

Emissions Impact of Elimination of the National 55 mph Speed Limit

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Information from the EPA Office of Mobile Sources:
Emissions Impact of Elimination of the National 55 mph Speed Limit

President Clinton recently signed into law a bill that includes a provision eliminating 55/65 mph speed limits as a prerequisite for Federal highway funding.[1] Several States have already acted to increase speed limits on limited-access highways, and others are considering such action. This has led to questions concerning the emissions impact of elimination of the national speed limit. This statement provides an initial look at those impacts, and discusses activity in progress at EPA to better quantify those impacts.

Also, this statement from EPA's Office of Mobile Sources (OMS) provides reaction on the part of OMS to the estimates of emission impacts made in an earlier memo from another EPA office. In response to questions regarding the impact on emissions from highway vehicles of eliminating the national speed limit, EPA's Office of Policy, Planning, and Evaluation (OPPE) released a memo dated November 30, 1995, "Environmental Impacts of Removing National Speed Limit Requirements." This memo was provided to EPA Regional Offices (Air Directors, Air Branch Chiefs, Air Section Chiefs, and Transportation Staff).

Available information

Estimating the overall emissions impact of elimination of the national 55/65 mph speed limits depends on a number of assumptions, including: for each specific highway on which the speed limit is raised, what was the pre-repeal speed limit and what is the new speed limit; what volume of traffic (vehicle miles traveled, or VMT) is carried on highways with newly increased speed limits, and what proportion of total VMT in a given area does this represent; and how much actual average speeds on each specific highway increase after the change in the applicable speed limit (many highways that have been posted as having 55 or 65 mph limits are in reality characterized by higher speed traffic). These factors complicate the characterization of the emissions impact of repeal of national speed limits.

Using the MOBILE5a highway vehicle emission factor model [2] to estimate exhaust emission factors for calendar year 1996 at average speeds of 55 and 65 mph (with 8.7 psi RVP gasoline and summer temperatures), the following trends are observed. Note that these estimates are for light-duty gas vehicles (passenger cars) only; the effects for other vehicle types are not necessarily similar, as discussed below. The difference in emission factors estimated for 55 and 65 mph is not directly applicable to rural highways, where speed limits in many areas were already 65 mph and may now be increased further; however, it is useful for looking at the effects of this change in urban areas, where speeds have been limited to 55 mph and now may be increased to 65 mph in some areas.

Finally, these emission factors are for 100% stabilized operation (in other words, no "cold-starts" or "hot-starts" are assumed -- all traffic is assumed to consist of fully warmed-up vehicles). This

is logical, in that the roadways affected by elimination of the national speed limits are all limited access highways (mostly interstates), and traffic on such roadways is characterized by virtually 100% stabilized operation.

Pollutant	Emissions at 55 mph (g/mi)	Emissions at 65 mph (g/mi)	% change
VOC	0.59	0.92	+ 55.9
CO	7.60	19.24	+ 153.0
NOx	2.19	2.40	+9.6

These increases are in the in-use fleet emission factor for automobiles actually traveling at the stated average speeds. Estimating the impact on overall emission levels for any specific area and timeframe requires assuming how much of total traffic (VMT) in the given area and timeframe will actually be subject to the increased speed. For example, nationally about 13.5% of all VMT is on urban interstates (where speed limit increases from 55 to 65 mph might be expected). If traffic on all such urban interstate highways increased in average speed from 55 to 65 mph, the increase in total vehicle emissions would be about 13.5% of the values shown (in this case, increases in national total emissions from highway vehicles of about 7.5% for VOC, 20.7% for CO, and 1.3% for NOx would be estimated as resulting from the speed limit change on urban interstates).

EPA has only very recently begun to collect data from testing of vehicles at even higher speeds, up to 80 mph. Analysis of such data, which is almost entirely from relatively new, current technology automobiles, is not complete. Indications are that emissions will continue to increase as speeds increase to above 65 mph. Data are not currently available for estimating the emissions impact of eliminating the national speed limit for older cars and trucks.

The "real-world" impact of eliminating the national speed limit will depend in large part on the actual increase in average traffic speeds on affected roadways, which is very difficult to estimate. Many States had already raised rural speed limits to 65 mph under the 1987 law permitting this. In some specific cases, average speeds are already so much above applicable 55/65 mph speed limits that they are unlikely to increase much due to the elimination of the national speed limit; in such cases, if emissions estimates have been based on currently posted speed limits, then those estimates are probably under-predicting actual current emissions, but the increase in those emissions (actual, not modeled) due to the speed limit change will be minimal. EPA's guidance to States has been to estimate emissions based on actual observed speeds rather than posted speed limits wherever possible, so for States that have developed emission estimates following this guidance, there may be only relatively limited changes (increases) in estimated total emissions due to the elimination of national speed limits.

