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CarTubes – The sustainable transportation or a hypothetical idea

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ABSTRACT

The use of latest technologies to curb the menace of traffic congestion and environmental problems like pollution, increase in GHG emissions etc., is in practice in such a way that the outcome results in sustainable transportation. One such idea is CarTube. This review paper is about how CarTube can help in the decrease of traffic problems and make long distance travels speedy and less costly. This article also puts light on the facts that why this particular concept is said to be hypothetical and mythical by some experts. This paper will help budding engineers and transportation planners to get familiar with the concept of how successful or unsuccessful the CarTubes would be, with all the reasons.

Keywords: Sustainable transportation, Transportation, Traffic mess, Congestion, Hypothetical, Urbanization, Pollution, Tunneling, CarTubes

1. INTRODUCTION

Considering the present scenario of demographic and socio-economic transformation, India is witnessing a unique phase of population growth, economic change, and radical spurt in levels of urbanization. One-third of India's population lives in urban areas and it is expected to grow at an unprecedented pace in future. By 2050 half of India's population is projected to reside in cities and towns (UN 2014). Population, income, and urbanization levels are expected to stimulate and diversify the vehicle ownership, travel and freight transport demand and transform the transportation sector.

Studies also reveal that intercity and intracity travel demand would increase approximately by 4.3 times between 2010 and 2050. This demand has to be met by road-based transport and a growing share of air transport would entail higher energy demand with a multitude of challenges of national energy security and greenhouse gas emissions. In cities, increasing travel demand, reliance on private motorized modes, declining share of public transport and non-motorized modes will increase energy demand and GHG emissions. This stupendous change is likely to pose multiple challenges and make provision of transportation infrastructure an arduous task. Besides, the impact on climate change, issues pertaining to the provision of wider mobility access at affordable rates, limiting the health impacts of air pollution, reducing the traffic congestion and dependence on fossil fuels would also emerge.

To make sure that our environment is clean, green and safe many ideas for sustainable transportation system have been developed and propagated. These significantly included the electric cars, use of public transportation, walking, and cycling. One such unique concept of CarTube was unveiled on December 2, 2016, at the Institution of Mechanical Engineers by Lars Hesselgren and his research team at London-based practice PLP Architecture.

CarTube is considered the future face of urban mass transportation. This idea is the fusion of two modes of transport, i.e. automated electric cars and the mass transit (small bore tunnels); into a single continuous urban mobility system. It is expected to revolutionize existing cities and allow for unprecedented flexibility in urban dynamics, development, and form in upcoming cities.

CarTube uses a network of small bore tunnels to integrate existing motorways. A dynamic platoon system controls these automated electric cars which circulate above as well as below the ground, allowing them to move within milliseconds of one another. Since all cars within the Car Tube communicate with each other, a good capacity for the vehicles could be provided, compared to the conventional public transport. The cars in CarTube can travel in a continuous flow at a steady speed without slowing down. This concept will help to circumvent the urban congestion through a tunnel-based system that is immune to traffic bottlenecks. Owing to an advanced driving system and app-based booking providing the drivers, exact details on the length of journeys and the cost implications would enable to sort out the gamut of urban transportation issues.

Since these automated cars embrace the smart technology driven by an app would be connected like a train and driven to the passenger's destination with the help of artificial intelligence. These would automatically be spaced just six or seven feet apart for optimum efficiency. When passengers are dropped off at any underground station, the cars would be parked in car stacks. Once the

cars begin to behave intelligently in their own right, then a person can negotiate with other cars and ensure pushover to their destination in the most efficient way possible. The idea, according to Lars Hesselgren, in a sense is his response to the excessive dependence and heavy push for multi-modal transport in the urbanized world.

CarTube allows for direct travel without interchanging, i.e. the stop-start model of the current transportation system in the idea of CarTube is being replaced with a fluid integrated network. In existing cities, CarTube would be established through a network of cost-effective small-bore tunnels which would manumit city roadways from traffic stress for new public realm and development. These high-speed moving car traffic below ground will help in revolutionizing our concept of the city planning and development, urban living, and allow scarce urban spaces to be judiciously designed for the people in more efficient and sustainable manner.

