1/8/96

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 limits 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.

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                  Emissions        Emissions
                  at 55 mph        at 65 mph
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Pollutant	(g/mi)	(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 underpredicting 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 raodway 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.

[OPPE Memo] [Full Report] [OMS Home Page]
html: 2/7/96

Date: November 30, 1995

MEMORANDUM

Subject: Environmental Impacts of Removing National Speed Limit Requirements

To: Regional Air Directors
Regional Air Branch Chiefs
Regional Air Section Chiefs
Regional Transportation Staff

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cc: Robin Miles-McLean
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Lucy Audette

Several people have been asked how the elimination of the federal speed limit, recently signed into law as part of the National Highway System Bill, will affect air quality. We have done an analysis of the effect on auto emissions, and hope that it is useful to you. You may want to share this information with the state air quality agencies with whom you work. The MOBILE5a runs on which the analysis is based are available upon request.

Background

The 55 mph national speed limit was originally introduced on Jan. 1, 1974, in response to the Arab oil embargo and subsequent energy crisis. While this restriction was not mandated by the Federal government, highway funding was linked to the adoption of the speed limit (and its enforcement) by the states. In 1987, this was modified to allow maximum speed limits on rural interstate freeways to increase to 65 mph. Prior to the adoption of these limits, most states had speed limits of 70 mph (with some having limits as high as 75 mph and Montana and Wyoming having no maximum limits). Only one state, New York, had a 55 mph speed limit prior to 1974. Speed limit increases will raise NOx emissions by at least 5%

The National Highway System Bill just signed by the President eliminates the federal national speed limit requirements for non-commercial vehicles. Since emissions of the ozone pre-cursor NOx increase as vehicle speeds increase above about 48 mph, speed limit changes may have important consequences for ozone nonattainment areas. Raising speed limits will affect the ability of some areas to reach attainment status, and of other areas to stay in compliance.

EPAs MOBILE5a emissions model shows that national NOx emissions would increase at least 5 percent in the following scenario: urban speed limits remain unchanged and rural speed limits increase to 65 mph except that those states with limits below 65 mph before 1974 would maintain those lower limits.

There are various reasons to believe this is a low estimate of the impact. New York state, for example, recently increased its rural speed limits to 65 mph, exceeding their pre-1974 maximum speed limit. Several states have already increased their speed limits to 70 and 75 mph. More states may follow suit; before 1974, most states had limits higher than 65 mph.

The 65 mph limit was modeled primarily because of the limitations of MOBILE5a, which is only capable of analyzing emissions at speeds up to 65 mph. In addition, actual average driving speeds may exceed 65 mph, as is discussed further below. State-by-state increases may be much higher. Under the above scenario, MOBILE5a shows NOx emissions may increase as much as 9 percent in portions of the I-95 corridor from Virginia to Maine.

* Increased NOx emissions may make it more difficult to meet attainment deadlines, and increase costs of compliance with NAAQS

Even if NOx emissions were only to increase in rural areas, those emissions could hamper efforts of nonattainment areas to reach attainment because NOx emitted in an attainment region one day often migrates to a nonattainment region the next day.

If states decide that these increases in mobile NOx sources are acceptable, they may face other costs to reduce ozone formation and meet or maintain National Ambient Air Quality Standards (NAAQS). For example, they may have to increase controls on industrial sources of NOx, including utility and industrial boilers. These controls will be more costly than maintaining current speed limits. Employers may also have to consider more stringent Traffic Control Measures to increase vehicle occupancy levels for work trips.

* Speed limit increases will raise CO emissions

Increased motor-vehicle speeds are likely to also increase CO emissions (Pechan, 1992). These emissions also result from the combustion process and will increase at speeds above 48 mph. Based upon similar reasoning, one could also expect increases in particulate matter (PM).

