ESTIMATION OF 18-KIP EQUIVALENT ON PRIMARY AND INTERSTATE ROAD SYSTEMS IN VIRGINIA

by

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(The opinions, findings, and conclusions expressed in this report are those of the authors and not necessarily those of the sponsoring agencies.)

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ABSTRACT

For pavement design purposes, the Virginia Department of Highways uses the AASHO method of determining the 18-kip equivalent single axle load (EWL-18). The evaluation of the EWL-18 is based on on-location truck axle weight studies that usually are carried on for one day only. This method is expensive and time consuming.

Because of the expense and time involved in the initial evaluation of the EWL-18, no attempt is made to reevaluate it during the life of the pavement, even when rehabilitation is proposed. For this reason a method by which the EWL-18 could be quickly estimated from the routinely available records seemed desirable. The Virginia Department of Highways issues yearly reports on (i) the traffic count on each section of the primary, interstate and arterial system, and (ii) the weights of vehicles using these systems.

In this investigation, several methods were tried to determine the best method for estimating the EWL-18. A method involving 3 equations was found to have the best correlation with the AASHO method. This method is very flexible and accounts for the weight and count of each vehicle type.

It is also shown in this report that even if the estimated EWL-18 deviates greatly from the AASHO value, the effect on the ultimate pavement design is very little. It is therefore recommended that this method of estimating the EWL-18 be used in connection with pavement rehabilitation studies when EWL-18 values are not currently available. The approach may be applied to develop traffic projections in cases where loadmeter studies are not feasible.

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INTRODUCTION

In Virginia, for pavement design purposes the AASHO Interim Guide [1] is used to determine the 18-kip equivalent single axle load (EWL-18) applications. The evaluation of the EWL-18 requires (i) a truck weight study in order to obtain the necessary axle weight distribution data, (ii) load equivalency factors and, (iii) a vehicle count by vehicle classification. The required truck weight study is perhaps the most difficult task (and a major drawback) in applying this method.

In Virginia, for pavement rehabilitation, the truck weight study usually is not carried out. For the design of new pavements, on-location weight studies of other roads — which are assumed to be carrying the same type of traffic — are utilized. These on-location studies usually are carried out in one working day. Thus, the accuracy in applying the AASHO method rests largely on the one-day truck weight study and on the evaluator's judgement in choosing the appropriate weight study to reflect the axle weight distribution for the proposed pavement design. In addition to these drawbacks, the on-location weight study is an expensive process.

For these reasons, less complex and inexpensive methods of estimating the EWL-18 that eliminates the on-location truck weight study have been developed by various agencies for different states. This study was made with the same objective.

PURPOSE

The purpose of this investigation was to determine a suitable method for estimating the EWL-18 (as would be obtained by the AASHO method) for the rehabilitation or design of primary and interstate roads.

In estimating the EWL-18 in Virginia, it was proposed to use data readily available to all divisions and districts of the Virginia Department of Highways, for example, the yearly reports on average daily traffic volumes (2) and truck weight studies. (3)

VARIABLES AND SCOPE

The variables considered in this investigation were as follows:

1. vehicle count,

2. average vehicle weight, and

3. vehicle classification in two types, (i) by axle weight classification, as given in the W-4 table of the "Truck Weight Study" and (ii) by vehicle type classification as given in the "Average Daily Traffic Volumes".

The other variables, like the ratio of empty to loaded vehicles, legal axle and gross truck weights, and seasonal changes in traffic patterns, were assumed to have a negligible effect on the evaluation in Virginia and hence were considered constant. The location, like coal area, industrial area, and commercial area, do have an effect on the evaluation but were not considered, though provision has been made for them. A distinction was made between rural and suburban areas, but the difference was so little that this distinction has been ignored, and is not reported here.

The annual truck miles figure is constantly increasing and will affect the forecast of the total vehicle count but does not affect the conversion rate of the present traffic into EWL-18 values.

In accordance with the practice of the Virginia Department of Highways the load equivalency factors were taken directly from the "AASHO Interim Guide" for flexible pavements for structural number 5 and a serviceability index of 2.5.

For the purpose of establishing the methodology of estimation, the following data were adopted:

1. On-location one-day truck weight studies on 93 projects consisting of 21 suburban and 72 rural areas for 1963 through 1966.

2. W-3 and W-4 tables of truck weight studies for the years 1961 to 1970.

3. Average daily traffic volumes on interstate, arterial and primary roads for the years 1960 to 1970.

4. Traffic data of 412 flexible pavement projects for Virginia, from 1960 to 1970.

METHODOLOGY FOR ESTIMATING

The first step in determining the methodology was to calculate the EWL-18 for each of the 93 on-location truck weight studies using the AASHO Interim Guide procedure. An example of this method is shown in Appendix I. The EWL-18 values obtained by other methods — as discussed below — were correlated with the EWL-18 values from the AASHO method, based on the assumption that the results obtained by the AASHO method were the true solutions.

In all methods, cars — which hardly add to the total EWL-18 value — were not considered. The W-4 table method discussed below accounts for 2-axle, 4-tire (2A-4T) vehicles by weight and volume. This vehicle type was, therefore, considered in the W-4 table method. However, it has been determined that EWL-18 due to 2A-4T vehicles do not add appreciably to the total EWL-18 value; on the contrary, they lead to poor correlations between the traffic count and the EWL-18 value. The 2A-4T vehicles, therefore, were not considered in any of the methods other than the W-4.

W-4 Table Method

The first method investigated was the W-4 table method. This method does not require the determination of mean ADT values, the average number of axles per vehicle, or the distribution percentages as does the AASHO method, but it is similar to the AASHO method in its use of equivalency factors and weight ranges. The W-4 method provides a means of determining the EWL-18 for each vehicle type, which is not provided by the AASHO method.

The correlation between the W-4 and AASHO methods is shown in Figure 1. This figure shows that the two methods correlate extremely well, with a correlation coefficient of 0.99. It also shows that the EWL-18 by the AASHO method is about 1.25 times the EWL-18 value obtained from the W-4 method.

