The New Planner — Spring 2010

Dual Mode Transportation: A Revolution in Motion

By Andrew Andrusko

Like something out of a science fiction movie, a once-futuristic concept for public transportation is attracting renewed attention from planners, engineers, and public officials.

Changes in energy technologies have once again sparked an interest in dual mode transportation, a concept that until recently was thought implausible. The dual mode concept offers a number of benefits, including energy efficiency, safety, and reduced air pollution. It essentially combines the advantages of railroad and automotive technologies, drawing on the best features of each to create a hybrid system.

What Is Dual Mode Transportation?

As any inventor will tell you, innovation often comes from the leftover bare bones of past ideas, and this is certainly true of the dual mode transportation concept.

In the late 1970s, responding to environmental and energy concerns, transportation planners began considering the idea of using adapted electric trains on tracks to provide rapid personal transit. But what would become of the billions of dollars in pavement investment? And where would the funding come from to replace roads and lay the amount of track needed? These were the problems that sparked the idea of dual mode transportation.

As originally envisioned, dual mode transportation is a system in which a person could operate a vehicle adapted to function in manual mode for short distances and then hook up to an automatic guideway for long distances. The idea has evolved to include entire specially designed vehicle systems. These systems would avoid the need to adapt nearly all local roads to railroad track and would allow for adaptation of electric operation in road-based vehicles. The idea is that people could drive long distances via an adapted interstate guideway system or commute locally on manual electric power only.

Why Now?

Combining the dual mode transportation concept with developing green technologies like the Vehicle to Grid (V2G) technology creates many possibilities.

For example, a V2G program recently unveiled by Pacific Gas and Electric Company and Tesla Motors would allow electric vehicles to link into the power grid, creating a highly efficient electric system. The high level of energy efficiency would be derived from the system's ability to act as a giant interconnected battery. It would assist the power grid by drawing power from the vehicle during peak usage and then charging the vehicle during periods of low usage. The system could also perform regulation, or the function of equalizing and tuning power supply and demand. This type of integrated transit system might use similar amounts of power as the current web of light rail transit systems.

A number of green concepts like this streetlight from T.A.K. studio can provide additional sources of power for transportation systems like dual mode. Photo courtesy of T.A.K. studio.

Case Studies and Prototypes

The dual mode transportation concept is not new; it has been studied and redeveloped many times over. While no actual full-form systems have been implemented, case studies have been performed to weigh the benefits and costs, and a number of prototypes have been built.

Back in 1976, the National Academy of Sciences & Engineering Highway Research Board reported on case studies of dual mode transportation use in Milwaukee, Wisconsin, and Orange County, California. Planners developed a theoretical model using ideas from General Motors and Rohr. The range of systems included ideas that were adaptations for use by conventional automobiles. These were not strictly based on electric operation, as the technology had not developed far enough and was too costly to be used across the board.

The studies determined that these theoretical systems could provide similar levels of service and

In the end, the 1976 case studies found that no one solution was viable at the time for one big reason: lack of public acceptance. The evaluators predicted that 90 percent of users would operate only in manual mode and avoid the guideways, thus negating the beneficial reduction in demand and energy consumption that long-distance guideway travel could provide.

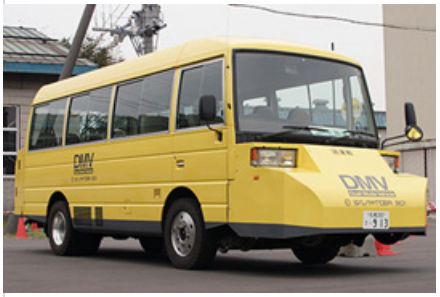
Jump ahead 30 years and consider the Danish prototype, the **rapid urban flexible (RUF) system**. The Engineering College of Copenhagen has undertaken the challenge of producing a working prototype of this system. The prototype has been successfully tested in manual operation and has run on a small test guideway. Relying only on a conventional electric drive and low-friction undercarriage wheels, it can travel seamlessly on the patented rail track. The goals of the RUF system are to reduce traffic congestion, improve air quality, reduce emissions, and increase economic efficiency in comparison with conventional highways.

Conceptual drawing RUF model in action during a test at the Copenhagen University-College of Engineering. Photo courtesy of **RUF International**.

Prototype RUF model in action during a test at the Copenhagen University-College of Engineering. Photo courtesy of **RUF International**.

