

## How Can Transportation In Bengaluru Be Sustainable?

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**ABSTRACT:** This research paper is about to transportation in India. I recognise an attempt to write roughly about sustainability issues in Bangalore and to develop a research proposal on the topic. First, I tried to define a clear and specific question for my paper. Second, I created the impression that the reader will understand basic concepts in urban research. I refer to time geography, the mobilities paradigm, travel demand theory and the planner's triangle - but then again, I start reproducing them accurately and link them to my research topic. My research text is practical and realistic to follow. I will need to think more clearly and carefully in order to develop a systematic piece of writing. Later, my research paper had gone through proof-reading original and then critically questioned myself, whether my paper text is understandable to a reader. As a result, the goal is improved efficiency, decrease air pollutants, and produce sustainability measures with a calmness research.

**KEYWORDS:** Transportation, Sustainable, Travel, Smart Mobility, Smart Cities, Data Analytics, Urban, Time geography.

### I. INTRODUCTION

Ideally, the development of transportation is a science which shadows growth in the city. Over the past few decades, India's GDP have peaked in the world's statistic. In this proposal we study Bengaluru which is the capital for South India of Karnataka State. Bengaluru is a third-largest city of the country with an estimated population of 12 million. Silicon Valley of India is globally branded for Bengaluru with corporate buildings and malls shimmering glass façade with massive skyline. The massive growing urban fabric of Bengaluru with enhanced quality of living and better infrastructure is making India highest ranked for its developing GDP growth. In addition, other states citizens are migrating to Bengaluru for reasons majorly being employment in Multinational company to fast pace growth leading to over population with limited available resources

in area. Overall, India's Silicon city is suffering with serious risk (city metric, 2018) of traffic congestion, short of water supply, clotting of sanitation reserve, deterioration of 1115 parks and 183 lakes, tacking air pollution etc. Architect Naresh Narasimhan (Scmp Business publication, March 2018) believes the doomsday predictions about Bengaluru becoming uninhabitable. With these challenges in Bengaluru, the government is addressing to re-build a sustainable platform with 3 retreat style (sustainability next report, 2019) that is defined as Urban Water, Urban Sustainability and Urban Climate change. The future of this city has higher chances of success in a democratic way.



**Figure 1.** Hebbal Flyover with vehicles stuck via travel to Bangalore International Airport (BIAL)

### II. LITERATURE WORK

The paper Survival and Arena by author Torsten Hagerstrand, put forward a range of concepts on the life history in 1970 of individuals in relations to their geographical environment research. Swedish geographer Hagerstrand discusses elements of human nature, history, place and culture of birth, death and family formation, cycle of access to home and work, interaction with social group and various engagement leading to conflict which is defined in time geography

(Hagerstrand, 1970) of human needs with the study of life in different conditions. With the help of Analyst, Hagerstrand observed, how the health and length of life was affected with regard to external condition of living style like low income, no employment or unsecular job and poor facility for household. Also, string co-variation of living with health and length of life.

Authors Mimi Sheller and John Urry (2006) describes a new paradigm for transportation in social sciences for interdependent movements of people, objects and technology. With the development growth there are changes in the magnitude and speed of the circulation of people, objects around the world with uneven effects upon the environment. Sheller and Urry (Caletrío, n.d.) argues a new framework of research in social science that's related between individuals in closed physical proximity. However, the travel and communication technology are focused at the distance and connections in social life together as a sense of example in Japanese society. In our case of Bengaluru, indeed radial growth of the city with various satellite nodes town interdependent around the CBD of Bengaluru. This new mobilities paradigm examine the nature of networks configured over time and space globally. This

paper creates a dialogue between science, humanities and impresses to test the theories of mobilities paradigm in various interests by advancing the extraordinary work by John Urry.

Thomas A Domencich (1975) developed a behavioural analysis theory of urban travel demand which analyses the urban transportation policy. Thomas has four main subjects focusing on scope of travel demand, objectives of travel demand analysis, behaviour responding to changes in attributes of the transport system. Indeed, the behavioural models represents the decisions that consumers make when conformed with alternative choices. in other words, models describe relationships between socio-economic and transport characteristics and trip making conditions. The approach of McFadden and Domencich admires the behaviour and travel decisions answering the four subjects in a feasible wand and this study is important for policy makers dealing with urban transportation problems. Furthermore, the authors explored in detailed the logit model which is connected between economic theory and econometric method. The model is explanatory dealing with travel demand but have limitation for city like Bengaluru with practical realistic issues of transportation.

