Petroleum Prices and Transportation Engineering

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The recent increase in global petroleum prices marks a major turning point in the modern history of transportation. The U.S. price of regular gasoline has increased 100% from June 2004 to June 2008, reaching nearly $4/gallon (Energy Information Agency 2008). In June 2008, the price of a barrel of crude oil exceeded US$120 (€77). The petroleum price increase was particularly noticeable in the United States, where it coincided with a fall in the value of the dollar on international monetary exchange markets, but the increase was certainly a global phenomenon.

There have been other temporary surges in the price of petroleum, notably the increase associated with the Organization of the Petroleum Exporting Countries (OPEC) oil embargo in the early 1970s. It could be that the recent surge in petroleum prices is due in part to speculative trading on the future price of oil, and the petroleum price could drop in the near term. However, increasing worldwide vehicle ownership and travel has led to surging demand for petroleum. World consumption of crude oil has now reached 1000 barrels per second (Tertzakian 2006). At the same time, new supplies of petroleum are both smaller than past discoveries and require more resources to extract. As a result, the increase in petroleum prices seems to be a long lasting phenomenon. Similar price increases have affected other supplies of energy, such as coal and natural gas. After decades of low energy costs, we face an era of much higher energy expenses.

Reactions to the higher price of petroleum are already being seen in the marketplace. In the United States, vehicle purchases are shifting to smaller and more fuel-efficient vehicles. Vehicle miles of travel are expected to drop in the United States in 2008. Airlines throughout the world are raising fares to compensate for higher fuel prices. International freight tariffs are experiencing similar increases.

The increased price of petroleum and the resulting transport changes have at least one silver lining: they will likely reduce the emission of greenhouse gases responsible for global climate change. Even without higher petroleum prices, there are new proposals for charges and restrictions on carbon emissions. Fig. 1 shows the equivalent fuel economy of the European Union and California Carbon Dioxide emission standards for passenger vehicles, where the carbon emission standard is converted into required fuel efficiency. In both cases, the carbon emission standard represents better fuel economy than the widely discussed new Corporate Average Fuel Economy Standards in the United States. Both carbon emission restrictions and the higher costs of fuel consumption motivate both more efficient vehicles and non-petroleum-based alternative fuels.

What does this historic turning point in transportation mean for the field of transportation engineering and for the Journal of Transportation Engineering in particular? In short, we have work to do. Most of the past practice and research in transportation engineering has assumed reliance on petroleum for transportation fuel with fairly stable or declining petroleum prices. This is no longer a good assumption.

Alternative fuels have significant new infrastructure needs and important implications for vehicle characteristics. For example, electric or hydrogen vehicles will have more limited ranges than conventional vehicles. Fuel efficient vehicles will accelerate slower than conventional vehicles. The vehicle fleet overall will likely become more heterogeneous, so standard traffic flow models should change.

Design standards and funding paradigms should be reexamined. Many parking lots provide different sized spaces for compact and non-compact vehicles. Public streets might also provide heterogeneous spaces, as is done for motorcycles. Separate truck and passenger vehicle roadways might be more desirable in an era dominated by the need for fuel efficiency. Reliance on gasoline taxes for funding transportation facilities would be inequitable and likely insufficient. Design standards intended to aid conventional, sprawling urban development should be reworked to reflect the higher cost of travel. Provision for bicycle travel and walking becomes more important.

New tools available for transportation engineering can be brought into use. Ride sharing is likely to be more attractive with the incentive of greater cost savings, especially if new information technology can help make ride matches. Real time pricing of transportation services using automated systems can be a new source of revenue and a means of making the entire system more efficient.

In short, higher petroleum prices are a major challenge both for society and for the transportation engineering profession. The authors and readers of the Journal of Transportation Engineering should strive to meet this challenge.

Fig. 1. Comparison of three fuel efficiency regulations for passenger cars (Shiau et al. 2008)
References

