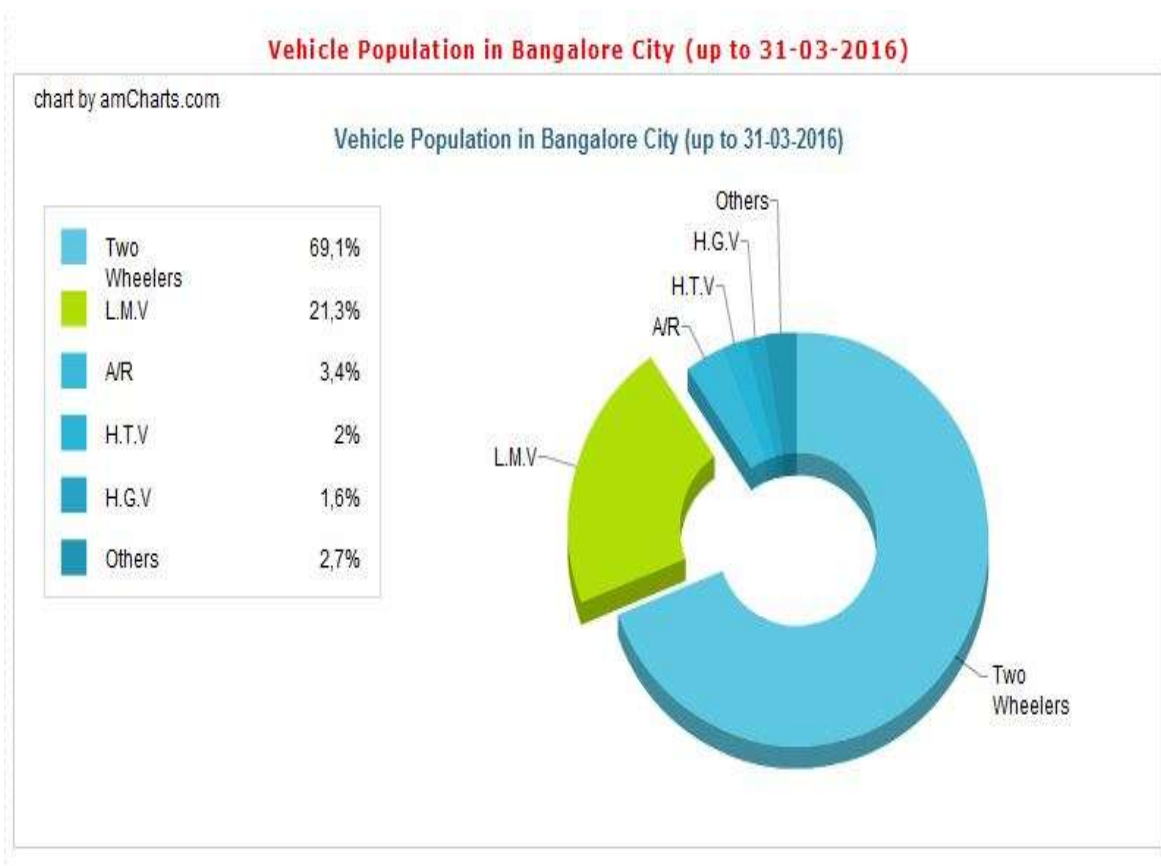
1.8 It is worth noting that Singapore experimented with running Air Conditioned as well as Non Air Conditioned Public Transport Buses on identical routes operated by the Trans-Island Bus Service (TIBS- Later absorbed into Singapore Mass Rapid Transit -SMRT) and by Singapore Bus Service (SBS), with differential fares, and elected to purchase Air Conditioned Buses outright or retrofit existing fleet, between late 1980s - early 2001. These as well as other measures, resulted in a complete overhaul of the Bus Services, and repudiation of the comment in the Wilson Report of 1970 which studied the Singapore Bus Service, "It is difficult to avoid the impression that bus passengers in Singapore are regarded as second class citizens for whom antiquated, poorly designed and badly maintained vehicles, lacking in comfort and cleanliness are good enough." (Public Transport Council, Government of Singapore)⁸. This rings true today, in Bengaluru's context.

1.9 CAUSAL FACTORS TO TRAFFIC CONGESTION

1.9 A number of studies were conducted on Traffic Congestion, Mobility Indicators, Improvement Research and Comprehensive Traffic and Transportation Studies⁵. What was not adequately emphasized was the absence of a mode for reliable Last Mile Connectivity for Bengaluru's Residents, causing progressively greater dependence on Private Vehicle Trips. An important study carried out by CISTUP (Reducing Traffic Congestion in Bengaluru City, Ramesh Babu, 2014) rightly pinpoints absence of basic infrastructure, among other issues also commonly identified elsewhere.

Last Mile Connectivity: A Viable Solution To Traffic Congestion

1.10 This is an important contributor to the ready adoption of Private Cars as well as 2-wheelers in lieu of Public Transport. Increased Private Car use for work-related trips has caused increased occupation of Road Volume, while inordinately contributing to Traffic Congestion. The recommendation of the above CISTUP Study lists out points like improving infrastructure, poor maintenance, Road design including Junction Improvements, additional Road Markings, providing Traffic Islands Medians and Road Furniture, Intelligent Transportation Systems, on and off-Street Parking, Restriction of Private Buses within city Limits, and regulation of School Buses: these are well understood and have been thoroughly researched in referenced studies conducted elsewhere too. However the interesting point on Travel Demand Management made in the Study, through the use of pooled Car or Van rides as a means of reducing congestion, is being further studied here for all its connotations, to further recommend a proposal to meet this critical aspect without dependencies – i.e. without the requirement of curing of all legacy issues, ab initio.



CHAPTER 2

2.0 THE MISSING LINK IN PUBLIC TRANSPORTATION

2.1 INTRODUCTION

2.1 Bengaluru grew from being a Pensioner's Paradise to a Garden City. Just like other Urban sprawls that are now classified as Cities, with Chandigarh a possible exception, Bengaluru has a patchy record of planning and execution in managing Land Use and Development related Infrastructure⁹. Bengaluru's unplanned growth has repeatedly been flagged by Civil Society: Notably by Praja.in/ Citizen Matters, Citizen Action Forum, Hasiru-Usiru (Environment Support Group), Janaagraha, et al. As Population growth sparked off by IT and Manufacturing Industries picked pace, so too did pressures on conversion of agricultural land for residential and commercial use. However, due to poor implementation and unplanned nature of development, erstwhile villages with their original narrow winding streets continue to coexist alongside retrofitted buildings, constructed in growing and permissive violation of extant Civic and Building Bye Laws (Appendix-8). Legal proceedings due to rampant encroachments, and illegal land-use conversions have inundated Civil Courts. Attempts to resolve the huge disparity between the reality existing on ground and violations with respect to the Comprehensive Development Plan set out in 2007 (CDP-2015) for planned execution of growth has thus far been nixed¹⁰. The fact that the CDP-2015 Document created for a growing Bengaluru did not consider Indian Railways as a stakeholder – despite being an owner of vast tracts of Land within the City – starkly illustrates the stand-alone nature of Development Planning in the country¹¹.

2.2 PROVIDING LAST MILE CONNECTIVITY

2.2 Transportation is adversely affected due to unplanned changes in Land Use: e.g., changing the planned Land Use from Residential purposes to Commercial purposes leads to reversing Traffic Flows - towards Commercial areas. All minor and major violations, encroachments and changes have had their cumulative adverse effects. The adverse effect is most acutely felt in the form of neglect of Last Mile Connectivity for access to Public Transport, that should have catered to walking as a means of accessing Bus Stops, Railway Stations and Metro Stations.