* Speed limit increases will raise CO2 (greenhouse gas) emissions

Vehicle fuel economy decreases as vehicle speeds increase, and markedly so above speeds of about 50 mph. The removal of current speed limits would significantly increase fuel use for the same amount of national vehicle travel, making Greenhouse Gas reduction targets more difficult to meet. EPA analysis indicates that carbon emissions would increase by 6-15 million metric tons of carbon equivalent (mmtCe) per year, or about 6-15% of the amount needed to return U.S. emissions to 1990 levels in the year 2000.

* Driver response is uncertain, but may contribute to progressively higher travel speeds (and therefore emissions) over time

One unanswered question is how drivers will respond to higher speed limits. Currently, a majority of drivers exceed the posted speed limit (FHWA, 1994). Average travel speed on urban interstates is about 59 mph, while on rural interstates it is about 61 mph. Prior to the setting of national speed limits in 1974, the average on rural interstates was 65 mph (for uncongested travel).

Generally, drivers prefer to maintain speeds similar to others traveling near them. It can be anticipated that the removal of legal restrictions against higher speeds (i.e., removal of the cost of being cited for speeding) will result in an average increase in speeds.

Increases in average speeds has been a consistent trend over the last 20 years. This has been fueled partly by better and safer road designs and by the design of safer automobiles. It is far more likely that an automobile driver will survive an accident today than 20 years ago. Therefore, the risks associated with higher speeds are not as great as they once were, and hence, all else equal, we can expect average speeds to exceed levels that existed prior to 1974.

Faster automobile traffic will have other effects which are likely to magnify the direct increase in emissions. Travel times will be reduced due to higher speeds. This will encourage people to use private automobiles rather than other modes of travel (such as public transit). While travel times probably will not be reduced much in congested areas, many newly developing areas not affected by congestion will see an increase in motor-vehicle travel. Reduced travel times will also encourage increased low density development. Both of these will result in future increases in NOx emissions.

Increased speed limits on arterial roads (which many states are expected to implement) will also increase the risk of travel to both bicyclists and pedestrians. The impact will be to reduce the use of these environmentally beneficial modes.

Many states will, in fact, be required by their own speed limit statutes to increase speed limits on arterial roads. These speed limits are generally set by the 85th percentile rule. This specifies that speed limits must be set at the speed at which the 85th percentile of the traffic is moving. Higher freeway speeds are likely to induce drivers to travel at higher speeds on arterial roads (due to a decreased perception of their actual speed when leaving a freeway). This will force many states to increase existing speed limits on these arterials, if they intend to abide by their own statutes.

The only indirect impact that may somewhat reduce any increase in emissions is the higher cost of traveling at higher speeds, due to decreased fuel efficiency. This is not expected to be a major off-setting factor, due to the relatively low cost of gasoline.

References

FHWA, 1994; Federal Highway Administration, Highway Statistics 1993, Washington, DC 1994.

Pechan, 1992; E.H. Pechan & Associates, Sensitivity Analysis of MOBILE4.1 Emissions Factors, Prepared for EPA Ozone/Carbon Monoxide Programs Branch, Springfield, Virginia, July 1992.

This report was prepared by E. H. Pechan and Associates for the U.S. Environmental Protection Agency, Office of Policy, Planning, and Evaluation. For further information, please contact Bob Noland at 202-260-2418.