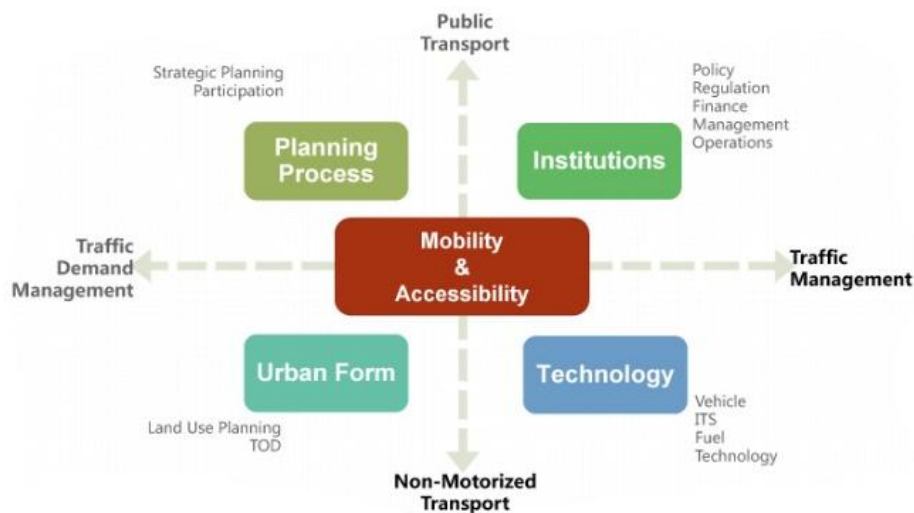


Figure 2. Sustainable transportation system planned in Smart city

## DEVELOPMENT OF BENGALURU

In this study we consider Bengaluru city centre when it's been compared to London in size of area and people. Indeed, many planners have argued on environmental protections and development of economy and social equity. (Campbell, 2016) Planners triangle with three main nodes associated with three conflicts (property, heavy resources and development) with three main

institution to manage the conflict (social welfare, environmental justice and environmental economic and regulation). The predefined planner's triangle with development of sustainability at centre which is ongoing process without any state of equilibrium expanded by Campbell (1992a,1996). In theory this concept is very critical but when we work analytically with city like Bengaluru its hard to shape and provide tangibility (albeit abstract).

Alternatively, as our city have to prioritise on expanding the sustainability measure, which could alter the triangle based on the measured sustainability growth. However the triangle symmetry with three main goals (social, economic and environment) with three conflict (resource, property and development) needs to literate change depending on the unintentional city growth.



**Figure 3.** Campbell (1996) Planners triangle. The triangle of conflicting goals and three associated conflicts. Planners define themselves where the predicted position stand on the triangle. The main central point being Sustainability development

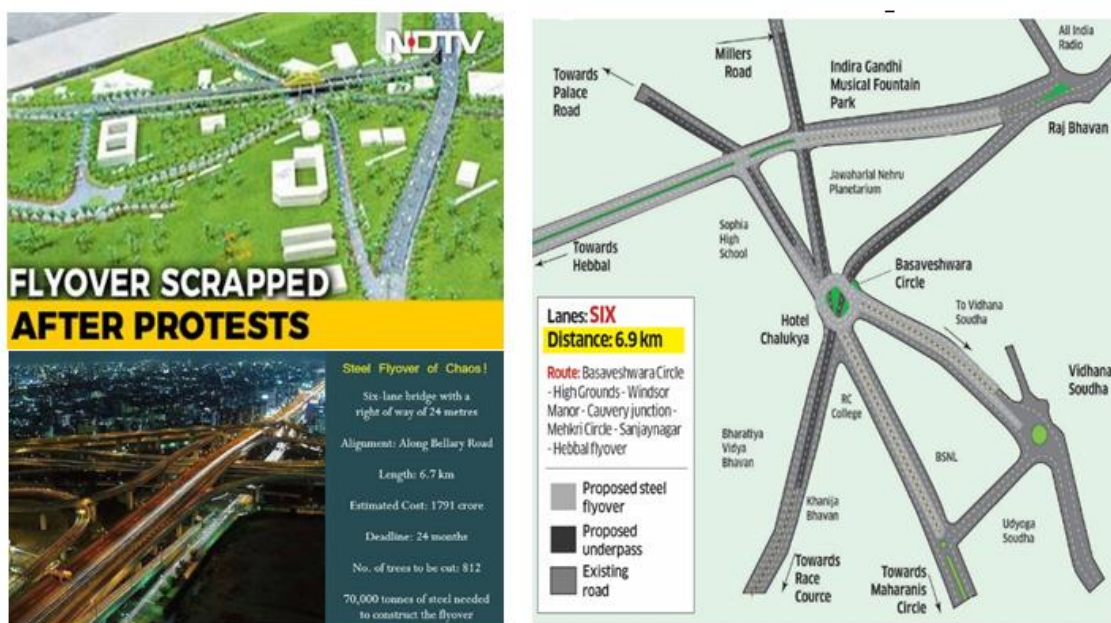
In theory, there is a balance between long term social-environmental planning concept, but it

