MINUTES OF THE
MEETING OF THE SENATE COMMITTEE
ON TRANSPORTATION

SIXTY-FIRST SESSION
NEVADA STATE LEGISLATURE
February 3, 1981

The Senate Committee on Transportation was called to order by Chairman Richard E. Blakemore, at 1:30 p.m., Tuesday, February 3, 1981, in Room 323 of the Legislative Building, Carson City, Nevada. Exhibit A is the Meeting Agenda. Exhibit B is the Attendance Roster.

COMMITTEE MEMBERS PRESENT:

Senator Richard E. Blakemore, Chairman
Senator William Hernstadt, Vice Chairman
Senator Joe Neal
Senator Lawrence E. Jacobsen
Senator James Bilbray
Senator Clifford E. McCorkle
Senator Wilbur Faiss

STAFF MEMBERS PRESENT:

Fred Welden, Senior Research Analyst
Kelly R. Torvik, Committee Secretary

Mr. Therm Sherard from the Western Highway Institute was introduced to the committee by Mr. Daryl Capurro from the Nevada Motor Transport Association. Mr. Sherard is an expert of the size and weights of trucks and their effect on the highways. Mr. Sherard was asked to advise the committee of the ramifications of the Governmental Accounting Office (GAO) report on size and weights of trucks and their effect on the highways.

In order to give the committee some history of the Western Highway Institute, Mr. Sherard explained that it is a research and engineering group that does work for the trucking industries in western Canada. The Western Highway Institute is funded mainly by all of the major motor manufacturers and shipping carriers.

Mr. Sherard began by pointing out that equivalent axle loads are merely one of the factors used as a measure of pavement damage or cost responsibility for various highway users. Mr. Sherard supplied the committee with information that supported this point. (See EXHIBITS C, D, and E).

Mr. Sherard explained that environmental elements are a major factor in road deterioration. Weather, temperature and lack of use cause a large percentage of the damage.

Mr. Sherard stated that heavy trucks do not necessarily cause most of the damage. The damage that a truck causes is not related directly to gross weight. It is related to the equivalency axle weight. Although this is only one factor in the overall deterioration of highways.

Mr. Sherard went on to say that all vehicles contribute to the fatigue of a highway. Maintenance is very important in all stages of the highway life. He added that most highways in Nevada were past their life expectancy.

Senator Bilbray asked if different speeds have any effect on the deterioration of roads. Mr. Sherard answered by explaining that in theory there is less impact on the pavement the greater the speed. This is not always true though because oscillation of the large trucks at high speeds can do considerable damage.

Mr. Sherard said that most of the damages to the highways are caused by overload. Roads are designed for certain weights and loads. An overload will break down a road faster than many legal loads.

Senator Faiss questioned whether tire types had any connection with roadway wear. Mr. Sherard said that this was very controversial. Some of the better grade tires could do more damage to the highway but this is not one of the more damaging factors.

Mr. Capurro quickly pointed out that Mr. Sherard's main point was that many factors go into the deterioration of highways. One thing the he noted was that Nevada's climatic conditions are actually one of the worst in respect to deterioration because of the freeze/thaw cycle.

Due to the fact that a large amount of people had arrived to testify on Senate Bill 83 Chairman Blakemore adjourned the meeting at 2:20 p.m. Senate Bill 83 was later heard in Room 131 of the Legislative Building on February 3, 1981.

Respectfully submitted by:

Kelly R. Torvik

APPROVED BY:

Richard E. Blakemore, Chairman

EXHIBIT A

REVISED SENATE AGENDA

COMMITTEE MEETINGS

Committee on Transportation, Room 323.

Day Tuesday, Date February 3, Time 2:00 p.m.