Analysis of the Effects of Eliminating the National Speed Limit on NOx Emissions

Introduction

Highway vehicles contribute approximately one third of the oxides of nitrogen (NOx) emissions released to the atmosphere in the United States annually (EPA, 1994). Since highway vehicles contribute such a large percentage of NOx emissions, proposed modifications in the National Highway System bill are examined in this analysis to determine their effect on this important source category. Specifically, the U.S. Senate has recently proposed to abolish the national maximum speed limit. Such a policy modification may have a significant impact on the magnitude of NOx emissions from motor vehicles. Motor vehicle NOx emissions result from combustion processes and tend to increase with increasing speeds above 48 miles per hour (mph) (Pechan, 1992). This analysis examines the potential consequences of the proposed Senate changes to the National Highway System bill on highway vehicle NOx emission levels. The Senate recently voted to repeal the national maximum speed limit on federally financed highways. The national maximum speed limit rule currently restricts vehicle speed limits to 65 mph on rural freeways, and 55 mph for all other corridors. The Senate proposal to repeal the national speed limit passed on June 19, 1995 with the stipulation that federal speed limits still apply to commercial vehicles such as trucks and buses. If the bill passes through the House of Representatives, States would have the authority to determine the maximum allowable speed limits for automobiles within their State boundaries. Trucks and buses would still be subject to the 55 mph urban and 65 mph rural limits. The national maximum speed limit was established in 1974; it restricted speed limits to 55 mph. The impetus for this regulation was to conserve fuel during the 1973 oil embargo and subsequent energy crisis. Prior to the national limit, States determined speed limits for all corridors within their jurisdictions. Table 1 presents the speed limits maintained by States in January 1973, prior to implementation of the national maximum speed limit. Also presented in Table 1 are current speed limits for automobiles and trucks, by State. In 1987, the maximum speed limit on rural freeways was increased to 65 mph. Rural freeways are defined as freeways located in designated "rural" areas, with a population less than 50,000. Freeways are "controlled access facilities," which means that access is by ramp only and freeways are divided highways which usually consist of four lanes. The likely effect of the recent Senate proposal abolishing the national speed limit will be increases in rural freeway speed limits for automobiles. Since most States adhered to the 55 mph speed limit in urban areas before the national maximum speed limit was established, changes in speed limits around metropolitan areas are expected to be minimal (FHWA, 1995). As shown in Table 1, speed limits on rural freeways before the national maximum limit of 65 mph did not exceed 75 mph, with the exception of Montana and Nevada -- which did not establish maximum limits. Most maximum speed limits for rural corridors ranged between 65 and 75 mph with the majority of States setting rural speed limits of 70 mph.

This analysis assumes that States are most likely to raise the maximum speed limits on their rural freeways to limits established prior to the national maximum speed limit and retain the 55 mph limit in urban areas.

Current Effects of Speeds Limits

Before estimating the likely effects that abolishing the national speed limit will have on interstate speeds, it is helpful to examine the effectiveness of the 55 mph speed limit. Based on data from the Federal Highway Administration (FHWA) published in the 1993 Highway Statistics report that analyzes trends in speeds on highways signed for 55 mph, a majority of vehicles exceed this posted limit (FHWA, 1994).

In 1993, 70 percent of drivers exceeded 55 mph on urban interstate highways and 78 percent exceeded the speed limit on rural interstate highways. Only highways with a posted 55 mph speed limit are included in this average. The average speed recorded on the urban interstate highways was 59 mph and approximately 61 mph on rural interstate highways. In addition, 18 percent of drivers on urban interstates and 24 percent of drivers on rural interstates were already exceeding 65 mph on 55 mph roads. Prior to the setting of the national speed limit, FHWA reports that the average speed of free-moving traffic on level, straight, uncongested sections of the rural interstate system reached a peak of approximately 65 mph in 1973. This compares to a current average speed on rural interstates posted with 55 mph limits of 61 mph. It is important to consider that the average speed in 1973 was calculated at ideal conditions whereas the current average speed includes all vehicle travel on the rural interstate system, not just the straight, uncongested portions analyzed for the 1973 data.

Analysis Methods

This analysis was performed within the constraints of the MOBILE5a model. Therefore, the maximum speed that could be examined was 65 mph. Two cases were compared with the 1994 highway vehicle NOx emission inventory prepared for EPA's Emission Trends report--a maximum effects case and a likely effects case.

In the base case analysis, the speeds modeled for each road type and vehicle type were determined using data from FHWA's 1987 through 1990 HPMS impact analyses. Speeds varied less than 1 mph over this time period for any given vehicle type/road type combination. Therefore, the 1990 data were used and aggregated to determine average speeds for three vehicle classifications (light duty vehicles, light duty trucks, and heavy duty vehicles).

