



# **INTRODUCTION OF LOW FLOOR AC BUS OPERATION IN CHENNAI AND THE IMPACT ON URBAN TRAVEL**

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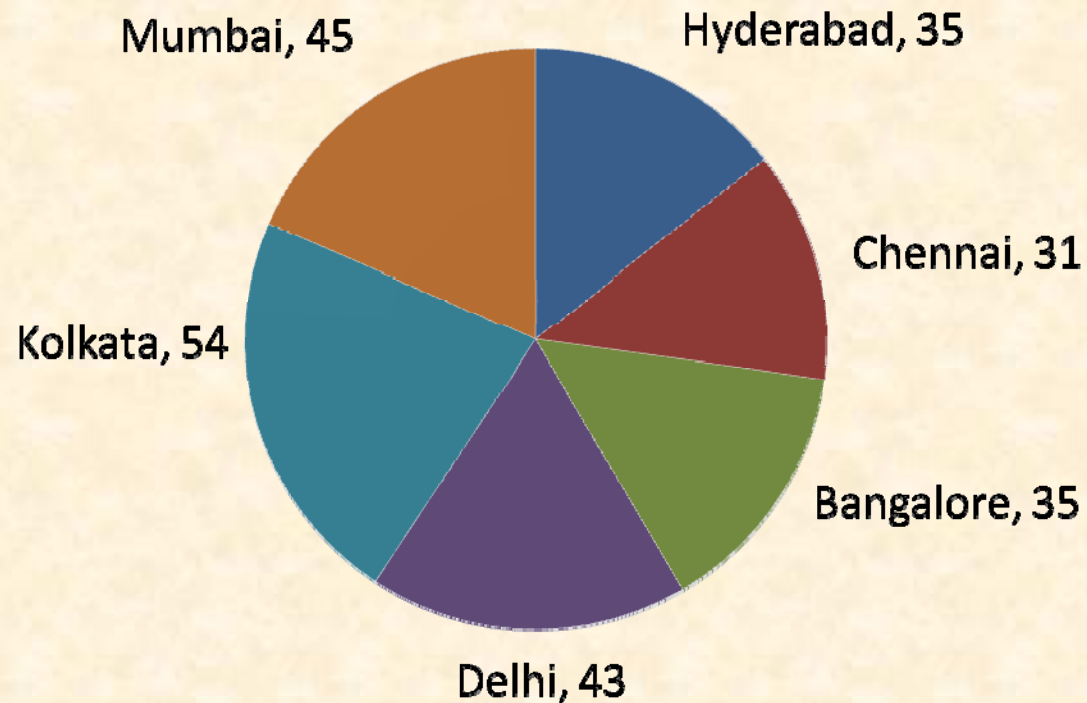
**Anna University Chennai**

# INTRODUCTION

- Bus Transport is the most preferred Public Transport System in many Indian cities
- Recent times the passenger patronage for bus transport is declining due to
  - increased travel time
  - low reliability
  - low frequency of services in urban fringe areas
  - Higher dependency on private modes of Travel



# Public Transport Scenario in Major Indian Cities

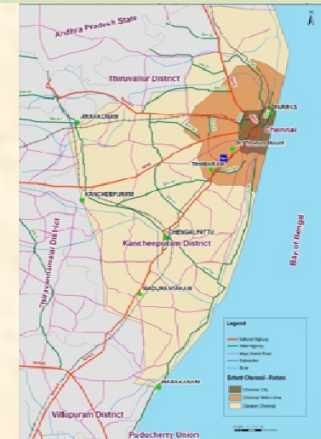


In Chennai Bus transport modal share has declined from 42% in 1970 to 26% share in 2008.

Challenging task to pull back the commuters who have switched to private modes opting comfortable, convenient and faster travel

# EXISTING TRANSPORTATION SCENARIO IN CHENNAI

Description	Area in sq.kms	Population in 2001	Total daily person trips in Millions	
Chennai Metropolitan Area (CMA)	1189	7 million	<b>9.153</b> <b>(in 2001)</b>	<b>20.760</b> <b>(in 2026)</b>
Chennai City	176	4 million		



Total number of motor vehicles in Chennai city has increased from 0.569 million in 1991 to 3.2 million in 2010

Average growth rate of vehicle population per annum is about 9.7%

3151 buses are operated by Metropolitan Transport Corporation (MTC) in 681 routes in Chennai

5.7 millions trips per day are performed in MTC buses

# BUS OPERATIONS IN CHENNAI

MTC is the monopoly bus operator in Chennai Metropolitan area

Initial fleet strength of 1029 buses in 1972 the fleet has increased to 3421 buses in 2010

80% of bus commuters belong to Low Income Group (LIG) (Study 2001)

Operates 22% of fleet as ordinary buses with low fare and the balance as special services and AC Services at 1.25 to 5 times the fare of ordinary busses.

Average passenger occupancy varied between 57% to 90% during the last four decades.

The average occupancy around 86% and 125-150% occupancy during the peak hours.

The average kilometer operated in a day increased from 223 km/bus in 1972 to 316 kilometers/bus in 2010.