Last Mile Connectivity: A Viable Solution To Traffic Congestion

2.3 The connecting journeys before and after the transit ride can be influential enough to encourage or discourage a person to ride transit again¹². However, pavements meant for walking are treated as luxuries in our context, and retrofitted at the end of all other possible developmental detailing for Transportation, and used for what it was not meant for, thereby ensuring the disincentivizing, alienating, and defeating of its very purpose.

2.4 LAST MILE PAVEMENTS AND ROAD NETWORKS

2.4 Unplanned Residential Layouts are springing up in the City that get by Regulatory scrutiny, by providing just 15 to 18 Feet width for Layout Lanes. Most new unregulated Layouts in Revenue Land – enterprisingly termed “B-Khata” Layouts have Lanes that interconnect only at one end; the other end is made a Dead End. This is done illegally during the development stage, to permit hiving-off of one extra plot for sale, carved out of the far end of each Lane, creating a Dead End (Appendix-8). Such Dead Ends prevent circulation of Traffic and necessitates executing a 180 degree turn to exit. Storm Water Drains provided at either side of these Lanes shrink usable width. Electricity Poles carrying Domestic feeder cables for providing Power Supply are installed between the edge of the Drain and of the road, further squeezing lane width available. Real Estate Prices have shot up considerably, changing the concepts used by unregistered Civil Engineers and civil contractors for House Designs over the years. The current Design Trend does away entirely with the Porch, traditionally outfitted inside the residential plot itself to provide a designated covered parking area for privately owned Motorized/Non-Motorized Transport (earlier, a covered Garage constructed as an adjunct to the main Building was catered to, for parking purposes). The parking trend visible in such Layouts, followed by all the newly-affluent Residents as a consequence, is of unregulated parking of Private Cars on the Layout Lane itself, rather than inside the residential plot - further preventing the free movement of vehicles along the Lane.(Appendix-9,10). Such development prevents Public Transport access into Collector Roads (Appendix-11) to penetrate Catchment areas, despite guidelines established in our own Country through IRC 106-1990. Thus, despite adequate repetitive research, and guidelines for implementation, it has not been possible to ensure availability of Public Transport access at convenient distances on Road Networks, with Bus Stops located too far for access by walking the Last Mile from the Catchment.

2.5 DISINCENTIVES TO WALKING

2.5 Poor Solid Waste Management and spotty collection – an area of responsibility that comes under the Civic Authority – has resulted in Garbage Black Spots sprouting in residential as well as commercial spaces. Most of these Black Spots start as uncollected Garbage, dumped onto pavements. Unregulated Hawkers, push-cart vendors and Kiosk-based eateries at street-corners (Appendix 12) dump organic wet-waste onto vacant areas and Layout pavements, as Door To Door Garbage Collection Teams operate only in early morning hours, while these eateries open only at night, with neither meeting the other. Resorting to unregulated disposal creates refuse dumps infested with fertile population of stray dogs fighting for territory, and a deterrent to most pedestrians from using such pavements, even when provided for¹³.

2.6 OTHER DISINCENTIVES TO WALKING

2.6 Inadequate provision of Public Toilets and non-existence of Porta-Toilets in the City has resulted in Open Urination at various public street corners, dissuading residents from using the Pavements. Inadequate maintenance of footpaths show up as broken Drain Covers, seeping Sewer-Manholes and uneven pavement slabs¹⁴: As a consequence, residents avoid them, preferring to walk dangerously on Road edges when unavoidable. Land based Public Transport, operating to and from such Catchment areas, are unable to reach deep enough to provide convenient boarding opportunities due to congested Layouts, developed in violation of Land Use and Bye Laws. Existing lack of adequate reliability, coverage, predictability and frequency of available public transport further exacerbate alienation for affluent Residents; Except those from the weaker economical class who have no choice. These disincentives have resulted in the relatively affluent to ignore walking as a viable sustainable means to Last Mile Connectivity¹⁵ in accessing Public Transport, even where there is one available - a factor most well-planned Cities globally cater to right at first, in their Urban Design.

2.7 These festering embedded and chronic social and infrastructural issues that are seemingly insurmountable, combine to take away any pretenses to availability of Last Mile Connectivity. This then drives those with the means to take recourse to either 2-wheelers or Private Cars for most end to end Trips, bypass Public Transport.

2.8 Even if Public Transport be made available, the gratification obtainable from the convenience of a readily available Private Vehicles - simply by stepping out of the Door - becomes difficult to desist or reverse, given the disincentives discussed - even after the original problems are set right: Unless attractive alternates are offered, that is, that demonstrably bypass experienced problems. Such adoption of Public Transport in the absence of other viable alternates, find resonance in studies into Experiential Avoidance, as a part of research in Behavioral Science ¹⁶.

2.9 SHARED VEHICLES AS LMC FOR METRO

2.9 The advent of Meru in Mumbai in 2007, and later New Delhi marked a revolution in use of IT, to provide instant mobility through registering and booking on the internet,. This was carried forward to Smartphone based faster access through Application Programming Interfaces, that allowed a host of other players into the market, like Ola, Mega and EasyCab. Uber demonstrated the future of commuting by launching shared Transit on demand ¹⁷ . Shared Transport is already being practiced by the older Manufacturing and newer IT Industries, effecting movement of their staff through dedicated Staff Buses. As the study by CISTUP has recommended - among various other important recommendations - Pooled or Shared Vehicles are the future for Public Transit Last Mile.

CHAPTER 3

3.0 PROBLEM STATEMENT

3.1 From the above identification of absence of Last Mile Connectivity, it can be inferred that the problem of Congestion of all Arterial Roads has been caused due issues of both Infrastructural neglect and social aspects, that is fuelling use of Private Modes of vehicles, inexorably driving the Roads of Bengaluru towards unmanageable congestion, or gridlock. The galloping problem of congestion, caused by increasing Population of vehicles, and lack of disincentives to use of Private ones, is together acting at a rate such that newly freed-up Capacity would be overrun in no time. This is true even if herculean efforts and massive investment amounts (both in considerable short supply) were to now be pumped in, to address and cure legacy infrastructural issues. While these efforts nevertheless need to be put in, there is an urgent need for an additional unconventional method to be adopted to commence a Virtuous Cycle – for adoption of Public Transport, keeping in mind the absence of Last Mile Connectivity. Insertion of the Metro and procurement of additional Public Transport Buses (reportedly, 3000 Buses are being procured this Financial Year¹⁸) come as measures too little, too late, keeping in mind the absence of Last Mile Connectivity for weaning the affluent from their adoption of private motorized transport.

3.1.1 The study is proposed to be done on the assumption that Private Cars are used because of lack of adequate, convenient, cost-effective, readily available Last Mile Connectivity.

3.1.2 The removal of (Few, Most, All) Private Cars with Single Occupancy could make a tangible difference to Traffic Stream, and reduce congestion.

3.1.3 Offering a Shared Door-To-Door economical Air Conditioned Cab service that also inserts a Metro Leg of the Trip to Private Car owners, as a intuitive means of circumventing Last Mile Connectivity issues, will wean them away from using Private Cars.

3.1.4 A Camera and a longitudinal Glass Divider provided in a Shared Cab enhances sense of security and privacy for a Female commuter.

CHAPTER 4

4.0 SOLUTION TO LAST MILE CONNECTIVITY

4.1 INTRODUCTION

4.1 The missing link therefore, to adoption of a Metro (or Volvo) Public Transport service by the affluent class in Bengaluru, is the absence of Last Mile Connectivity even where a comfortable Public Transport service is available at a reasonable distance. The advent of Meru, Mega, Ola and Uber Air Conditioned Cab hailing services are a physical manifestation and proof of aspirational and sociological needs of the relatively affluent, for meeting Transportation needs (now euphemistically termed as ‘Lifestyle’ needs). The public statement of Uber in defending its Pooling Service before the Government of Karnataka, claiming that 25 percent of all its business in Bengaluru is from pooling service ¹⁹, is a harbinger of the social willingness of the affluent in our Country to adopt a shared or pooled means of Transport, that would provide Door To Door Connectivity.

