

A Review of Research on Monorail as an Alternative Mass Rapid Transit System

Rewati Marathe¹, N. D. Hajiani²

¹Final Year Student, M.E. Transportation Engineering, L.D. College of Engineering, Ahmedabad, Gujarat, India

²Associate Professor, Department of Civil Engineering, L.D. College of Engineering, Ahmedabad, Gujarat, India

Abstract: India is experiencing exceptional growth. India's population will be enormously 1.523 billion by 2030. Due to over population, car ownership and personal vehicles lead to traffic congestion. To deal with such problems of moving large numbers of people and vehicle and air pollution (carbon emission) monorail be a good solution. It is relatively cheap to construct, also ideal for transporting people from a city's suburbs to its commercial districts and vice versa. A monorail is a railway in which the track consists of a single rail, typically elevated. In this paper literature review is carried out of previous monorail projects and on monorail researches on Monorail Transportation System as an alternative mode of transportation, gives information about land use and public transportation planning and can have systematic approach and techniques to improve monorail project. The system is feasible for basic criteria Technically, Economically, safety and Ecofriendly.

Keywords: Monorail, MRT, Congestion, Air Pollution, accident.

1. Introduction

The importance of transportation in the world development is multidimensional. It links residence with employment, good producer with the users. It also provides option for work, shopping, recreation, health, education, and other amenities. Urban Transportation infrastructure is looking up as transport demand in most Indian cities. It has increased due to increase in population as a result of migration from rural areas and smaller towns to cities. Transport in India has to be an integrated and diverse system with multiple modes of transport – buses, metro, monorail, private transport systems. Generally buses running in mixed traffic cannot maintain their schedule. In maximum part of India there are no exclusive bus lanes. The transportation that actually run for movement within a city (railway, bus, taxi, etc.) must be able to provide stable transportation services to users without strained finances, while running efficiently at the same time.

Transportation where mobility itself is one of the objectives, transportation where traveling to the destination is itself the objective, transportation that is enjoyable, stress-free, and comfortable is perspective of transportation.

2. Objectives of Study

The purpose of this Study is to introduce monorail transit system under study area. The study is to determine that “Monorail” a fixed guideway technology known “Automated Guideway Transit” in industry incorporated into a larger Alternatives Analysis of other high capacity transit options in India.

The objectives are summarized as follows:

- 1)To conduct study on existing Mass Transportation System in the study area.
- 2)To carry out viability study of Monorail Transportation System.

3)To study about the routes for Monorail Transportation System.

4)To compare various MRT system with Monorail Transportation System.

3. Literature Review

The Literature review is carried out of previous monorail projects and on monorail researches on Monorail Transportation System. This review consists of both study of monorail papers and papers which gives information about land use and public transportation planning.

Ashish Verma(2010) In paper Challenges in Transportation Planning for Asian cities author wanted to give what are the transportation challenges in high density cities in Asia. Most of Asian cities Delhi, Mumbai, Tokyo, Hanoi etc. are urban areas having absence of proper control on land use, lack of proper roads and parking facilities, poor public transport, poor infrastructure for nonmotorized transport, lack of road-user discipline etc. This results in transportation problems, including accidents, congestion, and pollution, having a very different and more severe shape than those in cities of developed countries.

John Pucher et.al (2004) The author in his paper the Crisis of Public Transport in India: Overwhelming Needs but Limited Resources wants to pay attention on the difficulties rising due to over crowd in big cities in India. Due to over population there is a burden on the supply of transport infrastructure and services. Public transport, in particular, has been completely overwhelmed. Most bus and train services are filled to capacity, unreliable, slow, and inconvenient. Public transport must be given priority attention to avoid further deterioration of air quality, traffic safety, congestion, and noise in Indian cities.

