Commission Briefing Paper 6B-06
Safety Performance of Analysis Scenarios: All Scenarios

Prepared by: Section 1909 Commission Staff
Date: August 4, 2007

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 the safety performance of all the analysis
scenarios, including the base case.

Background

Five analysis scenarios and a base case have been designed thematically to serve several
objectives for the Commissioners. These objectives are:

- To assess the relative performance of different strategies to improve freight movement,
  metropolitan mobility, interregional connectivity, and safety;
- To provide a scale in terms of expected costs, and thus defining "need" linked to a
  particular performance level; and
- To provide a framework for enumerating (and therefore targeting for further analysis and
  discussion) different programmatic, financial, and institutional arrangements that might
  be most appropriate for strategies under each scenario.

Most of the analytical evaluation of the highway and transit modes is being met through two U.S.
Department of Transportation analysis tools: the Highway Economic Requirements System
(HERS) and the Transit Economic Evaluation Model (TERM). These tools have been
extensively developed and tested over the past decade and are used for the biennial Conditions
and Performance Report to Congress. The rail and waterway modes are analyzed and reported
separately from highway and transit modes.

Papers 6B-01 through 6B-05 describe the freight movement, metropolitan mobility, and
interregional connectivity implications of Scenarios 1 through 5 for the highway and transit
modes, as analyzed using HERS and TERM, respectively. Neither HERS nor TERM is
appropriate for analyzing safety benefits of investments targeted to improve travel safety,
however. Accordingly, the safety analysis required for each scenario has been conducted from
outside the HERS and TERM frameworks.

Highway fatalities account for 95 percent of total surface transportation fatalities and are clearly the area of greatest potential progress in surface transportation safety initiatives. This paper explains how the safety analysis was conducted for the highway mode and quantifies the potential benefits to highway safety associated with the analysis scenarios. The effects of scenario strategies on transit safety, along with the safety of the other surface transportation modes, is explained in Paper 6B-07

Methodology

The performance of highway safety programs and projects must be calculated outside of the HERS process. HERS is designed to evaluate capacity and operations enhancement; safety benefits require many more site-specific variables than are available in the Highway Performance Monitoring System (HPMS) data used by HERS.

It is difficult to forecast highway safety performance. To complete this analysis, Commission staff relied on recent efforts by DOT experts to develop forecasts for traffic fatalities. Forecasts are typically provided in terms of fatalities per 100 million vehicle miles traveled (100M VMT). This scenario assumes that the gradual decrease the highway fatality rate that has been experienced in recent years will continue, resulting in a rate of 1.0 per 100 million VMT by 2031 if current funding levels were sustained. The analysis further assumes that the fatality rate could be reduced to "1.0" much sooner (e.g., by 2018 or 2015) with more aggressive funding and enforcement of laws and regulations, implementation of new regulations (whether using incentives or sanctions), reductions of roadway departures, improvements to intersections, etc. For this analysis, fatality rate trends for years prior to 2031 are extrapolated (using an exponential curve) through the year 2055.

The projected fatality rate trends for different safety initiatives were then assigned to the Current, Medium, and High funding levels of each analysis scenario based on the specific assumptions of the scenarios and the "level of effort" implied by the funding levels. The higher the funding level assumed within each scenario, the more aggressive is the assumed mix of safety actions taken under that scenario, and, correspondingly, the greater is the reduction in the fatality rate in future years. It is important to caution, however, that the attainment of aggressive safety objectives described below is not necessarily contingent on the overall funding level assumed for each analysis scenario. In particular, improved safety could be obtained by targeting high funding to the safety strategies of any scenario, even if the freight, mobility, and connectivity objectives of that scenario are not funded in full.

The rest of this paper summarizes the findings for each scenario as well as the Base Case to which the scenarios are compared. Table 1 (at the end of this paper) contains the numerical data addressed in the descriptions. In the discussion in the text, numbers in Table 1 are rounded to the nearest unit of 100.