4.2 AIR CONDITIONED SHARED CAB AS LMC FOR METRO

4.2 Thus a case exists to provide for an extension to existing understanding of Public Transport design, that exclusively caters to Last Mile Connectivity. Such a service would, without dependencies on rectification of previously described infrastructural and social issues, provide a method of accessing Public Transport such as the newly introduced Air Conditioned Metro. The famous quote in the American Context ”The car has become an article of dress without which we feel uncertain, unclad and incomplete.” by *Marshall McLuhan*, in *Understanding Media, 1964* is well applicable to Bengaluru today, as long as ‘Lifestyle’ requirement of class identification is retained. An Air Conditioned Car, therefore, is in the realm of possibility, when operated as a shared extension of Public Transport means, for Last Mile Connectivity, from Door To Door, incorporating a Metro Leg of the intended trip into the total journey.

4.3 For reinforcing the connection to the Metro, it is proposed that the Cabs be given the same Color Scheme as the Metro Lines they would connect to.

Last Mile Connectivity: A Viable Solution To Traffic Congestion

4.4 Conveniences of a Digital Age need to be offered to Private Car Owners to induce them to make the transition to such a service as well as to smoothen travel experience requiring Mode Change, such as Digital Trip Assignment (DTA) from Door To Door, and Digital Token Ticketing (DTT) to directly access the Metro (rather than having to stand in Queue for purchasing a Ticket). The Cabs themselves need to be small 4-seaters, and maneuverable in Narrow Lanes, capable of turning through 180 Degrees in Bengaluru's context - as the London Cab is specified to for UK Streets. A back-lit Roof Mounted 4-sided numbering system could help in easy spotting, when a specific Cab – identified by its Number – is digitally assigned.

4.5 A longitudinally fitted frosted-glass partition dividing the rear bench-seat can provide the needed privacy to female occupants. Keeping in mind the inadequate penetration of Smartphones and internet, with only 60 Lakhs internet connected Bengaluru residents (as of 2014 Internet&Mobile Assn of India,) a Call Centre and SMS based digital access should be adopted. This proposal was initially forwarded for consideration to Hon Minister for Railways on 29 Jan 2015, and to Hon Minister for Bengaluru Development, on 06 Nov 2015 for consideration (Appendix 13 & 14)

4.6 Feasibility obtained from a Pilot Project in a dedicated location, as proof of concept will enable fine tuning the model. Phase I could be considered as offering the service on Subscription. Phase II could include a Non-Peak Hailing model. Connectivity to Volvo Hubs can also be considered, allowing Volvo Services to spread with equity to greater numbers of corridors across Bangalore, offering the common Citizens a step up, rather than operate only in the IT and Airport corridors.

4.7 The Various agencies that have some stake in such a system, and could form a SPV for funding and operations, include the BMRCL (Benefit: Greater Ridership, Ticketing Change to Digital Mode); KSTDC (the only Cab Operating Commercial service in the Public Sector); BMTC (Feeder Services are traditionally run by Bus Operator; Expertise in Routing, Scheduling, and Fare); CISTUP, (The Nodal Agency for Transportation Study)

Last Mile Connectivity: A Viable Solution To Traffic Congestion

4.8 A Desk Research was done to test this assumption, to qualify its further exploration. A Model was created, of a Passenger arriving at Madiwala (Origin), from the South of Bangalore, desiring to go to Horamavu (Destination), located to the North of Bangalore. Scenarios considered as below, using different modes of Travel, from nearest Metro Stations, with results obtained for Distance + Fare + Trip Time are tabulated (Appendix 6), summarized below:

<u>Scenario</u>	<u>Distance</u>	<u>Trip Time</u>	<u>Fare</u>
A) Hiring a Full Cab from Madiwala To Horamavu	20	+ 65 Minutes	Rs360
B) Hiring Full Cab To/From Nearest Metro Station	36	77 Minutes	Rs 277
C) Using The Proposed Last Mile Connectivity	36	100 Minutes	Rs 161

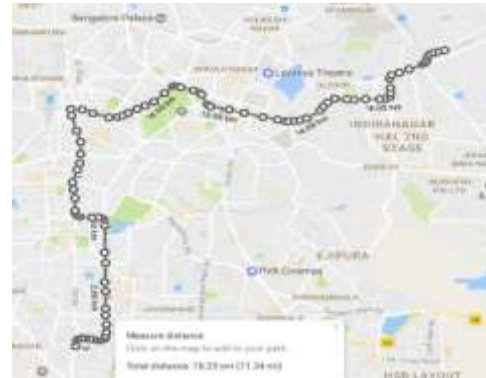
MAP B, C1& C2: Green Line Nearest Metro Station to Madiwala =Banashankari; And, Purple Line Nearest Metro Station to Horamavu =Byappanahalli)

MAP A



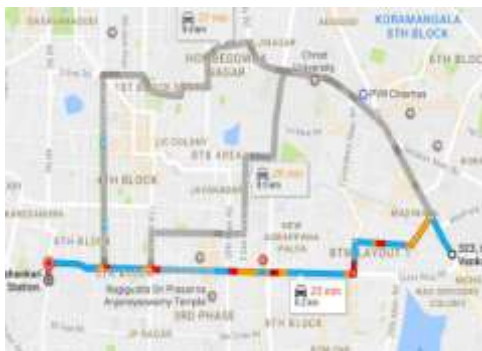
Cab: Madiwala– Horamavu

MAP B



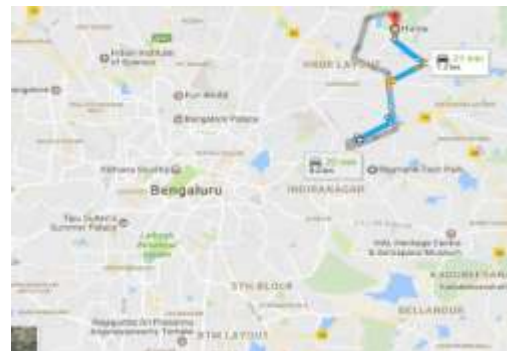
Metro: Banashankari-Byappanahalli

MAP C1



Cab: Madiwala – Banashankari Metro

MAP C2



Cab: Byappanahalli Metro - Horamavu

CHAPTER 5

5.0 SCIENTIFIC STUDY

5.1 INTRODUCTION

5.1 A Scientific study of the proposal is required, based on empirical modeling and measurable evidence that is subject to the principles of logic and reasoning to understand and connect various forces at play and confirming the benefits accruing as anticipated. Such a Study would establish assumptions to be beyond doubt, prove hypothesis and conclude feasibility. Certain assumptions have been made for the proposed solution to Last Mile Connectivity, with the solution based on a Shared Cab Ride connecting to a Metro Alignment for completing the intended trip. These assumptions need granular Data from the field to corroborate the feasibility of operating such a service in Pilot Mode, before scaling up to full size operations.

5.2 OBJECTIVE OF THE STUDY

5.2 The aim of the Study is to confirm feasibility of operating a subscription model of a mini-Car based Public Transport system that would provide Last Mile, Door-To-Door pooled connectivity to and from the nearest Metro Stations to begin with, aimed exclusively at Private Car owners, in order to effect a reduction in Traffic Congestion caused by single occupant Private Cars.

