

# TO STUDY OF INTELLIGENT HIGHWAY SYSTEM

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**Abstract:** Highway construction is an important part of infrastructural development of any zone and the highway construction process is carried out in a number of ways these days. Automated Highway System, abbreviated as AHS is a newly developed idea which uses different sensors and microprocessors for automatic design process. The management and control of traffic system using roadside controllers and intelligent vehicles is an innovative technique for the design of highway system. The Automated Highway System is the design concept introduced to enhance safety, efficiency and many other vehicular as well as user characteristics of highways. This concept has been introduced for the improved architectural layout of highway design and also helped in reducing the environmental effects of the vehicles running on the highways.

**Keywords-** Highway, management, network, techniques, road automatic system

**Introduction--**AHS, Automated highway system is a long term transportation system designed with future goals and numerous future benefits. AHS technology derives a new relationship between the transportation mediums and road networks. It is a driverless technique which uses an automatic control system for operation of vehicles. Different techniques related with computing ideas, microelectronics, various sensors and advanced civil engineering techniques are used for design of an automated highway system. The major components of any mechanically operated vehicles i.e. throttle, steering and braking are automatically operated in an automated highway system. The major requirement of any traffic facilities such as coordinated movement of vehicles, removal of obstacles, improved traffic system and safety are easily provided by an automated highway system. The newly introduced intelligence techniques are highly used for connecting highway system and vehicles running on those road networks. The use of this scientific system is controlled by mechanical systems and radio controls. The increment in capacity of vehicles running on the road with a fully controlled traffic system is a basic concept used for design of an automated highway system. With comparison to behavior of human drivers, the innovative concept of an automated highway system has played a crucial role in management of transportation network in developed cities.

## 2. Goals of Automated Highway System

The Automated highway system has been implemented in many cities and has now become an important technique for management of traffic network. The various goals for introduction of this technique in highway design are briefly described here:

- Improvement of safety and reduction on accidents which causes serious health fatalities, personal incidents, stresses on driving and other sufferings.
- Economical advantage by reduction on investments, protection of money, increased efficiency and proper architectural layout of highway systems.
- Provision of economical equipment, vehicles, low operation and maintenance cost as well as reduced fee for the users of road network.   Environmental conservation by proper consumption on non-renewable energy sources such as fuels as well as reduction on labor, insurance costs
- Optimum design of the road network as well as vehicles which helps by reducing cost of construction and providing maximum benefits.
- Provision of high revenue collection after stating of automated vehicles, increment on the customer numbers, less prone to accidents and highly developed security system for users.
- Vehicles using alternative energy sources which can be operated using electricity can be used on automated highway systems.
- Provision of job opportunities from public level to military level can strongly help in development of national economy.

### **3. Different types of lane systems on automated highways:**

The automated highway system uses three different types of road network on basis of number of lanes on the road. They are listed below:

#### **3.1. Single lane highway:**

This type of highway consists of automatically operated single lane and there is control on longitudinal velocity of traffic.

#### **3.2. Discrete lane highway:**

This type of road network consists of discrete number of automated lanes and there is control of longitudinal velocities which is in proportion with number of change in lanes.

#### **3.3. Discrete lane highway with multiple destinations:**

This type of road networks also contain a number of discrete lanes but final destination of vehicles decides the control over the lanes.

**4. Methodology-** A driver electing to use such an automated highway might first pass through a validation lane, in the same way today's high-occupancy-vehicle (HOV) or carpooling lanes. The system would then judge if the car will respond correctly in an automated mode, establish its destination, and deduct any tolls from the driver's credit account. Improperly operating vehicles would be diverted to manual lanes. The driver would then handle into a new area, and the car would be guided through a gate onto an automated lane. An automatic control system would guide the movement of newly placing and existing traffic. Once moving in automated mode, the driver could soothe until the turnoff. The reverse process would take the vehicle off the highway. At that point, the system would need to action whether the driver could retake control, then take proper action if the driver were asleep, sick, or even dead. The alternative to this kind of set lane system is a mixed traffic system, in which automated and non-automated vehicles would be diverted the roadway. This response requires more-extensive refurbished to the highway infrastructure, but would provide the biggest payoff in terms of capacity addition. In fact, a spectrum of approaches can be highlight for highway automation systems in which the degree of each vehicle's autonomy changes. On one end of the extent would be fully independent or "free-agent" vehicles with their own proximity sensors that would enable vehicles to stop safely even if the vehicle ahead were to apply the brakes suddenly. In the middle would be vehicles that could adapt to different levels of cooperation with other vehicles. At the other end would be systems that depend on a lesser or greater degree on the highway infrastructure for automated support. In general, however, most of the technology would be added in the car.

