PROCEEDINGS

Twenty-sixth Annual Meeting

Volume XXVI • Number 1 1985

TRANSPORTATION RESEARCH FORUM

PROCEEDINGS—

Twenty-sixth Annual Meeting

Theme:

"Markets and Management in an Era of Deregulation"

November 13-15, 1985
Amelia Island Plantation
Jacksonville, Florida

Volume XXVI • Number 1 1985

TRANSPORTATION RESEARCH FORUM
In conjunction with

CANADIAN TRANSPORTATION RESEARCH FORUM

The 55 M.P.H. Speed Limit on Rural Interstates: Is It Good Policy? (1985 TRF Best Student Paper)

*By Terrence M. Heffron**

ABSTRACT

The 55 mile per hour speed limit has been a subject of intense controversy since it became federal law in 1974. Sentiments about the law range from devout devotion to outright contempt. Commentaries have run the gamut from "What greater accomplishment could we hope for than a lessening of the carnage which has been increasing without letup year after year all across our road system . . . the slower speed not only has saved gasoline, as was the purpose, but reduced the slaughter" (Gaydos 1975. p.1990) to the rhetorical extremism of, "What has cost over $200 million to enforce wasted 102 man years for every life it has supposedly saved, turned one more government office into a pack of liars, and made us a nation of law breakers?" (Bedard 1983. p.67).

The 55 mile per hour speed limit was signed into law on January 2, 1974 as the Emergency Highway Energy Conservation Act, two months into the first Arab Oil Embargo. The traffic fatality rate in 1974 subsequently decreased by 13 percent. The 55 m.p.h. limit was extended indefinitely in the next year's Federal Aid Highways Amendments for its fuel saving effects as well as the presumption that the lower speed limit was responsible for much of the safety improvement of 1974. Responsibility for administration of the law has been vested in the U.S. Department of Transportation (DOT) and National Highway Traffic Safety Administration (NHTSA).

There has been a lively debate between the proponents and decriers of the 55 m.p.h. limit since its inception, and especially since its extension. The issue has made its way into some unusual places. The 1980 Republican Party National Platform contained a plank calling for the repeal of the 55 m.p.h. limit. President Ronald Reagan took no action in his first term, and the issue did not appear in the 1984 Republican Platform. But in the Surface Transportation Act of 1982, Congress directed that the National Academy of Sciences investigate the 55 m.p.h. speed limit. This study entitled, *"55 A Decade of Experience"* has recently been published (Altshuler et al. 1984); it very well could have an influence the future speed limit policy on U.S. highways. One of the conclusions the study reached was that it may be possible to raise speed limits on rural Interstates, and this paper will further investigate the effect of such a policy change.

The purpose of this paper is to take a critical look at the effects of the 55 m.p.h. speed limit, the desirability of imposing it on rural Interstate and other highways with similar characteristics, and the implications of a change in the law for the State of Iowa. In order to accomplish these objectives, it is desirable to present and evaluate the arguments for and against the speed limit, and attempt to find the most reasonable estimates of the effects of the 55 m.p.h. speed limit on highway safety, the economy, and energy. From this process it is hoped that sensible policy recommendations can be made and their implication understood. Before weighing the arguments, it would be helpful to understand the characteristics of the roads at issue, the rural Interstates and roads of similar design standards.

I. RURAL INTERSTATE CHARACTERISTICS

The Interstate road system began with the 1956 Federal Aid Highway Act. Funds were authorized for the building of a national highway system. The ostensible purpose for the system was to promote national defense, but the real reason was to increase accessibility. The Interstate system is our safest, with fatality rates lower than the other parts of our total highway network.

A. National System

The Interstate road system is characterized by multilane highways with controlled access and separation of traffic by direction. While it represents only one percent of the paved mileage of the nation's entire road system, the Interstate system carries 20 percent of all vehicle miles traveled. The Interstate system is our safest road system, with fatality rates well below other road systems. It accounted for only nine percent of all highway fatalities within the U.S. during 1982. The portion of the Interstate system that is classified as rural consists of approximately 31,000 miles, or .8 percent of the total U.S. road network. These rural Interstates are the high speed roads in our highway system, both in use and design. They were designed for speeds of 70 to 80 m.p.h., and the average speed before the 55 m.p.h. speed limit was established was as high as 65 m.p.h. in 1973. As a result of the new limit, the 1974 average speed dropped to 57 m.p.h., but it has since risen to 59 m.p.h. in 1983 (Altshuler et al. 1984, p.24).

