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THE RELATIONSHIPS BETWEEN SPEED,
SPEED LIMITS, AND MOTOR VEHICLE ACCIDENTS

An Annotated Bibliography

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PREFACE

This bibliography is intended to be of use to anyone interested in the relationships between speed, speed limits, and accidents. It resulted from a literature search initiated in connection with the controversy regarding the safety benefits of the national 55 m/h speed limit. By using the resources of the HSRI Library, we identified some 100 publications on the subject issued since the 1960 Highway Research Board bibliography on motor vehicle speeds. These were read for their relative significance, and notes on the authors' conclusions were prepared for the more important articles and reports. Those annotated publications are listed chronologically in Part I. Part II lists all of the publications reviewed.

In general, the research literature shows that lowered speed limits reduce (1) the number of vehicles traveling at high speeds; (2) the mean speed of traffic; (3) the dispersion of speeds about the mean; and (4) the number of serious- and fatal-injury accidents. Since 1964, when Solomon described the relationship between pre-accident speed and accident involvement rate as a U-shaped curve, speeds significantly higher or lower than that of the traffic stream have often been cited as associated with high accident rates. It is evident from this survey, however, that existing data do not contain sufficient detail concerning the pre-accident situation to clearly define the causes of accidents or to suggest countermeasures that might prevent them.

J.E.H.

K.W.

PART I

SELECTED REFERENCES WITH ANNOTATIONS

"Motor Vehicle Speeds; an Annotated Bibliography." Highway Research Board Bibliography, no. 27, 1960. 86p.

Lists and briefly describes publications on the subject of motor vehicle speeds as they relate to characteristics of drivers, highways, vehicles, traffic operations, and collisions. A state-of-the-art bibliography covering a period from the early 1920's through 1958.

Prisk, C. W. "The Speed Factor in Highway Accidents." Traffic Engineering, v. 29, no. 11, Aug 1959, pp. 16-17, 25.

Reports the results of a Bureau of Public Roads study of 600 miles of two-lane and four-lane rural highways in 11 states, drawing on 10,000 accident records and on observations and interviews with 290,000 drivers using those highways. The principal finding was that accident involvement rate as a function of travel speed is expressed as a reversed 'J', curving lower from 35 m/h down to 65 m/h, then rising with higher speeds.

Newby, R. F. "Effect on Accidents in London Area." Traffic Engineering & Control, v. 2, no. 3, July 1960, pp. 160-161.

Concludes that experimental imposition of a 40 m/h speed limit on selected main roads in the London area significantly reduced the number of injury accidents.

Baerwald, J. E. "The Influence of Speed and Speed Regulations on Traffic Flow and Accidents." Fifth International Study Week in Traffic Engineering. World Touring and Automobile Organization, London, 1960. Theme VI. 4p.

Cites study results showing that small upward changes in posted speed limits had little or no effect on driving speeds or accident rates.

Heyse, H. "The Influence of Speed and Speed Regulations on Traffic Flow and Accidents in the Federal Republic of Germany, Part II: Outside Built-up Areas." Fifth International Study Week in Traffic Engineering. World Touring and Automobile Organization, London, 1960. Theme VI. 2p.

Cites 1958-1959 autobahn accident experience as evidence that the imposition of a speed limit increases accidents by contributing to formation of long columns of vehicles closely following each other in the left lanes of expressways.

Lefevre, P. "Results of Speed Limits in Belgium." Fifth International Study Week in Traffic Engineering. World Touring and Automobile Organization, London, 1960. Theme VI. 4p.

Concludes that imposition of an 80 km/h speed limit outside built-up areas in Belgium in 1959 brought no decrease in the number of accidents.

Smeed, R. J. "The Influence of Speed and Speed Regulations on Traffic Flow and Accidents." International Road Safety and Traffic Review, v. 9, no. 1, 1961, pp. 51-66.

This author, The Reporter General for Theme VI of the Fifth International Study Week in Traffic Engineering, 1960, presents conclusions of his review of papers presented there, including some that accept data but challenge the conclusions some authors reached from it. Smeed's conclusions regarding studies of the effects of speed limits:

(1) A high proportion of drivers do not limit their speeds...to accord with legal requirements.

(2) In nearly all cases for which we have satisfactory data, a speed limit had a marked effect in reducing the higher speeds.

