STUDY ON MOBILITY INDICATORS, EAST-WEST CORRIDOR OF BENGALURU CITY- A CASE STUDY

Sushmitha G P[1] ,Manjunatha S[2]

[1]*Department of Civil engineering, Sri Krishnarajendra Silver Jubilee Technological Institute, Bengaluru-01*
[2]*Departmente of Civil engineering, Sri Krishnarajendra Silver Jubilee Technological Institute, Bengaluru-01*

Abstract— Present study on mobility indicators for Bengaluru city is based on the IRC(Indian Road congress)guidelines and MoUD(Ministry of Urban Development), Government of India. This study focuses on the traffic and transport planning issues, its deficiencies in the stretch selected, causes for the development of these deficiencies and the impact of these on the users and commuters. A set of performance indicators were developed to measure these issues with the increase in the demography and the expansion of the city Transport performance for the selected stretch of the city originating from Bengaluru East(Tin factory) to Bengaluru West (Sunkadakatte) passing through Central Business District (CBD) is assessed through the set of performance indicators known as Mobility Indicators.

Keywords-component; Congestion index, Travel Time index, Public Transport Accessibility Index, city bus supply index ,Para Transit Index, Walkability Index, Road safety index, On-street parking index.

I. INTRODUCTION

Bengaluru, capital of Karnataka, is one of the most congested cities in the India. Traffic congestion in Bengaluru city is increasing day by day due to increase in population over the decades. The population of Bengaluru as on the year 2011 was 95,88,910. Population has been increased with the growth rate of 35.09% for the decade 1991-2001 and 46.68% for the decade 2001-2011 according to Directorate of census operations, Karnataka, Government of India. Population of Bengaluru for the present year is around 1,31,82,115 with the total registered vehicles in Bengaluru city as on July 2018 is 76,22,332.

The study area is divided into two zones based on the distance to the CBD from the origin of both the zones. Zone 1 originates from Bengaluru East(Tin factory) and this zone ends at CBD of the city. Zone 2 originates from CBD of the city and ends at Bengaluru West (Sunkadakatte). an Introduction has been given on the Mobility, factors that affect mobility, a brief details about Transportation systems existing in the city, vehicles registration data, Bengaluru city traffic details and an overview on BMTC and Intermediate Public Transport systems and other related issues that affect the Mobility have been discussed.

II. OBJECTIVE OF THE STUDY

- *To discover the reason behind the decrease in the mobility of the East-West Corridor of Bengaluru city.*
- *To provide premise to further studies on mobility indicators for the town.*
- *To increase the mobility of the city alternative solutions will be recommended.*
- *Giving information related to whether or not the city wants consideration from the govt for the alternative or higher transportation systems.*
- *This work also includes study on the variables influencing the mobility of the city.*
- *To find out the reason behind increase in travel time and congestion by making use of the indexes found.*

III. LITERATURE REVIEW

Ashwin M and Mr. Gnanamurthy P B, 2016[1] In this project an attempt is made to study on Mobility Indicators for Bengaluru city is based on the guidelines of Indian Roads Congress (IRC) and Ministry of Urban Development, Government of India. Transport performance for the selected stretch of the city originating from Bengaluru North (Yelahanka) to Bengaluru South (Banashankari) passing through Central Business District (CBD). For his project he concluded that Congestion index for zone 1 is 0.55 indicates that the speed is reduced by 55% of the ideal speed and for the zone 2, and speed is reduced by 45% of the ideal speed.

Harish H.S and Dr. Suresha S.N, 2012[2] The Objective of the study is to determine the travel time and travel delay along the selected bus route. Stretch starts from Shantinagar Bus Stop to Kengeri Satellite Town Bus Stop. The detailed information and data required to improve the vehicle movement along the corridor is collected, This data includes traffic volume data, road inventory data, travel times for various modes of travel and signal timings of all signalized intersections. Using all the above data vehicular flow is determined using micro-simulation software.

To reduce congestion Changes with respect to road infrastructure, signal timings and various other possible solutions are recommended.