Table 2 presents the national distribution of VMT by vehicle class and road type. Table 3 summarizes the speeds modeled in the four road classes of interest (rural interstates, rural principal arterials, urban interstates, and urban other freeways and expressways) in this analysis. Emissions were estimated at the county, monthly, road type level. As seen in Table 2, these four road types account for 39 percent of the total VMT. To get an estimate of the maximum effects of abolishing the national speed limit, speeds for all vehicle types on all of the road types listed in Table 3 were modeled at a speed of 65 mph. This assumes that urban speed limits would be increased as well as the rural speeds and that heavy duty vehicles would also be able to increase to 65 mph. Due to factors such as congestion from heavy peak hour volumes, it is unlikely that urban speeds would ever reach an average of 65 mph even if the speed limits on these roads were increased. However, modeling this case gives an estimate of the upper bounds of possible emission increases. Other than the change in speeds for these four road types, all other modeling was done identically to the base case. A more realistic case was also examined. In this case, the base case speeds were modeled for the heavy duty vehicles.

This corresponds with the version of the bill that has passed the Senate, in which these vehicle classes would be subject to the current limits of 55 mph or 65 mph. In addition, it was assumed that urban speeds for all vehicle types would remain unchanged from the base case, reflecting the reality of the lower average speeds observed on urban interstates. Finally, the nine States shown in Table 1 to have maximum limits of 65 or lower prior to the setting of the national speed limit were modeled at the same speeds used in the base case. As seen in Table 2, light-duty VMT on rural roads accounts for only 18 percent of the total 1994 VMT. With nine States modeled at base case speeds, the percentage of VMT modeled in this case at 65 mph would be even less than 18 percent. Again, all inputs other than speed used in the base case were modeled in this case as well.

Results

Tables 4, 5, and 6 present the NOx emissions calculated for the base case, the maximum effects case, and the likely effects case, respectively. These results are presented at the State level, and with emissions from heavy duty vehicles separated from emissions from light duty vehicles. In this manner, results from the three cases can easily be combined in other configurations if changes occur in the present status of disallowing heavy duty vehicles from the higher speeds, or if urban speeds in certain States are likely to approach the higher rural speeds. Table 7 compares the results from the likely case with the base case results.

As seen in this table, NOx emissions are projected to increase by 5.2 percent with the elimination of the national speed limit.

States such as Montana, North Dakota, and South Dakota that have high rural interstate VMT relative to urban VMT show the greatest increases in NOx. In contrast, States like New Jersey, California, and Illinois that have high urban VMT relative to rural VMT show relatively small emission increases resulting from the change in speeds.

Related Issues

This analysis was completed using MOBILE5a.

The MOBILE model is designed to model vehicle speeds up to 65 mph. Therefore, it was not possible to use to the MOBILE model to estimate emissions resulting from vehicle speeds in the 70 to 75 mph range. Forty-two States posted speed limits above 70 mph prior to the maximum national speed limit set in 1974. It is, therefore, realistic that the majority of States will post speed limits in this range again. A rough estimate using the State of Texas as a sample indicates an increase in NOx emissions of an *additional* 11 percent for light duty vehicles on rural corridors if emissions are modelled using an emission factor reflecting emission rates applicable to vehicles travelling at 70 mph. This example was calculated assuming a linear increase in the emission factor with speed after 48 mph. This example illustrates that the effects of repealing the maximum national speed limit on NOx emissions may be more dramatic than the results in this analysis -- using MOBILE5a -- imply. Although this analysis examines the potential increase in highway vehicle NOx emissions as a result of increased automobile speeds on rural highways, carbon monoxide (CO) emissions are likely to increase as well.

Both CO and NOx emissions result from combustion processes. At lower speeds, around 15 mph, motor vehicle emissions of CO and NOx decrease with increases in vehicle speed as a result of more efficient combustion. However, after 48 mph, increases in vehicular speeds are accompanied by increases in emissions of both CO and NOx (Pechan, 1992). Thus, increases in highway vehicle CO emissions are also likely as a result of the proposed changes to the National Highway System bill. Using the same reasoning, particulate matter (PM) emissions may also increase.