(3) In cases where distribution of speeds was identical before and after the imposition of the limit, this may have been due to [inefficacy of] the signs or the measurements of speed.

(4) Speed limits seem to have a marked effect in reducing fatal accidents in urban areas. They have much less effect on slight or damage-only accidents.

(5) There is some evidence that motor cyclist and pedal cyclist fatalities are especially affected by speed limits.

(6) The imposition of speed limits on a number of main roads, including motorways, seems to have had a favorable effect on road accidents.

Oppenlander, J. C. "A Theory on Vehicular Speed Regulation." Highway Research Board Bulletin, no. 341, 1962, pp. 77-91. (See also Webster, L. and Gruen, W. T. A Summary of the Vehicular Speed Regulation Research Project. University of Illinois, Department of Civil Engineering, June 1966. 101p.)

Presents a method for determining the optimal maximum and minimum speed limits for a roadway, based upon the operation cost, time cost, and accident cost. Offered as a workable and more scientific method than the 85th-percentile-speed method.

Bross, I. D. J. "Highway Risks at Extreme Speeds." Public Health Reports, v. 78, no. 1, Jan 1963, pp. 27-33.

Cogent discussion of unmanageability of typical passenger cars in emergency maneuvers at high speeds, and suggestions of means of influencing manufacturers to improve designs.

Solomon, D. Accidents on Main Rural Highways Related to Speed, Driver, and Vehicle. Bureau of Public Roads, Washington, D.C., July 1964. 44p.

Reports the results and further analyzes the study previously reported by Prisk in 1959. Some of the conclusions:

The greater the variation in speed of any vehicle from the average speed of all traffic, the greater its chance of being involved in an accident.

Drivers of passenger cars having low horsepower had higher involvement rates than drivers of cars having higher horsepower, regardless of the other variables studied.

Nearly half of all accident involvements were either rear-end collisions or same-direction side-swipes. However, as travel speed increased, the proportion of these accident involvements decreased and the proportion of single-vehicle accidents increased. At 80 m/h, noncollision accidents constituted half of all involvements.

Taylor, W. C. The Effect of Speed Zoning on Traffic Operations. Ohio Department of Highways, Columbus, Feb 1965. 26p.

Concludes that there is a strong relationship between the rate of occurrence of accidents and the speed distribution on rural state highways; that accident rate is significantly higher in areas where the speed distribution curve is non-normal; and that it is reduced when the distribution is changed to a normal one.

Goen, R. L. The Tradeoff Between Lives and Driving Time. Stanford Research Institute, Menlo Park, Calif., 1966. 17p.

Argues that effectively enforced speed limits of 50 m/h on freeways, 40 m/h on rural highways, 30 m/h on urban arterials, and 30 m/h on business and residential streets would save 25,000 lives per year in the U.S. Includes assumptions that appear reasonable, plus some unusual and interesting factor comparisons, such as fatalities per year plotted against fractions of present speeds.

Hakkinen, S., et al. Research on Speed Limit in Highway Traffic in 1962. Central Organization for Traffic Safety (TALJA), Helsinki, 1966. 23p.

Presents results of an experimental four-month imposition of speed limits in three counties. There were significant reductions in number of accidents, injured, and particularly fatalities. The effect on weekends and holidays was greater than on weekdays. The effect was greater on main roads than in local speed-limited areas.

Munden, J. M. The Relation Between a Driver's Speed and His Accident Rate. Road Research Laboratory, Crowthorne, Eng., 1967. 29p.

Concludes that there is a U-shaped variation of accident rate (for drivers) with changes in relative speed. The average-speed vehicle has the lowest rate, while the rates for very slow and very fast vehicles are high. However, the fact that 'fast' and 'slow' drivers have high accident rates does not in itself necessarily mean that relatively high and low speeds are the only direct cause of the situation. It may imply that driving speed is also correlated with certain other driver traits which are likely to cause accidents.

Prisk, C. W. "Accident Rates on Motorways, Especially with Reference to (a) Speed Differences (b) Minimum and Maximum Speed Limits." International Road Safety and Traffic Review, v. 15, no. 2, Spring 1967, pp. 24-33.

Reports mixed and somewhat conflicting conclusions from studies of speed limits and accident rates in several countries, and discusses reasons why this should be so.