5.3 METHODOLOGY OF THE STUDY

5.3.1 Research and Media Advertisers acknowledge the leverage that Brands have, when using Older Children, for reinforcing Brand Loyalties, for obtaining discretionary consumer purchases through their parents, as well as sticking through these early choices through to their adulthood. It is proposed to conduct a part of the Data collection for the Study using Teenage Children, through what is recognized as ‘Advergaming’ or involvement in what appears to be a game, but meant to advertise a concept, after adequate briefing on Congestion and battling its outcome in terms of Pollution, Time and Cost, creating savings for their City from the execution of the proposed Study. The Traffic Police and Volunteering Schools will be facilitators in the Study.

Last Mile Connectivity: A Viable Solution To Traffic Congestion

5.3.2 The Police will provide some control over the flow of Traffic while carrying out enumeration and provide security. The Schools could provide Student-volunteers who would be presented with Mementoes from IISc for participation. The additional benefit of employing Children from High Schools is the bonus of Championing the concept of Car Pooling in their respective home environments.

5.3.3 The method of the Study is to identify single mode Trips that could be converted into Dual- Mode Trips by incorporating a Metro leg in the total journey. It is proposed to collect origin-destination Data (OD Study) to enumerate exclusive Private Car Trips, analytically identify replaceable independent Trips through providing an alternate Door-To-Door Multi-Modal Shared Last Mile Connectivity for a Metro Linked Trip, poll results for amenability of Private Car Owners in converting independent single-occupancy trips in to a Last Mile Connected Door To Door shared-mode Multi-Modal trip using a Car-Metro-Car combination, carry out an analysis using micro-simulation software on effects of reduced independent Private Car Trips through a multi modal Last Mile Connectivity on reduction in Traffic Congestion. The additional methodology that will be followed include use of previously collected Data from Traffic Surveys (if available already in selected areas, else to be collected ab initio) for developing baseline parameters of heterogeneous Traffic, Data Analysis, Simulation Steps and Scenario Analysis etc.

5.3.4 Data Collection in the study is compressed and focused to only owners of Private Cars driving in single occupancy mode, as a form of automatically stratified random sampling, unlike in other surveys where Socio-economic data collection is primarily resorted to and used for deriving definitions such as income, vehicle ownership, family size, modal splits etc. This will ensure that the sampled population and the target population are similar to one another for obtaining consistent results while modeling. For the Proposal of LMC, it is considered sufficient that a direct addressing of Target Customers is done, and a reverse analysis from Data collected will be used to arrive at their respective Catchment Origins relevant to the Study. It is understood informally that such focused Data is not available readily.

5.4 DATA COLLECTION

5.4.1 The Data Collection steps are divided into 5 Objectives: To identify Arteries along which to establish total number of Private Cars making single Occupancy trips during Peak and Off-Peak times; To identify locations along these Arteries to enumerate number of Trips along and across existing Metro Alignments undertaken by Private Cars; And , To identify the Catchment Areas. Lastly, Direct Interview method will simultaneously be used, on possibility of adoption of Metro if Last Mile Connectivity is provided through a shared Air Conditioned Cab, addressed separately for Male and Female Car Owner-Drivers. Modal Split specifically addressing Private Car usage, along the selected Arteries of the City passing through such zones, would be established, to later compare by simulation what the effect on congestion on reduction in Private Car. Data is required to establish the number of trips generated.

5.4.2 Objective 1 is to identify Road Arteries on the basis of visual confirmation of a larger modal split towards Private Cars using it. These Road Arteries could be identified with the help of Traffic Police Department.

5.4.3 Objective 2 proposes to Identify different signalized Junctions, located along the arteries selected in Objective 1, that are situated progressively greater than 1-2 KM away from nearest Metro Stations, preferably mid block. Also Land use inventory is to be identified and recorded including data on the housing density at residential zones, establishments at commercial and industrial zones . The locations could be numbered LA1, LA2 in one direction, and LB1, LB2 etc for the opposite direction, towards or away with the CBD as the reference point. Such a selection would account for the assumption made, on existence of conditions disincentivizing adoption of Public Transport, and use of alternate mean of Transport such as Private Cars. It is proposed to seek Traffic Police and Map References to identify such locations. Use of Cordon Lines and Screens will be effected on Maps of the area, to obtain focused Data on Trips that pass into, out of and across the zone of the location selected.

Last Mile Connectivity: A Viable Solution To Traffic Congestion

5.4.4 From such areas selected in Objectives 1 and 2, Objective 3 will be executed, by carrying out enumeration of single occupancy Private Cars using the Artery by a simple count of Private Cars using the Artery during Peak Hours and Off-Peak Hours, in both directions. This would further corroborate the correctness of selection in Objective 1.

5.4.5 A suitable Sample Size will be arrived at based on the population of Single Occupancy Private Cars enumerated in Objective 3 to apportion the quantum of Data to be collected from each location for Objective 4. Other Data to be collected include vehicle count of Private Cars with Multiple Occupants, and separately for Taxi Cabs with Driver and one Passenger. In addition, Cycle Time for the Signallized Junction, Traffic Volume or Flow (averaged, per Hour), Traffic Count by Type, and Space Mean Speed for each Type will be done and tabulated. Travel Time index and Congestion Index can be calculated and derived for each point. These data will be used primarily for establishing base line parameters of Traffic Flow Pattern and comparison during later analysis, on effects of Private Cars removed, in Simulation modeling. After the solution to Last Mile Connectivity has been injected, physical corroboration can be done using the Data Analysis done, by repeating the trials at the same locations.

5.4.6 Further, Signallized junctions on these Arteries located near the selection of location in Objective 1, 2 and 3 will be used for Objective 4, by conducting Direct Interview of Private Car owners stopped at a junction. This survey will provide Data on the origin and destination of the Single Occupancy Private Car trip (OD Study). The short Questionnaire with approx 20 Questions will includes Number of Trips, Seasonal Patterns, Frequency of Travel, Direction of Travel, Origin, Destination, the Trip Duration etc.

5.4.7 As time available at the Stop Light is relatively very less and equals Cycle Time for that Road Network, it is expected that the Signal will be switched from Auto to Manual Mode during the interview, to be coordinated by the Traffic Inspector on the Spot. A regimented approach to conduct of the Objective 4 is foreseen, with a protocol identified for execution by the enumerators (School Students) for maximum effective time. On a Signal from the Policemen at the head of the Junction, two columns of 12 Students each will walk into the stopped traffic in two or three rows. Each Student will identify two Cars that the interview will be addressed at.

5.4.8 The Constable manning the Signal Control Box will be given a pre-determined “All-Clear” signal by Constable on the Kerb side to confirm that all students are safely back. The Signal will then be manually operated as usual. A Tabulation of all collected Data for each location will be made at the end of the exercise.

5.4.9 Additionally, these Private Car owners could be polled to ascertain willingness to adopt a split mode Trip, entailing a Metro Leg.

5.4.10 QUESTIONNAIRE

5.4.10 Survey Questions designed by keeping researched points in view:

Convey that this is an questionnaire for Private Car Owners, replies can be anonymous, Data will help design a Last Mile solution. (Appendix 15)

5.5 DATA ANALYSIS

5.5.1 ESTIMATION OF PASSENGER CAR UNITS

5.5.1 Data Analysis is done after all Data has been cross verified for errors. The values for Traffic composition by numbers (Total Vehicle Count) is tabulated as per vehicle type in the Traffic stream. The Space Mean Speed obtained from a Trap marked on the road at 50 Mtrs from point of observation is calculated for every Type of Vehicle in the stream using a Stop Watch. To quantify the effect that Private Cars have on heterogeneous Traffic parameters including Capacity, all units of vehicle count are converted to their equivalent PCU value as per standard IRC norms.

5.5.2 To include the variability of speed into the Traffic parameters, the equation for a derived PCU given below at Equation (A) is used²⁰.