Conclusions

The results of this analysis indicate a 5 percent increase in motor vehicle NOx emissions annually on a national level. Current controls on NOx emissions are focused in ozone nonattainment areas where NOx and HC emissions react with sunlight to form tropospheric ozone. Although NOx emissions will increase on a national level as a result of repealing the maximum national speed limit on rural corridors, the net effect on ozone levels will likely be much less significant. Ozone nonattainment areas are predominantly urban areas where automobile speed limit changes are not as likely to occur. Despite the effect of transport, the increases in NOx shown in this analysis on a national level may not necessarily contribute to parallel increases in ozone formation. In order to more accurately assess the implications on air quality of the proposed Senate rule, a more thorough analysis should be conducted which analyzes increases in highway vehicle CO and PM emissions as well. Moreover, emission estimates should be determined using an appropriate correction factor to estimate emissions generated at 70 mph speeds. The effect of increased motor vehicle NOx emissions resulting from light duty vehicle speed increases on rural corridors on ozone nonattainment areas also deserves more in depth attention.

References

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FHWA, 1994; Federal Highway Association, "Highway Statistics 1993," Washington, DC, 1994.

FHWA, 1995; Federal Highway Association. Personal Communication with Ms. Julie Cirillo, June, 1995.

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Table 1 Maximum State Speed Limits

State	State Speed Limit Prior to 1974 (mph)	Current Speed Limits (mph)		Comments
		Automobiles	Trucks	
Alabama	70	65	65	
Alaska	70	65	65	
Arizona	75	65	65	
Arkansas	75	65	65	
California	70	65	55	
Colorado	70	65	65	Trucks lower in mountains
Connecticut	60	55	55	
Delaware	60	55	55	
DC	60	55	55	
Florida	70	65	65	
Georgia	70	65	65	
Hawaii	70	55	55	
Idaho	70	65	65	
Illinois	70	65	55	
Indiana	70	65	60	
Iowa	75	65	65	
Kansas	75	65	65	
Kentucky	70	65	65	
Louisiana	70	65	65	
Maine	70	65	65	
Maryland	70	55	55	65 mph on July 1, 1995
Massachusetts	65	65	65	65 mph on Mass. Tnpk only. All other locations 55 mph
Michigan	70	65	55	
Minnesota	65	65	65	
Mississippi	70	65	65	
Missouri	70	65	60	

Montana	unlimited	65	65	
Nebraska	75	65	65	
Nevada	unlimited	65	65	
New Hampshire	70	65	65	
New Jersey	70	55	55	
New Mexico	70	65	65	
New York	55	55	55	65 mph on August 1, 1995 - all vehicles
North Carolina	70	65	65	
North Dakota	75	65	65	
Ohio	70	65	55	
Oklahoma	70	65	65	
Oregon	75	65	55	
Pennsylvania	65	55	55	65 mph July 13, 1995
Rhode Island	60	55	55	
South Carolina	70	65	65	
South Dakota	75	65	65	
Tennessee	75	65	65	
Texas	70	65	60	Trucks limited to 60 mph daytime and 55 mph nighttime
Utah	70	65	65	
Vermont	65	65	65	
Virginia	70	65	65	
Washington	70	65	60	
West Virginia	70	65	65	
Wisconsin	70	65	65	
Wyoming	75	65	65	

Source: Department of Transportation/Federal Highway Association

Table 2 1994 Vehicle Miles Travelled (VMT) by Road Type and Vehicle Class

Road Type	Total VMT	Percent of Total VMT (Heavy Duty)	Percent of Total VMT (Light Duty)	Percent of Total VMT
RURAL				
Interstate	214,757	1.0	8.1	9.1
Other Principal Arterial	209,017	1.0	7.9	8.9
Minor Arterial	153,503	0.7	5.8	6.5
Major Collector	183,281	0.9	6.9	7.8
Minor Collector	49,932	0.2	1.9	2.1
Local	105,430	0.5	4.0	4.5
Total Rural	915,919	4.5	34.6	39.0
URBAN				
Interstate	322,023	0.6	13.1	13.7
Other Freeways & Expressways	144,284	0.3	5.9	6.1
Other Principal Arterial	360,146	0.7	14.6	15.3
Minor Arterial	279,419	0.5	11.4	11.9
Collector	122,536	0.2	5.0	5.2
Local	202,918	0.4	8.3	8.6
Total Urban	1,431,325	2.8	58.2	61.0
TOTAL	2,347,244	7.2	92.8	100.0