Report on the 70 m.p.h. Speed Limit Trial. Road Research Laboratory, Crowthorne, Eng., 1967. 64p.

Concludes that the speed limit markedly reduced numbers of cars traveling at high speeds on motorways; that accidents and casualties on motorways were reduced by about 20%; and that accidents on all-purpose roads were reduced by about 3.5%.

Wingerd, N. C. "Minimum Speed Limits [by lane] on Freeways." Highway Research Record, no. 244, 1968. 26p.

Reports that a California Division of Highways experimental study of posting lane-by-lane minimum speed limits on 4-lane, 6-lane, and 8-lane freeways revealed few if any beneficial results and showed some results definitely unfavorable to operation and safety--i.e., the differential limits induced more drivers to travel in left lanes and to pass on the right.

Cirillo, J. A. "Interstate System Accident Research Study II, Interim Report II." Public Roads, v. 35, no. 3, Aug 1968, pp. 71-75.

Concludes that on the Interstate system, as the speed of a vehicle varied from the mean speed of traffic, either above or below the mean, the chance of the vehicle being involved in an accident increased; that the level of enforcement had little or no apparent effect on the mean speed or on the accident experience of a study section; and that accident rates were by far highest at urban interchange entrance ramps.

Jeffcoate, G. O. "Effect of Speed Limits on Road Safety in Europe." World Survey of Current Research and Development on Roads and Road Transport, 1969. International Road Federation, Washington, D.C., Dec 1969. Pp. 331-343.

This review of European studies conducted since Smeed's review in 1960 concludes that:

(1) The introduction of a speed limit reduces the proportion of drivers who drive at higher speeds.

(2) The introduction of speed limits in urban areas was followed by reductions in all severities of accidents in all countries for which information is available, with more marked reductions in more serious accidents.

(3) In non-built-up areas, the results of imposing a speed limit are mixed. In some cases, speed limitations are followed by decreases in accidents, but in other cases the results are inconclusive.

Cleveland, D. E. "Speed and Speed Control." Traffic Control and Roadway Elements--Their Relationship to Highway Safety. Rev. ed. Highway Users Federation, Washington, D.C., 1970. Chapter 3. 13p.

Presents a summary of published findings. Draws upon 162 publications.

"Effectiveness of Speed Limits on Rural Roads and Motorways." Tenth International Study Week in Traffic and Safety Engineering. World Touring and Automobile Organization, London, 1970. Theme VII. 40p.

Contains six papers in which traffic safety experts from six countries present evidence supporting their conclusions that speed limits reduce accidents.

Roosmark, P. O., and Nilsson, G. Different General Speed Limits in Sweden; Effects on Road Accidents and Vehicle Speeds. Statens Vaginstitut, Stockholm, 1970. 16p.

Concludes that a speed limit of 100 km/h resulted in slightly fewer accidents than no speed limit on the same roads, and that a speed limit of 90 km/h resulted in a substantially lower number of accidents than a speed limit of 110 km/h on the same roads. A careful, detailed four-year study, with considerable control checks.

Speed and Accidents. Research Triangle Institute, Research Triangle Park, N.C., June 1970. 2v. Contract no. FH-11-6965.

Concludes that the likelihood of being involved in an accident is increased by a factor of 10 if one is driving at speeds which deviate considerably (approx 15 m/h) from the mean speed of the traffic; that a large proportion of accidents on two-lane roads studied in Monroe County, Indiana, are initiated by left-turning vehicles or by vehicles entering the road; also, that the Computer-Sensor System is an excellent but expensive method of collecting data on traffic flow characteristics during accidents.

Brooks, S. H., et al. "Causes of Injury in Motor Vehicle Accidents." Surgery, Gynecology and Obstetrics, v. 131, no. 2, Aug 1970, pp. 185-197.

Concludes that as speed increases, the injury level increases; that injury levels increase with age; that occupants in heavier cars suffer less severe injuries; that wearing of lap belts decreases injury levels; and that females have less severe injuries than males at higher speeds.

Joscelyn, K. B., et al. Maximum Speed Limits. Indiana University, Institute for Research in Public Safety, Bloomington, Oct 1970. 4v. Contract no. FH-11-7275.

Concludes that the best method of establishing maximum speed limits is based on 85th percentile of travel speeds. Includes detailed instructions for establishing such limits. Volume II is an extensive review of literature and contains a section on speed, speed limits, and accidents.