Also worth noting is the fact that the emission increases estimated for other vehicle types would not be the same as those presented here for automobiles. The behavior of emissions as a function of average speed varies by vehicle type, emission control technology, fuel delivery system (carbureted vs. fuel-injected engines), and pollutant. Emissions from diesel vehicles (including heavy-duty diesel trucks), as presently modeled, decrease slightly if average travel speeds for those vehicles is increased. (Although the speed limits for heavy-duty trucks are typically lower than those for automobiles and light trucks, it is reasonable to assume that

increasing the speed limit for most traffic will increase average speeds on affected highways, including the average speed of heavy-duty truck traffic.) As can be expected, there are considerable uncertainties in this modeled response of heavy-duty truck emissions to speed limit changes. Based on cruising operation at high speeds, rather than on average trip speeds, emissions from all types of vehicles would be expected to increase if travel speeds increase to greater than 65 mph.

EPA will continue to collect and analyze data on emissions from vehicles at high speeds, and may issue an updated statement on the effects of elimination of the national speed limit after collecting and analyzing more relevant data.

Comments on OPPE Estimates

1. "Speed limit increases will raise NOx emissions by at least 5%"

The OPPE analysis was based on MOBILE5a emission factors and data from the Federal Highway Administration (FHWA) on VMT by roadway type. The other assumptions made (e.g., what average speeds are assumed before and after the national speed limit requirement is eliminated, what fraction of traffic and in what areas is affected by this change, what temperatures and fuel volatilities are assumed, etc.) are important in determining the accuracy of this estimate. The OPPE estimates assume that urban area speed limits remain at 55 mph, which does not correspond to many state actions as reported in the recent press. These estimates also assume that the rural speed limit goes to 65 mph in most states, though it is unclear whether the base average speed for such roads was assumed to be 55 or 61 mph (cited as the average speed for rural areas). This statement is certainly within the range of reasonable estimates, based on the increase in the emission factors for automobiles presented above. It is unclear whether OPPE's estimates are based only on automobiles, or on all vehicles.

2. "State-by-State increases may be much higher"

OPPE's memo notes that the increase in NOx emissions could be "as much as 9% in portions of the I-95 corridor from Virginia to Maine." OMS has not attempted to recreate the OPPE analysis, but it is apparent that the effects of this change will vary by State, and some States will see larger emission increases than others.

3. "Speed limit increases will raise CO emissions"

Based on the emission factors presented above, the increases in CO will in fact be far larger than the increases in NOx or VOC emissions.

4. "Speed limit increases will raise CO2 (greenhouse gas) emissions"

As fuel economy falls, fuel consumption rises, and CO2 emissions increase. As in the other specifics, a number of assumptions had to be made to develop such an estimate and those assumptions are not provided in the memo. OMS agrees that directionally, higher speeds will lead to lowered fuel economy and hence to increases in CO2 emissions.

Footnotes

[1] The 55 mph national speed limit was introduced January 1, 1974 in response to the OPEC oil embargo and subsequent "energy crisis." While this speed limit was not mandated by the Federal Government, highway funding was linked to adoption of these speed limit, and its enforcement, by the States. In 1987, these provisions were revised to allow maximum speed limits of 65 mph to be adopted on limited-access highways outside of defined urban areas. Prior to the adoption of these limits, most States had speed limits of 70 mph on limited-access highways, with some less densely populated States (primarily in the West) having limits up to 75 mph and Montana and Wyoming having no specific speed limit in daytime hours only New York State had a 55 mph speed limit before 1974.

[2] EPA's official model for the estimation of in-use highway vehicle emission factors, currently MOBILE5a, allows emission factors to be estimated for average speeds up to 65 mph. The model and the emissions data that support its estimated emission factors are based on laboratory tests of vehicles operated over driving cycles of differing average speeds. Each of these driving cycles represents a kind of trip, in that all driving cycles start and end at idle (0 mph), and include varying amounts and rates of acceleration and deceleration and travel at different speeds; the average speed of a driving cycle is defined as total distance traveled divided by total time elapsed. The higher the average speed of a driving cycle, the less idle time is included in the cycle, and the more driving at and above the average speed of the cycle is included within the cycle. The fact that MOBILE model emission estimates are based on data from such trip-based cycles also complicates estimating the impacts of eliminating national speed limits. Since cycle-based emission factors include accelerations and decelerations, and each cycle includes some travel at speeds from zero to well above the average speed of that cycle, it is possible that emission increases resulting from the speed limit change will be different than are estimated from the MOBILE model.

For example, the Highway Fuel Economy Test (HFET) cycle has an average speed of 48 mph, and 60 percent of the time of the cycle is spent at speeds of 47 mph or greater. The highest average speed of a driving cycle for which EPA has significant data is 64.6 mph (California's ARB4 cycle); this cycle includes only 4 seconds of idle (0.6% of the total cycle time), and more than 60 percent of the cycle time is spent at speeds of 67.5 to 77.5 mph. Data from testing over these and other cycles form the basis of the MOBILE model's estimation of average in-use emission factors as a function of average speed. It is worth noting that based on the above driving cycle statistics, emission factors estimated by MOBILE5a for 65 mph average speed actually include significant vehicle operation at speeds well over 65 mph; thus, the estimates provided below are more applicable to the situation after an increase in the speed limit than might be apparent at first glance.

Related documents:

ENVSPOMS.TXT (this 1/8/96 OMS memo)
ENVSPMEM.TXT (11/30/95 OPPE memo)
ENV-SPDS.TXT or ENV-SPDS.W51 (E.H. Pechan report:
Analysis of the Effects of Eliminating the National
Speed Limit on NOx Emissions)

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