EFFECT OF LOWER SPEED LIMITS ON FUEL CONSUMPTION AND SAFETY

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This paper discusses section 107 of the 1974 Federal-Aid Highway Act, which designates state enforcement certification as a continuing prerequisite for approval of federal-aid highway projects. The certification procedure requires that states submit summaries of speed data collected on highways on which the speed limit is the only constraint on speeds. The paper also discusses the effect that the 88.5-km/h (55-mph) speed limit has had on safety and fuel consumption.

The national 88.5-km/h (55-mph) speed limit was originally instituted as a temporary measure in response to the severe fuel shortage that occurred in late 1973. This requirement, established as part of the Emergency Highway Energy Conservation Act of January 2, 1974, resulted in significant reduction in travel speeds on facilities that previously had higher speed limits. At the same time there was a noticeable decline in total travel, especially pleasure and recreational travel. In addition, traffic fatalities substantially declined, which may be attributed, at least partly, to the slower speeds.

The reduction in accidents and fuel consumption induced Congress to establish the 88.5-km/h (55-mph) speed limit as a nationwide permanent measure. Section 107 of the 1974 Federal-Aid Highway Act, designates state enforcement certification as a continuing prerequisite for approval of federal-aid highway projects. As part of the certification procedure, states are asked to submit summaries of speed data collected on highways on which the speed limit is the only constraint on motorists' speeds. These summaries will provide a measure of the public's compliance with the law and the effectiveness of enforcement efforts.

Before discussing speed monitoring, perhaps I should briefly discuss the effect of lower speeds on safety and fuel consumption. The 1973 fuel shortage illustrated how much our society is dependent on an adequate petroleum supply. Despite the subsequent easing of the crisis, those knowledgeable on the subject are convinced that we must conserve on petroleum products and learn to use them more efficiently. Accepting these facts, why should such an apparently heavy burden be placed on the transportation sector and on highway vehicles in particular? Consider the following:

1. Approximately 60 percent of the liquid fuel consumed in the United States is used for transportation purposes;
2. Within the transportation sector, highway vehicles are the major consumer, accounting for nearly 40 percent of all the petroleum used in the United States;
3. Petroleum requirements for transportation doubled between 1954 and 1974;
4. Of the more than 3.86 trillion person-kilometers of travel (2.4 trillion miles) annually in the United States, 92 percent is by automobile; and
5. Of all travel in the United States, 70 percent is by automobile.

Obviously, motor vehicles are of paramount significance in U.S. fuel conservation efforts because they are the predominant users (Table 1). In 1974, gasoline consumption was a staggering 1082.7 km^3/day (6.81 million bbl/day), of which passenger automobiles accounted for 785.4 km^3/day (4.94 million bbl/day). Trucks used 223.7 km^3/day (1.47 million bbl/day). The nation's 105 million automobiles, 26 million trucks, and 400,000 buses consumed nearly 405 billion liters (107 billion gallons) of petroleum in 1974.

How, then, do we go about realizing a significant reduction of fuel consumption from motor vehicles? The government has challenged the automobile industry to achieve a 40 percent improvement in fuel efficiency by 1979, an improvement to average passenger automobile performance of nearly 47 km/liter (20 mpg). More immediate results may be obtained if motorists can be convinced to practice good driving habits—including compliance with the 88.5-km/h (55-mph) speed limit. Tests by the Federal Highway Administration (FHWA) show improvements in automobile fuel economy ranging from 11.8 to 28.5 percent by driving at 88.5 km/h (55 mph) rather than at 112.6 km/h (70 mph), depending on the size of the automobile (Table 2). About half of all vehicle-kilometers are driven under conditions in which speeds above 88.5 km/h (55 mph) are possible. The potential savings if 90 percent of the motorists comply with the national speed limit are estimated at 318 km^3/liter (200 000 bbl) of gasoline per day (Table 3). Another recent FHWA study also shows that significant fuel economies can be realized when trucks operate at lower

Table 1. 1974 gasoline consumption.

Vehicles	Consumption (km^3/day)	Vehicles	Consumption (km^3/day)
Passenger cars		Trucks	223.7
Work	279.8	Farm vehicles	31.8
Pleasure	216.2	Other uses	31.8
Personal business	162.2	Total	1072.7
Business, government	127.2		
Subtotal	785.4		

Note: 1 m^3 = 6.29 bbl.