Hauer, E. "Accidents, Overtaking and Speed Control." Accident Analysis and Prevention, v. 3, no. 1, July 1971, pp. 1-13.

Equates accident involvement rates at different travel speeds with the rate of overtakings; demonstrates that the rate of overtakings is reduced much more by establishing a minimum speed than by reducing the maximum speed on two-lane roads; and recommends therefore that minimum speeds be established and enforced as an effective means of reducing accidents. Also offers several possible explanations for the U-shape of the accident-involvement/travel-speed correlation:

(1) Slow drivers are hesitant and uncertain drivers and thus may be expected to be accident-prone, while fast drivers are accident-prone because they are inconsiderate, risk-taking adventurers.

(2) Perhaps many low-speed accident involvements were counted on roads of low standards, so that the dangerous road is at fault—not the low speed.

(3) Drivers involved in accidents might supply biased speed estimates to escape legal charges or insurance claims.

(4) The fact that 21 per cent of accidents in the 1964 Solomon study did not report speed may result in an unknown bias.

Jonrup, H., and Svensson, A. Effects of Speed Limits Outside Built-Up Areas. National Swedish Council on Road Safety Research, Stockholm, June 1971. 319p.

Reviews results of speed-limit-imposition studies in Sweden, Germany, France, Britain, Finland, Portugal, Denmark, Austria, Canada, Belgium, and Switzerland. Concludes that the introduction of speed limits has usually altered the distribution of vehicle speeds by reducing the number of vehicles running at high speeds and thereby reducing the dispersion of the speed distribution. Concludes also that many of the speed restrictions have resulted in a reduction in accidents, although not all of the studies obtained data adequate for statistically indisputable conclusions; and that in no case did an increase in accidents occur that could not be explained by outside influences--i.e., increased traffic volume, etc.

West, L. B., and Dunn, J. W. "Accidents, Speed Deviation and Speed Limits." Traffic Engineering, v. 41, no. 10, July 1971, pp. 52-55.

Reports on the use of computer sensor sites in an Indiana highway study of vehicle speeds and accident involvements. Includes one conclusion that the accident involvement rate of vehicles moving slower than the mean traffic speed is greatly elevated by the inclusion of accidents involving vehicles turning off the road or slowed down preparatory to turning.

Beatty, R. L. "Speed Analysis of Accidents on Interstate Highways." Public Roads, v. 37, no. 3, Dec 1972, pp. 89-102.

Concludes that the higher the speed the more severe the accident, and the higher the speed the more injuries per accident; that, however, below a pre-crash speed of 55 m/h, fatalities are independent of speed; at speeds over 55 m/h, fatalities per accident increase very sharply as speed increases.

Roosmark, O., and Nilsson, G. The Effect of a 70 km/h Speed Limit on Traffic Accidents. [In Swedish.] Statens Vag- och Trafikinstitut, Stockholm, 1973. 6lp.

Concludes that the lowering of the speed limit from 90 to 70 km/h reduced the total number of accidents by 18 per cent, property-damage

accidents by 15 per cent, personal injury accidents 24 per cent, and personal injuries 29 per cent. A controlled one-year study.

Joksch, H. C., and Wuerdemann, W. "Estimating the Effects of Crash Phase Injury Countermeasures--II; The Fatality Trend and Its Modification by Countermeasures." Accident Analysis and Prevention, v. 5, no. 1, April 1973, pp. 1-26.

Cites problems which recommend caution when using relations between speed and accidents:

Practically no objective information on speed in accidents is available.

Only the impact speed, not speed before accident, can be estimated from vehicle damage information.

Two-vehicle accidents are treated as two involvements. Thus, if speed for each vehicle is given it will not be known whether a fatality or serious injury at low speed is due to the high speed of the other vehicle.

It is likely that low speed before an accident is due to the driver recognizing a danger.

There exists strong evidence (Cirillo, 1968; Munden, 1967; Solomon, 1964) that the relative speed of a vehicle to the average speed of traffic, rather than its absolute speed, is related to accident involvement.

Though no simple and reliable relationships exist between speed and accidents, relations between speed and accident severity or fatality risk are strong and consistent.

PART II
PUBLICATIONS REVIEWED

1959

Prisk, C. W. "The Speed Factor in Highway Accidents." Traffic Engineering, v. 29, no. 11, Aug 1959, pp. 16-17, 25.