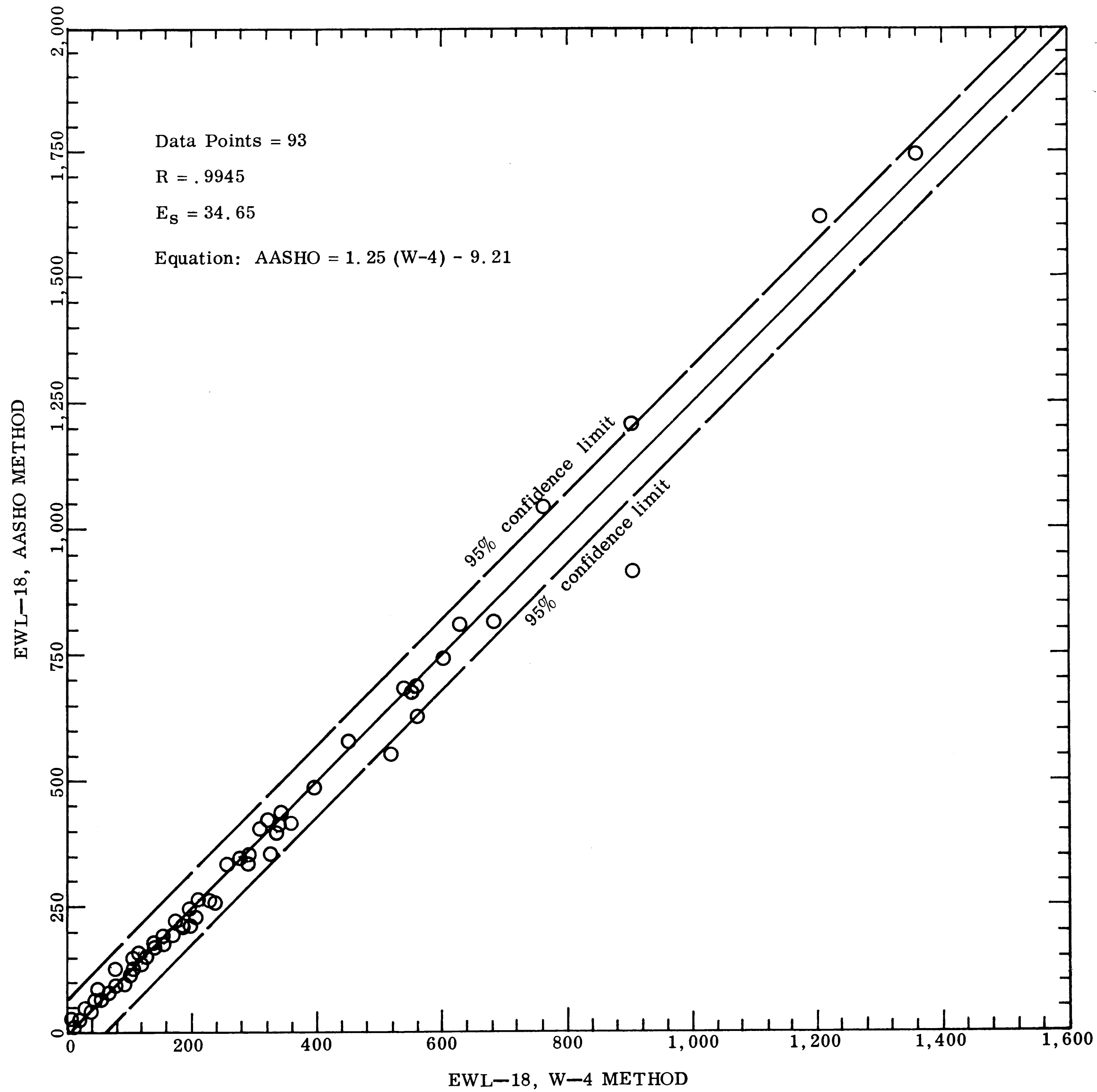

Figure 1. Correlation of the EWL—18 values obtained by the W—4 and the AASHO methods.

Asphalt Institute Method (A. I.)

This method is given by Shook and Lepp[4] of the Asphalt Institute and is based on the principle that trucks of two axles and six tires (2A-6T) and heavier are the prime developers of the EWL-18 and that vehicles lighter than these do not affect the final evaluation of the EWL-18. They have used a model equation as follows:

$$\log \text{EWL-18} = a + b \log S + c \log W + d \log N \qquad (1)$$

where,

a, b, c and d are constants

S = legal single axle load limit = 18 for Virginia
W = average heavy truck gross weight (2A-6T and heavier)
N = number of heavy trucks (2A-6T and heavier).

Using S = 18 for Virginia and the values of the constants as given by Shook, equation (1) reduces as follows:

$$\log \text{EWL-18} = -6.413 + 1.334 \log W + 1.051 \log N \qquad (2)$$

Equation (2) was applied to each of the 93 on-location studies by two methods. In the first method the equation was applied to each of five vehicle types: 2A-6T, 3-axle single unit, 3-axle trailer trucks, 4-axle trailer trucks, and 5-axle trailer trucks. The EWL-18's for each of the five types were summed to obtain the total for each weight study. In the second method, the average weight of the trucks (2A-6T and heavier) for each project was determined and then the equation was applied to get the total EWL-18 directly. It was found that there was very little difference in the results obtained by the two methods. The correlation coefficients, R, and standard error of estimations, E_s, were almost identical ($R = 0.97$ and $E_s = 76.8$ for the first method and $R = 0.971$ and $E_s = 77.8$ for the second). The correlation between the EWL-18's from the first method and the EWL-18's from the AASHO method is shown in Figure 2. This correlation shows that the EWL-18 by the AASHO method is about 1.42 times that obtained from the Asphalt Institute method by using equation (2).

Modified Asphalt Institute Method (Mod. A. I.)

New values of coefficients a, b, c and d for the Asphalt Institute model equation (1) above were determined by using a computerized multiple regression