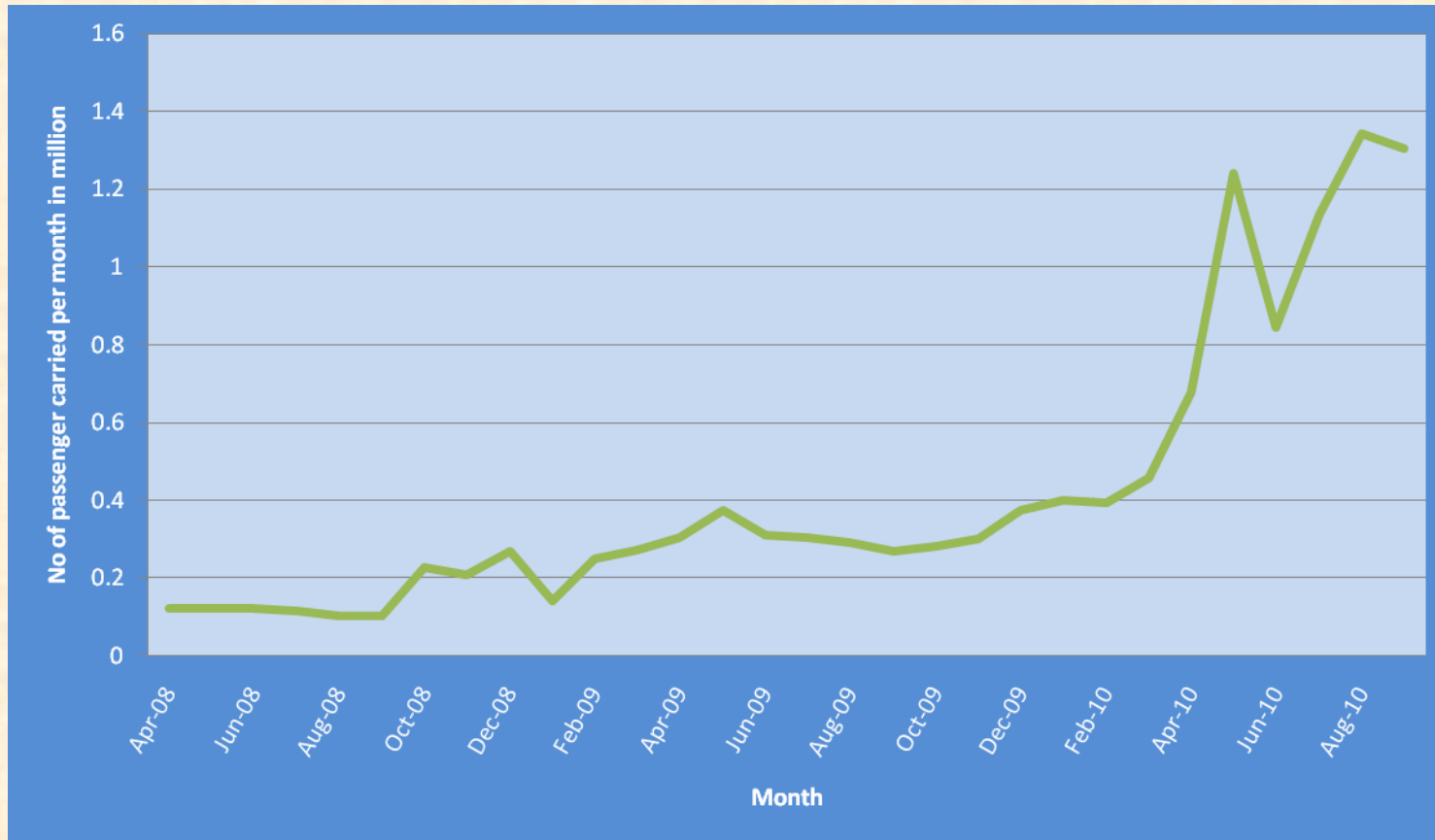
# AC Buses in Chennai

- ✓ 10 Air conditioned buses operated end of 2007 in Chennai
- ✓ Fleet was increased with MOUD financial support through JNNURM Scheme to 100 buses in the end of 2009
- ✓ AC buses were introduced to facilitate comfortable travel at cost higher than ordinary buses.
- ✓ Fare of AC buses was relatively lower than travel cost of two wheeler & Car trips.
- ✓ Higher fare initially had less takers and ridership gradually increased.

# Study Methodology

- ✓ The study was devised to analyze the **seasonal variations** on ridership to understand the influence of **climatic variations** on average occupancy level per bus
- ✓ To analyze the **trend/impact of increase in fleet strength** on ridership.
- ✓ It was planned to interview 1% of the commuters on a typical working day to understand the travel characteristics of the passengers.
- ✓ The **passengers** were interviewed during the travel to understand their **personal characteristics & travel preferences**
- ✓ Ridership level in AC buses needs to be analyzed to plan the operations

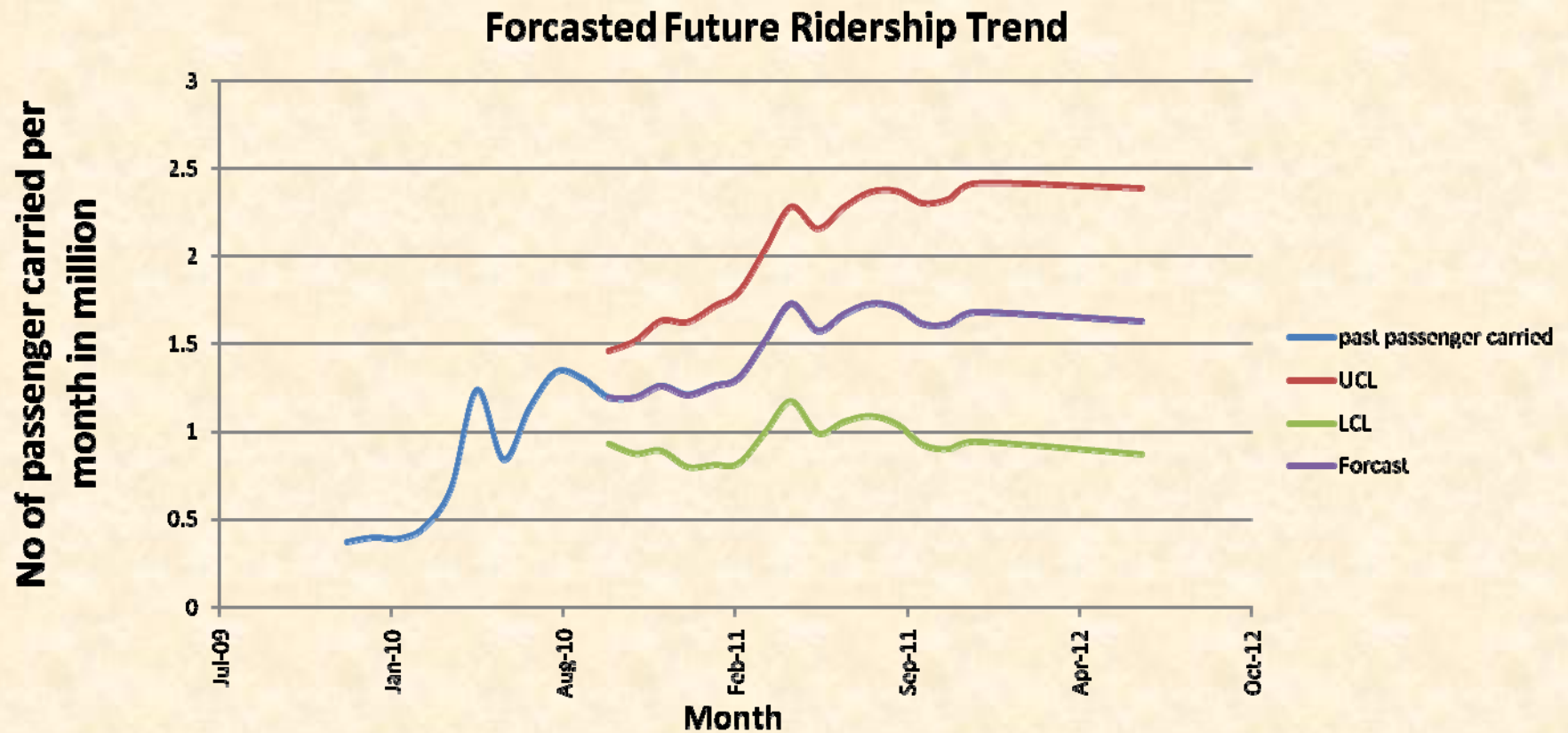
# Trend of Monthly Trips by AC Buses (2008 – 2010)