2

Findings and Observations – Base Case

The Base Case is the benchmark against which the five analysis scenarios are compared. The Base Case represents a continuation of existing programs and policies, without the impacts that would be caused by strategies associated the scenarios. The safety projections of the Base Case are as follows:

- Current Revenue Funding: Attainment of 1.17 fatalities per 100M VMT by the year 2020 (1.0 by 2031), reflecting a continued level of funding and effort under existing safety programs. By 2055, the fatality rate would drop to 0.70 fatalities per 100M VMT if the trend through 2031 were to continue. Note that although the fatality rate drops between 2005 and 2055, total fatalities increase somewhat to 45,900 by 2055 from the actual 2005 level of 43,400 due to the growth of total VMT over the 50-year period. In other words, the fatality rate drops but the VMT exposure increases.

- Medium Funding: Attainment of 1.06 fatalities per 100M VMT by the year 2020, reflecting higher levels of funding and effort in programs directed at alcohol-impaired driving; unbelted drivers/passengers; pedestrian safety; heavy truck safety; motorcyclists; and vehicle technologies. By 2055, the fatality rate would drop to 0.49 fatalities per 100M VMT. This reduction in the fatality rate more than compensates for the growth in VMT over the period, causing fatalities to fall to 36,200 by 2055 from the actual 2005 level of 43,400.

- High Funding: Attainment of 0.99 fatalities per 100M VMT by the year 2020, reflecting the programs under the Medium funding level (see the bullet above) plus higher funding and effort in programs directed at preventing roadway departure and improving intersections. By 2055, the fatality rate would drop to 0.41 fatalities per 100M VMT. Again, the reduction in the fatality rate more than compensates for the growth in VMT over the period, causing fatalities to fall to 32,000 by 2055 from the actual 2005 level of 43,400.

Scenario 1

Scenario 1 is the "Maximum Operations" scenario. Safety projections are based on implementation within this scenario of the "Aggressive Enforcement of Existing Safety Laws and Regulations" strategy. The following outcomes apply to this scenario:

- Current Revenue Funding: Attainment of 1.17 fatalities per 100M VMT by the year 2020 (1.0 by 2031), reflecting a continued level of funding and effort under existing safety programs. By 2055, the fatality rate would drop to 0.70 fatalities per 100M VMT. These assumptions are the same as those used for Current Revenue under the Base Case, since it is assumed that, without additional funding, new safety programs would be difficult to sustain. In this scenario, however, the estimated fatality rates apply to slightly higher VMT numbers than in the Base Case due to higher traffic flows enabled by a small increase in operations strategies. Thus, total fatalities are 46,200 by 2055, compared to 45,900 in 2055 in the Base Case, and higher than the actual 2005 total fatality level of 43,400.

- Medium Funding: Attainment of 0.98 fatalities per 100M VMT by the year 2020, reflecting higher levels of funding and effort in programs directed at alcohol-impaired driving; unbelted drivers/passengers; speeding enforcement; older and younger driver safety; pedestrian safety; heavy truck safety; motorcyclists; and vehicle technologies. By 2055, the fatality rate would drop to 0.37 fatalities per 100M VMT, down from 0.49 in the Base Case. Fatalities would fall to 27,400 by 2055 from the actual 2005 level of 43,400, even though VMT is much higher than in 2005.

- High Funding: Attainment of 0.91 fatalities per 100M VMT by the year 2020, reflecting the safety initiatives described in the previous bullet for the Medium funding level plus higher funding and level of effort in programs directed at reducing roadway departures and making intersections safer. By 2055, the fatality rate would drop to 0.29 fatalities per 100M VMT. Overall fatalities would fall to 23,000 by 2055 from the 2005 level of 43,400.

Scenario 2

Scenario 2 is the "Travel Demand and Energy Efficiency" scenario. Safety projections for this scenario are based on the implementation of the "Aggressive Enforcement of Existing Safety Laws and Regulations" strategy from Scenario 1, along with the effects of reduced overall VMT associated with the pricing and other travel demand management (TDM) strategies assumed for Scenario 2. Together, these assumptions lead to the following outcomes:

- Current Revenue Funding: Attainment of 1.17 fatalities per 100M VMT by the year 2020 (1.0 by 2031), reflecting a continued level of funding and effort under existing safety programs. By 2055, the fatality rate would drop to 0.70 fatalities per 100M VMT. These assumptions are the same as those used for Current Revenue under the Base Case, since it is assumed that, without additional funding, new safety programs would be difficult to sustain. However, the fatality rates apply to lower VMT numbers than in the Base Case due to the long-term effects of pricing and TDM strategies, which divert some highway travel to other, safer modes. Thus, total fatalities by 2055 are 43,100, compared to 43,400 in 2005, and are significantly lower than the 45,900 fatalities in 2055 for the Base Case.