Ashish Verma and S. L. Dhingra, (2005) In the paper Optimal Urban Rail Transit Corridor Identification within

Integrated Framework Using Geographical Information System discusses a model for optimally aligning an urban rail transit system within an integrated framework, on a demand-oriented corridor on a city transport network, using geographical information system GIS tools. Thane City, which is a part of Mumbai Metropolitan Region India, was taken as the case study. It consists of two stages: public transport travel demand forecasting, and rail transit corridor identification using a GIS-based heuristic algorithm. To provide reasonably direct access to the commuter from its origin to final destination, and also to achieve estimated ridership on the newly identified rail corridor, the feeder route generation integrated scheduling models are developed.

Naohito Matsui (2012) The paper Strategic Urban Public Transport Improvements in Japan describes the latest situations in Japan's initiatives of low-carbon cities and development of public transportation (APMs, etc.) from the viewpoints of planning and technical theories. Global warming is one of the most important environmental issues. In order to encourage low-carbon city development, it is important to reduce CO2 and carbon sink increase in whole city. In this paper the author had given comparison of Intermediate Mass Rapid Transit Systems in Japan.

| Monorails | AGTs | Guideway buses |
|--|--|--|
| Vehicles run on grade separated rails above roads. | The light and small, rubber-tired vehicles run on grade-separated tracks above roads, guided by rails. | Conventional buses with guide wheels that run on dedicated tracks along guide rails. |
| They are either straddle type running on the rails or suspension type running under the rails. | They are either center-guide or side-guide type. | They can run on dedicated tracks or general roads (Dual-mode system). |
| Little influence on road traffic due to grade-separated rails. | Little influence on road traffic due to grade-separated tracks. | |

This paper gives conclusion that development of public transportation is very important in view of the need to mitigate environmental burdens, increased in population and regeneration of cities. Monorails and AGTs can fill a gap between LRTs, buses and subways, providing public transport systems with high punctuality and carrying power.

Sadatsugu Nishiura and Mihoko M. Matsuyuki (2005) The paper A MEPLAN model for Tama Urban Monorail paper assesses a wide range of alternative policies and scenarios for TAMA urban monorail by applying an urban simulation package. The package is MEPLAN model that is designed as a general mathematical framework for modeling the spatial economies of cities or regions. MEPLAN needs several key projections as control factors for forecasting the future. These include Household, Employment, Land, Transportation assumptions include public transport fares, toll highways, car and truck costs, parking costs and values of time, Model results.

Taketoshi Sekitani, et.al. (2005) This paper China's First Urban Monorail System in Chongqing described the features of the Chongqing Monorail No. 2 Line—China's first urban monorail. On the hilly roads in the center of Chongqing city in China, traffic congestion composed of buses, taxis, and private cars is predominantly bad, and the exhaust fumes from this traffic is continuing to worsen atmospheric pollution. As a public-transport measure to deal with pollution problem, a straddle-type monorail has been introduced as the first urban monorail introduced in China.

Bo Wang (2003) In the paper Constructability Analysis of Monorail Project, Constructability is an important objective in the whole phases of a construction project, and experts with knowledge and experience play an important role in achieving superior constructability. It will help to eliminate hidden costs and change orders, ensure schedule, improve

construction quality and enhance safety in construction project. A typical life cycle of monorail includes planning, design, construction and operation and maintenance.

Thomas H. Hopkins (2001) In the paper G 4 A Nationwide High-Speed Monorail Grid for the United States author gives opinion about the rapid transit rail. The term "transit" system, is fixed guideway system which carries passengers, be it a city system that stops every block, a metro system with stations several miles apart, or a high-speed intercity system with stations 50 to 100 miles. There is no city in the world not having congestion problem, and for that there is need some system which attracts rider and such problem should be technically feasible, economically viable, environmentally desirable, and politically achievable.