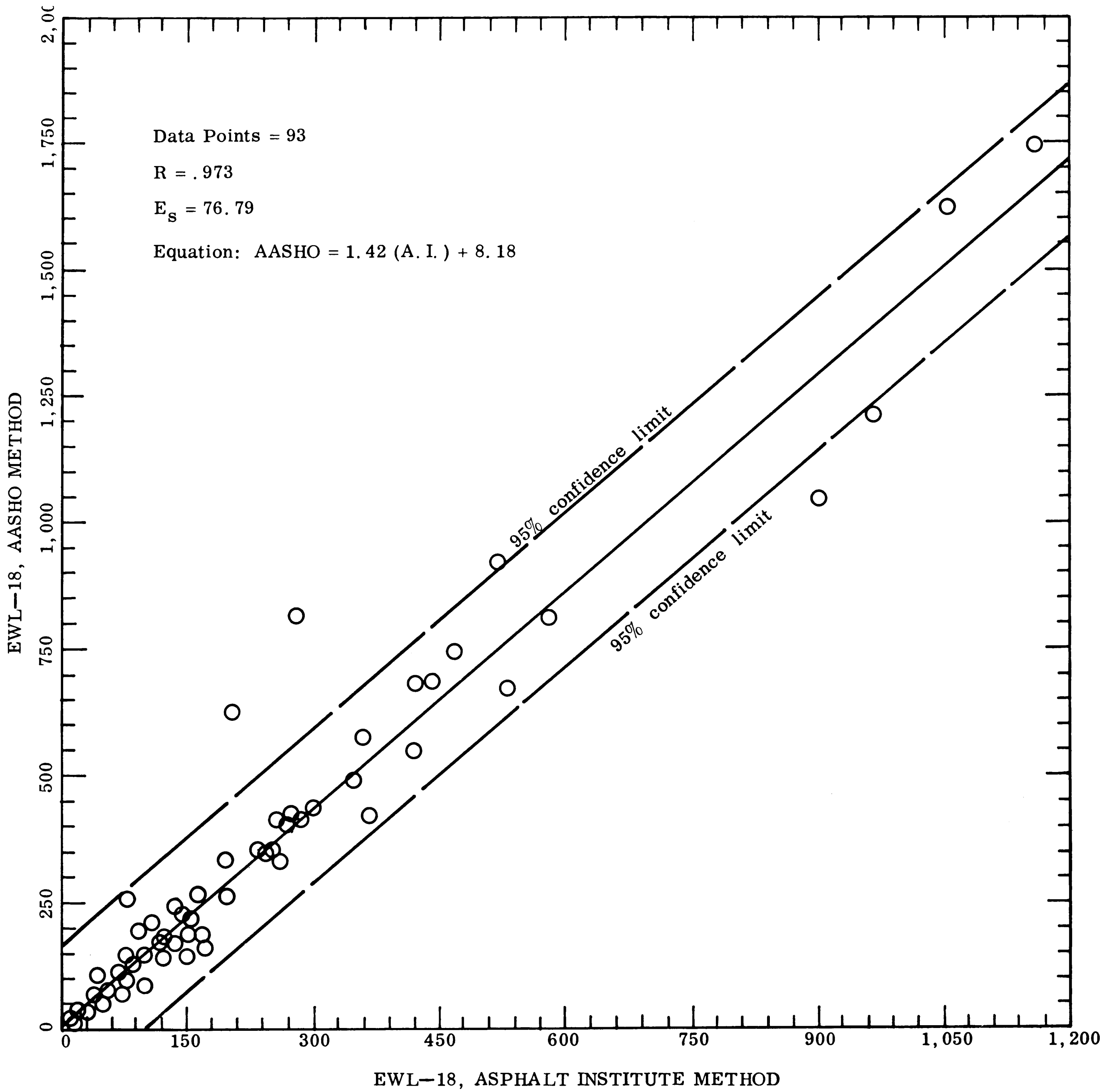

Figure 2. Correlation of the EWL—18 values obtained by the Asphalt Institute and the AASHO methods.

analysis. The dependent variable in the equation was the EWL-18 of each of the 93 on-location weight studies obtained from the AASHO method and the independent variables were (1) W, the average weight of the combined vehicle types for each weight study, and (2) N, the vehicle count (again, 2-axle, 6-tire and heavier). The resulting equation was

$$\log \text{EWL-18} = -8.483 + 1.873 \log W + 0.989 \log N \qquad (3)$$

The correlation between this method and AASHO method is given in Figure 3 and is expressed by this equation

$$\text{AASHO (EWL-18)} = 0.894 \text{ (Mod. A.I.)} + 24.79 \qquad (4)$$

This has a correlation coefficient of 0.98, which proves that the Mod. A.I. method correlates extremely well with the AASHO method.

Percent Method

In developing this method, a percentage distribution of the number of vehicles for different weight groups in each of the five vehicle classifications was made. From this the EWL-18 per vehicle by different weight groups in each vehicle classification was determined and is shown in Appendix II. In developing these data the Asphalt Institute equation for Virginia as developed by Shook, et al.[4] was used.

With these ratios and the vehicle count for each vehicle type, the EWL-18 for each of the 93 on-location studies was determined. The correlation between this method and the AASHO method is shown in Figure 4. The correlation coefficient is 0.94, which proves that this method correlates extremely well with the AASHO results, though it has a high standard error of estimate, i.e., $E_s = 116.72$.

If one assumes that the EWL-18/vehicle ratio, as determined by this method, holds for all projects, the total EWL-18 for any project could be obtained if the vehicle count by each vehicle classification is known.

Five Equation Method

In another attempt to remove weight as a variable, a multiple regression technique was used to develop the equation for each vehicle classification independently. The independent variables were the average vehicle weight and vehicle count for each vehicle classification, and the dependent variable was the EWL-18 for the corresponding vehicle classification as determined from the W-4 method.

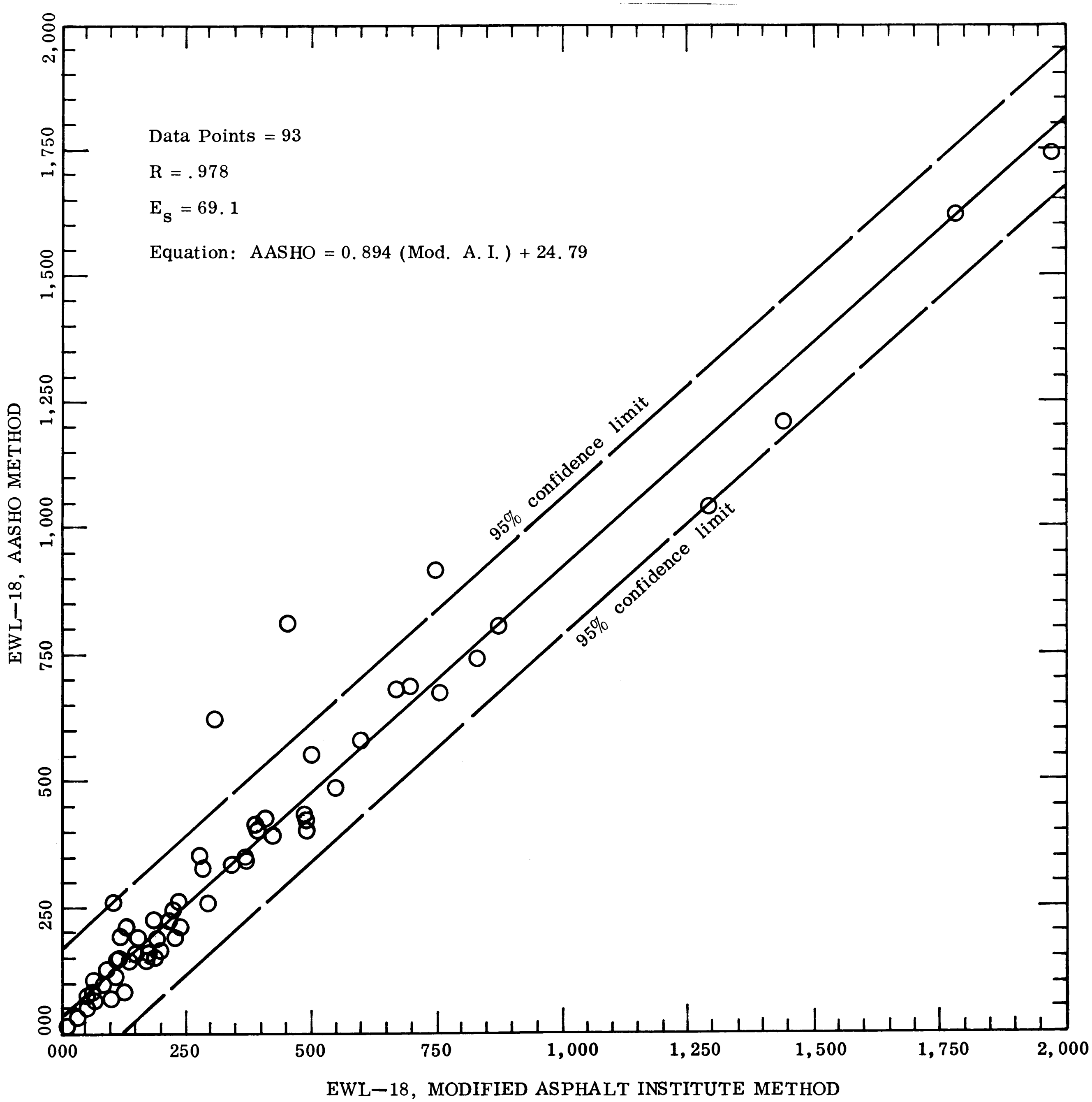

Figure 3. Correlation of EWL—18 values obtained by the Modified Asphalt Institute and AASHO methods.