IV.   METHODLOGY

The following steps are adopted for the present study:

- Present study stretch is selected which originates from Bengaluru East and ends at Bengaluru West passing through CBD of the city. The study area is divided into two zones, one from Tin factory to CBD and another from CBD to Sunkadakatte.
- Road inventory survey has been done to get the information about the current stretch. All the mandatory preliminary surveys will be conducted that are required for future calculations.
- Formulation of the required eight indexes as per IRC codes and guidelines from the Ministry of Urban Development(MoUD).
- All the obtained eight indexes have been found out and the mobility of that stretch will be decided and further measures to increase the mobility of that stretch will be suggested.

V.   DATA ANALYSIS

5.1 Congestion Index: Congestion is one of the major problem to be managed. By managing congestion, the below related parameters can have a positive impact. i.e. decrease in accident rates, decrease in the travel time, increase in journey speed, decrease in road user cost, reduction in fatigue and travelling discomfort
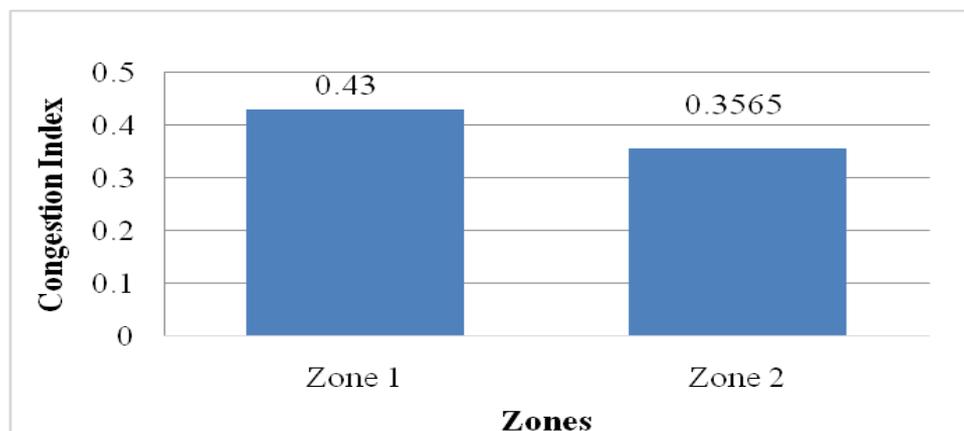

Graph 5.1: Figure showing the Congestion Index

5.2 Travel Time Index: Travel time index is defined as the ratio of the time required to travel along the identified section of the roadway during peak period / congested conditions to the time required to travel along the same section during free flow period. Travel time is inversely proportional to travel speed. The travel time study gives information for the quantity of time required to travel a specific road network. These types of data provide information about speed and delay data.
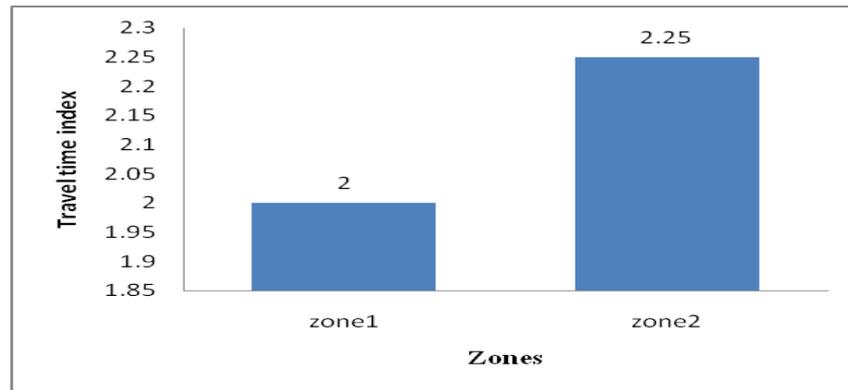
Graph 5.2: Travel Time Index for both the Zones