B. Iowa's System

The State of Iowa has about 730 miles of Interstate highways, of which 612 miles are classified as rural. The major east-west segment is Interstate 80, which bisects Iowa and runs from the east to west coasts of

* University of Iowa.

the nation. There also is a north-south Interstate segment, I-35, which connects St. Louis and Minneapolis, passing through Des Moines and other Iowa communities in the central part of the state. A high volume of interstate travel and trucking of goods takes place on the east-west Interstate 80, one of the most important highways for interstate commerce in the nation. Except for a declining and disappearing rail system and the Mississippi river, the Interstates, especially I-80, are Iowa's most vital transportation assets.

II. IMPACTS OF SPEED LIMIT CHANGES

There are three major issues or components that are affected by a change in speed limits on rural Interstates. These are the impacts on fuel consumption, highway safety, and time consumed in travel. The decision to change speed limits ought to be based on the net change in these three components.

Each of the three components can be measured in specific terms. Fuel consumption can be measured in terms of the quantity consumed, and it is fairly easy to put a monetary value to quantities of fuel. Highway safety is commonly measured in terms of accidents, injuries, and fatalities per one hundred million vehicle miles travelled. While it is fairly easy to put a dollar value on accident damage to vehicles and property, it is difficult if not impossible to find agreement on the cost of a disabling injury or fatality. Although this means that an exact comparison of safety benefits and fuel benefits cannot be made, a rough judgment has to be made, and of course, comparison in highway safety levels under one policy as opposed to another can be made.

The time, or economic component, is easily measurable in theory but an acceptable valuation of time is more difficult. Time can be measured in minutes, hours, years, and other units, but putting a value on the time saved or lost by a change in speed limits becomes complex. The value of time seems to be variable in that time can be valued more highly by one group of people than another, and value can also vary by the length or increment of time saved per trip. Society is likely to value the time saved by a person employed at a high-paying job to a greater degree than the same unit of time saved by an unemployed person, and time saved in many small increments per trip may be valued differently than the same amount of time saved in larger increments over fewer trips. Although it is known that 'time is money', it cannot be easily decided how much time equals how much money. Again, rough estimates and comparisons based on outcomes of different policies must be made. The purpose of the comparisons is to decide which policy will result in the maximum net benefit to the public.

III. FUEL CONSUMPTION

Virtually all vehicles today run on petroleum-based fuels, either gasoline or diesel. While other power sources such as electricity have been used in the past and are being developed for the future, there is little doubt that petroleum-based fuels will remain the major source of energy for road vehicles for some time to come. As petroleum is a non-renewable and increasingly scarce resource, the concern over the rate at which it is consumed is obvious.

A. Arguments for the 55 m.p.h. Limit.

The first issue to be examined is the energy impacts of the 55 m.p.h. limit. Proponents point to estimates of fuel savings of 112,000 barrels per day (BPD) for cars, 22,000 BPD for light trucks, and 26,000 BPD for heavy trucks, for a total savings of 160,000 BPD in 1979. Updated estimates for 1983 increase this to 167,000 BPD (Altshuler et al. 1984, p.110). Advocates of the 55 m.p.h. limit predict that the amount of fuel saved by the limit will increase as the vehicle fleet becomes smaller and vehicles themselves shrink in size. They also cite studies that show fuel consumption rates rising with higher speeds more rapidly for lighter cars than for heavier cars (Mason and Zub, 1981). Most estimates put the total amount of fuel saved by the 55 m.p.h. speed limit at one to two percent of the country's total fuel consumption. The fuel saved would have a current market value of about $2 billion per year.

B. Arguments Against the 55 m.p.h. Limit

Those arguing against the lower speed limit as a fuel saving policy contend that it doesn't save much energy and that other policies would be cheaper and more effective for saving fuel. They further contend that technological developments will reduce the impact of the 55 m.p.h. limit as a fuel saving policy. Detractors point out that the one to two percent fuel savings comprises less than one half of one percent of the nation's total energy requirements (Tomerlin, 1980, p.156), and because of this, the 55 m.p.h. speed limit does little in saving fuel. Supporters of higher speed limits express the opinion that many other simple choices can save more fuel, such as using a manual transmission, deleting power accessories, performing tuneups when needed, changing driving habits, and perhaps the simplest of all, keeping tires inflated properly. Critics point out that each of these actions could, if universally applied, save much more fuel than the lower speed limit (Kamurud, 1983, p.55, and Tomerlin, 1980, p.157). From an energy conservation standpoint, the 55 m.p.h. speed limit does not seem to be a highly effective energy saving policy, but there are other national energy policies. The Corporate Average Fuel Economy (CAFE) standards for domestic manufacturers and the penalties to foreign manufacturers for importing vehicles with high fuel consumption are the major U.S. energy policies for highway transportation.