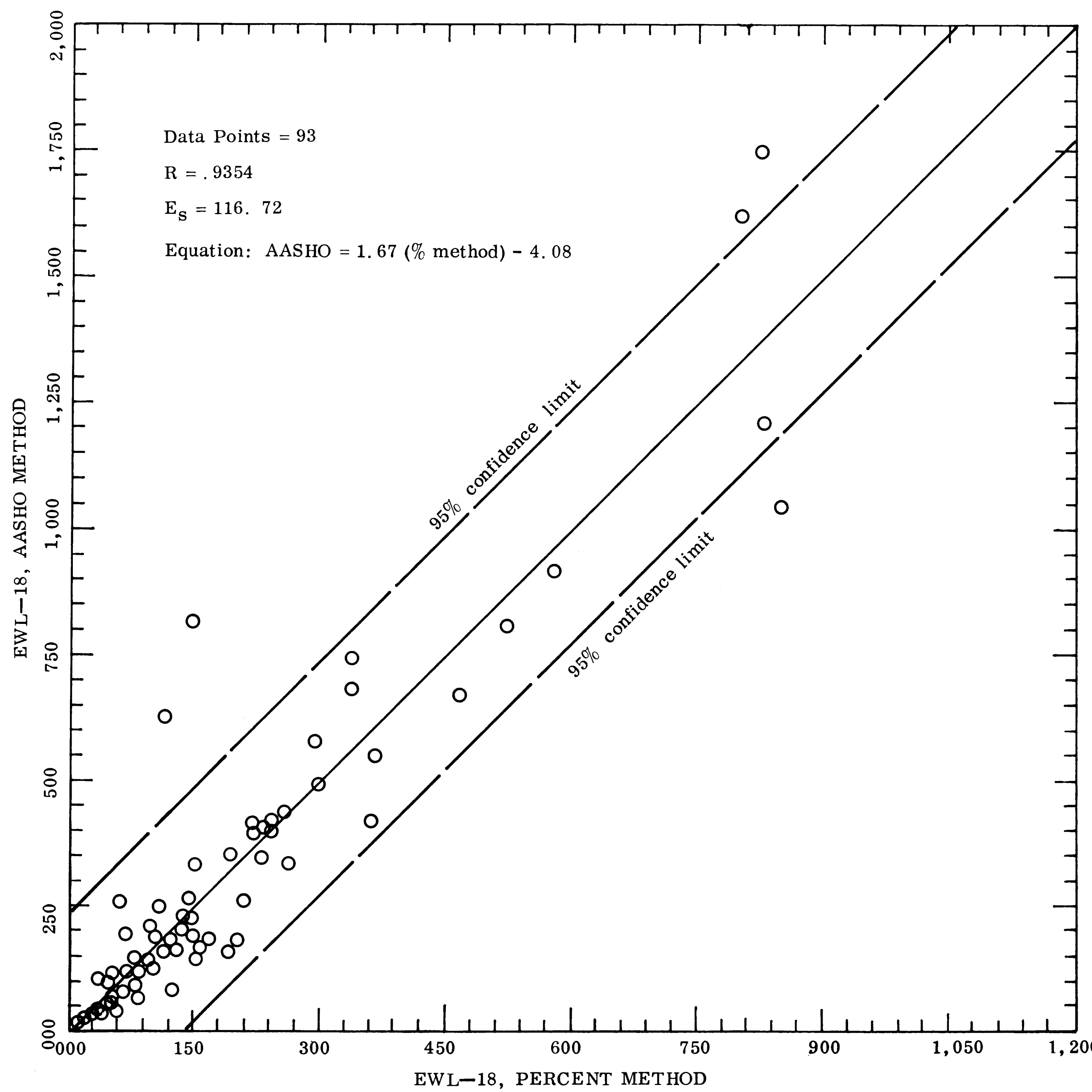

Figure 4. Correlation of EWL—18 values obtained by the percent method and the AASHO method.

The EWL-18's from the W-4 method were chosen because of the high correlation the W-4 method has with the AASHO method, which does not give EWL-18's for each vehicle classification. Once the five equations were developed the average weight of each vehicle type was inserted, thereby removing weight as an independent variable. The resulting equations are as follows:

1. For 2-axle, 6-tire single unit vehicles

$$\log (\text{EWL-18})_1 = -21.34 + 5.00 \log W_1 + 0.99 \log N_1 \quad (5)$$

$$= -0.70 + 0.99 \log N_1 \quad (5a)$$

2. For 3-axle single unit vehicles

$$\log (\text{EWL-18})_2 = -0.74 + 0.04 \log W_2 + 1.0 \log N_2 \quad (6)$$

$$= -0.55 + 1.0 \log N_2 \quad (6a)$$

3. For 3-axle trailer trucks

$$\log (\text{EWL-18})_3 = -0.04 - 0.10 \log W_3 + 1.05 \log N_3 \quad (7)$$

$$= -0.49 + 1.05 \log N_3 \quad (7a)$$

4. For 4-axle trailer trucks

$$\log (\text{EWL-18})_4 = -0.08 - 0.078 \log W_4 + \log N_4 \quad (8)$$

$$= -0.44 + 1.11 \log N_4 \quad (8a)$$

5. For 5-axle trailer trucks

$$\log (\text{EWL-18})_5 = -0.017 - 0.035 \log W_5 + 0.95 \log N_5 \quad (9)$$

$$= -0.18 + 0.97 \log N_5 \quad (9a)$$

In equations (5) through (9a), subscripts 1 through 5 for the EWL-18, W, and N show the five vehicle classifications for the EWL-18, the average weight of vehicles, and number of vehicles in each classification, respectively.

The correlation between this method and the AASHO is shown in Figure 5. The correlation is 0.94 which proves that this method correlates extremely well with the AASHO method.