Table 2. Gasoline consumption rates of four automobile classes.

Speed (km/h)	Subcompact (km/liter)	Compact (km/liter)	Standard (km/liter)	Luxury (km/liter)
48.3	13.4	9.1	8.6	7.8
64.4	15.0	9.1	8.5	8.2
80.5	14.0	8.0	7.4	6.6
88.5	13.6	7.7	7.2	6.3
96.6	13.1	7.4	6.9	6.0
112.6	9.7	6.5	6.3	5.4

Note: 1 km/h = 0.62 mph; 1 km/liter = 2.35 mpg.

Table 3. Estimated annual gasoline savings of four automobile classes traveling at 88.5 km/h instead of 112.6 km/h.

Trip	Distance[a] (km)	Subcompact Liters	Subcompact Dollars[b]	Compact Liters	Compact Dollars	Standard Liters	Standard Dollars	Luxury Liters	Luxury Dollars
Work	24.1	117.3	17.05	98.4	14.30	75.7	11.00	109.8	15.95
	32.2	257.4	37.40	193.0	28.05	151.4	22.00	219.6	31.90
	48.3	511.0	74.25	382.3	55.55	299.0	43.45	435.3	63.25
	64.4	768.4	111.65	571.6	83.05	450.5	65.45	651.1	94.60
All	24.1	276.3	40.92	234.7	34.32	181.7	26.40	265.0	32.28
	32.1	617.0	89.76	458.0	67.32	363.4	52.80	526.2	76.52
	48.3	1226.5	178.20	916.1	133.32	715.4	104.28	1044.8	151.80
	64.4	1843.5	267.96	1370.3	199.32	1082.6	157.08	1563.4	227.04

Note: 1 km = 0.62 miles; 1 liter = 0.26 gal.

[a]Trips of 16.1 km (10 miles) are considered to be urban or suburban, where speeds as high as 88.5 km/h (55 mph) cannot be achieved.
[b]Gasoline costs are computed at 14.5 ¢/liter (55 ¢/gal).

Table 4. Traffic fatalities in 1973 and 1974.

Month	1974	1973	Change (%)	Month	1974	1973	Change (%)
January	2950	3834	-23.1	July	4320	5156	-16.2
February	2625	3479	-24.5	August	4537	5227	-13.2
March	3192	4328	-26.2	September	4190	4899	-14.5
April	3442	4454	-22.7	October	4371	5203	-16.0
May	3732	4813	-22.5	November	4113	4410	-6.7
June	4141	5135	-19.4	December	3868	3908	-1.2

Note: December marked the fourteenth consecutive month that traffic fatalities fell below the corresponding month a year earlier. December 1974 totals show a 19 percent decline from December 1972.

speeds. The increase in fuel consumption between 80.5 and 96.6 km/h (50 and 60 mph) ranged from 6.8 to 20.6 percent for the vehicles tested.

An additional benefit of slower highway speeds is increased safety. During the 1973 fuel crisis and subsequent temporary 88.5-km/h (55-mph) speed limit, traffic fatalities decreased remarkably. The 1974 highway traffic toll dropped to 45 500 fatalities, 17 percent below that in 1973, the fewest number of highway deaths since 1963 (Table 4). The fatality rate declined from 4.3 to 3.56 deaths per 160.9 million vehicle-kilometers (100 million vehicle-miles). There were those who attributed this safety improvement merely to the decrease in vehicle-kilometers of travel caused by the shortage of gasoline. Fatality statistics recently released for August 1975 tend to support the premise that lower speeds are responsible for decreased traffic fatalities. Although total travel was at or above estimates for August 1973, traffic fatalities in August 1975 dipped 15 percent below the level for 1973 (Table 5). The death total was 4 percent below that for the same period in 1974. Lower speeds save lives by preventing accidents—increasing reaction and evasion time—and by reducing the severity of injury in what might be lethal accidents if they occurred at higher speeds. The 88.5-km/h (55-mph) speed limit, instituted to save fuel, is proving to be a most effective action in saving lives on the highway.