2. SALIENT FEATURES

- i. **Journey Time:** The system of CarTube integrates easily with the existing motorways and can be achieved with today's technology. The primary network of CarTube, controlled by the system, would flow at a steady speed of 50 mph which will not only modernize the urban transportation system but will reduce urban travel time by 75%, for that reason CarTube is considered next best to teleportation.
- ii. **Cost:** According to PLP's research, CarTube will typically double the transport capacity for the same cost as conventional mass transport. It is estimated that CarTube will cost a fraction of conventional mass transport systems, due to the proposed infrastructure of the network, as well as the size of the tunnels. The diameter of a CarTube tunnel would not be large but like some of the typical tunnels of today. For this reason, there is a need of ventilation for the people, however, as the cars will run on electricity problem of emissions would not arise. Additionally, CarTube stations would be more compact than conventional stations as there are no escalators, pedestrian tunnels, staff, and crucially, no interchange system warranted, as the cars can always travel directly to the requested destination.
- iii. **Dynamic Pricing:** The CarTube could be run on a dynamic pricing model, i.e. allowing fees charged to flexible, according to the evolving needs of a city. This could include varied tariffs depending on the time of travel, or reduced fares for cars carrying a minimum number of three passengers. Users could, for example, be able to book a CarTube trip through their smartphones using either their own cars or public cars. The CarTube app will calculate a fare and an estimated arrival time based on an optimal route through the network.
- iv. **Environmental friendly:** an Entire system of CarTube can work on renewable energy system. A maximum of 10-15 batteries is sufficient for urban vehicles which would weigh even less than the riders. Light batteries can be swapped robotically, reducing anxiety range. These battery banks can be recharged easily using the wind or solar energy. Thus, this technology has zero or minimum emissions with the minimalistic use of fossil fuels, curbing the pollution in a much effective way. The concept is demonstrably sustainable and eco-friendly in nature.
- v. **Timeframe:** The technology to support the implementation of CarTube exists; therefore, practical work on the idea could be realized relatively on a fast-track basis.
 - a. According to Lars Hesselgren, CarTube, if worked out expeditiously could be implemented in less than a decade.
- vi. **Integration with mass transit system;** Since our megacities are bustling at the seam and are in great need to streamline the transportation infrastructure. The inorganic and haphazard growth of our cities and current scenario present a dismal picture with problems aggravating with each passing day. Existing physical condition and morphology of our cities is posing serious challenges in integration of various modes of transport. Government is also committed to transforming most of the megacities into smart cities through smart city mission where mobility is one of the key components. Therefore due to inherent potential of integration of mass transit with car tube, it is expected to provide a solution to the most vexing problems transportation sector and hold great promise for finding a way forward in the transportation sector of cities.
- vii. **Solution to unidirectional movements;** In most of the megacities because of unidirectional movement of people, either from work to home or vice versa, peak hour jams are a regular feature of city traffic. Since CarTube provides the unidirectional mobility, it can be of great help to mitigate the peak hour jams and save large working hours which are otherwise lost in mobility with positive implication on the urban economy.

3. LIMITATIONS

- i. **Lane changing:** In CarTube, there is no concept of lane changing. Lane changing, which otherwise helps in avoiding traffic mess and easy turns at intersections and junctions. In CarTube, a car must remain at its own position and thus, can neither change lanes nor can overtake as such is most suited for unidirectional destination-oriented travels like the workplace to home or vice versa etc.
- ii. **New skills:** Not only the operators but also people would need to learn the latest technology just for the sake of traveling which is not possible for everyone. Thus, would require gestation period to familiarize with the system.
- iii. **Cost issues:** Since the cars in CarTube are only electrically automated, there would be a requirement of the huge amount of money either for retrofitting of the existing cars or for the purchase of new cars, which is no profitable proposition in comparison to the cheaper cost of manually driven cars.
- iv. **Emergency exit:** There is no such parameter which talks about the emergency exit in the mid-way of CarTube especially in case of an emergency like an accident, health concern, etc.
- v. **Underground tunnels:** Construction of bore-tunnels underground is not as easy as it seems to be. The presence of gas pipelines, water pipelines and the sewers below the ground can hinder the tunnel boring. Thus, becoming an obstacle to the construction of the basic infrastructure required for the CarTube.
- vi. **Bizarre concept:** Some of the experts also commented on CarTube concept to be the most bizarre concept because CarTube is exclusively for the cars and no other vehicle which would make a costlier concept.
- vii. **Commercial and economic disadvantage:** Even if CarTube has environmental advantages, this concept for commercial use would not go a long way. At a commercial scale, use of CarTube for any individual will be much expensive than his normal vehicle or prevailing public transportation system because of CarTube being such a ideated concept. And maybe the basic

construction of bore tunnels requires less amount of money when compared to the convenient transportation system but the additional cost of the electric vehicles, the battery banks, the charging points, the far system cannot be ruled out. Experts also express their reservations that for transportation going underground would prove to be much expensive. Even with technologies like automated cars and platooning, life cycle cost of a system like this will be much higher than the conventional system of transportation at grade per passenger per km.

- viii. **Potential-less idea:** The idea of CarTube shows no potential that free market fundamentalists anchor in the real business potential for realizing what will, in fact, work and sustain.
- ix. **Unemployment:** The concept of CarTube is about the automated vehicles which means the taxis and other cars which are driven manually will not be in use as much as they are right now. This would create cease livelihood opportunities for a cross-section of skilled and semi-skilled manpower, is a very serious concern associated with it.
- x. **Land use pattern;** Existing land pattern of most of the cities in our country is going to pose a daunting task for extension of CarTube facilities especially in historically congested cores and haphazardly grown area inhabiting the majority of city population who generate maximum trips each day.
- xi. **Mixed Development;** Most of the cities have developed over the years saving a comprehensive land use policy with poor enforcement existing urban laws and regulation which have in the process bestowed most of the cities a mixed land use character with serious impact on the pattern of mobility and trips. Wherever mixed development pattern is predominant, the unidirectional movement would be a common feature which might affect the success of the car tube in those cities.
- xii. **Standards of living and income differentials;** Most of the megacities inhabit in juxtaposition both areas of rich and poor/under a privileged extension of car tube facility and its operational success locational connectivity would prove a major factor and deprive many areas of such facility.

Being more practical about the idea of CarTube; socially, economically and virtually, no shift from other modes can be expected for realistic and better returns on investment. The concept of CarTube demonstrates the ultimate intention of state monopolism and socialism to destroy the individual and lose him/her in the crowds of the desperate. Despite its advantages and disadvantages, there is no harm in implementing and trying it in the form of a pilot project to have a realistic assessment of benefits likely to accrue or hypothetical losses to be incurred for making the fairer decision ultimately.