Andrew S. Jakes () The objective of the study of this paper Economic Analysis Of A Monorail Link Between The Stratosphere Tower And Downtown Las Vegas was to assess the feasibility of developing a monorail transit system between the Stratosphere Tower and Downtown Las Vegas. The economic impact of a monorail system can be implemented by the following two perspectives:

- 1) Tangible Element such as Patronage Projections, Capital and Life Cycle Costs (investment), Revenues, Project Schedule.
- 2) Intangible Elements such as Risks, Property and Area Value Enhancements (indirect revenue), System Extension Potential.

The conclusion is that the monorail project is definitely worth further immediate consideration. The monorail transit solution emerges very capable in both solving passenger transportation needs along the study corridor as well as generating measurable profits for the project participants and the Downtown area in general.

Ryan R. Kennedy() in the paper considering Monorail Rapid Transit for North American Cities Ryan Kennedy gives definition of monorail, types of monorail. Characteristics of monorail technology such as safety and evacuation, rubber traction and guidance, energy consumption, acceleration and braking, gradient, weather, noise. Operational characteristics such as power, speed, ride, switching and maintenance.

4. Monorail System

A monorail is a railway in which the track consists of a single rail, typically elevated. The term is also used to describe the beam of the system, or the vehicles traveling on such a beam or track. The term originates from joining mono (one) and rail, from as early as 1897 possibly from German engineer Eugen Langen, who called an elevated railway system with wagons suspended the Eugen Langen One-railed Suspension Tramway. There are five basic monorail types: Schwebbahn, Straddle, Suspension, Cantilever and Maglev monorail.

Characteristics of Monorail Systems

A grade separated.

It is adaptable.

Cost Effective.

Safety.

Rubber tired traction on concrete surface /steel rails.

Energy consumption is 25% to 30% greater than rail technology.

Rubber tire has higher acceleration and braking.

Rubber tired vehicle overcome gradient more than 15%.

Noise does not produce pollution.

Congestion Impacts.

Workforce Development

5. Operational Characteristics

Power: On board electric motor power shoe behind skirt pick up electricity.

Speed: Generally 20 to 30 mph.

Ride: Superior than cars and buses.

Switching: are extremely important.

Weight: 8 to 11 metric tons/axle.

Columns: Technologically 120 ft /36 mt span supported by 36 inch /.91 mt dia 30 ft /9.15 mt column.

Straddle bent are given when crossing are very wide.

6. Conclusions

This review consist the study of methodology for Monorail as an alternative mass transit system. Monorail is well suitable for the urban transportation in Indian tier II cities having less space. With the help of Technology and high passenger capacity option it is feasible to construct monorail. The system can overcome problems accidents, congestion, and pollution. Public transport must be given priority attention to avoid further worsening of air quality, traffic safety, congestion, and noise in Indian cities.

References

- [1] Ashish verma (2010) Challenges in Transportation Planning for Asian cities;J.Urban plan .2010.136:1.2.
- [2] John Pucher et.al (2004) Crisis of Public Transport in India:overwhelming Needs but Limited Resources; Journal of public Transport volume 7, no. 4;2004.
- [3] Ashish Verma and S. L. Dhingra, (2005) Optimal Urban Rail Transit Corridor Identification within Integrated Framework Using Geographical Information System; Urban plan 2010.131:98-111.
- [4] Naohito Matsui (2012) Strategic Urban Public Transport Improvements in Japan APM-ATS 2011@ASCE2012.
- [5] Sadatsugu Nishiura and Mihoko M. Matsuyuki (2005) A MEplan model for Tama Urban Monorail;eastern Asia society for transportation studies vol 5pp.209-217,2005.
- [6] Taketoshi Sekitani, et.al. (2005) China's First Urban Monorail System in Chongqing.
- [7] Bo Wang (2003) Constructability Analysis of Monorail Project.
- [8] Thomas H. Hopkins (2001) G 4 A Nationwide High – Speed Monorail Grid for the United states, G4.
- [9] Andrew S. Jakes () Economic Analysis of A Monorail Link between the Stratosphere Tower And Downtown Las Vegas.
- [10] Ryan R. Kennedy () Considering Monorail Rapid Transit for North American Cities.