- Medium Funding: Attainment of 0.98 fatalities per 100M VMT by the year 2020, and 0.37 in 2055, reflecting the higher levels of safety funding and effort assumed for the Medium funding level in Scenario 1. In Scenario 2, however, these fatality rates (carried over from Scenario 1) apply to lower VMT numbers than in Scenario 1 due to the pricing and TDM strategies of Scenario 2. Thus, total fatalities by 2055 are 25,400 for Scenario 2, compared to 27,400 for the Medium funding level of Scenario 1 in 2055.

- High Funding: Attainment of 0.91 fatalities per 100M VMT by the year 2020, and 0.29 in 2055, reflecting the higher levels of safety funding and effort assumed for the High funding level in Scenario 1. In Scenario 2, however, these Scenario 1 fatality rates apply to lower VMT numbers than in Scenario 1 due to the pricing and TDM strategies of Scenario 2. Thus, total fatalities by 2055 are 21,200 for Scenario 2, compared to 23,000 for the High funding level of Scenario 1 in 2055.

Note that Scenario 2 also calls for a 10 percent reduction in truck VMT due to an increase in truck size and weight limits. The incorporation of this effect cannot be completed until truck VMT projections are available.

Scenario 3

Scenario 3 is the "Aggressive System Expansion" scenario. In this scenario, the safety projections are based on the implementation of the "Aggressive Enforcement of Existing Safety Laws and Regulations" strategy from Scenario 1, along with the effects of the "Aggressive Safety Improvements and Regulations" strategy called for in Scenario 3. These assumptions lead to the following outcomes:

- Current Revenue Funding: Attainment of 1.17 fatalities per 100M VMT by the year 2020 (1.0 by 2031), reflecting a continued level of funding and effort under existing safety programs. By 2055, the fatality rate would drop to 0.70 fatalities per 100M VMT. These assumptions are the same as those used for Current Revenue under the Base Case, since it is assumed that, without additional funding, new programs would be difficult to sustain. However, the fatality rates apply to slightly higher VMT numbers than in the Base Case due to improved traffic flows enabled by operations strategies. Thus, total fatalities by 2055 are 46,200, compared to 45,900 in 2055 in the Base Case.

- Medium Funding: Attainment of 0.88 fatalities per 100M VMT by the year 2020, and 0.27 in 2055, in response to the higher levels of safety funding and effort assumed for the Medium funding level in Scenario 1 as well as the implementation and enforcement of new safety regulations called for under Scenario 3. In Scenario 3, total fatalities by 2055 are 20,100, compared to 36,200 for the Medium funding level of the Base Case in 2055, and 27,400 fatalities in 2055 for Scenario 1.

- High Funding: Attainment of 0.83 fatalities per 100M VMT by the year 2020, and 0.20 in 2055, reflecting the higher levels of safety funding and effort assumed for the High funding level in Scenario 1 as well as the implementation and enforcement of new safety regulations called for under Scenario 3. In Scenario 3, total fatalities by 2055 are 15,800, compared to the 32,000 for the High funding level of the Base Case in 2055 and the 23,000 fatalities in 2055 for Scenario 1. In terms of both fatality rates and numbers, this outcome is much improved from the 2005 actual fatality rate of 1.45 per 100M VMT and fatality total of 43,400.

Scenarios 4 and 5

Scenario 4 is the "Exclusive Passenger and Freight Facilities" scenario. The safety projections for this scenario must reflect the implementation of the "Aggressive Enforcement of Existing Safety Laws and Regulations" strategy from Scenario 1, along with the effects of the "Dedicated Truck Lanes with Increased Vehicle Size and Weight" strategy of Scenario 4. This latter strategy separates trucks from light vehicles on major freight routes and reduces the overall number of trucks throughout the highway system.