Table 3 Average Speeds by Road Type and Vehicle Type Modeled for the Base Case

	Rural		Urban Other	
Vehicle Type	Interstate	Principal Arterial	Interstate	Freeways & Expressways
Light Duty Vehicles	60 mph	45 mph	45 mph	45 mph
Light Duty Trucks	55 mph	45 mph	45 mph	45 mph
Heavy Duty Vehicles	40 mph	35 mph	35 mph	35 mph

Table 4
1994 Highway Vehicle NOx Emissions with Current Speed Limits (Base Case)

1994 Base Case NOx Emissions (tons)

State	Light-Duty Vehicles	Heavy-Duty Vehicles	All Vehicles
Alabama	108,578	53,320	161,898
Alaska	10,843	4,500	15,343
Arizona	78,660	35,363	114,023
Arkansas	57,374	30,694	88,067
California	500,401	213,317	713,718
Colorado	75,598	32,384	107,982
Connecticut	64,465	23,245	87,710
Delaware	15,142	6,902	22,044
District of Columbia	7,737	2,286	10,023
Florida	252,135	108,530	360,665
Georgia	179,504	81,615	261,119
Hawaii	16,470	6,983	23,453
Idaho	28,555	14,902	43,457
Illinois	213,507	83,066	296,573
Indiana	147,618	68,419	216,037
Iowa	63,270	31,458	94,727
Kansas	58,571	27,933	86,504
Kentucky	93,233	45,802	139,035
Louisiana	76,049	38,144	114,193
Maine	30,784	16,103	46,887
Maryland	98,724	38,949	137,673
Massachusetts	108,300	36,795	145,095
Michigan	206,614	83,471	290,085
Minnesota	105,734	45,987	151,721
Mississippi	62,248	35,023	97,270
Missouri	131,072	59,523	190,594
Montana	22,571	11,854	34,425
Nebraska	36,876	18,277	55,152

Nevada	25,996	11,843	37,839
New Hampshire	26,392	12,325	38,717
New Jersey	129,949	47,339	177,288
New Mexico	44,555	22,952	67,507
New York	255,046	98,126	353,172
North Carolina	162,538	78,311	240,850
North Dakota	16,118	8,190	24,308
Ohio	233,350	97,841	331,190
Oklahoma	83,252	39,856	123,108
Oregon	68,076	32,079	100,156
Pennsylvania	211,943	92,727	304,670
Rhode Island	16,431	5,371	21,802
South Carolina	83,695	43,879	127,574
South Dakota	19,791	10,472	30,263
Tennessee	123,994	56,331	180,325
Texas	379,434	160,823	540,257
Utah	41,066	16,572	57,637
Vermont	15,528	7,698	23,227
Virginia	151,518	70,200	221,718
Washington	111,867	43,970	155,838
West Virginia	40,811	21,793	62,603
Wisconsin	120,804	55,905	176,709
Wyoming	17,972	9,503	27,475
Total	**5,230,757**	**2,298,948**	**7,529,705**

Table 5
1994 Highway Vehicle NOx Emissions with Maximum Effects of New Speed Limit (Max Case)