Thus the number of PCUs that occupy a given zone selected on the Artery at Peak and Off-Peak times is compared, to identify the effect of Private Car PCU, keeping in mind that Single Occupancy Private Cars are to be treated as a separate entity in the study from those with more than one occupant.

$$PCU_i = \frac{V_c/V_i}{A_c/A_i}$$

EQUATION (A)

5.5.3 Where, in the Equation (A)

PCU_i = Passenger Car Unit of vehicle type i.

V_c, V_i = Average speed (time mean) of small car and vehicle type i, respectively

A_c, A_i = Projected rectangular area of small car and vehicle type i, respectively.

The speed ratio in Equation (A) depends on the composition of traffic stream as the speed of any vehicle varies with its own proportion and proportions of other vehicles in the stream. The second ratio is space ratio, which indicates maneuverability and weight-power ratio of a vehicle with respect to car. Carriageway width is considered in this study analysis, but as the V/C Ratio or congestion and rampant lack of Lane discipline is so high that the negligible beneficial effects of additional Lanes in the study zones may effectively be taken to be single lane, as to be ignored.

5.5.4. The Time taken by each type of vehicle is tabulated, and using Equation (B) for obtaining Congestion Index for each location²¹.

Congestion index = $1 - (A / M)$ (B)

Where,

M= Desirable ideal average journey speed on major road networks of a city during peak hour, assumed 40KMPH per DULT (Directorate of Urban Land Transport, Karnataka 2009).

A= Average journey speed observed on selected Artery during peak and off-peak period.

5.5.5 O-D SURVEY

5.5.5 The Origin-Destination Survey carried out through Direct Interview Method effectively provides the Count of Single Occupancy Private Car Trips, Travel Pattern, Trip Purpose and Trip Frequency in a focused manner. This Data will provide an overview of what could possibly be the theoretical effect of reducing their PCU numbers to NIL and of replacing them with half the PCU numbers, in the same Traffic Stream with Modelling using Micro Simulation.

5.5.6 SURVEY ON ACCEPTABILITY OF SHARED CONNECTIVITY

5.5.6 A hint of acceptability towards use of a Shared mode of Transport has been obtained for Bengaluru from Uber's statement made to Transport Commissioner, Government of Karnataka and Local Media that up to 25% of total Trips are Pool or Share operations. However, as the total Trip and other details like direction, pattern, peak or off-peak etc are not available, this data has no real meaning. The Direct Interview Survey will provide a ratification of acceptability and amenability of Shared/Pooled Car Rides as an alternate means for Transit. Research into Incentive Theory of Motivation identifies some form of external reward as a means to motivate people to change behavior. An incentive can also be effectively used as a method to bypass an existing disincentives discussed earlier. The sample numbers agreeing to adopt Shared means for accessing Public Transport,, when extrapolated to Total Private Car Count, will be able to show percentage of general acceptability.

5.6 SIMULATION USING SOFTWARE

5.6.1 Micro-simulation model using VISSIM etc, can be done using number of vehicles, classes of vehicles, number of lanes, width of the carriageway, signal cycle time as inputs. The output provides the Expected (or Actual Travel) Time for each class. By removing the Private Car from the vehicle count, it is possible to study the effect on the Traffic Stream. For various percentages of reduction effected, the VISSIM output of Expected (or Actual) Travel Time is tabulated, to validate the original assumption that removal of Private Cars from Traffic Stream results in lower congestion.

Travel Time Index = Actual Travel Times / Ideal Travel Times.

Where,

The Ideal Travel time (Hrs) = Length of Artery (in KM approx) / Ideal Speed in Free-flow conditions

5.6.2 Macro-simulation modeling using VISUM can be done, by imputing the background GIS map along with Network of Roads. Using Data obtained, the model for a Public Transport can be created, by using Headway Data based on the OD-Survey. VISUM provides for linking alternate Mode Split like Metro, and hence this feature should be used to obtain a number of likely Routes incorporating nearest Metro Stations. The output of VISUM will provide the most plausible routes, along with duration for the Split Mode Trips.

5.6.3 The Visual Overlays should provide Density and Network of the flow of the Shared Cabs Public Transport from Origin to Destination, as well as a workable operational Routing, should the plan need to be executed at any time.

5.7 Scenario Analysis

5.7.1 The Two Scenarios that can result include:

- A. Positive interest in adopting the proposal for Last Mile Connectivity.
- B. Indifferent on adopting the proposal for Last Mile Connectivity.
- C. Negative interest on adopting the proposal for Last Mile Connectivity.

5.7.2 In the event of the results of the Sample survey indicating scenario A, a case exists for providing results of the study along with recommendation, to the Government of Karnataka (DULT & BMLTA) to study the proposal for executing a limited Pilot, for further experimenting and fine tuning modalities of operation.

5.7.3 In the event that the results of the sample Survey indicates Scenario B, even as simulation results of removal of Private Cars indicates a high direct effect on Congestion, a case exists for forwarding the Study Results to Government of Karnataka (Transport Department) for considering the creation of clever Hoarding and Media Advertisements that target single occupancy Private Cars highlighting the collective costs inflicted on the Environment, Time and Fuel, due to avoidable Congestion attributable to usage of single occupancy Private Car, with the aim of reducing the same.

5.7.4 A Do- Nothing scenario for results that indicate C, where the Data collected can be accessed in a Central Repository for other research projects of CISTUP.

CHAPTER 6

6.0 DELIVERABLES

6.1 The Study undertaken should provide the following outputs:

6.1.1 Validation of Assumption that lack of Last Mile Connectivity drives people to use Private Transport.

6.1.2 Validation that use of Private Cars for Single Occupancy Trips increases Congestion and Travel Time for a given Traffic Stream.

6.1.3 Removal of (Few, Some, All) Private Cars will create the maximum improvement to existing Congestion and Travel Time for a given Traffic Stream.

6.1.4 When alternate mode of Last Mile Connectivity is provided, probability of the affluent for adoption of Public Transport (Metro). (is Low Medium High)

6.1.5 Probability of Private Car Owners adopting an Air Conditioned Door To Door Shared Car service (is Low Medium High):

6.1.6 Private Car Owners (Few Some Most).are Likely to adopt the System of Last Mile Connectivity as a Economical, Reliable, Comfortable and Faster mode.

6.1.7 Female Passengers (Few Some Most)consider provision of Frosted Glass Divider on Rear Passenger Seat favorably.

6.1.8 Female Passengers (Few Some Most) consider provision of Camera inside cabin for security favorably.

6.1.9 Modal Split, showing emphasis of Private Cars that constitute Traffic Stream (As per Time of Day, Day of Week.)

6.1.10 There is a relative preference to Subscription-Model Share over a Cab-Hailing service.

END NOTES

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Last Mile Connectivity: A Viable Solution To Traffic Congestion

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APPENDIX

APPENDIX-1

Presentation By HG Kumar, Addl Commissioner –Transport and Secretary- STA, May 2016