C. Fuel Savings and the Future

The argument that downsized vehicles with lighter weights experience more rapid rises in fuel consumption with higher speeds than do heavier vehicles is not persuasive. Weight plays a small factor in fuel consumption rates at a steady speed, and Hucho (1978, pp.10-12) has shown that lighter vehicles have a smaller loss in economy than do heavier vehicles. In addition, new applications of vehicle aerodynamics are reaching the market in large quantities. Add-on aerodynamic aids for trucks have been designed and are in fairly wide use. Autos and trucks designed for low aerodynamic drag can achieve significantly greater fuel economy at speeds above 25 m.p.h. than can older designs. While higher speeds will lead to greater fuel consumption for a given vehicle, a more aerodynamic design will minimize the difference in fuel consumption from a lower speed to a higher speed, in comparison to vehicles with poor aerodynamic qualities. This leads to the conclusion that as the vehicle fleet downsizes and modernizes, fuel savings from the 55 m.p.h. speed limit will shrink, and that higher speeds would be possible with smaller fuel penalties.

D. Conclusions

It can be argued that for a given vehicle, a lower speed will generally yield higher fuel economy than will a higher speed. However, new applications of aerodynamic principles will decrease the gap, making higher speeds possible with less penalty than before. The amount of fuel presently saved by the 55 m.p.h. limit doesn't seem to be highly significant, as it is such a small proportion of total fuel consumption and energy needs. Other policies, such as the Corporate Average Fuel Economy (CAFE) standards, have been formulated to address fuel economy issues, and have been highly effective. Limiting speeds to 55 m.p.h. on rural Interstates doesn't seem to be an effective policy for saving fuel, and the continuance of the policy probably cannot be justified solely on fuel saving grounds.

IV. HIGHWAY SAFETY

In 1974, the year the 55 m.p.h. speed limit went into effect, the national fatality rate declined by 15 percent with 9,100 fewer deaths from highway accidents than in 1973. This was the largest single peace-time drop in both the rate and number of fatalities in U.S. history. Influenced by this result, Congress voted in the 1975 Highway Amendments to extend the speed limit indefinitely. While there has been pressure to lift the limit at both the Federal and state levels, the 55 m.p.h. limit remains law. The fact that it has not been repealed or altered is largely because of its perceived safety effects. There is little doubt that the 55 m.p.h. speed limit has helped to save lives, although there is little concensus as to exactly how many lives it actually saves. The question at issue here is whether the lower speed limit is an effective safety policy for rural Interstates, and what would be the effect on safety of raising the speed limit on rural Interstates by five or ten m.p.h.? The safety arguments for and against the 55 m.p.h. speed limit will be analyzed as they pertain to rural Interstates.

A. Arguments for the 55 M.P.H. Limit

Included in the arguments against higher speeds are some physical characteristics that govern a vehicle in motion. These include reaction time for humans, severity of crash force, and braking distances. While increased speed does not affect reaction times, a vehicle at higher speed will travel farther during the reaction time than a slower moving vehicle would. If the perception/reaction time is estimated at 2.5 seconds, a vehicle traveling at 70 m.p.h. will travel 55 feet farther during this set time than will a vehicle traveling 55 m.p.h. (Altshuler et al, 1984, p.36).

Crash severity or force increases disproportionately with the speed of impact. Crash severity is essentially a product of vehicle deceleration, as related in the old saying, "It isn't the fall that hurts you, it's the sudden stop." If a vehicle impacts a fixed object, the deceleration may be calculated according to the following formula:

$$G = \frac{V^2}{30(S)}$$

where G = the number of forces of gravity, V = the change in speed from time of impact until the vehicle stops, and S = the stopping distance in feet.

This example will assume a stopping distance of 5 feet, which would be an estimate of the amount the vehicle crushes as it strikes the fixed barrier. According to the formula, a vehicle traveling at 55 m.p.h. has a deceleration of:

$$G = \frac{55^2}{30(5)} \qquad G = 20.2$$

The deceleration of a vehicle traveling at 65 m.p.h. will be:

$$G = \frac{65^2}{30(5)} \qquad G = 28.2$$

Thus, the deceleration is 40% higher for the vehicle traveling 65 m.p.h. than for the one traveling at 55 m.p.h.

Braking distances also increase with greater speed. From 60 m.p.h., braking distances for new cars average around 170 feet, while braking distances from 70 m.p.h. are close to 220 feet. This is roughly a 30 percent increase in braking distances for the 10 m.p.h. increment between 60 m.p.h. (approximately the present average speed on rural interstates) and 70 m.p.h.[1] Heavier and older vehicles tend to have larger braking distances. Heavier vehicles, of course, have more energy to dissipate in braking because of their greater mass, and older vehicles often have less efficient tires and braking systems.