5.3 Public Transport Accessibility Index: Accessibility is the simplicity in the transportation framework in supporting suburbanites to get their destination in sensible time. Accessibility to open transport can be characterized as the beginning to the closest public transport stop/metro station/railroad stations. Accessibility is influenced by land–use and inter dependency of various transport facilities
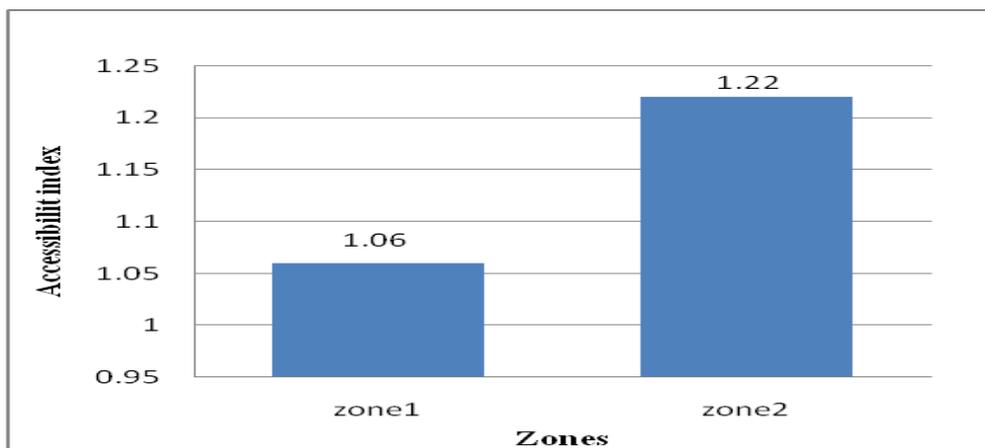

Graph 5.3: Public Transport Accessibility Index

5.4 Para Transit Index: Para Transit Vehicles are the intermediate public transport carriers, as these provide last mile connectivity, the volume of Para transit vehicles affect the mobility. As per MoUD, Para Transit Index is defined as the number of Intermediate public transit vehicles available per 10,000 population of the city. The vehicles population is obtained from Regional Transport Office (RTO) Bengaluru.
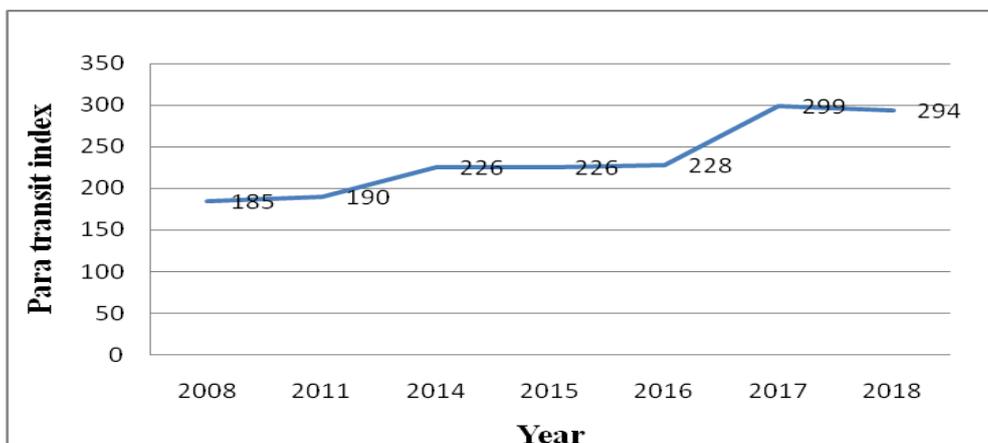

Graph 5.4:Para Transit Index

5.5. **City Bus Supply Index***:* City bus supply index is defined as the number of city buses available in the city per 1,00,000 population of the city. City buses are the main transport carriers of the Bengaluru city serving around more than 3 million passengers every day. BMTC provides 70900 bus trips per day and it has 6138 bus schedules and these values will vary monthly according to its functions.
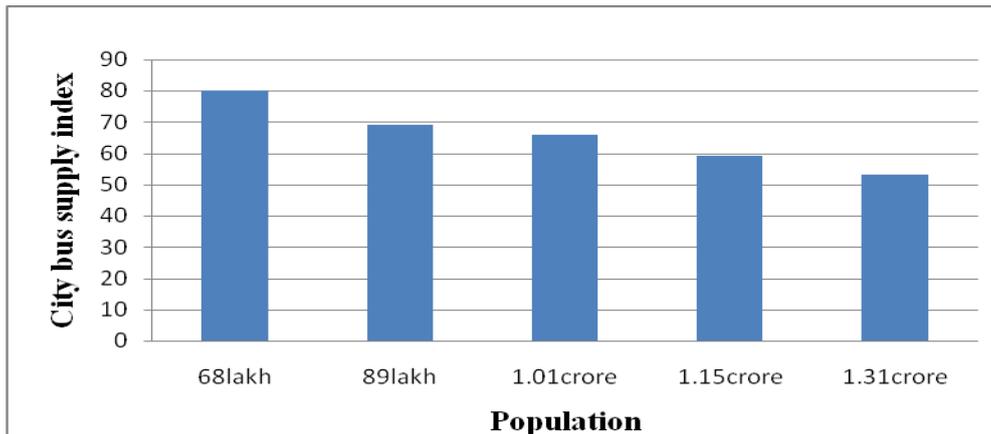