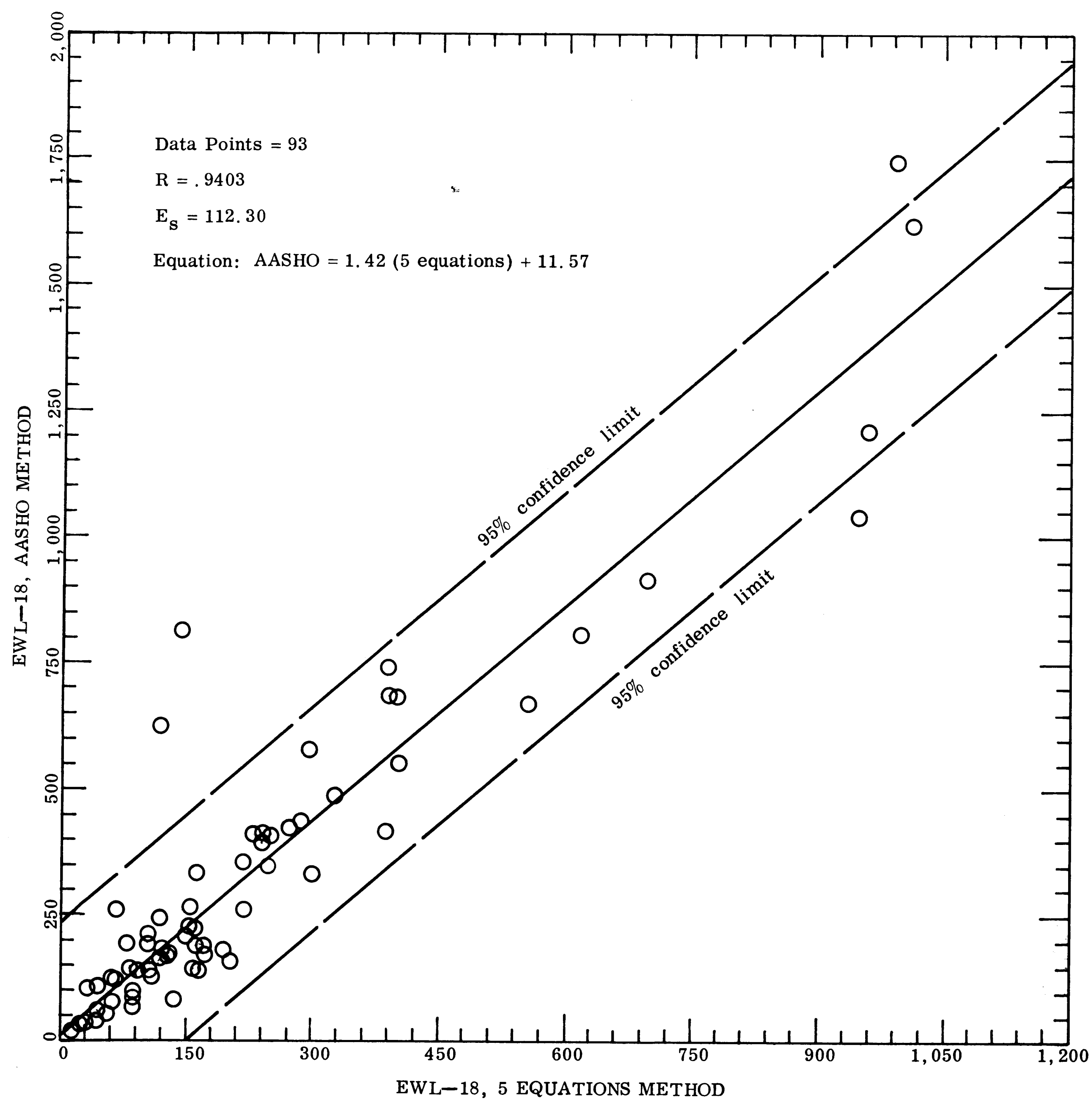

Figure 5. Correlation of EWL—18 values obtained by the five equation method and the AASHO method.

Three Equation Method

The three equation method is a simple reduction of the five equation method. Instead of using an equation for each of the axle groups in the three classifications of tractor semitrailers, one equation was developed to cover all tractor semitrailers (3-, 4-, and 5-axle trucks). The equations for the single unit vehicles (2-axle, 6 tires and 3-axle) remain the same as equations (5a) and (6a) as restated below:

$$\log (EWL\text{-}18)_1 = -0.7 + 0.99 \log N_1 \quad (5a)$$

and

$$\log (EWL\text{-}18)_2 = -0.55 + 1.0 \log N_2 \quad (6a)$$

The equation developed for trailer trucks having 3, 4 and 5 axles is as follows:

$$\log (EWL\text{-}18)_T = -13.92 + 3 \log W_T + \log N_T \quad (10)$$

Based on the W_T values given in Table 2 discussed later in this report

$$\log (EWL\text{-}18)_T = \log N_T - 0.0578 \quad (10a)$$

where W_T and N_T is the average weight and the number of trailer trucks, respectively.

The correlation between this method and the AASHO method is shown in Figure 6. The correlation coefficient is 0.98, which proves that the method correlates extremely well with the AASHO method. The correlating equation is as follows:

$$\text{AASHO (EWL-18)} = 16 + 1.22 \text{ (EWL-18 by 3 equation method)} \quad (11)$$

SELECTION OF THE METHOD FOR USE

The above investigation shows that given the necessary information the following methods enable good estimations of the AASHO EWL-18 for a given project:

1. Percent method,
2. W-4 method,
3. Five equation method,
4. Modified Asphalt Institute method, and
5. Three equation method.