Arguments for the 55 m.p.h. Limit Based on Speed Variation Another argument for the present speed limit is that it appears to lessen the variation of speeds between vehicles. In 1973, the average speed on rural Interstates was 65 m.p.h., with a standard deviation of slightly over 6 m.p.h. (Altshuler et al. 1984, p.24). A study cited by Altshuler, (Cirillo,1968) shows a link between variation and accident involvement rate on Interstate highways, with greater variation increasing the probability of accident occurrence.

Problems in Estimating Past Impacts. Many of the arguments for the 55 m.p.h. speed limit focus on the change in the accident, injury, and fatality rates in 1974. This makes the effects of the lower limit much more difficult to quantify. There were many other events occurring in 1974 that impacted upon highway transportation, in addition to the new speed limit. The Arab Oil Embargo made gasoline shortages a common occurrence, which affected the type of travel on the roads. Total vehicle miles traveled (VMT) in the U.S. declined by 1.45 percent in 1974, according to estimates based on fuel consumption and estimated fuel efficiency (Altshuler, 1984. p.44) One of the problems when comparing rates from 1974, however, is that the estimate of VMT is uncertain. This estimate of VMT is used as the denominator in all the per mile rates. The data from automated counters suggest that the fuel based estimate of VMT may be too high (Altshuler, 1984. p.44), which would mean that the fatality rates also are understated. There are many other similar problems with data from 1974, which confound efforts to gauge the effect of the new speed limit. As a result, estimates of the number of lives saved nationally by the lower speed limit in 1974 vary considerably from 7,500 to 3,200.

B. Arguments Against the 55 m.p.h. Limit

Those arguing against the 55 m.p.h. speed limit as it relates to safety usually dispute the number of lives saved and the number of accidents avoided in 1974 and later years. These arguments offer reasons other than the lower speed limits as the cause of the drop in fatality rates in 1974 and later years, such as safer vehicle design. Others charge that the 55 m.p.h. limit is arbitrarily set and not especially safe, from a traffic engineering standpoint (Tomerlin, 1980, p.159). Finally, it is argued that the 55 m.p.h. is too low a limit for well-designed rural Interstates, and may cause drivers to divert to other roads which, statistically are not as safe as the Interstates.

There can be no dispute as to the reductions in fatalities and accidents since 1974. The decrease in 1974 was dramatic, but as stated earlier, it is hard to discern how much of the decrease should be attributed to the lower speed limit. Some argue that the fatality rate can be tied to economic activity (Bedard, 1983, p.69). This argument seems plausible, even as we look at fatality rates tied to more recent economic activity. During the recession and high unemployment of the early 1980's, fatality rates dropped by 5.14 percent in 1981, 11.75 percent in 1982, and 5.8 percent in 1983.

Safety Improvements in Automobiles. There have been numerous safety regulations adopted for automobiles which have had an impact on the fatality rate. Other advances in safety have been developed by auto manufacturers in the normal course of technological progress. Table I lists some of the improvements to vehicles.

As these and many later safety-oriented standards were implemented, the effects took time to reveal themselves. Many manufacturers built in the improvements a year or two before the changes were mandated, but there is a time lag in which the auto stock's older, unimproved vehicles are replaced with the new and safer models. Estimates of the degree to which the improvements have permeated the auto stock are available for 1972. By 1972, it was estimated that 95 percent of autos had lap belts, but only 49 percent also had shoulder belts as well. Fifty-six percent had energy absorbing steering wheels, 58 percent had high-penetration resistant windshields, and 49 percent had padded instrument panels. Dual braking systems were estimated to have been installed in 58 percent of the auto stock by 1972. (Peltzman, 1972, p.32).

TABLE I
SAFETY IMPROVEMENTS TO AUTOMOBILES

Mandated Improvements	
Brakes	Dual braking circuits required on all new cars. Lowers amount of total braking loss.
Structural Integrity	Five m.p.h. bumpers, door beams to resist side intrusions, roll-over standards.
Steering Columns	Energy absorbing steering wheels lower risk of injuries and deaths from steering column intrusion.
Lighting Standards	Larger, brighter tail lights and side marker lights enhance visibility.
Seat Belts	Lap and shoulder belts for front seat occupants can greatly lower probability of injury and fatality when used.
Penetration-Resistant Windshields	Decrease severity of injuries and padded instrument panels to vehicle occupants.
Non-Mandated Improvements	
Brakes	Disk brakes have been widely applied in new autos. Greatly increase braking performance.
Tires	Radial tires are a dramatic improvement over older designs, and modern materials are superior to earlier materials. Modern tires increase braking and cornering capability and control, and greatly decrease frequency of tire blow-outs.