Graph5.5: City Bus Supply Index

5.6 Walkability Index: Infrastructure fecilities offered for the pedestrian to walk such as pathway, skywalks and subways will be evaluated employing a performance index called Walkability index.
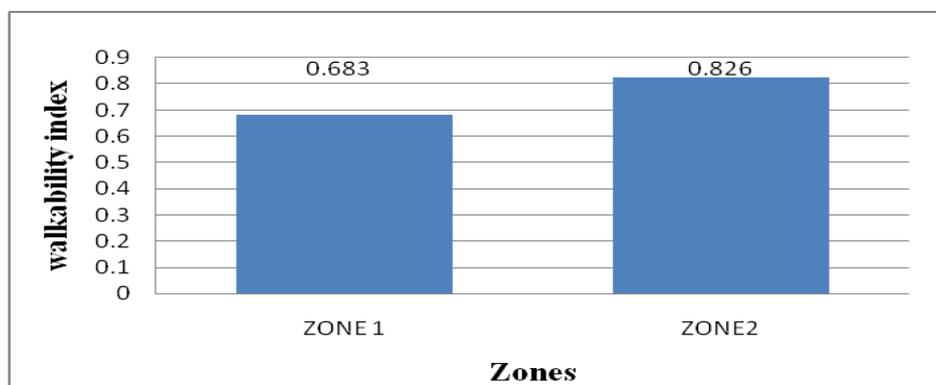

Graph 5.6: Walkability Index

*5.7.***Road Safety Index***:* Road safety index is calculated using two indexes namely, accident death index and Accident injury index. Accident death index (ADI) is defined as the total number of deaths per million population of the city.
Accident injury index (AII) is defined as the number of injured accidents per million population of the city. Road safety index can be defined by combining the above two Accident Death Index and Accident Injury Index and multiplying it with the suitable weightages.
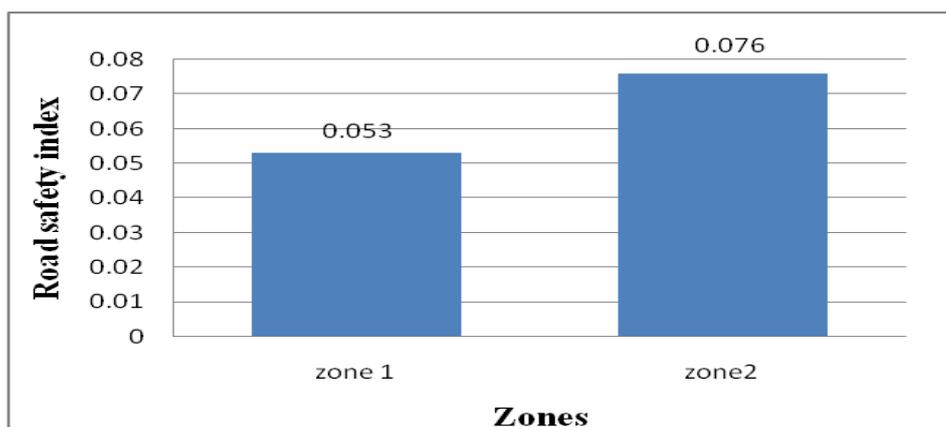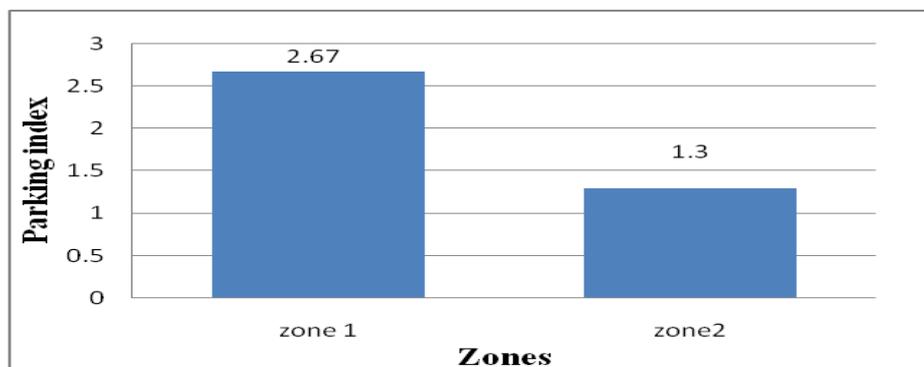