does not allow us to measure sustainability and determine the risk related to the environment. Ironically, we could break the triangle and form three clusters of concept surrounded by sustainability and three associated conflict and three planners concept is in the centre of cluster to make it un-holistic. This paper is debatable and forms a reconciliation in the three areas of planning and sustainability that is been offered by the triangle.

The research question in this paper of making Bengaluru mobility as sustainable is transforming and developing the understanding of the growth. How can we sustain the growing city into green? Once we get there, what are the limitation and social view on their development. Architects and planners are not able to provide adequate answers to these questions; however, we need to create and encounter the political resistance of the city growth and have concrete strategies to achieve a sustainability development in Bengaluru.

On the ongoing path of the green world, we believe that economic, social and environmental are the edges of the Planners triangle (Campbell, 1996) which transform the nature and provide holistic blend in the growth of the cities. It also merges with the interest of employment with sustainability and nature, adding to the social justice of the triangle.

### III. BENGALURU STEEL BRIDGEDEBATE



**Figure 4.** Proposed Steel Flyover Map for Bengaluru, India

Bengaluru had proposed a steel bridge for 6.7 km from CBD to Hebbal leading to Bengaluru Airport. The cost of the project was 20 billion (1800 crores) awarded to our company Larsen and Toubro construction – India’s largest construction company. With the buzz of construction activity to kick start in year 2015, the project had to remove about 1000+ trees and some central heritage buildings. Bengaluru citizen parade and various campaign continued to ban the steel flyover to save the environment. L&T definably lost a major deal as the problem of traffic was neither resolved nor redirected. As citizens, we

#### IV. RESEARCH QUESTIONS

The question for this research proposal is how transportation in Bengaluru can be sustainable. To narrow down the research scope, this research will be focusing on sustainability in India and is identifying the main characteristic of any city that is

##### 1. WHAT ARE THE ISSUES IN CITY OF BENGALURU FOR TRANSPORTATION?

Bengaluru is the fastest growing city of India, it not able to handle the transportation problems. The main issue is traffic congestion. Medium article (Aug 2018) by UX-design stated that Bengaluru is suffering with traffic due to the star street pattern which is a result of unplanned rapid growth. Other issues for worst traffic of Bengaluru is timings of citizens, distance of the work: home ratio which is ineffective to distribute the load of traffic. Lastly the poor connectivity with the public transport is another reason for cram on roads.

##### 2. WHY IT NEEDS TO BE SUSTAINABLE?

Supremely, sustainable solution will be answer to the occurring issues in Bengaluru. With the growing city it’s very important to sustain its economy and improvise the quality of life. Bengaluru architects and planners need to provide environmental decisions on four main categories:

#### V. RESEARCH PLAN

Looking back on this project, the overall outcome of results to be observed. This can be evaluated by looking at how well our objectives were met. So, the different modes of transport need to be analysed with a sustainable solution. Based on this study, four methods could be proposed for the list;

1. Retrofitting the existing transportation
2. Redevelopment of mobility
3. New modes of transportation
4. New Smart solutions for mobility

see the global warning and signal from the environment to stop any further damage to the nature. Indeed, Planners triangle here plays a role where the authority had not considered sustainability during the planning project stage later the steel bridge was a major flop at time of kickstart at site in Bengaluru. The people into cities comes with the growth in the urban areas with significant influence on our built environment. It is really important to take into consideration the environment into our urban system as explained well by Campbell in Planners triangle.

transportation. Before we carry out actual research in Bengaluru transportation to make it more environment friendly. It is critical to identify and study the groups: city issues, sustainability regarding its urban environment. The main research question is broken into three part for this study.