S. B. No. 83--Increases punishment for driving under influence of intoxicants.

S. C. R. No. 7--Directs study of feasibility of special permits for overloaded vehicles.

S. B. No. 51--Requires unloading of overweight vehicles on second or subsequent offense for operator.

S. B. No. 52--Establishes schedule of fines for overloaded vehicles.

S. B. No. 53--Increases allowable limits on size of vehicles.

S. B. No. 54--Provides alternative weight limits for certain vehicles.

EXHIBIT B

ATTENDANCE ROSTER FOR COMMITTEE MEETINGS

SENATE COMMITTEE ON TRANSPORTATION

DATE: 2/8/81

PLEASE PRINT NAME	PLEASE PRINT PLEASE PRINT ORGANIZATION & ADDRESS	PLEASE PRINT TELEPHONE
T. TANKAVICH	NV-Dept of Transportation	885-5440
Pat Bates	Churchill Council on Alcohol	423 6048
Beauchamp	self 5445 Wintergreen Reno	849-1391
David A. Funk	Self 3120 Santa Ana Dr. Reno	826-5952
Vernita M. Funk	231 [illegible] Way Sparks	359-5570
HP Sturm	435 Moran #17 Reno	329-3224
Tina Cox	205 Bret Harte Reno	786 6836
Rochelle Gray		
Lee Boardman.	1520 Westwood Dr Reno 09	322-3664
Virgil Anderson	RAA Ormsby House	882-1890
Kent Goble	Greyhound Lines, Inc. Sacramento, Calif.	916-443-3966
John Borda	Nev. Motor Trans. Assoc	331-6884
Ken Thurston	535 Gregory Way Sparks	358-2778
Beverly Thurston	535 Gregory Way Sparks	358-2778
Caroline Vista	560 Gregory Way Sparks	358-4972
J.A. [illegible]	Western Highway Institute 1200 Bayhill Dr San Bruno CA	415/952-4900
Jerry Mack	Douglas Co. Sheriff	702/782-2211
Larry Ketzenberger	LV Metro Police Dept	702/386 3486
[illegible]	332 Smithridge Pk, Reno	825-4195
Russ Boardman	1520 Westwood Dr Reno 89509	322-3664
Roy E. Wiegand	1435 Dove Dr Reno NV 89503	747-0864
J A Tuggs	739-16th St Sparks NV 89431	359-0808
Levine	LEGISLATIVE INTERN - BOX 8242 Reno 89507	784-4497

ATTENDANCE. ROSTER FO COM TEE MEETINGS

SENATE COMMITTEE ON TRANSPORTATION

DATE: 2/3/81

PLEASE PRINT NAME	PLEASE PRINT PLEASE PRINT ORGANIZATION & ADDRESS	PLEASE PRINT TELEPHONE
Kevin [illegible]	Intern Assemblyman Sader.	
Dolores McBride	Storey Co Sheriff's Office Virginia City	847-0728
Paul Prengaman	Assemblyman – District 26	
Murray Cohen	No. Nev. Food & Bev. Assoc. – Carson City	882-9792
Stanley Lahodny	117 Greenwood Dr. Reno	851-4124
Mrs Stanley Lahodny	117 Greenwood Dr Reno	851-4124
Pat [illegible]	146 [illegible] – Reno	[illegible]-1553
Bettie [illegible]	Nev. State Republican Women 225 Pine Ln. C.C.	882-3896
Estelle [illegible]	Hangmans TREE 455 HWY 395 N	849-2788
JoAnn Hammond	Hangman's Tree 455 Hwy 395 N	849-2788
LYNNE HARTUNG	205 BRET HARTE RENO	786-4987
Gene Phelps	NDOT	5813
Julie [illegible]	Intern for Assemblyman Dini	
Kim Stoll	Intern for Paul Prengaman –	
Pat [illegible]	910 West Musser Carson City	882-1408
[illegible]	10 [illegible] Rd. CC	883-6640
Betty [illegible]	408 N Curry C.C	882-3604
[illegible] Ray Ceccarelli	115 Greenwood Dr Reno – Victim of Drunk Drivers	852-22
June Pena	409 Hackamore Way CARSON VICTIM-DWI Concerned Citizen	883-0890

ATTENDANCE ROSTER FOR COMMITTEE MEETINGS

SENATE COMMITTEE ON TRANSPORTATION

DATE: 2/3/81

PLEASE PRINT NAME	PLEASE PRINT PLEASE PRINT ORGANIZATION & ADDRESS	PLEASE PRINT TELEPHONE
Ray Pirozzi	30 Galleon Way Sparks	359-7091
JAKE PENA	409 HALLAMORE WY CARSON	883-0890
Don Nichols	352 Smithridge Park Reno 89502	825-2198
Margaret Alcorn	DMV	885-5360
[illegible] Harn	BADA	885-4790
Barbara Duncan	Parole & Probation - Dep Chief	885-5040
Dennis Blackwell	CHS High School	452-5266
Mrs Ray Ceccarelli	[illegible] Concerned Citizens of Drunk Drivers	852-2265
Mike Trank	990 North Sierra, Reno Nev.	329-3131
[illegible] Mack	Sheriff Douglas Co	782-5211
[illegible]	Washoe Sheriff [illegible]	7866451
Dan Heath	INSURANCE DIVISION	885-4270