1960

Baerwald, J. E. "Speed as a Cause of Traffic Accidents." National Safety Congress Transactions, 1960, v. 24, pp. 12-18.

"The Influence of Speed and Speed Regulations on Traffic Flow and Accidents." Fifth International Study Week in Traffic Engineering. World Touring and Automobile Organization, London, 1960. Theme VI. 65p.

"Motor Vehicle Speeds; Annotated." Highway Research Board Bibliography, no. 27, 1960. 86p.

Newby, R. F. "Effect on Accidents in London Area." Traffic Engineering and Control, v. 2, no. 3, July 1960, pp. 160-161.

"Showdown on Speed." Journal of American Insurance, v. 36, March 1960, pp. 1-4.

Smeed, R. J. "Speed, Flow and Accidents." Traffic Engineering and Control, v. 2, no. 8, Dec 1960, pp. 474-478, 482.

1961

Smeed, R. J. "The Influence of Speed and Speed Regulations on Traffic Flow and Accidents." International Road Safety and Traffic Review, v. 9, no. 1, 1961, pp. 51-66. (Also in Roads and Road Construction, v. 38, Dec 1960, pp. 393-397; v. 39, Jan 1961, pp. 15-24.)

1962

Newby, R. F. "Effect on Accident Frequency in London Area." Traffic Engineering and Control, v. 3, no. 11, March 1962, pp. 678-679.

Newby, R. F. "Speed Restrictions." Traffic Engineering and Control, v. 4, no. 3, July 1962, pp. 156-158, 175, 177.

Oppenlander, J. C. "A Theory on Vehicular Speed Regulation." Highway Research Board Bulletin, no. 341, 1962, pp. 77-91.

1963

Bross, I. D. J. "Highway Risks at Extreme Speeds." Public Health Reports, v. 78, no. 1, Jan 1963, pp. 27-33.

Schwartz, R. L. "The Case for Fast Drivers." Harper's Magazine, v. 227, no. 1360, Sep 1963, pp. 65-70.

Temporary Speed Limits of Motor Traffic During 1961-62; Findings of the 1961 Traffic Safety Committee. [In Swedish.] Swedish Department of Communication, Stockholm, 1963. 163p.

1964

Janeway, R. N. "Comments on Highway Speeds." Public Health Reports, v. 79, no. 1, Jan 1964, pp. 87-90.

Motor Vehicle Speed...Its Control and Regulation. American Automobile Association, Washington, D.C., June 1964. 10p.

Solomon, D. Accidents on Main Rural Highways Related to Speed, Driver, and Vehicle. Bureau of Public Roads, Washington, D.C., July 1964. 44p.

Taylor, W. C. "Speed Zoning: A Theory and Its Proof." Institute of Traffic Engineers Proceedings, v. 34, 1964, pp. 13-23.

"Here Are the Proportions in Which the Severity of Collisions Increase with Vehicle Speed." [In French.] ONSER Actualites, v. 11, 1964, pp. 6-8.

1965

"Speed and Accidents." Symposium on Road Safety. Department of Local Government, Dublin, 1965. Theme III. Pp. 83-114.

"Speed's Impact on Accidents." Commercial Car Journal, v. 109, May 1965, pp. 82-87.

Taylor, W. C. The Effect of Speed Zoning on Traffic Operations. Ohio Department of Highways, Columbus, Feb 1965. 26p.

1966

"Accident Rates on Motorways, Especially with Reference to: (a) Speed Differences, (b) Minimum and Maximum Speed Limits." Eighth International Study Week in Traffic Engineering; 1966 International Road Safety Congress. World Touring and Automobile Organization, London, 1966. Theme III/3. 70p.

Goen, R. L. The Tradeoff Between Lives and Driving Time. Stanford Research Institute, Menlo Park, Calif., 1966. 17p.

Hakkinen, S., et al. Research on Speed Limit in Highway Traffic in 1962. Central Organization for Traffic Safety (TALJA), Helsinki, 1966. 23p.

Interim Report on the 70 m.p.h. Speed Limit Trial. Road Research Laboratory, Crowthorne, Eng., 1966. 48p.

Moses, R. Safety and Our Highways; Peak Loads; Speed and Safety. Triborough Bridge and Tunnel Authority, New York, Sep 1966. 11p.