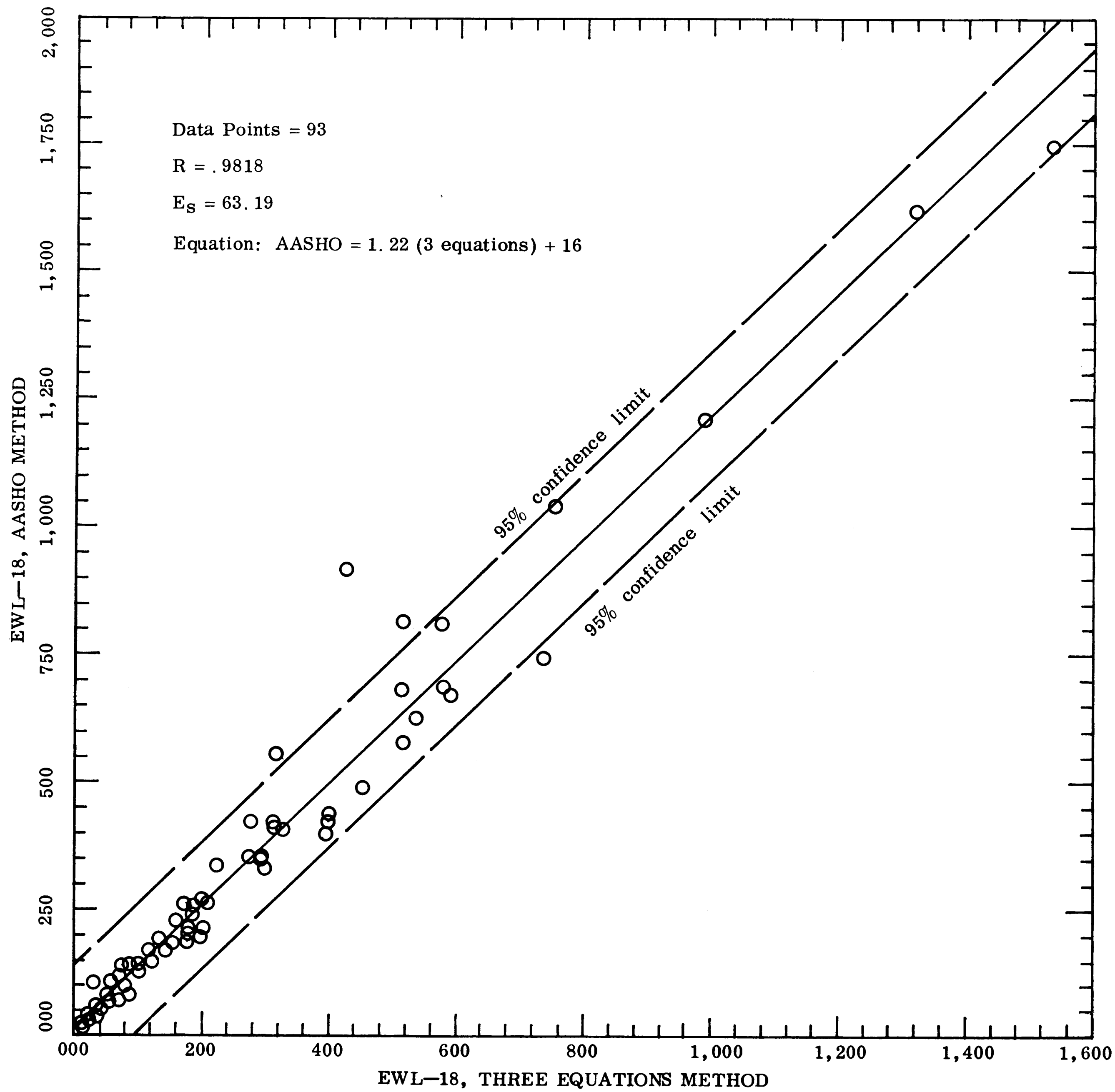

Figure 6. Correlation of EWL—18 values obtained by the three equation method and the AASHO method.

The percent method requires the percent vehicle count in different vehicle weight groups to determine the EWL-18 per vehicle as shown in Appendix II. The values given in this appendix may not be applicable to the data of the following years due to possible changes in the traffic pattern. This method is, therefore, not recommended for application on a long-term basis.

In the W-4 method, axle counts by each weight classification need to be known. This information is not obtainable for any project without the collection of data on the site. This method therefore cannot be used for estimation purposes.

In the remaining three methods, the needed average truck weights by vehicle classification or total average weight of trucks could be obtained from the W-3 tables in Virginia's Truck Weight Studies. The vehicle count for any interstate or primary highway is obtainable from Virginia's annual Daily Traffic Volume Reports.

In the traffic volume reports the trailer trucks are not categorized as 3-, 4-, and 5-axle which information is needed for the five equation method. The five equation method might therefore be difficult to apply in many cases. This method is therefore not recommended for general purposes of estimation.

The annual "Truck Weight Study" reports of the Virginia Deparment of Highways shows that from 1963 to 1970 there was no tendency towards an overall increase or decrease in truck weights. Thus, the average truck weights during this period as obtained from the W-3(03) and W-3(04) tables are given in Table 1 below. and could be applied for eatimating the EWL-18 for any project.

TABLE 1

AVERAGE WEIGHT OF VEHICLES BY VEHICLE CLASSIFICATION

Vehicle Classification	Avg. Weight of Vehicle
Single unit — 2 axles, 6 tires	13,705
Single unit — 3 axles	25,980
Tractor semitrailers — 3, 4, & 5 axles	41,760

These average weights could be applied directly in the three equation method. For the Modified Asphalt Institute method, the average weight of the vehicle, W, is obtained as follows:

$$W = \frac{N_1W_1 + N_2W_2 + N_3W_3}{N_1 + N_2 + N_3} \tag{12}$$

where

N_1, N_2, and N_3 are the counts and W_1, W_2, and W_3 are the weights of 2A-6T, 3A-single unit and trailer trucks respectively.

In the three equation method equations (5a), (6a), and (10a) are obtained from equations (5), (6) and (10) by the use of the truck weights given in Table 1 . The average weights given in Table 1 could be used for design all over Virginia except in the coal areas of the Bristol District. In the coal areas, permits for higher wheel and truck loads are issued free of charge. The permit limits the maximum weight on single and tandem axles to 24,000 and 36,000 lb. against the conventional maximum permissible weights of 20,000 and 32,000 lb. on single and tandem axles, respectively.

The values given in Table 1 could be used, and for the coal areas these values could be exceeded by 20 percent. If the weight values are changed, equations (5), (6) and (10) should be used for the three equation method.

The correlations between the three equation and the modified A. I. methods in Figures 3 and 6 show that though their correlation coefficients with the AASHO method are the same, the standard error of estimate in the three equation method is slightly lower than that in the modified A. I. method.

To further evaluate the choice between these two methods 412 satellite projects designed between 1960-70 were selected and their traffic counts obtained from the reports of Average Daily Traffic Volumes on Interstate, Arterial and Primary Roads, which are published by the Virginia Department of Highways. In these traffic volume data, buses are given separately. The buses are classed as either school buses of the 2A-6T class or commercial buses with 3 axles. Since these data are collected on working days only and between 8 a. m. and 5 p. m. almost all the school buses are counted while not all the commercial buses are. Thus 70 percent of the buses counted were assumed to be of the 2A-6T and the remaining 30 percent 3-axle vehicles. It is, however, recommended that for general application 80 percent of the buses counted should be considered to be of the 2A-6T class and the remaining 20 percent in the 3-axle vehicle class. This breakdown is necessary for the three equation method while it is not needed for the modified A. I. method.

1778

For the three equation method, equations (5a), (6a) and (10a) were used to determine the total EWL-18 for each project. For the modified A.I. method equation (4) was used. The EWL-18 values so obtained by these two methods were correlated with each other. The correlation coefficient was 0.995 with a standard error of estimate = 15.8. This is an excellent correlation. The relation between the EWL-18 values obtained by the two methods was found to be:

$$\text{Mod. A.I.} = 13 + 1.2 \text{ (3 equation)} \tag{13}$$

Total truck traffic consisting of 2A-6T and heavier was correlated with the EWL-18 obtained by each of these two methods by the use of their equations.

In the three equation method the correlation coefficient was 0.92 with standard error of 80. The correlation equation was as follows:

$$\text{EWL-18 (3 eq.)} = -7 + 0.7\,(N_1 + N_2 + N_T) \tag{14}$$

This correlation is shown in Figure 7.

In the modified A.I. method the correlation coefficient was 0.88 with a standard error of 96.

The two correlations show that the three equation method is statistically superior to the modified A.I. method. Moreover, by use of different equations for different vehicle types, as in the three equation method, one can obtain better estimates of the EWL-18 than from one equation for trucks as in the modified A.I. method.

The three equation method is therefore considered the best choice for estimating the AASHO EWL-18.

For the easy conversion of the traffic count to the AASHO EWL-18, equation (14) (correlating count v/s EWL-18 by 3 equation) and equation (11) (correlating EWL-18 by AASHO and EWL-18 by 3 equation) could be combined. Based on these two equations

$$\begin{aligned}\text{AASHO EWL-18} &= 164 + 1.22\,\left[-7 + 0.7(N_1 + N_2 + N_T)\right] \\ &= 7 + 0.85(N_1 + N_2 + N_T) \qquad (15)\end{aligned}$$

This shows that the EWL-18 obtained by the AASHO method is about 0.85 times the total 2A-6T and heavier truck traffic.