ಬೆಂಗಳೂರು ನಗರದಲ್ಲಿ ಮೇ 2016 ರ ಅಂತ್ಯಕ್ಕೆ ಒಟ್ಟು ನೋಂದಣಿಯಾಗಿ ಚಾಲ್ತಿಯಲ್ಲಿರುವ ವರ್ಗಾವಾರು ವಾಹನಗಳ ವಿವರ TOTAL VEHICLES REGISTERED AND KEPT FOR USE IN BENGALURU CITY AS ON May 2016												
TYPE OF VEHICLES ವಾಹನಗಳ ವಿವರ	B-CENTRAL ಬೆಂಗಳೂರು ಕೇಂದ್ರ	B-WEST ಬೆಂಗಳೂರು ಪಶ್ಚಿಮ	B-EAST ಬೆಂಗಳೂರು ಪೂರ್ವ	B-NORTH ಬೆಂಗಳೂರು ಉತ್ತರ	B-SOUTH ಬೆಂಗಳೂರು ದಕ್ಷಿಣ	K.R.PURAM ಕೆ.ಆರ್.ಪುರಂ	Jnanabharathi ಜ್ಞಾನ ಭಾರತಿ	E-CITY ಎರಕ್ಕಾನಿಹಳ್ಳಿ ಸಿಟಿ	YELAHANKA ಯಲಹಂಕೆ	NELAMANGALA ನಲಮಂಗಲ	RTO A/R	TOTAL REGISTERED AS ON 30-4-2016 ಒಟ್ಟು
NON TRANSPORT VEHICLE ಸಾರಿಗೆಯ ವಾಹನಗಳು												
TWO WHEELERS ದ್ವಿ ಚಕ್ರ ವಾಹನಗಳು	477389	727486	690535	671322	719443	288826	203728	322485	146255	42572	0	4290041
CAR ಕಾರು	182870	133646	225293	191638	195946	67445	49959	123275	36136	4570	1	1210779
JEEPಜೀಪ್	1712	670	1932	1040	1259	0	123	6	734	11	0	7487
OMNI BUS ಆಂಬುಲೆನ್ಸ್	5596	4763	9270	16538	7288	34	2346	460	1813	319	0	48427
TRACTOR ಟ್ರ್ಯಾಕ್ಟರ್	211	492	1095	1146	2589	1179	816	925	586	883	0	9922
TRAILOR ಟ್ರೈಲರ್	188	460	866	1107	1360	1169	727	765	331	813	0	7786
CONSTRN EQUIPMENT VEHICLE ಕಟ್ಟಡ ನಿರ್ಮಾಣ ಸಾಮಗ್ರಿ ವಾಹನ	146	49	5	0	401	0	177	835	355	60	0	2028
OTHER VEHICLE ಇತರ ವಾಹನಗಳು	7058	4970	2094	2402	3232	1608	918	2290	618	574	0	25764
TOTAL NON-TRANSPORT ಒಟ್ಟು ಸಾರಿಗೆಯ ವಾಹನಗಳು	675170	872536	931090	885193	931518	360261	258794	451041	186828	49802	1	5602234
TRANSPORT VEHICLES ಸಾರಿಗೆ ವಾಹನಗಳು												
MULTIAXLED/ARTICULATED ಮಲ್ಟಿ ಆಕ್ಸ್‌ಲ್ಡ್ ಆರ್ಟಿಕುಲೇಟೆಡ್ ವಾಹನಗಳು	26576	1703	833	1859	2721	1453	665	3031	493	352	0	39686
TRUCKS&LORRIES ಟ್ರಕ್ಸ್ ಮತ್ತು ಲಾರಿಗಳು	12262	1699	9976	6584	10735	2686	3482	9221	842	2039	0	59526
TOTAL ಒಟ್ಟು	38838	3402	10809	8443	13456	4139	4147	12252	1335	2391	0	99212
LMV GOODS ಲಘುವೇಗಾರು ವಾಹನ												
4 WHEELERS ನಾಲ್ಕು ಚಕ್ರದ ವಾಹನಗಳು	13340	9254	2943	6624	15220	7138	3031	9616	2592	2415	0	72173
3 WHEELERS ಮೂರು ಚಕ್ರದ ವಾಹನಗಳು	6362	8353	3138	3931	8027	1638	3595	4885	1228	1696	0	42853
TOTAL ಒಟ್ಟು	19702	17607	6081	10555	23247	8776	6626	14501	3820	4111	0	115026
BUSES ಬಸ್ಸುಗಳು												
STAGE CARRIAGES ಸ್ಟೇಜ್ ಕ್ಯಾರೀಜ್ ಗಳು	2939	400	98	7988	400	214	196	250	64	304	1634	14487
CONTRACT CARRIAGES ಒಪ್ಪಂದದ ವಾಹನಗಳು	443	99	276	2	75	16	3	756	2	21	0	1693
PRIVATE SERVICE VEHICLE ಖಾಸಗಿ ಸೇವಾ ವಾಹನಗಳು	4754	2171	427	297	702	572	93	1171	23	306	0	10516
EDUNL INSTITUTION BUS ಶಾಲಾ ವಾಹನಗಳು	1262	274	644	173	1453	1124	573	2480	841	242	0	9066
OTHER BUSES ಇತರ ಬಸ್ಸುಗಳು	2225	131	166	77	158	45	28	2343	257	35	0	5465
TOTAL ಒಟ್ಟು	11623	3075	1611	8537	2788	1971	893	7000	1187	908	1634	41227
TAXIES ಟ್ಯಾಕ್ಸಿಗಳು												
MOTOR CAB ಮೋಟಾರು ಕ್ಯಾಬ್ ಗಳು	5825	10169	18101	6600	6776	1954	8017	6052	3885	923	0	68302
MAXI CAB ಮ್ಯಾಕ್ಸಿ ಕ್ಯಾಬ್ ಗಳು	4088	4558	3842	2806	7121	2348	2504	4303	1405	506	0	33481
OTHER TAXI ಇತರ ಕ್ಯಾಬ್ ಗಳು	2330	110	186	4455	288	1417	569	307	1601	81	0	11344
TOTAL ಒಟ್ಟು	12243	14837	22129	13861	14185	5719	11090	10662	6891	1510	0	113127
LIGHT MOTOR VEHICLES ಲಘು ಮೋಟಾರು ವಾಹನಗಳು												
3 SEATER (A/R) ಮೂರು ಆಸನಗಳ ವಾಹನ	19535	39382	32871	18001	33743	5642	11169	1767	1346	1579	0	165035
4 TO SIX SEATER 4ರಿಂದ 6 ಆಸನಗಳ ವಾಹನ	5722	7500	3881	4737	4789	2830	56	504	364	206	0	30589
TOTAL ಒಟ್ಟು	25257	46882	36752	22738	38532	8472	11225	2271	1710	1785	0	195624
OTHER VEHICLE ಇತರ ವಾಹನಗಳು	4804	3457	20512	2414	3546	4922	953	2704	1009	387	0	44708
TOTAL TRANSPORT ಒಟ್ಟು ಸಾರಿಗೆ ವಾಹನಗಳು	112467	89260	97894	66548	95754	33999	34934	49390	15952	11092	1634	608924
GRAND TOTAL(TRANS+NON-TRANSP)ಒಟ್ಟು (ಸಾರಿಗೆ + ಸಾರಿಗೆಯ)	787637	961796	1028984	951741	1027272	394260	293728	500431	202780	60894	1635	6211158

Appendix-2

Volume To Capacity Ratio For Major Arteries

Impact of growth on Traffic

- All or most of the roads are operating above their capacity and the volume: capacity ranges from 1:2, 1:3 and 1:5

SL No.	Name of Road	V/C Ratio
1	Nrupatunga Road	3.62
2	District Office Road	2.51
3	K.G. Road	2.51
4	Lalbagh Fort Road	2.67
5	Puttanna Chetty Road	2.45
6	Richmond Road	2.26
7	M.G. Road	2.26
8	Chord Road	2.51
9	Tumkur Road	2.62
10	Sankey Road	1.52

- Travel speed has dropped to 15 kmph during the peak hours
- Insufficient or no parking spaces for vehicles
- Public transport vehicles vying for road space with private modes

APPENDIX- 3

TOWING CASES BOOKED

Whenever its siren is on...I [Home](#) | [About Us](#) | [FAQs](#) | [Contact Us](#)

Enforcement Statistics

STATEMENT SHOWING THE NUMBER OF M.V.ACT, K.P.ACT, K.T.C ACT, AUTOMATION CASES AND TOWING CASES BOOKED FROM THE YEAR 2007 TO 2017 IN BANGALORE CITY