- ✓ 10 AC buses introduced in September 2007, increased to 30 in October 2008 and to 100 March 2010 with the addition of buses procured with MOUD financial support.
- ✓ In 2008 nearly 120,000 passengers were carried per month, increased to 1.4 million passengers per month in 2010
- ✓ The ridership has grown 11.5 times in the last two and half years



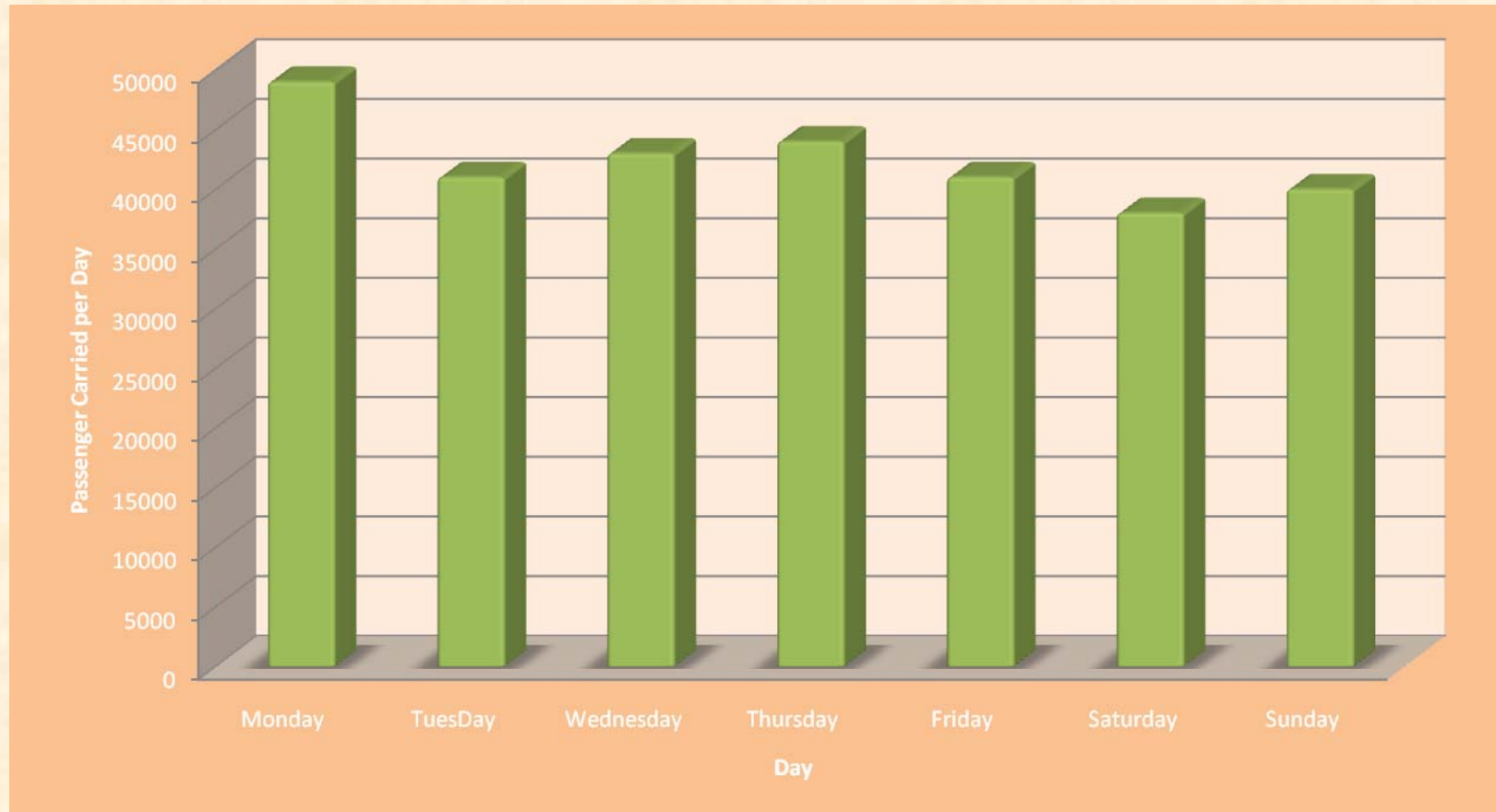
# Time Series Forecast using Auto-Regressive Integrated Moving Average (ARIMA) Model