### **5. Social and institutional challenges for automated highway systems**

The development and establishment of new technologies and innovations always create some tensions on social level. Let us take example: These days talking on phone during driving is banned because of safety provisions which may cause problems during the driving of vehicles. In the same way Automated Highway System also has a number of social and institutional challenges and some of them are discussed below:

#### **5.1. Unclear Social and Environmental Impacts**

On the basis of various studies done by researchers and professionals on field of transportation system, the effects of automated highway system on social and environmental level are murky yet. Some considerable disagreement regarding these topics are discussed below:

**5.1.1. Congestion at Entry and Exit** With the application of automated highway systems, there occurs more of vehicles in the entry and exit points. This might create problem in maintaining the proper traffic system on highways. There may occur problem at intersections and lane changing points.

#### **5.1.3. Unclear Impact on Land Use and Environment**

The automated highway system allows high speed for the vehicles and due to this reason the highway lanes constructed are for freeways. Freeways are usually constructed far away from residential areas which may cause a little inconvenience to users. Hence there are issues regarding land use patterns and development whenever the automated highway system is introduced. The impacts due to vibration of vehicles as well as impacts on air quality by vehicles are serious environmental issues caused by Automated Highway System.

**5.1.2. Safety** The vehicles operated on Automated Highway System don't use any drivers for driving and vehicles are operated automatically. If any mechanical problems occur on vehicles like braking failure and steering system, there may occur chain reaction accident and its effect on human loss as well as economic loss will be unpredictable. So as matter of safety the automated highway system becomes more unpredictable sometimes.

### **5.2. The Dilemma of Transition From Conventional Highway to Automated Highway**

There has occurred a number of disputes regarding comparison between the conventional highway systems and automated highway systems. The main issues for the creation of dilemma on choosing between these two highway systems are:  Cost of construction of automated highway system on comparison to conventional highway is more and difficult also.  Highly skilled manpower as well as professionals are required for design and construction of automated highway systems.  Lack of investors for construction of automated highway system  Vehicles used on automated highway system should be designed differently and are automatically operated.

**6. Potential Benefits** Many professionals and researchers are working on the evaluation of benefits of automated highway system and they have derived a number of benefits from their studies and research works. The different benefits that are considered to play vital for users, environment as well as government are discussed below:

**6.1. Roadway capacity:** By using automated highway system, more number of vehicles can be run and used on highway. On the basis of various studies it has been estimated as 2 to 3 times more vehicles can be used on this highway system which eventually helps in lane changing and merging operation of vehicles.

**6.2. Safety:** The driving safety can be improved highly by use of automated highway system. Human errors can be reduced to a high degree by use of this concept. It is estimated that 50% more improvement can be witnessed in traffic system with help of automated highway system.

**6.3. Less impact of Weather and environmental effects:** The effects due to change on environmental and weather factors such as extreme sunlight, heavy rainfall, haze, darkness, high wind speed, snowfall, etc. have zero impacts on the driving of vehicles and operation of automatic highway system.

**6.4. Energy Conservation:** The use of automated highway systems has really good impacts on environment and helps a lot in environmental conservation. The use of non-renewable energy sources like fuels, oils is reduced and hence it helps in conservation of energy sources. The use of alternative energy sources such as hydropower, electricity, etc. is more preferred during operation of vehicles on automated highway system.

**6.5. Land Use:** The concept of automated highway system has also introduced the efficient use of land resources. It helps in optimum utilization of land which reduces over consumption of agricultural land and areas of cultural importance.

**6.6. Commercial and Economic gain:** The economy of the society as well as country can be increased with use of newly developed idea of automated highway system. The collection of revenues and fees from the customers help in increasing the economic growth and also help in commercial development of that area.

## 7. Conclusion

Automated Highway Systems bring major transportation benefits in terms of safety, efficiency, affordability and usability, and environment in order to achieve its development goals. A key feature of the control design architecture is the separation of the various control functions into distinct layers with well-defined interfaces. Each layer is then designed with its own model that is suited to the functions for which it is responsible. The models at the various layers are different not only in terms of their formal structure (ranging from differential equations to state machines to static graphs), but also in the entities that have a role in them. The AHS is a complex large-scale control system, whose design required advances in sensor, actuator, and communication technologies (not discussed here) and in techniques of control system synthesis and analysis. It is a measure of the advanced state of the art that these techniques have reached a stage that they could be successfully used in the AHS project. Though it has been said so, the reasons why many federal programs like the National Automated Highway System Research Program (NAHSRP) failed was that the program was trapped in technology optimism. Several U.S. DOT reports on AHS show that there are no technical and non-technical showstoppers. However, legal, institutional, and societal challenges just as critical as technical issues. Moreover, these institutional and societal issues cannot be settled in one day, because they are much to do with people's perception, behavior, consensus and social changes based on those. Without the advantage of increased throughput through platooning, the only advantage of using automation in mixed traffic is improved safety.

## 7. Reference

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