Possible Effects of Auto Improvements. As the auto stock in the U.S. was modernized from the first safety regulations taking effect in 1968, the gains in safety should have lead to a decline in both the accident rate and the fatality rate. A portion of the decrease in the fatality rate around 1974 onward could be from these early and many later auto safety regulations. Most researchers estimating the differences in projected 1974 fatality rates from actual rates have assumed that the projected rates were decreasing at a constant percentage rate, or a straight line drop. These researchers have attributed much of the difference between actual and observed rates to the lower speed limit. If these rates were declining at a greater than constant rate, as would seem reasonable with an increasingly safer auto stock, the effect of the 55 m.p.h. speed limit on the fatality rate would be overestimated. As vehicle design is just one of the many factors that affect accident and fatality rates, it is difficult to pinpoint the resultant decline in these rates. However, it can be pointed out that fatality rates rose for every year except 1965 in the period of 1962 to 1966. Furthermore, the rates declined every year from 1967 until 1977. The former year was the first time that many auto manufacturers made the previously mentioned safety equipment standard in anticipation of the 1968 regulations.

One factor in auto evolution may be working in the opposite direction. As autos are downsized and constructed with a lighter weight, there are studies that show that lighter cars may offer less protection in a crash than their larger predecessors (Evans and Blumfield, 1982, pp.5-6). This could work to negate some of the gains made from other safety measures.

Arguments Against the 55 m.p.h. Limit Based On Highway Engineering Principles. There are objections to the 55 m.p.h. speed limit based on studies showing that other more flexible methods of setting speed limits tend to minimize accidents. The 55 m.p.h. speed limit is seen as an artificially low limit which may not be the safest speed. Some recommend the use of the 85th percentile method of setting speeds (Tomerlin, 1980. p.160). This method sets the speed limit by observing the speed at which motorists travel on an unposted road and then sets the limit at about 5 m.p.h. below the 85th percentile. The 85th percentile is the speed that 85 percent of the traffic is under and 15 percent is above. This method would not be very practical for setting speed limits on Interstates, as the method is best suited to smaller segments of roads with more traffic than is carried on most rural Interstates. Earlier studies, however, have showed that speeds higher than 55 m.p.h. actually can be safer. The U.S. Bureau of Public Roads, as cited by Kearney (1966, p.119) stated:

> "The rate of driver involvement in accidents expressed for the first time in terms of miles of driving, is at its maximum at the lower operating speeds. The rate drops with increased speeds, reaching its lowest value at about 65 m.p.h. and then climbs again as speed continues to increase. The finding that moderately high speeds are associated with the lowest accident rates, or highways properly engineered for accomodation of high speed, is of much significance and should lead to more realistic speed control practice based on an engineering study."

Diversion Effect. A seldom mentioned factor in studies of the 55 m.p.h. speed limit is the diversion effect. This diversion factor is brought about by the lack of speed differential between interstates and primary or secondary highways. Due to the act that speed limits are often the same, motorists frequently choose the less safe primary and secondary routes because travel time may be slightly less in comparison with Interstate highways due to the more direct routes. The level of enforcement also could contribute to this effect, as motorists may feel the chance of being ticketed for speeding is less on primary and secondary roads in comparison to the more heavily patrolled Interstate system. The net result of this effect would be greater numbers of accidents, injuries, and fatalities as more vehicle miles are traveled on less safe primaries and secondary highways. A speed differential that would make Interstate travel significantly less time costly than primary and secondary highways would lure motorists to the safer Interstates.

Studies by the Iowa Department of Transportation (Iowa DOT, 1981) have investigated the probable level of diversion within the state from raising the speed limit on Interstates and other rural 4-lane divided highways to 65 m.p.h. These studies forecast an increase in Interstate VMT of 21 percent, the bulk of this increase coming from primary roads. As a result, fatalities within the state would drop by an estimated 15 per year, with an overall monetary savings from reduction of accidents of $10 million. The reduction in travel time would save $69 million. The estimated amount of fuel that is used in the state would increase by approximately two percent, due to the higher speeds and the fact that motorists would travel further as they use the Interstates. Nationally, the percentage increase in fuel consumption from motorists going out of their way to use the Interstate highways probably would not be as significant as it as the state level, because as trip lengths increase, the percentage of fuel used to get to the Interstate would drop as a percent of the total travel.

C. Safety Conclusions

From these conflicting arguments, it is possible to draw some solid conclusions, but other conclusions must be more uncertain. There can be little doubt that the 55 m.p.h. speed limit does save lives and reduce injuries and accidents. The bulk of these savings, however, is achieved on primary and secondary roads. It is also certain that higher speeds lead to increases in crash force and lengthen reaction time and braking distances.