M.V.ACT, K.P.ACT, K.T.C ACT, AUTOMATION CASES AND TOWING CASES						
YEAR	M.V.Act Cases	K.P.Act Cases	Towing Cases	K.T.C Act Cases	Automation Cases	Total Cases
2007	1340056	5298	51736	-	47008	1444098
2008	1784590	4883	111246	-	178352	2079071
2009	2310479	7836	118811	-	203160	2640286
2010	2999303	8648	124549	-	200612	3333112
2011	3177992	8916	123974	-	164592	3475474
2012	3505344	8847	65894	-	1624715	5204800
2013	3652285	11434	72908	704	1696185	5433516
2014	4516130	9135	84074	52	2826945	7436336
2015	4456509	2980	99236	1894	3066052	7626671
2016	4217238	424	79340	1063	4882373	9180438
2017(January)	333462	17	17789	0	374900	726168

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APPENDIX-4

Towing Cases Booked

M. V. ACT CASES BOOKED IN DIFFERENT HEADS		
Sl. No.	Type of Offences	No. of Cases booked
1	Reckless Driving	13299
2	Over Speeding	6038
3	Carrying excess passenger	1095
4	Drunken Driving	3405
5	Refuse to go for Hire	930
6	Demanding Excess Fare	623
7	A/R - Without Display card	166
8	Use of horn at prohibited places	32
9	Defective Silencer	126
10	Free Wheeling	3
11	Shrill Horn	324
12	Using Black Film/Other Materials	2052
13	Without D.L	4016
14	Jumping Traffic Signal	58144
15	Lane discipline	30189
16	Over taking by left	180
17	Wrong parking	158562
18	Defective Registration No Plate	8614
19	No Entry	38016
20	HTV prohibited	381
21	Without Uniform	9402
22	Footpath parking	2441
23	Without Insurance certificate	936
24	Dazzling head light	310
25	Triple riding	6898
26	Racing and trials of speed	219
27	Using Mobile phone	22349
28	Without Safety belt	21410
29	Carrying lengthy material	8651
30	Violating Permit condition	218
31	Carrying Excess school children	129
32	Riding without Helmet	155251
33	Pillion Rider -with out helmet	132474
34	Zig Zag Driving	759
35	Parked at Intersection	1287
36	Parked at BMTc bus stop	2010
37	Riding on Footpath	1524
38	Not produced documents	2712
39	Others	13888
Total		70, 83, 62

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APPENDIX-5

TOWING CHARGES RECOVERED AS FINE

STATEMENT SHOWING THE NUMBER OF M.V.ACT, K.P.ACT, K.T.C. ACT, AUTOMATION FINE AND TOWING FINE AMOUNT COLLECTED FROM THE YEAR 2007 TO 2017 IN BANGALORE CITY

M.V.ACT, K.P.ACT, K.T.C. ACT, AUTOMATION FINE AND TOWING FINE AMOUNT						
YEAR	M.V.Act Fine	K.P.Act Fine	Towing Charges	K.T.C.Act Fine	Automation Fine Amount	Total Fine Collected
2007	182018650	258570	10776000	-	6058900	199112120
2008	252772000	388700	21731100	-	20123000	295014800
2009	321889150	705900	24364500	-	29165820	376125370
2010	425399650	838000	25181900	-	24167302	475586852
2011	453031800	870900	25149550	-	26609275	505661525
2012	506146700	826800	13369775	-	18174654	538517929
2013	538585850	1040500	14410700	36650	15735560	569809260
2014	629999100	858900	16772875	1550	11589024	659221449
2015	667438140	272350	19254675	158170	17314941	704438276
2016	616650541	39700	30686250	87010	22298025	669761526
2017(january)	45592875	1200	12612550	0	2288300	60494925

APPENDIX-6

DESK RESEARCH FOR LAST MILE CONNECTIVITY- MADIWALA TO HORAMAVU

Mode, Distance, Time	Car KM//Min	Metro KM//Min	Metro KM//Min	Car KM//Min	Cab Only	Metro+ Full Cab	Metro+ Shared Cab
Trip O-D	Madiwala	Banashankari	Kempegowda	Byapanahalli	Fare	Fare	Fare
Madiwala	--	--	--	--	--	--	--
Banashankari	6.2 // 27	--	--	--	--	111	55
Kempegowda	--	8 // 12	--	--	--	20	20
Byapanahalli	--	--	10.2 // 17	--	--	26	26
Horamavu	20 // 65	--	--	7.2 // 21	360	120	60
Total Fare & Trip Time					360 // + 65	277 // 77	161 // 100

Notes:

Estimates Were Generated By Google, Uber and Ola Applications
 Metro Reach 2 Phase I Green Line Is Not Yet Opened But Distance Fare And Time were Compared With Equivalent On Purple Line From BMRCL Website-Fares Distance Fares And Time For Type Of Mode Is Filled In With The Identifying Color (Metro =Green & Purple: Cab= Orange from Same Company For Fair Comparison)
 Greatest Values For Time Were Considered except in 'Cab Only', shown for Off-Peak Best Time.
 Direct Cab Drive From Madiwala To Horamavu Taken via Less Busy IRR, Not Hosur + MG Road
Time For Interchange Of Mode Has Been Rounded Assuming A Walk-In Access To Metro All Trip Times are Estimates based on Traffic On The Day Of Research

Last Mile Connectivity: A Viable Solution To Traffic Congestion

APPENDIX-7

Photograph (Left) showing an 18 Ft wide street in Kammanahalli-HRBR (Ward with extensive BDA Development), retrofitted with concrete Lane, and widened at the mouth-end by private developers.



APPENDIX-8

The yellow industrial Factory building at end of Lane was constructed only after all Residences were constructed in the Layout, after blocking access to a connecting 25 Ft Local Road behind creating a Dead End. (The Factory was later dismantled under orders of KSPCB, BMTF to BBMP, and converted into Residence to prevent demolition.) Horamavu Ward - 25



APPENDIX-9

No Porch construction, anymore! BDA Developed 20X30 Kammanahalli-HRBR



APPENDIX-10

No using the existing Porch, anymore! BDA Developed 30x40 Sites. Kammanahalli



Last Mile Connectivity: A Viable Solution To Traffic Congestion

APPENDIX-11

(L) Narrow Collector Roads with Garbage Black Spots; (R) Village Roads, Tarred As-Is.



APPENDIX-12

Hawkers, Street Vendors, Shop Extensions

100 Ft Road with Pavements Occupied by Shop Extensions, Food Carts,



(Left): Shop Owners Parking on Pavement (Right): Shop Extension On Collector Road



Last Mile Connectivity: A Viable Solution To Traffic Congestion

APPENDIX-13

Web Portal Of Suresh Prabhu: 29 Jan 2015- Proposal Sent To Hon Minister For Railways



Alex Thomas <commanderalexthomas@gmail.com>

Copy of: Making a METRO Project Vigorously viable

Suresh Prabhu - Official Website <officeofsureshprabhu@gmail.com>
Reply-To: commanderalexthomas@gmail.com
To: commanderalexthomas@gmail.com

29 January 2015 at 12:15

This is a copy of the following message you sent to Reach Me At via sureshprabhu.in

This is an enquiry email via <http://sureshprabhu.in/> from:
Commander Alex Thomas (Retd) <commanderalexthomas@gmail.com>

Hon Minister. I submit that METRO Projects need last-mile connectivity to the very residence of potential commuters, to make these Indian projects successful in financial & social development terms. Current dependence on public transport--urban Bus Service-- overlooks the ad-hoc manner of Town-Planning that permits indiscriminate construction and lack of provision for public amenities such as transportation. Our culture prevents/inhibits female commuters from equal status ride-share in public transport. I propose the operation of ride-sharing mini-cars operated by a newly formed Public Corporation; Such that these mini-car are able to execute 180-degree turns inside dead-ended by-lanes; Use acrylic/polycarbonate separators between seats to provide physically exclusive seats (NY Taxis); Use on-board Camera for a 3-G GPRS video live-link to a Control-room, and deployed at one-third rate tariff (for a max three possible Commuters each) calculated on a destination-based matrix rather than distance thereby providing fixed rates; Permit a Smart-Card based swipe-to-ride allowing the same ride to be divided into inter-modal sections, by taking advantage of discounted Metro rides where available, permitting seamless public transportation available from door-to-door. Should you need more information, or think this is a plan you already have had yet interested to give me a hearing, I am available at my cost for you to run through possibilities. I write to you, as I also dream that someday, our Country would be lead to a developed state, without having to invest in extreme steps to reach there. For example, the GPRS based connectivity mentioned above has already been executed (in 2002) for the Army's Signal Corps, by an Indian Company.