Graph 5.7 : Road Safety Index
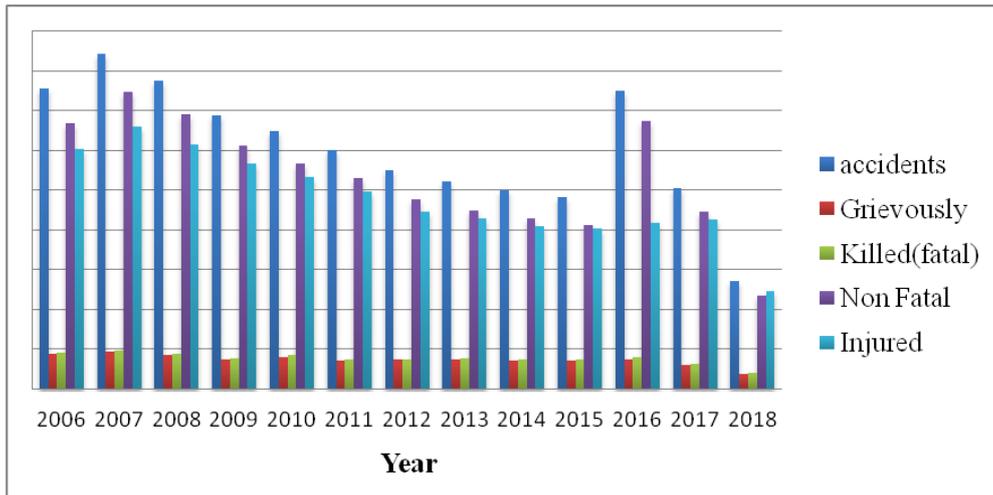
Graph5.8: Fig showing all types of accidents occurred in Bengaluru city.

5.8 On –Street Parking Index: On-street parking is one of the method of accommodating parking wherein, vehicles are parked on the accessible sides of the road itself.

Figures showing on street parking

Graph 5.8 : On-Street Parking Index

VI.   CONCLUSIONS AND RECOMMENDATIONS

- **Congestion Index-** For the zone 1, a value of 0.43 indicates that the speed is reduced by 43% of the ideal speed and for the zone 2; a value of 0.36 indicates that speed is reduced by 36% of the ideal speed. Hence it can be said that in both the zones, the reduction in speed is greater than 35% of the ideal speed.
  Some of the possible ways to decrease the congestion in the zones are listed here, for the zones; mobility can be increased by enforcing strict laws on parking vehicles. As this both zones have high on-street parking interference index value , indicating that parked vehicles are interfering more with the moving traffic. And on those areas regulating laws can increase its mobility a more.

- **Travel Time Index-** Travel time index for zone 1 is 2.0 indicating that in this zone 35 minutes travel requires 70 minutes to reach to the destination. In zone 2 The Travel time index of 2.25 indicates that 20 minute travel requires 45 minutes to reach to the destination.
  Other factors that can be adopted to reduce travel time are signal timings in the junctions by improving the footpath facility.(this interference also decreases and increasing the mobility).

- **Public Transport Accessibility Index-** For the zone 1, this index is 1.06 which is lower than the desirable value and hence this zone has not so good accessibility to the bus stops. For the zone 2, the index of 1.22 shows that this zone has accessibility nearest to desirable value that is 2.
  Transport Accessibility can be increased by placing the bus stops nearer to their origin that is walking distance should be less than 500m from their origin.

- **Para Transit Index**- As per the desired value suggested by MoUD, this index should be 65 per 10,000 population of the city. Whole Bengaluru city is considered for the calculation of this index and this value is as high as 294 including population of the 4 to 6 seater.
   Neglecting the population of 4 to 6 seater , the index would be 268, which is a high value for the 10,000 population of the city.