MAPE – Mean Absolute Percent Error : 33.02%

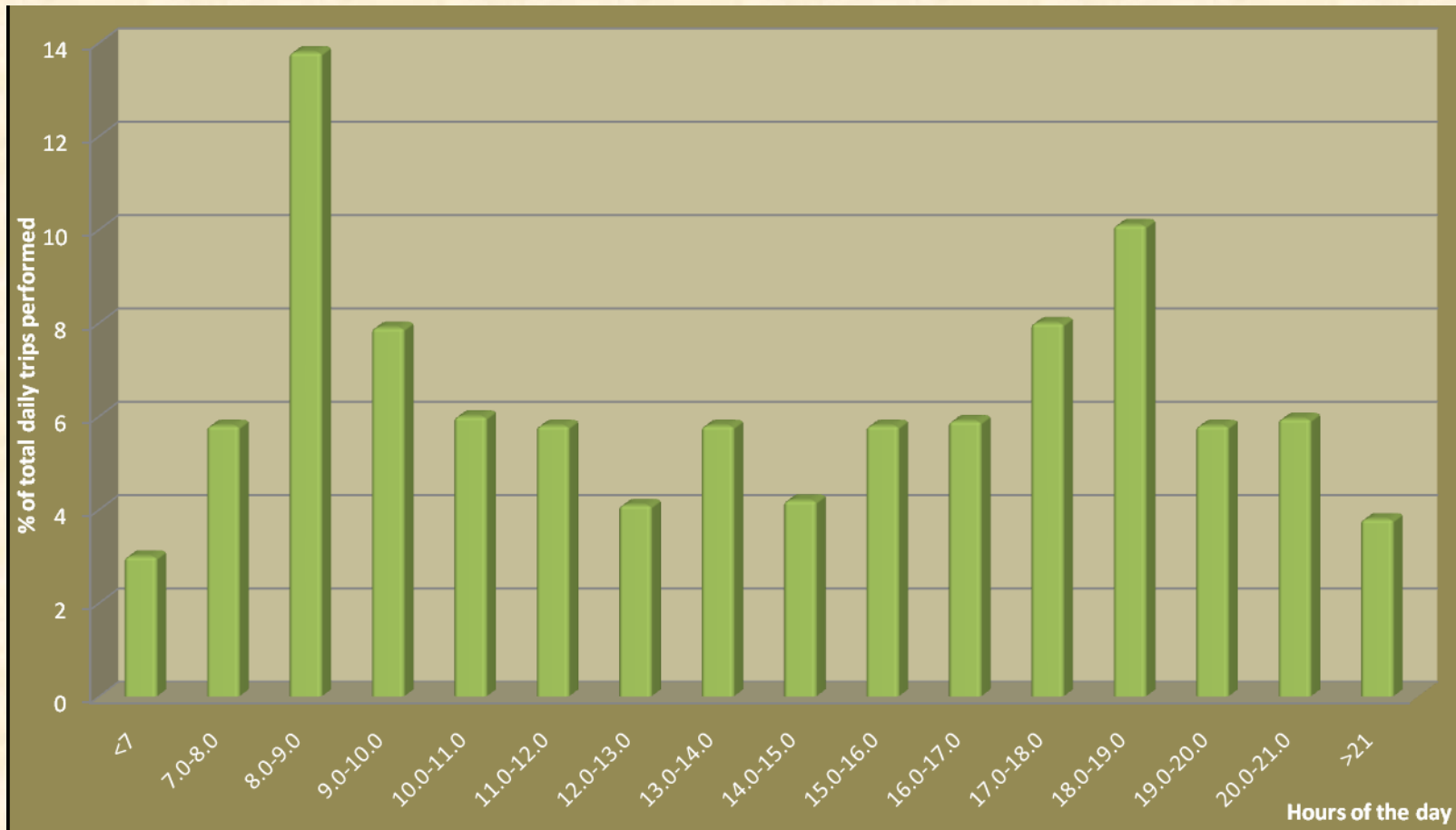
R Squared : 0.889

# Daily Variation of Passengers carried (Sep' 2010)



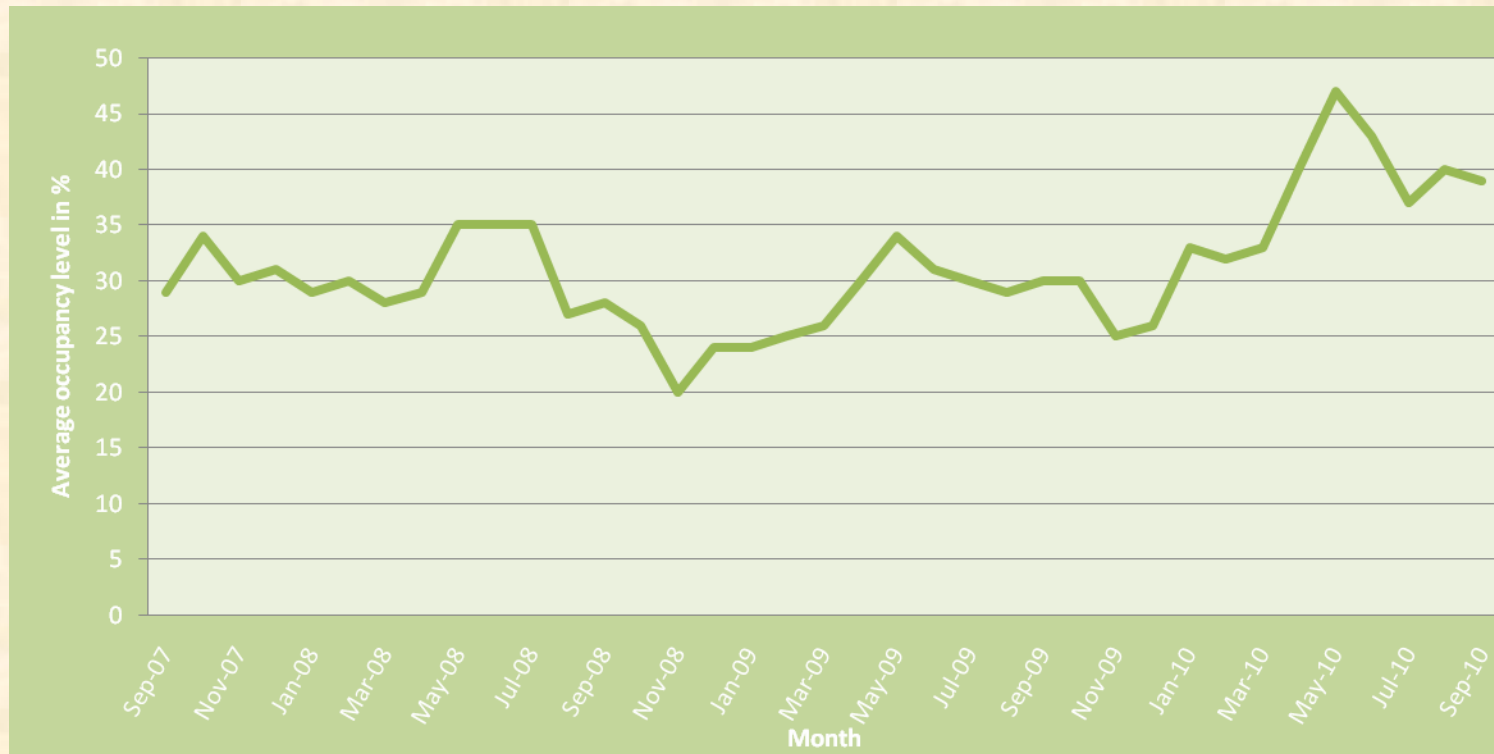
- Maximum ridership was realised on Monday
- work trips from Monday to Friday and the recreational/social trips on Sundays in equal numbers