Another working prototype called the dual mode vehicle, or DMV, may be the first practical example of dual mode transportation. The DMV system has been developed through a partnership between Kawasaki Heavy Industries/Nichijo Co. for the Japan Rails Hokkaido Railway Company in Japan. The idea is based on a real-world adaptation of a hybrid-style train car that lowers onto the railway from road operation. The intent is to respond to declines in train ridership by reducing costs while maintaining similar levels of service and allowing greater levels of accessibility and mobility.

The original DMV prototype was diesel-powered, seated 25 passengers, and could transfer from road to rail in 10 seconds. It was tested on the Gakunan railway and on a city street in Fuji in early 2007 and was later implemented temporarily along the scenic Senmo Line, where it was used primarily by tourists. Testing operations were subsequently replaced and DMVs were serviced from another partnership between Toyota and Hino Motors once Japan Rails Company negotiated new contracts to speed up development and production. Though it only operated for a few months, the system gained considerable attention and was featured on the websites of *Time*, *BusinessWeek*, and *Wired*.



Dual Mode Vehicle – Salamander model. Photo courtesy of **train.sakura.ne.jp**.

Another important related concept — automated-unmanned operation or automated assisted operation — was tested by a partnership through Doppelmayr and the Fraunhofer Institute for Transportation and Infrastructure Systems in their AutoTram prototype. This vehicle is similar to a streetcar that is modular and can operate as a road train. Its main advantage is that it works in an energy-efficient manner without emissions, using a hybrid flywheel system with electric fuel cells. A similar prototype called the Z Capsule has been developed by Toyota, which subsequently coined the term Intelligent Multimode Transport Systems to describe this type of system.

This AutoTram prototype has the same capacity as a large trolley car. Photo courtesy of the Fraunhofer Institute for Transportation and Infrastructure Systems in Dresden.

The current focus on the part of planners has been on how to estimate the actual real-world costs of these systems. The downsides of these first prototypes include the difficulty of quantifying actual implementation costs and carrying capacities. Another potential drawback: Without proper planning, these systems could be just as unsightly as conventional highways.

The Message for Planners

Planners should keep an open mind about dual mode transportation. Acting ethically requires planners to consider all possible alternatives for providing necessary services, and dual mode transportation is one such alternative. It has the potential to provide greater accessibility and mobility — often said to be the key to the well being of cities. Dual mode transportation is an excellent channel for interdisciplinary cooperation. It offers planners the opportunity to work strategically with engineers and inventors to harness developing technologies.

In today's age of technology, planners are in danger of being left behind as the number of innovations in green technology surpasses our ability to evaluate and incorporate them. Many different futuristic transportation concepts have been formulated to address the need for alternatives to fossil fuels. So far, the dual mode concept shows the most promise as an all-encompassing approach to reducing carbon emissions, traffic congestion, and accidents.

If the invention of the automobile or the train is any example, it is a long road from prototype to general acceptance and implementation. Don't expect a science fiction-style automated revolution anytime soon. For now, pause and give serious reflection to the possibilities that dual mode transportation could offer. The future of transportation will certainly depend on the resourceful human spirit to adapt and overcome challenges.

References

Azcarate, Lara, and Francisco Javier. 2007. "Dual-Mode Transportation: Impact on the Electric Grid." Texas A&M University. December.

CEETI. 2006. "TxDOT Awards Contract to CEETI for Study of Dual Mode Automated Transportation." **www.ceeti.org/**

Kocur, George, Earl Ruiter, and Darwin Stuart. 1977. "Dual Mode Planning Case Study – Milwaukee." UMTA.

Lew, Alexander. 2008. "It's a Bus. It's a Train. It's Both!" Wired.com. May 27. **www.wired.com/autopia/2008/05/half-bus-half-t/**

News Release. 2007. "PG&E and Tesla Motors Co-Pilot Vehicle-to-Grid Research." September 12. Pacific Gas and Electric Company. **www.pge.com/about/news/mediarelations/newsreleases/q3_2007/070912.shtml**

Time.com. 2007. "Rubber Meets the Rail." The Best Inventions of 2007: Cars & Buses. **www.time.com/time/specials/2007/article/0,28804,1677329_1677971_1677988,00.html**

Transportation Research Board, Commission on Sociotechnical Systems. 1976. "Dual Mode Transportation," in National Research Council, Washington D.C.

Walton, Marsha. 2001. "Future of vehicle transportation could be 'RUF.'" CNN.com. **http://archives.cnn.com/2001/TECH/science/03/09/ruf.car/index.html**

Zeitvogel, Karin. 2010. "New Electric Car Pays for Itself." **http://news.discovery.com/tech/scion-electric-car-power-grid.html**

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