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FACT SHEET

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Human Factors Design Of Automated Highway Systems: Scenario Definition

Attention to driver acceptance and performance issues during system design will be key to the success of the Automated Highway System (AHS). A first step in the process of defining driver roles and driver–system interface requirements of AHS is the definition of system visions and operational scenarios.
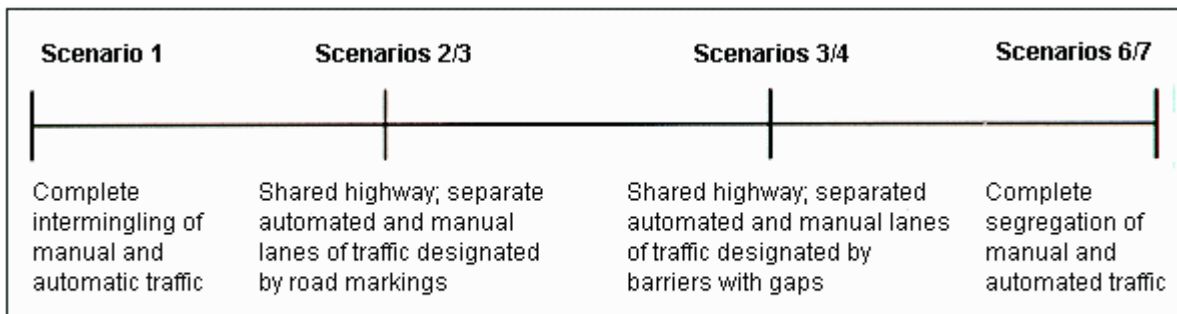
Seven operational AHS scenarios were defined, six of which were differentiated by varying three key dimensions: (1) degree to which automated and manual traffic is separated; (2) degree to which automated lanes are separated from one another; and (3) vehicle–following rules (e.g., groups versus individual vehicles). The first scenario (free agent/self–contained) describes a transitional AHS vision representing an intermediate stage of complexity and technology between current highway practices and full automation scenarios. The scenarios are:

1. Free agent/self–contained.
2. No barriers on the highway with individual vehicles.
3. No barriers on the highway with grouped vehicles.
4. Barriers on the highway with individual vehicles.
5. Barriers on the highway with grouped vehicles.
6. Segregated highway with individual vehicles.
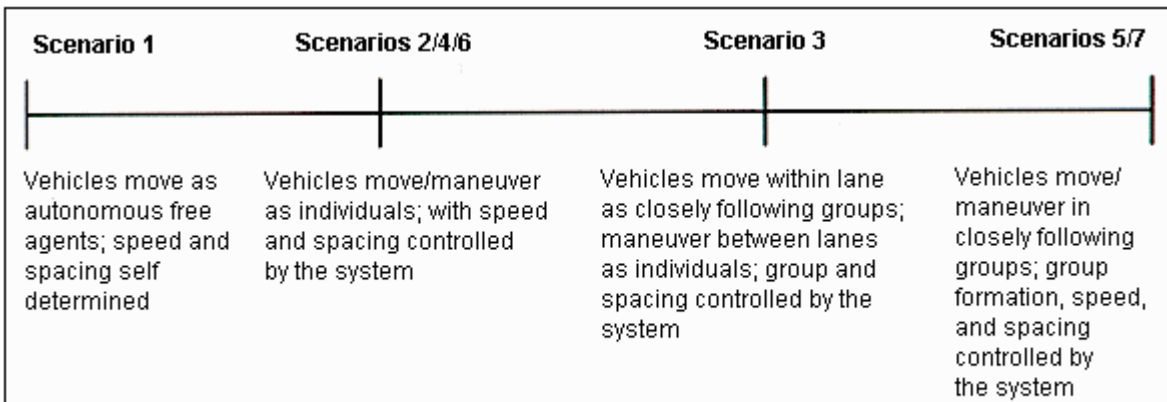7. Segregated highway with grouped vehicles.

The seven scenarios vary in the complexity of the automated and manual maneuvers required, the physical space allowed for maneuvers, and the nature of the resulting demands on the driver.

Figures 1 through 3 depict each scenario's relative position on the three key dimensions. Based on these dimensions, three scenarios were selected for further study. *Free agent/self–contained* was selected since it represents a partial automation scenario. *Barriers on the highway with grouped vehicles* was included because it is the most complicated scenario and includes a shared highway, barriers, and maneuvers that must be performed by vehicle groups. Finally, the *segregated highway with individual vehicles* was selected since it would be the least complex full automation scenario.
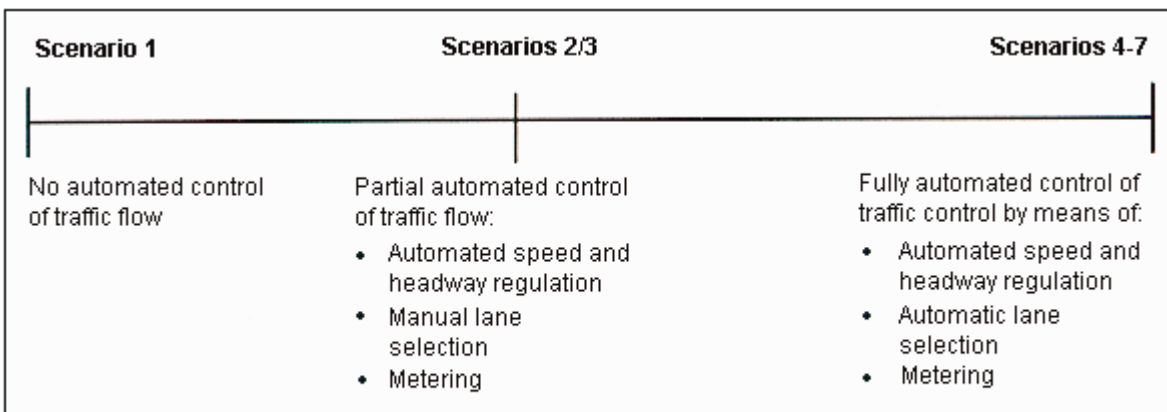
These scenarios became the basis for a series of analytical studies and provided a framework to systematically explore impacts on driver behavior. Many of the variables identified via the scenario development process have become candidates for experimental research in this program.

Figure 1. Placement of AHS operational scenarios along the dimension of roadway separation.

Scenario 1	Scenarios 2/3	Scenarios 3/4	Scenarios 6/7
Complete intermingling of manual and automatic traffic	Shared highway; separate automated and manual lanes of traffic designated by road markings	Shared highway; separated automated and manual lanes of traffic designated by barriers with gaps	Complete segregation of manual and automated traffic

Figure 2. Placement of AHS operational scenarios along the dimension of vehicle control rules.

Scenario 1	Scenarios 2/4/6	Scenario 3	Scenarios 5/7
Vehicles move as autonomous free agents; speed and spacing self determined	Vehicles move/maneuver as individuals; with speed and spacing controlled by the system	Vehicles move within lane as closely following groups; maneuver between lanes as individuals; group and spacing controlled by the system	Vehicles move/ maneuver in closely following groups; group formation, speed, and spacing controlled by the system

Figure 3. Placement of AHS scenarios along the dimension of control of traffic flow.

Scenario 1	Scenarios 2/3	Scenarios 4-7
No automated control of traffic flow	Partial automated control of traffic flow: • Automated speed and headway regulation • Manual lane selection • Metering	Fully automated control of traffic control by means of: • Automated speed and headway regulation • Automatic lane selection • Metering

For More Information

Topics: research, safety, human factors
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