1994 Max Case NOx Emissions (tons)

State	**Light-Duty Vehicles**	**Heavy-Duty Vehicles**	**All Vehicles**
Alabama	127,531	68,944	196,476
Alaska	12,626	5,977	18,603
Arizona	91,844	46,780	138,623
Arkansas	70,699	42,242	112,941
California	659,405	296,651	956,056
Colorado	93,065	45,069	138,134
Connecticut	84,009	31,378	115,387
Delaware	18,844	9,096	27,939
District of Columbia	9,211	2,709	11,920
Florida	299,930	144,682	444,612
Georgia	217,807	107,692	325,499
Hawaii	20,091	8,159	28,250
Idaho	33,742	19,813	53,555
Illinois	253,580	107,783	361,363
Indiana	174,579	89,146	263,725
Iowa	76,480	43,497	119,978
Kansas	71,893	37,959	109,851
Kentucky	113,245	61,522	174,767
Louisiana	89,839	49,970	139,809
Maine	35,515	20,660	56,175
Maryland	126,817	53,138	179,955
Massachusetts	137,296	48,748	186,044

Michigan	252,893	109,273	362,166
Minnesota	132,464	62,094	194,558
Mississippi	72,498	45,020	117,518
Missouri	167,001	83,125	250,126
Montana	27,322	17,026	44,348
Nebraska	43,766	24,731	68,497
Nevada	30,988	16,321	47,309
New Hampshire	32,351	16,897	49,248
New Jersey	159,460	61,426	220,886
New Mexico	52,269	31,958	84,227
New York	317,253	126,359	443,612
North Carolina	192,285	100,044	292,330
North Dakota	19,531	11,508	31,039
Ohio	282,603	126,366	408,969
Oklahoma	100,295	52,658	152,953
Oregon	84,930	45,058	129,988
Pennsylvania	254,841	121,159	376,000
Rhode Island	20,489	6,998	27,487
South Carolina	98,405	58,821	157,226
South Dakota	23,804	14,612	38,416
Tennessee	148,259	75,407	223,667
Texas	476,931	216,639	693,570
Utah	50,521	23,425	73,946
Vermont	18,131	10,162	28,293
Virginia	182,925	93,046	275,971
Washington	142,421	60,383	202,804
West Virginia	48,686	29,510	78,196
Wisconsin	144,875	74,397	219,271
Wyoming	21,408	13,445	34,853
Total	**6,417,650**	**3,069,488**	**9,487,138**

Modeled with 65 mph speeds on rural interstates and principal arterial roads and on urban interstate and other freeways and expressways for all vehicle types.

Table 6
1994 Highway Vehicle NOx Emissions
with Likely Effects
of New Speed Limit
(Likely Case)

1994 Likely Case NOx Emissions (tons)

State	**Light-Duty Vehicles**	**Heavy-Duty Vehicles**	**All Vehicles**
Alabama	119,344	53,320	172,664
Alaska	11,747	4,500	16,247
Arizona	84,239	35,363	119,602
Arkansas	66,001	30,694	96,694
California	527,430	213,317	740,748
Colorado	82,742	32,384	115,125
Connecticut	64,465	23,245	87,710
Delaware	15,142	6,902	22,044
District of Columbia	7,737	2,286	10,023
Florida	274,081	108,530	382,611
Georgia	193,385	81,615	275,000

Hawaii	16,561	6,983	23,544
Idaho	32,405	14,902	47,307
Illinois	226,292	83,066	309,359
Indiana	161,397	68,419	229,816
Iowa	73,464	31,458	104,922
Kansas	66,126	27,933	94,059
Kentucky	104,264	45,802	150,065
Louisiana	83,044	38,144	121,188
Maine	34,433	16,103	50,536
Maryland	105,618	38,949	144,567
Massachusetts	108,300	36,795	145,095
Michigan	222,395	83,471	305,866
Minnesota	105,734	45,987	151,721
Mississippi	69,836	35,023	104,859
Missouri	146,705	59,523	206,227
Montana	26,957	11,854	38,811
Nebraska	42,201	18,277	60,478
Nevada	28,532	11,843	40,375
New Hampshire	29,945	12,325	42,270
New Jersey	136,708	47,339	184,047
New Mexico	50,320	22,952	73,271
New York	255,046	98,126	353,172
North Carolina	177,367	78,311	255,678
North Dakota	19,168	8,190	27,358
Ohio	248,014	97,841	345,855
Oklahoma	91,459	39,856	131,315
Oregon	77,448	32,079	109,528
Pennsylvania	211,943	92,727	304,670
Rhode Island	16,431	5,371	21,802
South Carolina	93,254	43,879	137,132
South Dakota	23,296	10,472	33,768
Tennessee	135,117	56,331	191,448
Texas	407,912	160,823	568,734
Utah	44,536	16,572	61,108
Vermont	15,528	7,698	23,227
Virginia	165,109	70,200	235,309
Washington	120,682	43,970	164,653
West Virginia	46,365	21,793	68,158
Wisconsin	136,212	55,905	192,118
Wyoming	20,931	9,503	30,434
Total	**5,623,370**	**2,298,948**	**7,922,318**