# Hourwise Passenger Loading in AC Buses



- ❖ 32.5% of ridership during the morning peak period (7-11 AM) and 29.5% during the evening peak period (4-8 PM).
- ❖ 13.5% of daily ridership was observed from 8AM to 9 AM in a day, higher than peak hour ridership (9.2%) of all MTC buses.

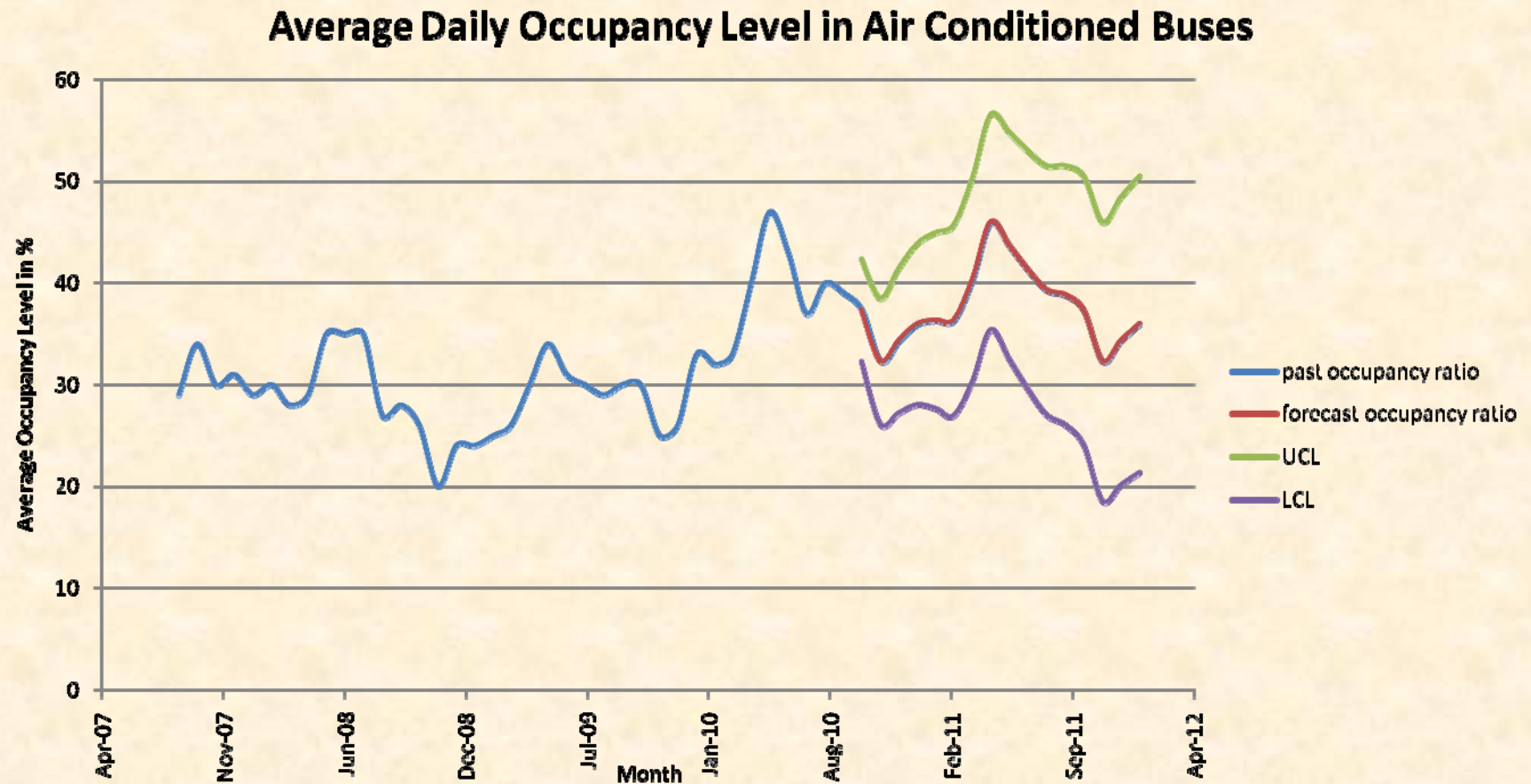
# Average Daily Occupancy Level in AC Buses



- ❑ In spite of nearly twelve fold increase in fleet strength the average occupancy level increased from 26% to 33% in the last three years.
- ❑ Occupancy level is low - November to February due to pleasant weather in Chennai & in hot summer period (April to July) the occupancy level is highest.
- ❑ The low ridership is a cause of concern and MTC can collect **reduced fare to encourage ridership during the lean hours and periods.**