The validity of arguments that increasing the speed limit will cause an increase in speed variation and cause more accidents is less certain. While speed variation declined from 1973 after the 55 m.p.h. speed limit was instituted, this does not necessarily lead to the conclusion that raising the speed limit on Interstates now will increase the speed variation to 1973 levels. There probably would be some rise in variation, but it is not clear that the result would be a significant increase in the number of accidents. A lot of the danger from speed variation comes from roads that are difficult to pass on, which generally do not include Interstate highways.

Arguments that other factors besides the 55 m.p.h. speed limit were involved in the drop in fatalities have some merit. There has been a long-term downward trend in the fatality rate, and the contention that the new interest in safer design in autos in the late 1960's has led to a relatively steep decline in the 1970's appears to be valid. The argument tying fatality rates to economic activity also is plausible. But most of the foregoing arguments, except some relating to the safety improvements to autos, are not really germane to the raising of the speed limit on Interstates. Concern with the past in this discussion is relevant only as it will affect the future, and many of the arguments are about what has happened in the past and would not necessarily impact future increases in speed limits on Interstates.

The argument that the speed limit ought to be based on traffic safety engineering principles such as design speeds and accident rates seems to have merit. If a highway is safe for faster travel than 55 m.p.h., then limits probably should be increased on that highway. If this is the case, future investigations should be made into the feasibility of implementing higher speeds on rural Interstate segments.

The theory that a differential in speed limits between the safer Interstates and the less safe primary and secondary roads seems to be very strong, and there appears to be good evidence that the policy would work to increase safety. This argument also is consistent with the idea that speed limits should reflect the conditions on the road, such as design speed and congestion. Rural Interstates generally have no congestion problems.

It is often a concern that raising speed limits on rural Interstates to pre-1974 levels will increase the accident, injury, and fatality rates to pre-1974 levels. This view ignores the diversion factor. The numbers of accidents, injuries and fatalities may rise slightly on the rural Interstates, but these increases would be more than offset by reductions in other parts of the highway system, most notably on primary highways. From the Iowa DOT studies, it would appear that the outcome would be a net reduction in accidents, injuries and fatalities.

V. TIME SAVINGS AND ECONOMICS

The economic impacts of raising the speed limits on rural Interstates are quite complex. Assumptions of the value of time must be made to arrive at dollar amounts for time savings, and different values must be estimated for different types of travel. As a result of this great complexity, this discussion will be general in nature, and examine the estimates of other authors. Also investigated will be how the change in speed limits may differentially benefit the economics with similar characteristics. The costs of enforcement for the change also will be examined.

A. Estimates of Time Saving and Value

Altshuler et al (1984, pp.176-177) estimate the time that would be saved by raising the speed limits on rural Interstates to 65 m.p.h. at 445 million hours annually. Kamurud (1982, p.57) estimates that truck time rose by seven percent as a result of the 55 m.p.h. speed limit on Interstates alone with a two to three percent cost increase in the trucking industry from the lower speed limits on the overall road system.

While it can be argued that the time savings for short trips are small in terms of time per trip, and therefore, are not very valuable, it is clear that for longer trips the time-savings can be substantial. Long-haul trucking costs increase as the labor costs increase for the same length trip. This is offset to some extent by lower fuel costs, but as labor prices have risen faster than fuel prices for the last few years, the value of fuel saved has become less significant.

The same effect also is true of other business-oriented trips. Many long trips are made by business people who travel by automobile for sales calls and meetings with clients. The time lost due to increased travel time for this group also is substantial. As they spend more time behind the wheel and less time with clients or other business matter, their productivity declines in the same manner as with long-haul truckers. While the impacts are less visible, this same reasoning holds true for smaller increments of time as well. A good example of this may be the commute to work. The worker may have to rise a few minutes earlier in the morning and arrive home a few minutes later in the evening to offset the travel time loss. It is unlikely, however, that this time loss has a great economic impact.

B. Effects on State Economies

Changes in the costs of travel can impact different states' economies in different ways. Some states are more transportation dependent than others. The less transportation-dependent states produce much of what they consume, and consume much of what they produce. Iowa is a good example of a transportation-dependent state. Iowa consumes very little of the total agricultural product of the state, and is, therefore, a large agricultural exporter. On the other hand, Iowa produces few finished industrial or consumer products, and must import most of these.

States that are more transportation dependent are affected by changes in transportation costs to a much greater extent than less transportation-dependent states. If transportation costs rise, the transportation-dependent states are disbenefitted relative to other states, while if the costs fall, they benefit relative to less transportation-dependent states. Raising rural Interstate speed limits would lower highway transportation costs in states such as Iowa.