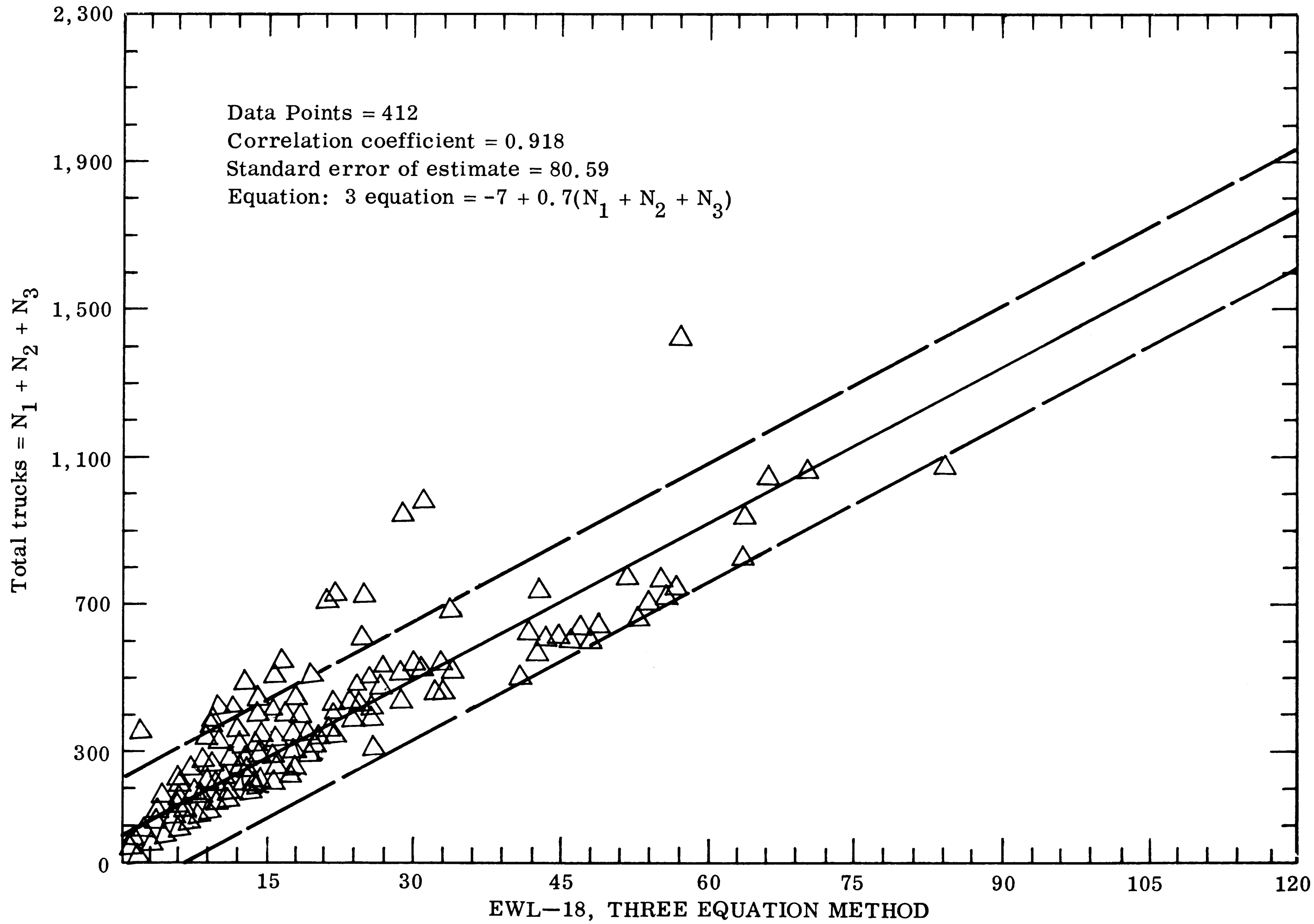

Figure 7. Correlation of EWL—18 obtained by the three equation method and the total truck traffic (2A-6T and heavier).

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EFFECT OF ESTIMATING THE EWL-18 ON PAVEMENT DESIGN

As mentioned before, the AASHO method is used for the purpose of pavement design only. Though it has been shown that the estimated EWL-18 values have an excellent correlation with the AASHO values on a statistical basis, it was necessary to confirm the maximum possible deviation a designer is likely to get by using the estimated method as compared to the AASHO method presently used.

In Virginia for the design of primary, interstate, and arterial roads, the pavement design method developed by Vaswani [5] is used. In this method, the thickness index of the pavement is determined.

The estimated values of EWL-18 obtained from the three equation method were used to determine the thickness index for each project. The soil support values for all pavements were assumed to be 10. Given the soil support and EWL-18, the thickness indices obtained were correlated with the thickness indices obtained by using the AASHO EWL-18 method. The correlation graph is shown in Figure 8. The correlation coefficient of 0.97 and standard error of estimate of 0.45 show that the estimated value enables pavement design from estimated EWL-18 values.

CONCLUSION AND RECOMMENDATION

1. The small errors resulting from calculating or estimating EWL-18 values do not much affect the ultimate pavement design.