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EXHIBIT C

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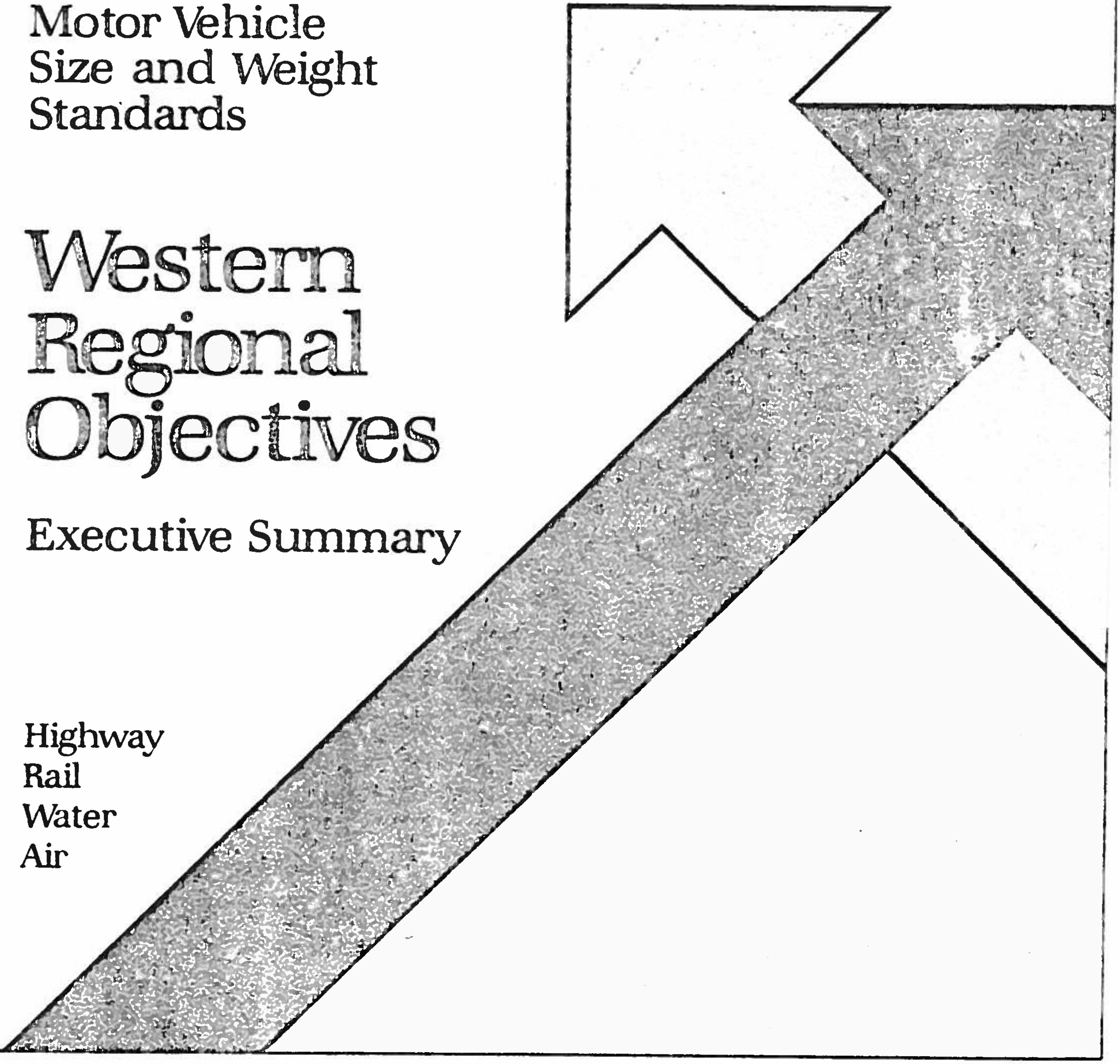
Transportation—Research—Education—Development