For example, consider a truck traveling from Los Angeles, California to Des Moines, Iowa. This truck will be driven by a Teamster driver paid at a total wage rate of $21.50 per hour.[2] To point out the savings possible by higher speed limits, consider the labor costs of the 1,750 mile trip at an average speed of 55 m.p.h. The trip would take 31.8 hours, resulting in a total labor cost of $684.10. If the average speed was 65 m.p.h., the trip would take 26.9 hours, with a total labor cost of $578.85. The reduction in labor costs of the higher speed limit trip is $105.25, a reduction of 15 percent over the slower trip. Because of the current overcapacity in the trucking industry, this cost saving probably would be passed on in the form of lower shipping costs by the trucking firm. It should be pointed out that the higher speed trip will use more fuel because of lower fuel efficiency at higher speeds, however this increase in fuel costs will be much less than the savings in labor costs.

C. Enforcement Costs

The 55 m.p.h. sped limit has a fairly high enforcement cost to the public. Altshuler (1984, p.101) estimates a national cost of about $512 million annually in 1983 for enforcing the 55 m.p.h. speed limit. These costs include installing speed monitoring devices to measure compliance of the 55 m.p.h. speed limit. If speed limits were raised on rural Interstates, some portion of these costs would be avoidable. More importantly, enforcement efforts could be concentrated on other more dangerout parts of the road system. Because Interstates carry one-half of all travel posted at 55 m.p.h. even though they make up less than five percent of all highway mileage posted at 55, they are attractive areas to enforce the speed limit, despite their low fatality rate (Altshuler et al 1984, p.159). The enforcement effort expended on Interstates is far out of proportion to the possibilities of improving safety on these roads. This is an inefficient allocation of enforcement resources, from a safety perspective. While it is uncertain how much of the enforcement costs could be avoided by raising the speed limit on rural Interstates, it is fairly certain that the resources that enforce highway safety laws could be shifted to result in a net improvement in safety.

From the previous evidence, the economic cost savings of higher speeds on rural Interstates seem to be substantial, as are the time savings which are not easily given a monetary value. A higher speed limit also would tend to favor the more transportation-dependent states such as Iowa. Enforcement costs may drop or remain the same, but more the resources for traffic safety law enforcement could be diverted from the safer Interstates to the less safe primary and secondary road system. Overall, economic considerations seem to favor a higher speed limit than 55 on rural Interstates.

VI. CONCLUSIONS AND POLICY IMPLICATIONS

The three major factors affected by changing the speed limit on rural Interstates seem to be fuel consumption, highway safety, and time costs. Time costs also can be interpreted as having an effect on the economic cost of shipping goods. Fuel consumption would rise as result of raising speed limits on rural Interstates but the increase would not be very substantial. It would appear that the fuel consumption issue, which was the original cause of the 55 m.p.h. national speed limit, should not have a great impact on policy making for highway speeds. This is not to say the fuel consumption issue should be ignored, because part of the reason it is such a small factor now is that fuel and oil prices have stabilized and dropped. If, or more likely when fuel prices rise or fuel becomes scarce again, the fuel consumption factor would gain in importance. The price rise would have to be precipitous for fuel consumption to be a major factor in the future.

The safety issue is the most important factor in the analysis. The safety impact of the 55 m.p.h. limit on rural Interstates is questionable. While fatality rates dropped in 1974, it is difficult to determine how much of the safety improvement to assign to the lower speed limit, and how much was the result of the myriad factors which were active in the same time period. Opinions vary on these points for a number of reasons, and the data for the period are sufficiently questionable to make positive judgments based on the period very difficult. The important point is that these arguments are not central to the analysis. The focus ought to be on the present and future safety impact of raising the speed limits on the rural Interstate portion of the road system. The evidence presented indicates that overall safety can be enhanced by allowing a speed differential between the rural Interstates and other roads designed to lower safety standards. The lowering of fatalities and injuries would be on the primary and secondary roads, as more travelers opt for the more attractive interstates.

The time saving, or economic element of the analysis also favors higher limits on rural Interstates. It is obvious that higher speeds mean more productivity among the workers that depend on the Interstate system for their transportation. Transportation costs for many goods would be lowered because of this increase in productivity. It is likely that trucking firms would pass on this cost savings to their customers because of the overcapacity and high degree of competition in the trucking sector. Whether these cost savings would result in an appreciable increase in economic activity is a matter of conjecture, but the direction of the effect is clearly an improvement. Transportation-dependent states would benefit more than those states which are less transportation dependent. The economic impact of raising the speed limit on rural Interstates would clearly be positive but whether the effect would be large or small is unknown.

The analysis indicates that raising the speed limit on rural Interstates would cost slightly more in terms of fuel, but would result in a substantial reduction in injuries and fatalities, and lower transportation costs. As a result, the net benefit of raising the limits are clearly positive. The questions remains of what speed limits would be desirable and on what roads the limit should be raised.