# Time Series Forecast using Auto-Regressive Integrated Moving Average (ARIMA) Model



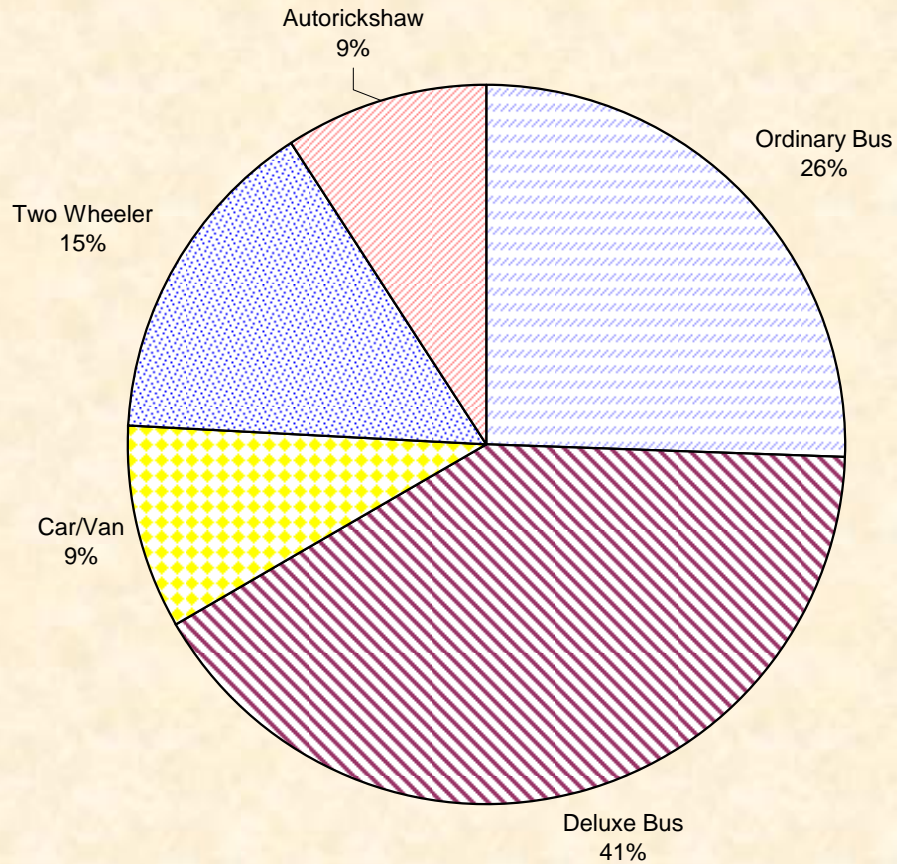
MAPE – Mean Absolute Percent Error : 8.8 %

R Squared : 0.575

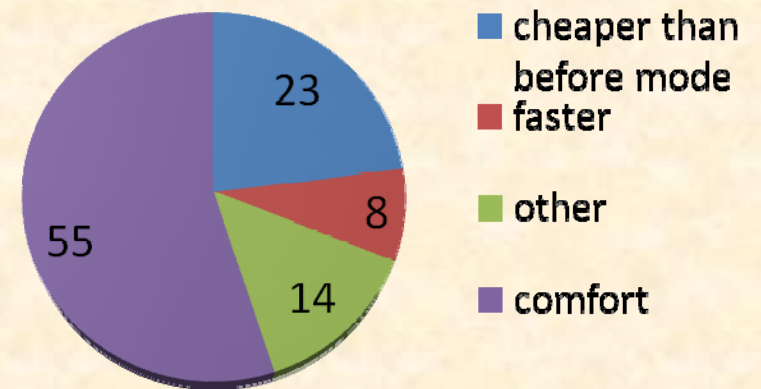
# Travel Characteristics of Commuters

- ✓ Nearly 40,000 passengers travel by AC buses in a day
- ✓ Based on the survey 37% of the commuters in AC buses were regular travelers
- ✓ 55% of the passengers were aged between 20 - 40 years
- ✓ 33% between 40 - 60 years
- ✓ 61% of the commuters interviewed were employed
- ✓ 47% of the commuters mainly for work trips
- ✓ 10% of trips were for education purpose
- ✓ Balance were for shopping, social and recreational activities
- ✓ It was observed that 74% of the travelers owned vehicle but opted for travel by AC buses