Motor Vehicle Size and Weight Standards

Western Regional Objectives

Executive Summary



Highway
Rail
Water
Air

Table 6-10 - Equivalence factors (18,000 pound EAL) for flexible and rigid pavements as computed from the AASHO road test. 1/

Axle Load	Equivalence Factors - p = 2.0			
	Flexible Pavement, SN = 4		Rigid Pavement, D_2 = 9 in.	
	Single Axle	Tandem Axles	Single Axle	Tandem Axles
Pounds				
2,000	0.0002		0.0002	
4,000	0.002		0.002	
6,000	0.01		0.01	
8,000	0.03		0.03	
10,000	0.08	0.01	0.08	0.01
12,000	0.18	0.01	0.18	0.03
14,000	0.35	0.03	0.34	0.05
16,000	0.61	0.05	0.60	0.08
18,000	1.00	0.08	1.00	0.13
20,000	1.55	0.12	1.58	0.20
22,000	2.31	0.17	2.38	0.30
24,000	3.33	0.25	3.47	0.44
26,000	4.68	0.35	4.88	0.62
28,000	6.42	0.48	6.70	0.85
30,000	8.65	0.64	8.98	1.14
32,000	11.46	0.84	11.82	1.50
34,000	14.97	1.08	15.30	1.95
36,000	19.28	1.38	19.53	2.49
38,000	24.55	1.72	24.63	3.13
40,000	30.92	2.13	30.75	3.89
42,000		2.62		4.78
44,000		3.18		5.82
46,000		3.83		7.02
48,000		4.58		8.40

1/ From "AASHO Interim Guides" for design of flexible and rigid pavement structures.

18,000-pound axle loads are reduced. For example, in Figure 6-11, if a 2-S1-2 vehicle has a GCW of 85,500 pounds, its equivalent axle load totals approximately 5.1. A 2-S1-2-2 combination with a GCW totalling 105,500 pounds develops about 3.6 equivalent axle loads or approximately 41 percent less than the 2-S1-2 while carrying 20,000 more pounds.

When the five vehicle combinations listed above are loaded to the gross combination weight (GCW) limit listed in the Western regional minimum size and weight objectives, the EAL s from Figures 6-10 and 6-11 are as follows:

Vehicle Type	No. of Axles	GCW (Pounds)	EAL s Flexible	EAL s Rigid
2-S1-2	5	85,500	5.1	5.1
3-S2	5	80,000	2.3	5.1
2-S1-2-2	7	105,500	3.6	3.6
3-S2-4	9	105,500	1.1	1.8
3-S2-2	7	105,500	3.4	4.4

This table demonstrates the reduction in EAL s when a vehicle combination is lengthened and axles are added. The figures further illustrate that longer and heavier vehicle combinations with a larger number of axles can transport more weight and at the same time reduce pavement effects.

It is also noted that only those vehicles in the traffic stream which "gross out" will be able to take full advantage of any increase in axle load limits. Since a majority of intercity freight vehicles "cube out" and other vehicles are empty or carry a partial load, only a small percentage of vehicles will be operating at the new maximum axle weight limits. Thus, increading axle weight limits for single and tandem axles from 18,000 to 20,000 pounds and 32,000 to 34,000 pounds, respectively, will have a minimal adverse effect and will probably have a lesser impact upon the life expectancy of pavements than the expected increases in intercity freight traffic.

Design of Pavements

In the previous section, the effects of axle loads on existing pavements was discussed. It can be shown that 20,000 pound single and 34,000 pound tandem axle limits will not require a pavement design much different from that for 18,000 and 32,000 pound limits.

Most states design highway pavements in accordance with guidelines, specifications and procedures recommended by the American Association of State Highway and Transportation Officials (AASHTO). The guide developed by AASHTO[8] is based on empirical relationships derived from the AASHO Road Tests conducted from 1956 to

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[8] American Association of State Highway and Transportation Officials, AASHTO Interim Guide for Design of Pavement Structure, 1972.