Warm Regards & Respectfully,

Alex Thomas.

Mobile 9900855105

Previously Director (Operations) KELTRON.

APPENDIX-14 (Pages 33& 34 : 2 Pages)

Email 06 Nov 2015: Proposal To Hon Minister For Bangalore Development



Alex Thomas <commanderalexthomas@gmail.com>

Improvement to Traffic Density in Bengaluru--A Smart-City proposal

Alex Thomas <commanderalexthomas@gmail.com>
To: kjg@kelachandragroup.com
Cc: kjg@kjgeorge.com

6 November 2015 at 12:28

To,
Shri K.J. George
Honourable Minister for Development, Bengaluru

Respected Minister,

Sir.

1. Please accept my respect and regard for taking over this huge challenge for Karnataka State--- as a Minister for the development of Bengaluru--to help solve problems of a City that could not yet be solved till date despite the existence of the world's best IT Companies and their finest minds resident in the City.

2. I have a proposal for your consideration, that will impact how the City functions and commutes, as a pioneering proposal not yet implemented in any City anywhere. This proposal, if studied for implementation by BMTC, KSTDC & BMRCL jointly, will drastically reduce traffic density on our Roads, without requiring Road-widening, Flyovers etc. It attempts to use existing infrastructure, and will need the use of Social Media to propagate involvement of Citizens of the City. Such a program---a Crusade--- will set the Honorable Minister apart from other leaders who tend to follow tried and tested scripts, and do not dare try out-of-box, different and pioneering methods.

3. It employs a ride-share Cab system that offers a FREE Metro ride as part of the Fare. As the Minister will note, the ridership of BMRCL METRO is currently low, partly due to incrementally increasing coverage. All established Cities have a culture of walking to and from Metro Stations, and getting connecting rides to destinations in the cheapest manner possible. However, due to our City Culture that is averse to walking, and difficulty in negotiating fares with recalcitrant Autorickshaws, it is easier to take a ride on a Private Car/Motorbike that provides an assured commute without getting out of the vehicle till one's destination is reached.

4. I propose a Ride Sharing, with Citizens subscribing to the service, with the ride itself being provided by Low-Cost Hatchback Cars, that can execute a 180 Degree turn on narrow streets, to be operated by KSTDC Division for Taxi service operations (or a new Corporation, as decided by the Honorable Minister). A FREE METRO Ride should be offered as included in the fare. This will ensure that people use the offered METRO ride, and the Culture of Private Car/Motorbike rides in the City changes to METRO Rides. A Coupon offered by the Driver of the Cab could be redeemed at the Ticketing Counter of the BMRCL with gross settlement on Daily/weekly basis with BMRCL against Coupons collected.

5. The Fare for such a ride should be calculated on a Fixed Slab-rate (not on the basis of distance in the manner of private Cab Tariff), at a rate that may require some subsidy input till

Last Mile Connectivity: A Viable Solution To Traffic Congestion

the Program is successful. The Route must terminate at any Metro Station in one direction. The Cabs should Carry Route Numbers just like BMTC Bus services, to give an indication on what route it will run on.

6. A Radio connected AC Service Cab, that permits shared rides (and hence one-third tariff for each commuter), with SMS Based Passenger Information Service for arrival time intimation, offering a FREE METRO ride, and stopping at all Bus Stops, will help wean away Passengers from using Motorbikes and Private Cars. The service should terminate at the Door of Commuters in one direction, and a METRO Station in the other.

7. A color scheme for the Cabs as applicable for the METRO Line could help in easily identifying the Cab as it approaches an area, and the Cabs could be fitted with on-board CCTV (for providing enhanced safety for Women, Seniors and Children). A Poly-carbonate partition between the two rear-seat passenger positions will help enhance sense of security for traveling women commuters.

8. This program could also be rolled out as a Pilot Program in one or two select wards for feasibility study. The service could be named NAMMA GAADI, or as the Honorable Minister thinks fit.

9. The above are broad bulleted points submitted for consideration by the Honorable Minister, for an IT Based service delivery to drastically reduce traffic congestion in our City,

10. Should any help be required on the above, I am willing to spend my personal time in assisting in an Honorary capacity.

With regards.

Sincerely,

Commander Alex Thomas (Retd)
Mobile 9900855105

#84, 1st Cross Bethel Layout,
Banjara Layout Main Road,
Horamavu ward 25
Bengaluru--560043

APPENDIX-15

PROPOSED QUESTIONNAIRE - 25 Questions

(Record: Male or Female Driver.)

1. Have you participated before in this IISc survey.
Yes/No
2. If yes, when have you participated before.
Date/Time
3. Do you live in Bangalore.
Yes/No
4. If yes, in which Locality or Ward area.
Locality Or Ward Or PinCode
5. From which place are you coming now:
Locality Or Ward Or PinCode
6. Where are you going to:
Locality Or Ward Or PinCode
7. What is the Trip for:
Going To Work/To Home/For Training/To Shop/ Other
8. Do you take this trip regularly
Same Time Daily / Different Time-Daily / Same Time-Certain Days / Not Regularly
9. How many Trips do you make in a Day.
1/ 2/ 3/ Many
10. Do you return by same route or different route.
Same/Different
11. When do you normally return.
Time
12. Do you use any other methods of Transport.
No/Metro/ Volvo/ BMTC Bus/ Cab / Friend-Shared / Auto/2-Wheeler
13. How long does it take to reach your destination UP Trips & DOWN Trip:
UP= DOWN= (Each In Minutes)
14. Do you frequently travel with one or more passenger co-occupants.
Yes/ No

Last Mile Connectivity: A Viable Solution To Traffic Congestion

15. If yes, is there a pattern to co-occupant Trips.
As at Question 8 above / Not regularly
16. If a Shared AC Cab comes to pick you and drop you from Door To Door, both ways.
Very Convenient / Will Consider / Not convenient
17. If a Shared AC Cab comes to pick you and drop you from Door To Door, both ways,
using a
Metro leg in between: At fares less than a Private Car
Very Convenient / Will Consider / Not convenient
18. How far is the nearest Bus Stop from your Trip: Origin
Meters
19. How far is the nearest Bus Stop from your Trip: Destination.
Meters
20. How far is the nearest Metro Station from your Origin.
Meters
21. How far is the nearest Metro Station from your and Destination
Meters
22. How many times do you travel in Public Transport(Metro, Volvo or BMTC Bus):
Once a Day/ More Than Once a Day/ Once a Week/ Once a Month/ Once a
Quarter
23. How will you rate a service that provides AC Shared Door-To-Door Cab for Pick &
Drop costing less than Private Car with portion of the Trip in Metro.
Rating From 1 -To-10 (Ten = Very Convenient)
24. For service at point 21, a subscription-based model is better than a model for hailing
a cab when needed.
Yes/No
25. **Female Owner-Drivers ONLY:** Please Rate a Door-To-Door Service in Shared
Cab, with Frosted-Glass Divider on rear passenger seat, with an internal security Camera.
Rating From 1-to-10. (Ten = High security reliability)