Wadsworth, J. The Effect of Conventionally Enforced Maximum Speed Limits on Motor Vehicle Accidents. National Research Council of Canada, Motor Vehicle Accident Study Group, Ottawa, Nov 1966. 24p.

Webster, L., and Gruen, W. T. A Summary of the Vehicular Speed Regulation Research Project. Illinois University, Department of Civil Engineering, June 1966. 101p.

Wingerd, N. C. Minimum Speed Limits on Freeways. California Division of Highways, Sacramento, Nov 1966. 82p.

1967

Cribbins, P. D., et al. "Effects of Selected Roadway and Operational Characteristics on Accidents on Multilane Highways." Highway Research Record, no. 188, 1967, pp. 8-25.

Munden, J. M. The Relation Between a Driver's Speed and His Accident Rate. Road Research Laboratory, Crowthorne, Eng., 1967. 29p.

Prisk, C. W. "Accident Rates on Motorways Especially with Reference to: (a) Speed Differences (b) Minimum and Maximum Speed Limits. General Reports." International Road Safety and Traffic Review, v. 15, no. 2, Spring 1967, pp. 24-33.

Report on the 70 m.p.h. Speed Limit Trial. Road Research Laboratory, Crowthorne, Eng., 1967. 64p.

1968

Heimbach, C. L., et al. Developing Traffic Flow Indices for the Detection of High Accident Potential Highways in North Carolina. North Carolina State University, Department of Civil Engineering, Raleigh, Jan 1968. 95p.

Heimbach, C. L., and Vick, H. D. "Relating Change of Highway Speed Per Unit of Time to Motor Vehicle Accident Rates." Highway Research Record, no. 225, 1968, pp. 44-64.

Cirillo, J. A. "Interstate System Accident Research Study II, Interim Report II." Public Roads, v. 35, no. 3, Aug 1968, pp. 71-75.

Erlander, S., et al. Some Investigations on the Relationship between Road Accidents and Estimated Traffic. Stockholm University, 1968. 31p.

Ferguson, W. S. Truck Speeds in Virginia; a Study to Evaluate the Adequacy and Advisability of Differential Truck-Car Speed Limits. Virginia Highway Research Council, Charlottesville, Jan 1968. 76p.

Hakkinen, S., and Leppanen, U. Speed Limit Trial in Highway Traffic in October-November 1966. Central Organization for Traffic Safety (TALJA), Helsinki, 1968. 50p.

How Fast? A Paper for Discussion. Ministry of Transport, London, 1968. 56p.

Wingerd, N. C. "Minimum Speed Limits on Freeways." Highway Research Record, no. 244, 1968, pp. 1-26.

1969

Jeffcoate, G. O. "Effect of Speed Limits on Road Safety in Europe." World Survey of Current Research and Development on Roads and Road Transport, 1969. International Road Federation, Washington, D.C., Dec 1969. Pp. 331-343.

Maximum Safe Speed for Motor Vehicles. National Highway Safety Bureau, Washington, D.C., Jan 1969. 81p.

"Speed-Related Accident Countermeasures and Their Priorities." Proceedings of the National Highway Safety Bureau Priorities Seminar. Washington, D.C., 1969. Vol. 5. 89p.

Traffic Speeds as Related to Accidents; Selected References. Highway Research Board Library, Washington, D.C., April 1969. 3p.

1970

Brooks, S. H., et al. "Causes of Injury in Motor Vehicle Accidents." Surgery, Gynecology and Obstetrics, v. 131, no. 2, Aug 1970, pp. 185-197.

Cleveland, D. E. "Speed and Speed Control." Traffic Control and Roadway Elements - Their Relationship to Highway Safety. Rev. ed. Highway Users Federation, Washington, D.C., 1970. Chapter 6. 13p.

Joscelyn, K. B., et al. Maximum Speed Limits. Indiana University, Institute for Research in Public Safety, Bloomington, Oct 1970. 4v. Contract no. FH-11-7275.

"Effectiveness of Speed Limits on Rural Roads and Motorways." Tenth International Study Week in Traffic and Safety Engineering. World Touring and Automobile Organization, London, 1970. Theme VII. 40p.