The new speed limit should be high enough to make the rural Interstates more attractive to highway users so that the diversion effect would take place. It should not be so excessively high that safety on the rural Interstates is impaired. In addition, a set of standards should be created to decide what rural Interstate segments should be eligible for the increased speed limits.

The speed limit for rural Interstates should be uniform. A speed limit which seems particularly attractive is the 62 m.p.h. limit which corresponds to 100 kilometers per hour. This limit is attractive because it not only promotes the metric system, which the nation has been trying to do for years, but would also result in a speed which is reasonable for the rural Interstate system. Almost all drivers 'hedge' the speed limit by varying degrees, and most drivers seem to go three or four m.p.h. over the limit, as can be seen by the current average speed of 59 m.p.h. on Interstates. With a 62 m.p.h. limit, most drivers would probably travel at about 65 m.p.h., which seems to be reasonable speed. If the limit were 65 m.p.h., most drivers would be traveling at nearly 70 m.p.h. which may be too high for safety, while a 60 m.p.h. limit may be too low to divert traffic to rural interstates from primary and secondary roads. The 62 m.p.h. (100 k.p.h.) limit appears to strike a happy medium.

While this paper has referred to 'rural Interstates' throughout, this analysis could apply to other roads with similar characteristics, including urban Interstate segments. Additionally, some roads designated as rural Interstates should probably remain at a speed limit of 55 m.p.h. A set of criteria needs to be developed to decide on what roads the limit should be increased. These criteria should include design speed, road conditions, past and present accident experience, and the degree of congestion on the roadway. The safety effect of the change should be monitored, as should the amount of diversion.

The change should be made at the national level in the U.S. Congress. States which attempt to act unilaterally will face the loss of federal highway funds allocated to their state. The state's representatives could urge the change to take place administratively or could propose and pass a bill changing the limit. Some states have considered lowering penalties for speeding, such as not adding 'points' to the offender's license. This would not be a very good solution, as it would promote greater speed variation, would not be uniform, and would probably not cause much diversion.

While there has been an intense amount of controversy surrounding the 55 m.p.h. speed limit, the debate must not be obscured by extremist arguments from either side. The highway policy of the U.s. should be formulated to make the most efficient use of our existing highway resources. It is the conclusion of this analyst that the goal of safe and efficient transportation could be more closely attained by raising the speed limits on the majority of the rural portions of the U.S. Interstate system.

ACKNOWLEDGEMENTS

The author gratefully acknowledges Professor David A. Forkenbrock for his technical assistance and advice in the preparation of this paper. The author also gratefully acknowledges his wife, Robin for the typing of this manuscript.

ENDNOTES

1. Estimates from calculations by author from recent and current road tests in various automotive publications.
2. Information obtained from American Trucking Association.

REFERENCES

Altshuler, Alan A. 1984. *55: A Decade of Experience*. Special Report 204, Washington, D.C. Transportation Research Board.

Bedard, Patrick. 1983. The 55 M.P.H. Speed Limit. *Car and Driver,* Vol. 29, No. 1, July. pp.67-72.

Cirillo, J.A. 1968. "Interstate System Accident Research—Study II—Interim Report II." *Public Roads,* Vol. 35, No. 35.

Evans, Leonard and Dennis E. Blumenfeld. 1982. *Car Occupant Life Expectancy: Car Mass and Seat Belt Effects*. Warren, Michigan: General Motors Research Laboratories, June 29.

Gaydos, Joseph M. (Representative-Penn). 1975. *Congressional Record*. Vol 121, Part 2. 94th Congress, 1st Session, January 31, 1975.

Hucho, W.H. 1978. *The Aerodynamic Drag of Cars. Current Understanding, Unresolved Problems, and Future Prospects*. Aerodynamic Drag Mechanisms of Bluff Bodies and Road Vehicles, New York: Plenum Press.

Iowa Department of Transportation. 1981. *Assessment of Interstate Highway Speed Limits*. Ames, Iowa.

Kamerud, Dana B. 1983. The 55 M.P.H. Speed Limit: Costs, Benefits, and Implied Trade-Offs. *Transportation Research*. Vol. 17A, No. 1. (January). pp. 51-64.

Kearney, Paul W. 1966. *Highway Homocide*. New York: Thomas Y. Crowell Company.

Peltzman, Sam. 1975. *Regulation of Automobile Safety*. Washington, D.C.: American Enterprise Institute for Public Policy Research.

Tofany, Vincent L. 1981. Life is Best at 55. *Traffic Quarterly,* vol. 35, No.1. (January). pp.5-19.

Tomerlin, John. 1980. The 55 M.P.H. Myth. *Road and Track,* Vol. 31, No. 9, (May). pp.154-159.