## Earlier Mode of Travel

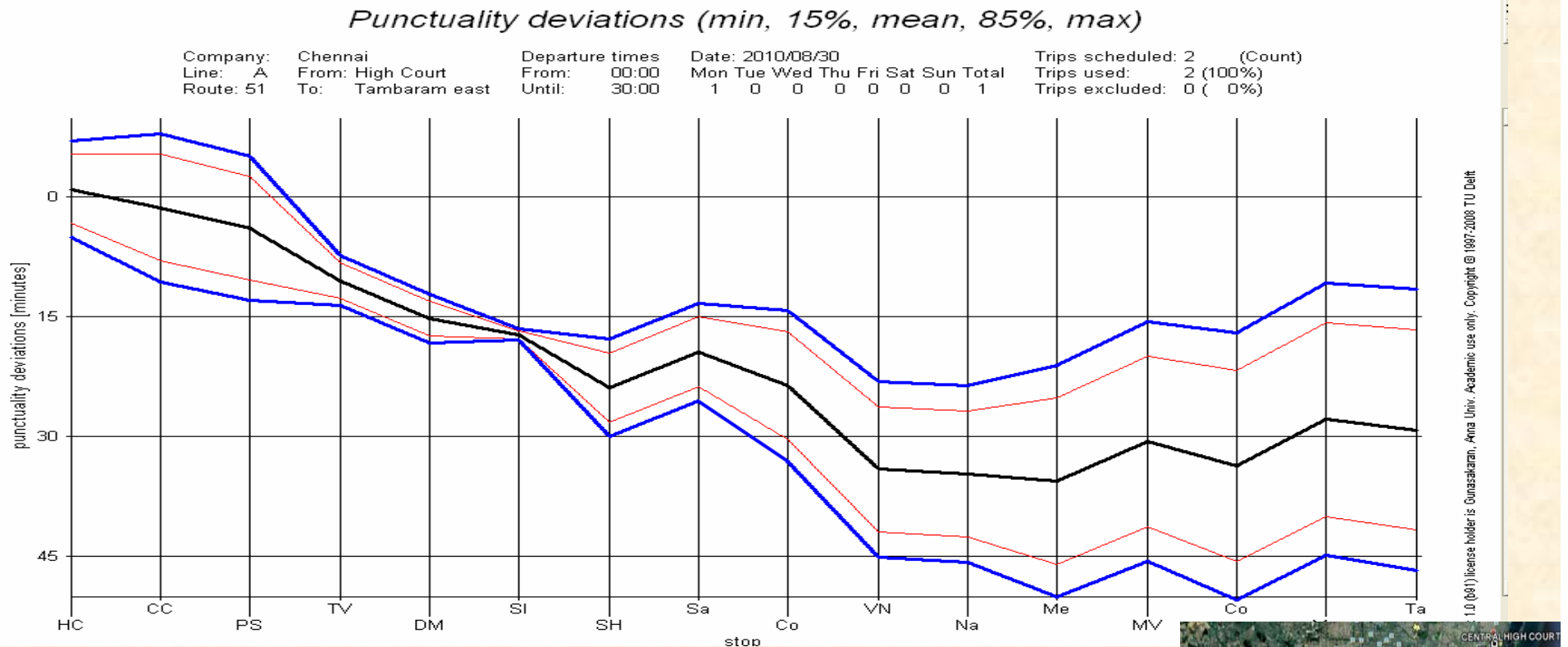


## Reasons for traveling in AC bus

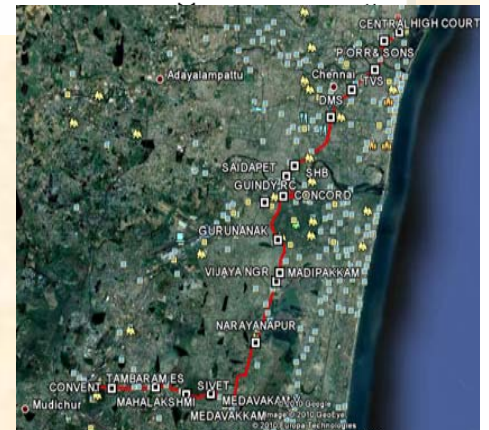


**The AC buses are successful in attracting 24% private vehicle users. Higher level of Comfort in AC Buses was prime reason for choosing it.**

# Punctuality Deviations of AC buses measured from Vehicle Tracking Facility



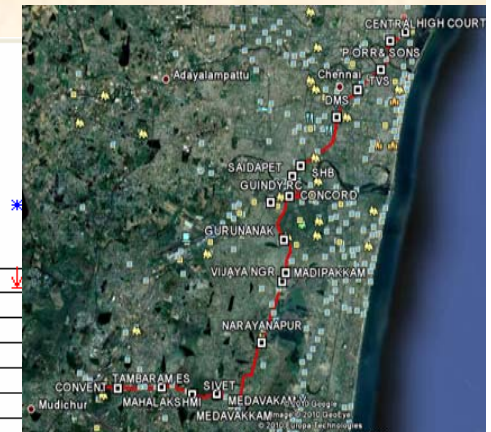
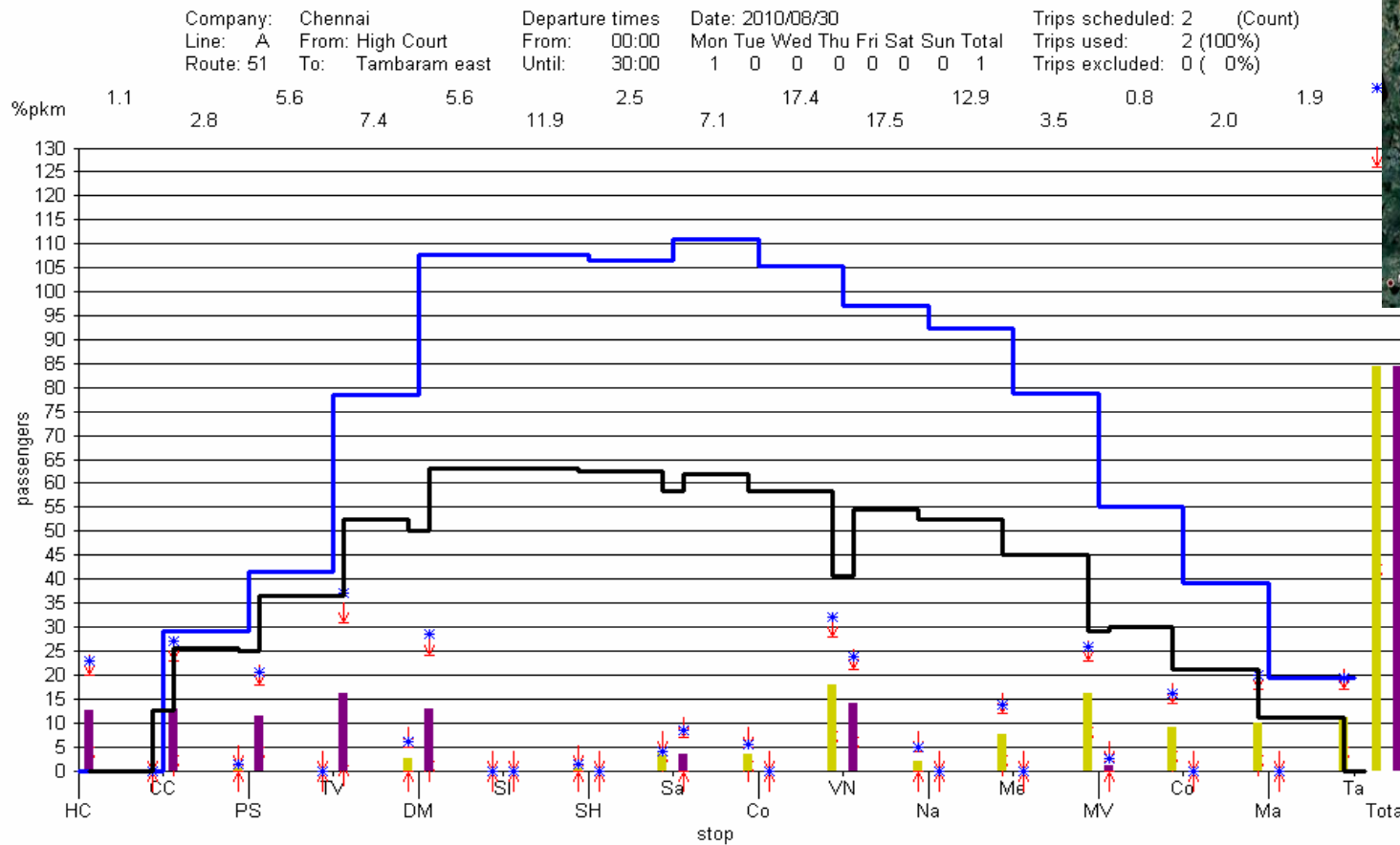
- + punctuality deviation means that a vehicle is late
- - value indicates that a vehicle is early
- — indicate the earliest and latest vehicle observed
- — shows the mean punctuality deviation
- — indicate the 15% and 85% values