Modeled with 65 mph speeds on rural interstates and principal arterial roads for light duty vehicles and trucks only and only in states with former limits above 65.

Table 7
Comparison of Base Case and Likely Case
1994 Highway Vehicle NOx Emissions

	1994 Total NOx Emissions from All Vehicle Types (tons)		Increase in 1994 NOx Emissions	Percentage Increase
State	**Base Case**	**Likely Case**	**(tons)**	**in Emissions**
Alabama	161,898	172,664	10,766	6.65

Alaska	15,343	16,247	904	5.89
Arizona	114,023	119,602	5,579	4.89
Arkansas	88,067	96,694	8,627	9.80
California	713,718	740,748	27,030	3.79
Colorado	107,982	115,125	7,143	6.62
Connecticut	87,710	87,710	0	0.00
Delaware	22,044	22,044	0	0.00
District of Columbia	10,023	10,023	0	0.00
Florida	360,665	382,611	21,946	6.08
Georgia	261,119	275,000	13,881	5.32
Hawaii	23,453	23,544	91	0.39
Idaho	43,457	47,307	3,850	8.86
Illinois	296,573	309,359	12,786	4.31
Indiana	216,037	229,816	13,779	6.38
Iowa	94,727	104,922	10,195	10.76
Kansas	86,504	94,059	7,555	8.73
Kentucky	139,035	150,065	11,030	7.93
Louisiana	114,193	121,188	6,996	6.13
Maine	46,887	50,536	3,649	7.78
Maryland	137,673	144,567	6,895	5.01
Massachusetts	145,095	145,095	0	0.00
Michigan	290,085	305,866	15,781	5.44
Minnesota	151,721	151,721	0	0.00
Mississippi	97,270	104,859	7,588	7.80
Missouri	190,594	206,227	15,633	8.20
Montana	34,425	38,811	4,386	12.74
Nebraska	55,152	60,478	5,325	9.66
Nevada	37,839	40,375	2,536	6.70
New Hampshire	38,717	42,270	3,553	9.18
New Jersey	177,288	184,047	6,758	3.81
New Mexico	67,507	73,271	5,764	8.54
New York	353,172	353,172	0	0.00
North Carolina	240,850	255,678	14,828	6.16
North Dakota	24,308	27,358	3,050	12.55
Ohio	331,190	345,855	14,664	4.43
Oklahoma	123,108	131,315	8,207	6.67
Oregon	100,156	109,528	9,372	9.36
Pennsylvania	304,670	304,670	0	0.00
Rhode Island	21,802	21,802	0	0.00
South Carolina	127,574	137,132	9,559	7.49
South Dakota	30,263	33,768	3,505	11.58
Tennessee	180,325	191,448	11,123	6.17
Texas	540,257	568,734	28,477	5.27
Utah	57,637	61,108	3,471	6.02
Vermont	23,227	23,227	0	0.00
Virginia	221,718	235,309	13,591	6.13
Washington	155,838	164,653	8,815	5.66
West Virginia	62,603	68,158	5,554	8.87
Wisconsin	176,709	192,118	15,409	8.72
Wyoming	27,475	30,434	2,959	10.77
Total	**7,529,705**	**7,922,318**	**392,613**	**5.21**

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