Transport, infrastructure, land parcel and energy. Indeed, protection of the environment in the urban areas from damage and demolition is the main criteria of this research proposal.

##### 3. EXPLAIN SUSTAINABILITY WITH RESPECT TO TRANSPORTATION OF ACITY?

Environment protection is the primary concern in our urban system. Additionally, with massive disruption in transportation causes severe problems not only to the city but also to the citizens. The air quality of Bengaluru due to increase in traffic has been recorded as 169 (BWSSB, Bengaluru AQI 2019). The monitoring stations have measured PM2.5 pollution as one the most harmful air pollutants (GAIA, aqicn.org) in Bengaluru. To achieve a solution, the awareness of green needs to highlight particularly to transportation department in Bengaluru.

My intention is to create a method which explains how the various modes of motilities can be made sustainable about the environment. Additionally, I will like to reflect on the factors that’s been affecting the city of India – Bengaluru with major crisis of Traffic and this further impacts the health and personal life for human needs.

Bengaluru is undergoing one of the greatest challenges in environment that lies in mobility. As a mix crowd of people with infinite network of automobiles and transportation systems part of social sciences. 2-wheeler, 4-8 wheelers, and other models of transport are making an impact on the nature.



Figure 5 Smart Source of Travel

One quarter of global CO<sub>2</sub> emission is from mobility of citizens and goods. As per WWF's One planet city challenge 2017-18, sustainable transportation creation is one of the biggest opportunities for cities. However, modes like bicycle, pedestrian lanes, electric vehicles, car sharing, and rail freight are few sustainable urban mobility for mitigating climate change and creating climate safe cities.

Smart solutions concept with the use of technology in a large citywide system like Bengaluru. There is a single system window for intelligent transport system solutions. The new mode of traffic transportation could be planned with the help of movement data. The traffic could be predicted within the time frame, location based and cost availability. In this context, a study on the global warming and pollution across the world caused due to transportation, there is a growth in zero emission smart technology as a solution for these issues. Green mobility technology has matured in couple of years.

## VI. REFLECTION

This study outlines key ideas and concepts to help us understand the sustainability challenge in Bengaluru reflecting clean, convenient and congestion free mobility. My concern about the planner's triangle for the sustainable future is often expressed as steady growth, political support on the economics that's much needed in the developing city of India. However, it is wishful thinking to analyse the economy needs to socially distribute the right resource, culture and other dependent boundaries. Growing GDP and economy of this

city, indeed, added to environment degradation. The vision of the stop growth raises a fear or negative vibe where the planners are not able to answer. Otherwise, the understanding neither the potential economist nor the nature of opposition on the sustainability development in Bengaluru.

Despite the limitations in the formulation of green cities, sustainable technology in transportation needs to be retained with its integrity and heritage value of Bengaluru. Additionally, the four methods which answered the question of sustainability needs to be redefined and made more precise. In APAC region, Bengaluru growth have reached many peaks hitting other competitive green cities, we should think to create a whole sustainable mobility and practise it universally around the world. To broaden our study with the idea of 'sustainability', we need to find the inability of the system and try to define in terms of economic and political system as well for India. Similarly, the new modes of IOT transportation, retrofitting and rebuilding the existing infrastructure need to strive in our whole system. The goal of this study is to prioritise sustainability for the growing city of Bengaluru with a balance of Campbell's Planner triangle with associated conflicts and new paradigm of mobilities. Indeed, the restructuring and redistribution of the global sustainability is most specific for local and industry advances.

## VII. CONCLUSION

A comprehensive vision for mobility in Bengaluru primarily focusses on Sustainability and Green technology to provide a better quality of living and higher standard of growth. Certainly, with its shortcomings and theoretically thinking, this research is a start for sustainable development. Finally, with help of time geography, planner's triangle and new mobility paradigm concept have been very effective to visualise and mitigate the difference in sustainability and transportation. Our approach for Bengaluru has tried to reduce the nature resources and create a win-win solution as explained with Steel bridge example. The overall study for technology and improvement of nature has guaranteed a distribution of growth in our city and address the risk that's been stated in problem statement.

In the end, however, to narrow down the research and produce a clear result, it is necessary to discuss with leaders in the industry to solve the problem in economic and environmental impact in Bengaluru. The solution should have a timeline and also thought over the question is really important at this crisis state of Bengaluru which is among the world's 3rd ranked top cities.

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