- **City Bus Supply Index-** BMTC operates about 6648 buses handling more than 3 million passengers every day. As per the statistics of number of buses and for the corresponding population, the city bus supply index of 51 is very low.
  BMTC should take this issue into account and increase the number of buses to serve the increasing population of the Bengaluru city.

- **Walkability Index-** Walkability index for the zone 1has the value of 0.68 which indicates that this value is good and the footpath condition is also good. For the zone 2, Walkability index is 0.82 indicates footpath condition is fair as footpath is used by vendors, shop keepers to park the vehicles.
  for Zone 1 workability index justifies that people can use the footpath, as footpath is not much affected by other activities. For zone 2 Proper enforcement, provision of pedestrian infrastructure facilities may increase the usage of footpath.

- **Road Safety Index-** The Road Safety Index (RSI) for the zone 1 is 0.053 and for the zone 2 is 0.076. The value of RSI which is close to the zero indicates that, the zone has higher safety while which is nearing to the 1 indicates that, the zone has lower safety.
  Road accidents can be decreased by combined effort of Enforcement, Engineering and by Educating the road users(commuters).

- **On-Street Parking Index-** For the zone 1, On-Street Parking Index is 2.67 and for the zone 2 it is 1.30, it can be concluded that zone 2 has higher interference to the traffic than zone 1.
  Government should regulate on-street parking time, allowing only the vehicles of the residents to park on-street and restrict the heavy vehicles and other personal vehicles for parking on-street. And also Parking should be priced with respect to time to encourage the use of public transport.

VII.   SCOPE FOR FURTHER STUDIES

- This work on Mobility Indicators for the Bengaluru city is based mainly on the population of the city, increase in traffic, increase in Para Transit vehicles and increase in number of Bus fleet size. This work needs continuous updating of database.

- This work is done for Bengaluru demography, wherein population of slow moving vehicles, it can be expected that, many other cities of the country has more number of slow moving vehicles affecting the mobility, this value can be considered and further studies can be carried out.
- Mobility Indicators are not restricted to the above mentioned indexes, based on this, other elements of infrastructure and many other factors which affect the mobility can be defined and work can be carried out.

VIII.   REFERENCES

[1]] Ashwin M and Mr. Gnanamurthy P B, "Study on Mobility Indicators for the Bengaluru City – A Case Study" IJSRD - International Journal for Scientific Research & Development| Vol. 4, Issue 06, 2016[1]

[2 Harish H.S. and Dr. Suresha S.N "Studies on Mobility Indicators and the Effect of Congestion Reduction Measures on the Movement of Vehicular Traffic along G-6 Bus Route in Bengaluru city using micro Simulation Software", The International Journal of Engineering And Sciences(IJES),Volume 2,Issue 1, pp. 93-96, 2013[2]

[3] Wilbur Smith Associates private limited (2008) "Study on Traffic and Transportation Policies and Strategies in Urban Areas in India", (2008) submitted final report to Ministry of Urban Development.

[4] Wilbur Smith Associates (2008) "Bengaluru Mobility Indicators 2008" Submitted final draft copy to Ministry of Urban Development, Government of India.

[5]Urban Mass Transit Company Limited (2011), "Bengaluru Mobility Indicators 2010-11", submitted draft final report to Directorate of Urban Land Transport (DULT), Karnataka.

[6] S.K. Khanna and C.E.G.Justo, "Highway Engineering", Published by Nem Chand & Bros., Civil Lines, Roorkee 247667, India.

[7] IRC:106-1990, "Guidelines for Capacity of Urban Roads in Plain Areas", Published by The Indian Roads Congress, Jamnagar House, Shahjahan road, New Delhi-1100 .

[8] Ms. Ritu Anand, "Intermediate Public Transport", technical session -5A, Proceedings of Urban Mobility India 2013.

[9] Census of India 2011, Directorate of census operations, Karnataka, Government of India.

[10] I. Kaparias and M.G.H Bell, "Key performance Indicators for traffic management and Intelligent Transport Systems" – conduits, 7th frame work Programme, Imperial College, London.

[11] Traffic Management center (TMC) - Bengaluru city traffic police.

[12] Regional Transport Office (RTO), Bengaluru city.

[13] National transport development policy committee (NTDPC), "Urban Transport", volume 3, part 2, Planning commission, Government of India.