New regulations implementing the national 88.5-km/h (55-mph) speed limit require the submission of certain speed data summaries as part of a state's annual certification package. These speed data should be useful at both the state and federal levels. At the federal level, they will provide a measure of the compliance with the speed limit as well as an indication of enforcement effectiveness. At the state level, speed data from individual station locations, along with accident data, should be useful in planning the efficient use of available enforcement.

If the speed summaries are to be the useful tools anticipated, data must be both accurate and representative of conditions to be found throughout the individual states. Also data collection techniques used by the states should be consistent. To this end, FHWA has developed the Procedural Guide for Speed Monitoring, which was distributed on September 25, 1975. The purpose of the guide is to describe an approach for use by states in establishing a comprehensive speed-monitoring program. Virtually all aspects of the activity are examined, from sampling to data collection and analysis. Accuracy and reliability standards that the states must follow for the data summaries are presented. Sampling methods that may be followed are described in sufficient detail to allow a state to set up its sampling scheme. In addition, detailed guidelines for the preparation of the speed data portion of the annual certification package are presented.

The objective of the speed-monitoring program is to produce summary statistics, classified by highway type (Interstate rural, Interstate urban, other multilane divided rural and urban, major nonindividual rural), that include average speed, median speed, 85th percentile speed, and percentage of vehicles exceeding 88.5, 96.6, and 104.6 km/h (55, 60, and 65 mph). Statistics submitted annually will be for a 12-month period ending on September 30.

The following objectives should be the basis for any sample design:

Table 5. Estimates of traffic fatalities by state.

State	August 1973	August 1974	August 1975	State	August 1973	August 1974	August 1975
Alabama	110	80	93	Nevada	31	24	21
Alaska	4	13	16	New Hampshire	8	30	22
Arizona	105	78	45	New Jersey	133	112	83
Arkansas	61	54	52	New Mexico	77	61	56
California	454	408	369	New York	283	260	267
Colorado	84	67	64	North Carolina	177	156	188
Connecticut	38	41	45	North Dakota	26	14	16
Delaware	12	22	11	Ohio	221	127	229
District of Columbia	4	6	9	Oklahoma	70	85	61
Florida	207	202	154	Oregon	66	89	51
Georgia	170	137	156	Pennsylvania	193	216	216
Hawaii	16	16	14	Rhode Island	11	13	8
Idaho	48	34	37	South Carolina	87	87	76
Illinois	231	210	233	South Dakota	44	30	26
Indiana	149	113	74	Tennessee	118	118	75
Iowa	104	71	56	Texas	380	341	293
Kansas	83	53	60	Utah	34	19	35
Kentucky	90	86	70	Vermont	19	10	17
Louisiana	108	82	85	Virginia	97	101	112
Maine	26	20	39	Washington	101	91	82
Maryland	68	62	43	West Virginia	57	43	50
Massachusetts	97	86	70	Wisconsin	116	94	108
Michigan	201	178	208	Wyoming	30	25	28
Minnesota	106	93	77	Total	5241	4616	4434
Mississippi	86	54	53	Change, percent			
Missouri	130	116	105	From 1973			-15.4
Montana	28	45	40	From 1974			-3.9
Nebraska	42	43	36				

Note: These estimates were adjusted by the National Highway Traffic Safety Administration based on early state reports and in some cases may differ slightly from preliminary figures published by the states.

1. Speed data should be collected under conditions in which the 88.5-km/h (55-mph) limit is the primary constraint on vehicle speeds;
2. The sample should include all major types of state highways and all types of vehicles; and
3. Only free-flowing vehicles should be included in the data sample.

The following criteria are recommended:

1. For both individual sampling sessions and statewide, significance level of 5 percent of all statistical estimates;
2. For individual sampling sessions, average speed within ±1.6 km/h (1 mph) and all proportions to within ±5 percent; and
3. Statewide estimates of average speed by highway type to within ±3.2 km/h (2 mph) and all proportions within ±5 percent.

The guide describes a sampling scheme using a small number of locations where measurements are made quarterly and a large number of locations where they are made once a year. Sampling locations should be selected to be representative of the entire state. Existing study locations should form a basis for this new data collection effort.

The goals of this program are the conservation of fuel and the saving of lives. The result of the speed-monitoring program is merely a means for measuring the effectiveness of our enforcement and public education programs. The most important and difficult part of this campaign is to convince motorists that compliance with the national speed limit is to their best interests.