2. The three equation method should be used for estimating the EWL-18, when loadmeter studies are not feasible.

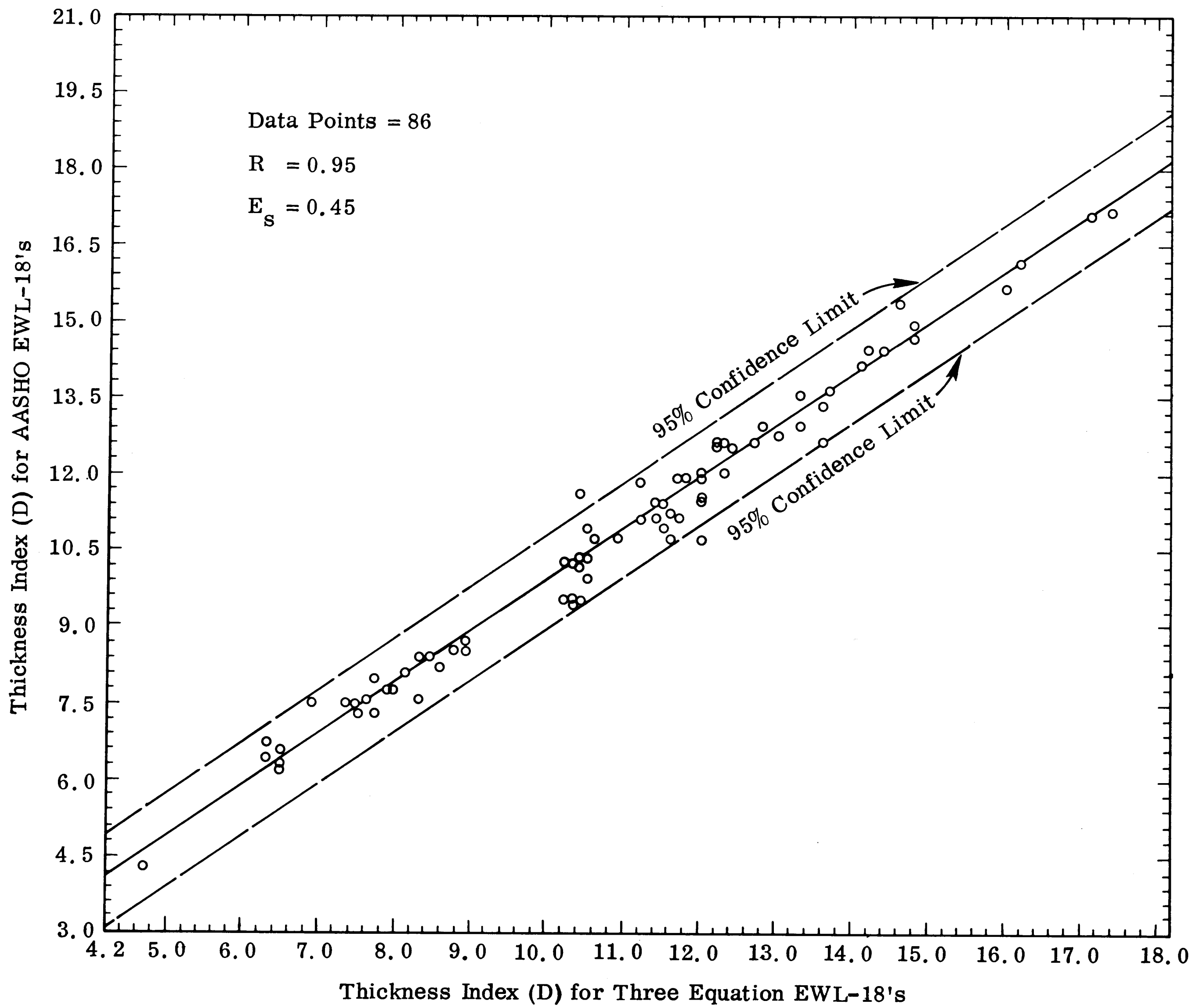

Figure 8. Correlation of thickness index (D) by 3 equation method and AASHO method.

ACKNOWLEDGEMENT

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PREPARED: June 14, 1966

APPENDIX I

EQUIVALENT 18^k AXLE LOADING
FOR PAVEMENT THICKNESS DESIGN
USING FLEXIBLE PAVEMENT DESIGN GUIDE

ROUTE: 29 PROJECT: 6029-056-103, PE-101
TERMINI: N. End of Madison By-Pass - 2.8 Mi. W. of Culpeper Co. Line
COUNTY: Madison

1. ASSUMPTIONS
   A. Serviceablilty Index - 2.5
   B. Traffic Analysis Period - 20 Years
   C. Type of Pavement Flexible

2. TRAFFIC ANALYSIS
   The estimated date of completion of this roadway is 1968.

   A. The ADT is estimated to be 6170 VPD in 1968 and 10980 VPD in 1988.

   The traffic in one direction will be:

1968 ADT	=	3085	(2378 Cars -	707	Trucks)
1988 ADT	=	5490	(4231 Cars -	1259	Trucks)
Mean ADT	=	4288	(3305 Cars -	983	Trucks)

   B. Average weights of commercial vehicles over the design period as determined from loadometer studies on Route 29 are:

   Average Gross Weight - 21735 Pounds
   Average Single Axle Weight - 7891 Pounds

Then:
   Average Number of Axles per Commercial Vehicle = 2.75
   Single Axle Loads per day for Commercial Vehicles = 983 x 2.75 = 2703

   C. The loadometer studies indicate that axle loads are distributed percentagewise in the following weight catagories:

GROSS AXLE WEIGHT (lbs.)	PERCENTAGE OF ADT SINGLE AXLES	PERCENTAGE OF ADT TANDEM AXLE SET
Under- 8000	55.41	0.74
8000-15999	18.54	5.73
16000-19999	7.44	1.46
20000-23999	0.50	1.49
24000-29999		3.74
30000-33999		4.20
34000-37999		0.50
38000-43999		0.25
44000-47999		
TOTAL	81.89	18.11

1785

D. Equivalent daily 18^k load applications using values given in guide are as follows:

GROSS AXLE WEIGHT (lbs.)	NUMBER		PER CENT		EQUIV. FACTOR		EQUIV. 18^k LOADS
	SINGLE AXLES						
Under- 8000	2703	X	55.41	X	0.006	=	9
8000-15999	2703	X	18.54	X	0.20	=	100
16000-19999	2703	X	7.44	X	1.00	=	201
20000-23999	2703	X	0.50	X	2.20	=	30
24000-29999		X		X		=	
	TANDEM AXLE SETS						
Under- 8000	2703	X	0.74	X	0.02	=	0
8000-15999	2703	X	5.73	X	0.09	=	3
16000-19999	2703	X	1.46	X	0.21	=	4
20000-23999	2703	X	1.49	X	0.50	=	8
24000-29999	2703	X	3.74	X	0.87	=	51
30000-33999	2703	X	4.20	X	1.38	=	99
34000-37999	2703	X	0.50	X	2.30	=	19
38000-43999	2703	X	0.25	X		=	16
44000-47999		X		X		=	
Passenger Cars	3305	X	2	X	0.0002	=	1
					TOTAL		541

Assuming 80% of all vehicles will use the heaviest traveled lane, the Design 18^k Loads = 541 X 0.80 = 433.

DATA ON CONNECTIONS

ROUTE	COUNTY	LOCATION	AVERAGE DAILY TRAFFIC 1965	AVERAGE DAILY TRAFFIC 1978
680 Rt.	Madison	Conn. Rt. 29	40	60
639 Lt.	"	"	7	10
603 Lt.	"	"	30	40
630 Rt.	"	"	150	240
630 Lt.	"	"	80	140
638 Lt.	"	"	40	70
647 Rt.	"	"	180	310
683	"	"	380	720

APPENDIX II

EVALUATION OF EWL-18 PER VEHICLE BY DIFFERENT WEIGHT GROUPS IN EACH VEHICLE CLASSIFICATION

Vehicle Weight Group in kips	Single Unit 2A-6T 19,355 46.5% % count	EWL/veh.	Single Unit 3-axle 4,472 10.8% % count	EWL/veh.	Tractor Semi-Trailer 3-axles 3,841 9.2% % count	EWL/veh.	Tractor Semi-Trailer 4-axles 11,509 27.5% % count	EWL/veh.	Tractor Semi-Trailer 5-axles 2,519 6% % count	EWL/veh.
11-12	17	.1273								
12-13	47	.1432	3.5	.118	2.5	.1201	-	-	-	-
13-14	19	.1555								
14-15	7	.1687								
15-16	10	.1867	-	-	-	-	-	-	-	-
15-20	-	-	10	.2036	7.5	.2199				
20-25	-	-	26	.2884	26	.2880	8	.2641	-	-
25-30	-	-	32.5	.3736	36	.3609	9	.3853	-	-
30-35	-	-	13	.4547	23.5	.4596	18.5	.4614		
35-40	-	-	12	.5483	4.5	.5455	29.5	.5900	18	.5149
40-45	-	-	3	.7637			23	.6984		
45-50	-	-	-	-	-	-	9	.7867	33	.7218
50-55	-	-	-	-	-	-			18	.8718
55-60	-	-	-	-	-	-	3	.8443	10.5	.9608
60-65	-	-	-	-	-	-	-	-	13.5	.9715
65-75	-	-	-	-	-	-	-	-	7	1.1604
TOTALS	100	.149	100	.369	100	.357	100	.572	100	.801