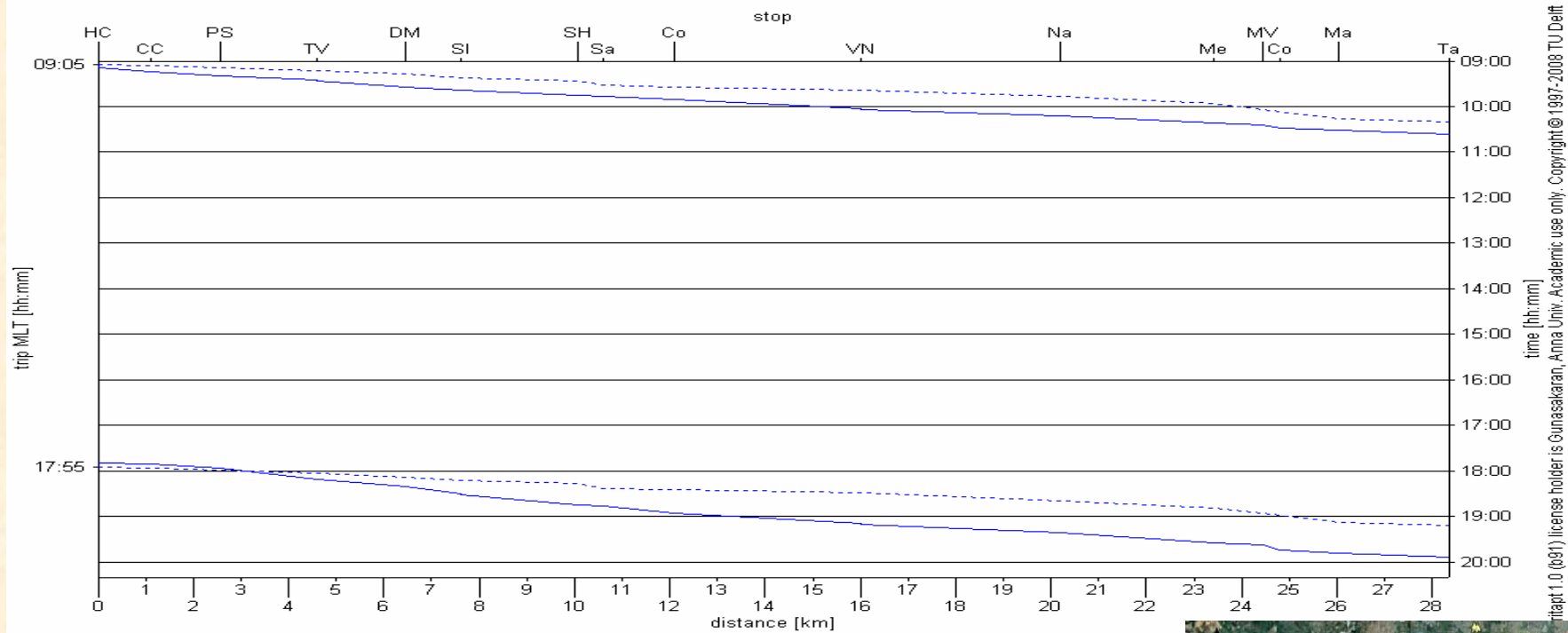
# Passenger Counts using Electronic Ticketing Machine Data

Unbalanced passenger counts (min, mean, 85% and max)

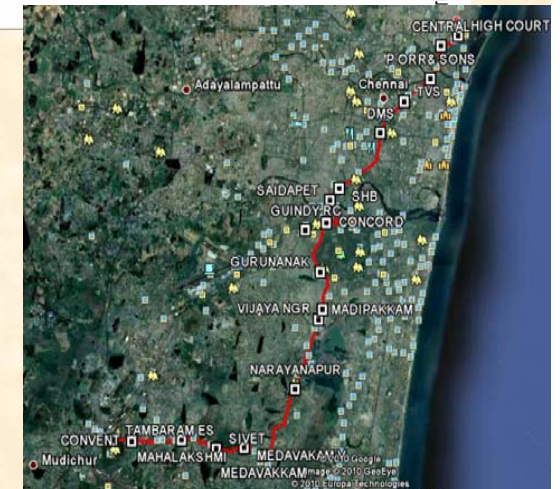


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# Time –Space Plot to Monitor Operations



**Dashed line indicates scheduled trip's trajectory**  
**Solid line indicates the observed trip's trajectory**



# FINDINGS AND CONCLUSION

- Nearly 5.7 million trips in Chennai are performed by buses
- Upgraded fleet of 100 Air Conditioned buses carry 40,000 passenger per day
- Cost of AC bus travel is relatively higher than other category of buses
- Successfully attracted the private vehicle riders to bus travel as AC Buses offer comfortable travel at reasonable cost.
- Public transport system offering a comfortable similar to AC buses is required.
- As considerable segment have opted to travel by AC Buses due to the less travel time use of ITS facilities need to be used for monitoring and maintaining the reliability of services.





Thank You