Roosmark, P. O., and Nilsson, G. Different General Speed Limits in Sweden; Effects on Road Accidents and on Vehicle Speeds. Statens Vaginstitut, Stockholm, 1970. 16p.

Speed and Accidents. Research Triangle Institute, Research Triangle Park, N. C., June 1970. 2v. Contract no. FH-11-6965.

Vaughan, R. J. "Speed and Accidents on Rural Roads." Australian Road Research, v. 4, no. 3, March 1970, pp. 71-79. (See also comments by Foldvary, L. A., and Bryant, J. F. M. Australian Road Research, v. 4, no. 4, June 1970, pp. 63-66.)

The Effect of Temporary Speed Limits During 1961-1964. [In Danish.] Radet for Trafiksikkerhedsforskning, Lyngby, Denmark, 1970. 32p.

White, S. B., Jr., and Nelson, A. C., Jr. "Some Effects of Measurement Errors in Estimating Involvement Rate as a Function of Deviation from Mean Traffic Speed." Journal of Safety Research, v. 2, no. 2, June 1970, pp. 67-72.

1971

Grunwald, A. Analysis of Literature on Skid-Marks, Vehicle Damage and Speed in Relation to Road Accidents. Road Safety Centre, Haifa, Nov 1971. 63p.

Hauer, E. "Accidents, Overtaking and Speed Control." Accident Analysis and Prevention, v. 3, no. 1, July 1971, pp. 1-13.

Jonrup, H., and Svensson, A. Effects of Speed Limits Outside Built-Up Areas. National Swedish Council on Road Safety Research, Stockholm, June 1971. 319p.

Some Characteristics of North Carolina Accident-Involved Drivers Relative to the Estimated Speed Prior to the Accident. Research Triangle Institute, Research Triangle Park, N.C., Jan 1971. 72p.

West, L. B., Jr., and Dunn, J. W. "Accidents, Speed Deviation and Speed Limits." Traffic Engineering, v. 41, no. 10, July 1971, pp. 52-55.

Zuercher, J. D., et al. "Analysis of Near-Accidents and Accidents on the Highway." Behavioral Research in Highway Safety, v. 2, no. 2, Fall 1971, pp. 98-106.

1972

Beatty, R. L. "Speed Analysis of Accidents on Interstate Highways." Public Roads, v. 37, no. 3, Dec 1972, pp. 89-102.

A Characterization of Collisions, Resulting Damage and Occupant Injury. National Highway Traffic Safety Administration, Washington, D.C., Aug 1972. 31p.

Fee, J. C. "Accident Experience on Speed-Change Lanes of the Interstate Highway System." Public Roads, v. 37, no. 2, Sep 1972, pp. 61-64.

Haddon, W., Jr. "Approaching the Reduction of Road Losses - Replacing Guesswork with Logic, Specificity and Scientifically Determined Fact." National Road Safety Symposium, Papers Presented. Australian Department of Shipping and Transport, Canberra, 1972. Pp. 21-41.

Kovacik, B., and Bates, O. "Unsafe At What Speed?" Wheels Afield, v. 6, no. 7, July 1972, pp. 36-37, 40.

Lamm, R., and Klockner, J. H. "Speed Limits and Accident Occurrence." [In German.] Zeitschrift fur Verkehrssicherheit, v. 18, no. 1, 1972, pp. 3-18.

Mingard, R. "The Speed Limit on Major Roads." Proceedings of the Seventh International Congress of Traffic Police. Federation Internationale des Fonctionnaires Supérieurs de Police, Paris, 1972. Pp. 70-86.

Roosmark, P. O., and Nilsson, G. Different General Speed Limits in Sweden; Effects on Road Accidents and on Vehicle Speeds. Statens Vag- och Trafikinstitut, Stockholm, 1972. 19p.

Speed Limits Outside Built-Up Areas. Organisation for Economic Cooperation and Development, Paris, Aug 1972. 81p.

Rice, R. A. "A Study of Varying Degrees of Speed Limit Enforcement." National Road Safety Symposium, Papers Presented. Australian Department of Shipping and Transport, Canberra, 1972. Pp. 94-104.

Taragin, A. Geometric Design Criteria and Traffic Operational Experience on High Speed Freeways and Interchanges, an Indepth Study. Federal Highway Administration, Washington, D.C., 1972. 71p.