Scenario 5 is the "Maximum Technology" scenario. The safety projections for this scenario must follow from the "Aggressive Enforcement of Existing Safety Laws and Regulations" strategy from Scenario 1; the effects of the "Dedicated Truck Lanes with Increased Vehicle Size and Weight" strategy of Scenario 4; and a "Vehicle Infrastructure Integration" strategy in Scenario 5.

The safety impacts of Scenario 4 are currently under development and are dependent on the resolution of the amount of truck VMT separated from automobile VMT in future years. Scenario 5 depends both on the outcome of the Scenario 4 safety analysis and the development of a consensus position on the eventual safety impacts of advanced VII technologies. These impacts are highly speculative, particularly in the medium- to long-term future, given the difficulty in determining the capabilities of future communications and data processing technologies.

TABLE 1: SAFETY PERFORMANCE FOR HIGHWAY ANALYSIS SCENARIOS

	2005 VMT (1000000)	2005 Fatalities per 100M VMT	2005 Total National Fatalities	2020 VMT (1000000)	2020 Fatalities per 100M VMT	2020 Total National Fatalities	2035 VMT (1000000)	2035 Fatalities per 100M VMT	2035 Total National Fatalities	2055 VMT (1000000)	2055 Fatalities per 100M VMT	2055 Total National Fatalities
Base Case												
Current Revenues	2,989,807	1.45	43,443	4,043,000	1.17	47,303	5,027,000	0.94	47,254	6,560,000	0.70	45,920
Medium	2,989,807	1.45	43,443	4,140,000	1.06	43,707	5,347,000	0.76	40,487	7,398,000	0.49	36,162
High	2,989,807	1.45	43,443	4,263,000	0.99	42,176	5,581,000	0.67	37,607	7,884,000	0.41	32,009
Scenario 1 (Maximum Operations)												
Current Revenues	2,989,807	1.45	43,443	4,054,000	1.17	47,432	5,049,000	0.94	47,461	6,598,000	0.70	46,186
Medium	2,989,807	1.45	43,443	4,148,000	0.98	40,507	5,363,000	0.64	34,430	7,429,000	0.37	27,396
High	2,989,807	1.45	43,443	4,269,000	0.91	38,848	5,597,000	0.56	31,343	7,923,000	0.29	22,977
Scenario 2 (Travel Demand and Energy Efficiency)												
Current Revenues	2,989,807	1.45	43,443	4,054,000	1.17	47,432	4,929,000	0.94	46,333	6,154,000	0.70	43,078
Medium	2,989,807	1.45	43,443	4,148,000	0.98	40,507	5,227,000	0.64	33,557	6,890,000	0.37	25,408
High	2,989,807	1.45	43,443	4,269,000	0.91	38,848	5,463,000	0.56	30,593	7,315,000	0.29	21,214
Scenario 3 (Aggressive System Expansion)												
Current Revenues	2,989,807	1.45	43,443	4,054,000	1.17	47,432	5,049,000	0.94	47,461	6,598,000	0.70	46,186
Medium	2,989,807	1.45	43,443	4,148,000	0.88	36,502	5,363,000	0.53	28,424	7,429,000	0.27	20,058
High	2,989,807	1.45	43,443	4,269,000	0.83	35,433	5,597,000	0.45	25,187	7,923,000	0.20	15,846
Scenario 4 (Exclusive Passenger and Freight Facilities)												
Current Revenues	2,989,807	1.45	43,443	TBD	TBD	TBD	TBD		TBD	TBD		TBD
Medium	2,989,807	1.45	43,443	TBD	TBD	TBD	TBD		TBD	TBD		TBD
High	2,989,807	1.45	43,443	TBD	TBD	TBD	TBD		TBD	TBD		TBD
Scenario 5 (Maximum Technology)												
Current Revenues	2,989,807	1.45	43,443	TBD	TBD	TBD	TBD		TBD	TBD		TBD
Medium	2,989,807	1.45	43,443	TBD	TBD	TBD	TBD		TBD	TBD		TBD
High	2,989,807	1.45	43,443	TBD	TBD	TBD	TBD		TBD	TBD		TBD