Commission Briefing Paper 6B-05

Observations on Scenario 5: Maximum Technology

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Introduction

This paper is part of a series of briefing papers to be prepared for the National Surface Transportation Policy and Revenue Study Commission authorized in Section 1909 of SAFETEA-LU.

Section 1909 requires the final report of the Commission to include an assessment of future needs over 15-, 30-, and 50-year time horizons. A number of alternative scenarios are being developed that make different assumptions about future transportation system emphasis. This paper describes selected observations pertaining to Scenario 5, the “Maximum Technology” scenario.

Background

The purpose of Scenario 5 is to explore the bounds of what new technologies could potentially accomplish in improving the overall performance of the surface transportation system. The scenario was intended to be speculative, and to venture beyond more traditional approaches to solving transportation problems.

One of the more promising long-term strategies that has been discussed in recent years is vehicle infrastructure integration (VII). Substantial work involving both public and private sectors is underway to develop architecture for VII and to work out the roles of various potential partners. VII holds tremendous promise for improving safety and relieving congestion, but the timing of full deployment and what the basket of services ultimately will be offered currently is unclear.

Dealing with technology-focused strategies looking 50 years out is very challenging. Many of the most knowledgeable individuals in regards to these types of technologies are unwilling to speculate about the far distant future, based on the large uncertainties concerning technologies that will be available and the cost of deploying those technologies. In reviewing the research conducted to date on VII, there has been a wide range of assertions made concerning the technology’s ultimate potential. However, information on the cost of implementing an advanced long-term VII program has been elusive; practitioners in this field have been focusing their efforts in the last few years on identifying components of an integrated VII system that could potentially be implemented in the short to medium term, and the cost estimates that are readily available in the literature are associated with these more limited versions of the technology.

In light of the relative dearth of information about the potential gains that could ultimately be achieved through advanced technology, the illustrative approach adopted in this scenario was to assume a uniform increase in the effective capacity per lane of each highway section of 25 percent, phasing in after 2020. No price tag was placed on the implementation of this technology, as it is very unclear what costs would be borne by private vehicle owners (when they make their car purchases) as opposed to the public sector, and to what extent the timing of public sector improvements can be integrated with other highway improvement projects to minimize their incremental costs.

While this scenario is ultimately envisioned to cover a wider array of technologies and other aggressive strategies pertaining to highways, transit, freight rail, passenger rail, and waterways, the results available at this time pertain to highways only, specifically in terms of advanced VII.

Findings and Observations - 2020

The highway findings for the first 15 years are identical to those in Scenario 1, as the analysis assumes the implementation of the strategies included in Scenario 5 would not be implemented until after 2020.

Results pertaining to the Medium funding level are not yet available for any of the time periods covered as part of this analysis.

Findings and Observations - 2035

The analysis indicates that at current sustainable funding levels for highways, the adoption of new technologies resulting in a 25 percent increase in the effective capacity per lane of the highway system would result in a significant reduction in average delay on urban principal arterials in 2035 (from 8.7 to 6.7 hours per 1000 VMT, a 23 percent reduction) relative to the base case (although average delay would still be higher than in 2005 due to VMT growth over the analysis period). This relative improvement in operational performance would be achieved despite a significant reduction in the number of new lanes miles added over the 30-year period (approximately 100,000 new lane miles would be added compared to approximately 128,300 in the base case).

The “high funding level” for highways (an amount sufficient to support all cost-beneficial investments) would be significantly lower under Scenario 5 than in the base case, with an average annual cost of $176 billion (in $2006) over 30-years compared to an average annual cost of $218 billion (in $2006) in the base case. This difference is even more dramatic than it appears, since the scenario assumes that the new technologies (and the resulting cost savings) would not begin until halfway through the 30-year period. This reduced level of investment would achieve a reduction in delay relative to the base case of approximately 20 percent (from 5.2 to 4.1 hours per 1000 VMT on urban principal arterials) yet would require the addition of approximately 109,000 fewer new lane miles over the 30-year period. But again, no costs have been estimated for the advanced VII technology because of the extreme uncertainty about the magnitude of those costs, who would pay them, and how they would be paid.

Findings and Observations - 2055

By 2055, the analysis indicates that at current sustainable funding levels for highways the differences between Scenario 5 and the Base Case would still be pronounced. Average delay on urban principal arterials in 2055 under Scenario 5 would be 24 percent lower than under the base case (8.9 hours per 1000 VMT compared to 11.6 hours). This relative improvement would occur despite the addition of approximately 55,000 fewer lane miles as part of Scenario 5.

The level of cost beneficial investments for highways under Scenario 5 in terms of the “High funding level” would be significantly lower under Scenario 5 than the base case (with an average annual level of $214 billion in 2006 dollars compared to $259 billion in the base case). However, the effectiveness of this investment would be greater, as average delay on urban principal arterials would be 16 percent lower than under the base case (5.5 hours per 1000 VMT compared to 6.5). The number of new lanes miles added under Scenario 5 would be approximately 196,000 lower than in the base case over 50 years.

General Observations

Comparing the results of Scenario 2 and Scenario 5 reveals many similarities. Both approaches would result in significant improvements to operational performance at a lower cost than the base case. In terms of relative effectiveness in reducing delay, Scenario 5 fares better than Scenario 2 in the 2035 time period than in the 2055 period. This finding suggests that rising population and travel volumes would eventually overtake significant technological advances unless technological progress could be sustained or other changes (e.g., travel demand management) could be made to the nature of the system.

Scenario 5 is very speculative by its very nature. In order to achieve the level of relative performance improvements envisioned by this scenario, it would be necessary for significant technological progress to be made over time, supported by an active program of related research. Questions have also been raised whether the increased effective capacities assumed in this scenario would be physically possible when the full operation of the highway system (including traffic interactions at entry and exit points) is taken into account. While the uncertainties regarding the nature of technological advances over 50 years may preclude the adoption of recommendations regarding specific technologies, this scenario does tend to support the notion that policies designed to foster research and innovation may be a critical component of a comprehensive long-term transportation vision.