Vorwerk, C. "Influence of Vehicle and Traffic Parameters on the Speed and Accident Hazard on Two-Lane Roads." [In German.] Automobil-Industrie, v. 17, no. 4, Nov 1972, pp. 51-65.

Wahlgren, O. "Effect of Temporary Speed Limits on Road Accidents." Traffic Engineering and Control, v. 13, no. 9, Jan 1972, pp. 384-387.

White, S. B., and Clayton, C. A. "Some Effects of Alcohol, Age of Driver, and Estimated Speed on the Likelihood of Driver Injury." Accident Analysis and Prevention, v. 4, no. 1, March 1972, pp. 59-66.

Wright, P. H., and Mak, K. K. Relationships Between Off-Road Fixed-Object Accident Rates and Roadway Elements of Urban Highways. Georgia Institute of Technology, School of Civil Engineering, Atlanta, Sep 1972. 60p. Contract no. DOT-HS-166-2-260.

1973

Dieleman, R. "The Evolution of the Number of Casualties Since the Enforcement of the Regulations Concerning the Speed Limit of 90 km/h Dated the 1st July, 1971." [In Dutch.] Technical Aspects of Road Safety, no. 53, 1973, pp. 3.1-3.13.

Hofner, K. J., et al. The Effects of Speed Limits. [In German.] Verkehrspsychologisches Institut, Vienna, 1973. 20p.

Kelley, B. Speed and Car Crashworthiness: Unfixing a Great Gulf. Insurance Institute for Highway Safety, Washington, D.C., Nov 1973. 9p.

Rew, R. "A Better Road Speed Maximum." Journal of Environmental Systems, v. 3, no. 4, Winter 1973, pp. 301-306.

Roosmark, O., and Nilsson, G. The Effect of a 70 km/h Speed Limit on Traffic Accidents. [In Swedish.] Statens Vag- och Trafikinstitut, Stockholm, 1973. 61p.

Some Hard Data Relative to Highway Losses in Damaged People and Property and Changes that Might Result from the Energy Shortage. Insurance Institute for Highway Safety, Washington, D.C., Dec 1973. 49p.

Weldon, E. "A Note on Differences Between Urban-Rural and Speed-Limit Categorisations of Road Accident Data." Accident Analysis and Prevention, v. 5, no. 4, Dec 1973, pp. 367-370.

West, L. B., Jr., and Heimbach, C. L. "Correlating Instrumented Car Responses with Certain Geometric Elements of Highways and Accidents Utilizing Short Section Analysis." Highway Research Record, no. 461, 1973, pp. 17-29.

1974

Breinbauer, W., et al. Psychological Effects of the 100 km/h Speed Limit. 1st Interim Report. [In German.] Verkehrspsychologisches Institut, Vienna, April 1974. 53p.

Fiander, A. D. "North American Speed Zoning Criteria." Traffic Engineering and Control, v. 15, no. 12/13, April/May 1974, pp. 560-562.

Gadallah, A., et al. Special Traffic Speed Report. Speeds on Indiana Highways under Voluntary 55 m/h and Mandatory 55 m/h and 70 m/h Maximum Speed Limit Conditions. Purdue and Indiana State Highway Commission, Joint Highway Research Project, Lafayette, June 1974. 7p.

Hall, J. W., and Dickinson, L. V., Jr. "Truck Speeds and Accidents on Interstate Highways." Transportation Research Record, no. 486, 1974, pp. 19-32.

Hoffman, G. A. "Fuel Savings, Speed and Fatality Reductions, Travel Time Losses: What Are the Analytical Research Requirements?" Proceedings of the Third International Congress on Automotive Safety. National Motor Vehicle Safety Advisory Council, Washington, D.C., July 1974. Vol. 2, paper 45. 17p.

Jennrich, J. H. Accident Study Raises Questions on 55 m.p.h. National Speed Limit. Highway Users Federation, Washington, D.C., Aug 1974. 5p.

An Operational Evaluation of Truck Speeds on Interstate Highways. Maryland University, Department of Civil Engineering, College Park, Feb 1974. 118p.

E R R A T U M

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An Annotated Bibliography

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The following citation was inadvertently omitted from page 18:

Council, F. M., and Waller, P. F. "How Will the Energy Crisis Affect Highway Safety?" Traffic Safety, v. 74, no. 4, April 1974, pp. 12-14, 39-40.

