



AERIS | Applications for the Environment: Real-time Information Synthesis

What Are Transformative Concepts?

TRANSFORMATIVE CONCEPTS are integrated operational concepts that use vehicle-to-vehicle (V2V) and/or vehicle-to-infrastructure (V2I) data and communications in innovative ways to operate surface transportation networks to reduce environmental impacts resulting from transportation-related emissions and fuel consumption.

Transformative Concepts are intended to change the way transportation systems operate, with an emphasis on combining applications to provide significant environmental benefits to surface transportation networks. Transformative Concepts also consider regulatory/policy and educational tools.



Transformative Concepts

Fact Sheet

*Intelligent Transportation
System Joint Program Office
(ITS JPO)*

Eco-Signal Operations

This Transformative Concept includes the use of Connected Vehicle technologies to decrease greenhouse gases (GHGs) and criteria air pollutant emissions on arterials by reducing idling, reducing the number of stops, reducing unnecessary accelerations and decelerations, and improving traffic flow at signalized intersections. A foundational component of this concept utilizes Dedicated Short Range Communication (DSRC) wireless data communications among enabled vehicles and roadside infrastructure. This includes broadcasting signal phase and timing (SPaT) data to vehicles. Upon receiving this information, in-vehicle systems calculate and provide speed advice to the driver of the vehicle, allowing the driver to adapt the vehicle's speed to pass the next signal on green or to decelerate to a stop in the most eco-friendly manner. This is referred to as an eco-driving information application. Eco-driving assistance applications can also be more active, connected with vehicle systems to implement eco-driving tactics without distracting the driver. This Transformative Concept also considers eco traffic signal system applications. These applications would use real-time data collected from vehicles to optimize traffic signals for the environment. Transit Signal Priority (TSP) is also considered as part of this Transformative Concept.

Low-Emissions Zone

This Transformative Concept includes a geographically defined area (i.e., cordon) which seeks to restrict or deter access by specific polluting vehicles within the zone, for the purpose of improving the air quality within the geographic area. Connected Vehicle technology would be leveraged to determine fees for vehicles entering the low-emissions zone. The fee for entering the low-emissions zone would be based on the vehicle's engine emissions standard or historical emissions data collected directly from the vehicle using V2I communications. This Transformative Concept would also encourage eco-driving inside the low-emissions zone. Once inside the low emissions zone, if real-time data from the vehicle shows that it is being driven in a manner that reduces emissions (i.e., practicing eco-driving tactics), the driver would be given an economic reward. Connected eco-driving—from the previous Transformative Concept—may also be implemented within the low-emissions zone to encourage eco-friendly driving. Transit vehicles would be able to enter the low-emissions zone without paying a fee, encouraging commuters to use public transportation.

Eco-Lanes

This Transformative Concept includes dedicated eco-lanes on freeways that are optimized for the environment. Drivers would be able to opt-in to these dedicated lanes to take advantage of eco-friendly applications. Low emission, high occupancy, freight, transit, and alternative fuel vehicles would be encouraged to use these lanes. Once in the eco-lanes, drivers would be provided with recommended or variable speeds optimized for the environment. Vehicles would be encouraged to drive at these speeds to improve throughput and reduce transportation-related emissions.

This Transformative Concept also considers eco-adaptive cruise control applications for the eco-lanes. These systems would automatically adjust a vehicle's speed targeted at fuel-consumption reduction. Eco-adaptive cruise control applications consider topography, roadway geometry, and vehicle interactions to determine a driving speed for a given vehicle that uses the momentum of the vehicle, when suitable, to avoid unnecessary accelerations and reduce emissions.

Eco-Integrated Corridor Management (E-ICM)

This Transformative Concept includes the integrated operation of a major travel corridor to reduce transportation-related emissions on arterials and freeways. It includes the partnering of various surface transportation modes—such as highway agencies, transit agencies, commuter rail agencies—to treat a major travel corridor as an integrated asset coordinating their operations simultaneously, with a focus on reducing transportation related emissions. At the heart of this Transformative Concept is a real-time data fusion and decision support system. It involves using multi-source, real-time V2I data on arterials, freeways, and transit systems to determine the best operational decisions that are environmentally beneficial to the corridor.

This Transformative Concept includes a combination of multi-modal applications defined in the other Transformative Concepts that together provide an overall environmental benefit to the corridor. It is expected that this Transformative Concept will be further defined after analysis of the other Transformative Concepts is completed.

Eco-Traveler Information

The AERIS Program seeks to enable the development of new, advanced traveler information applications through the provision of integrated, multi-source, multi-modal data. Although specific traveler information applications may not be directly developed by the AERIS Program, an open data / open source approach is intended to engage researchers and the private sector to spur innovation. Applications considered under this Transformative Concept include:

- Dynamic Eco-Routing – applications targeted at providing drivers with a recommended travel route that would be determined based on reducing emissions instead of reducing travel time.
- Multimodal Real-Time Traveler Information – applications that convey real-time pre-trip and en-route information to encourage greener transportation choices.
- Smart Parking – applications targeted at providing real-time parking information to reduce time searching for a parking space.

Support Alternative Fuel Vehicle Operations

This Transformative Concept supports operations of alternative fuel vehicles (AFV) — vehicles that run on a fuel other than "traditional" petroleum fuels, including vehicles whose engines do not solely use petroleum (e.g. electric cars and hybrid electric vehicles). Potential strategies include: (1) disseminating information on the locations and availability of charging/refueling stations, (2) applications targeted at engine performance optimization, (3) inductive charging, and (4) smart parking systems whereby AFVs would have prioritized parking.

For more information, visit <http://www.its.dot.gov/aeris/index.htm>