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1960 and is supplemented by data developed from state construction practices. However, each state which uses the AASHTO guide must modify the procedures to reflect the environmental, materials, terrain, climate, and traffic characteristics found in their own area of jurisdiction.

The design procedure involves the determination of the thickness of each structural component of the pavement as well as its total thickness. The pavement structure is a layered system designed and constructed to distribute traffic loads to a compacted roadbed soil embankment (commonly referred to as the subgrade).

In most highway design practices, the pavement surface is either an asphalt or Portland cement concrete pavement, and the subgrade's ability to support the pavement is usually expressed as a support value. The soil support values in turn influence the pavement thickness required, i.e., a poor soil with a low support value will require a thicker pavement.

Other major factors which determine the pavement structure thickness include the serviceability index and the predicted traffic mix which will use the roadway. For an existing pavement, the present serviceability index (PSI) is an indicator of existing condition and is merely a numerical rating based upon a series of physical measurements and subjective evaluations of the pavement, i.e., roughness, cracking, rutting, and other factors affecting ride quality. For design purposes, a terminal serviceability index (p_t) is selected which will provide satisfactory traffic service over a designated period of time and is the lowest index that can be tolerated before the road is either resurfaced or reconstructed

The serviceability index has a numerical range from 0 to 5 with the higher numbers indicating the best roadway condition and the lower the poorest condition, as follows:

PSI	Condition
0-1	Very poor
1-2	Poor
2-3	Fair
3-4	Good
4-5	Very good

Usually when a high traffic volume road reaches a serviceability index of 2.5, reconstruction or resurfacing is considered necessary. An index of 2.0 is normally used for lower traffic volume conditions.

The important element of the design equations developed from the results of the AASHO Road Test is the traffic load impact. The test consisted of multiple applications of identical axle loads on each of six test loops. Ten vehicle types were used in the test with gross weights (GVW) ranging from 4,000 pounds to 108,000 pounds. Single axle loads varied from 2,000 pounds to 30,000 pounds, and tandem axle load ranged from 24,000 pounds [illegible] 48,000 pounds per unit. Vehicle configurations and weights utilized in the road test are shown in Figure 6-12.

The procedure used in design requires an estimate of the surface life loadings and, as a result, the prediction of the future traffic mix that will use the facility. The predictions are usually based upon the existing operating experience as recorded by truck weight (or loadometer) studies. These studies are conducted by the states on various types of roadways on an annual or biennial basis and result in the tabulation of the number of axles observed within a series of load groups usually at 2,000 pound intervals. The observed mix of axles is then converted to the common denominator of equivalent 18,000 pound single-axle loads (EAL) by multiplying the number of axles in each axle weight group by the appropriate equivalency factor as developed from the AASHO Road Test data.

A summation of the EALs for the various load groups of a specific roadway or highway system provides the basis of projecting the design load for the selected design period or service life (generally 20 years). The EAL total that is expected on the new facility is subsequently used to determine a pavement design such that the serviceability will be reduced to a value of 2.5 or 2.0 at the end of the design period.

If the actual traffic exceeds the predicted value, it is generally expected that the facility's service life will be reduced. Conversely, if traffic is less, the service life will be extended. Changes in the predicted number of EALs can result from a change in traffic volume, a change in traffic composition, a revision of vehicle axle weight limits, or a combination of all three. However, it must be emphasized again that EALs are only one factor which influences a road's service life.

- Design of Asphalt Concrete Pavement:

An asphalt concrete (flexible) pavement usually consists of three different layers of material placed upon the roadbed soil or embankment. These are commonly referred to as the subbase course, base course, and surface course. The highest quality material, a mixture of asphalt cement and well-graded gravel or aggregate, is placed in the surface course. The next highest grade material is placed in the base course and is normally a well-graded gravel, which is sometimes treated with an additive (cement, asphalt, or lime) to increase its quality and strength. The subbase is a third layer which is used between the earth embankment and the base course when the soil in the embankment is weak or of poor quality. The subbase is generally an economical material of higher quality than the roadbed soil, but lower than that of the base course. A typical cross section for a flexible pavement structure is illustrated in Figure 6-13.

EXHIBIT D

Library

WASHINGTON STATE HIGHWAY DEPARTMENT RESEARCH PROGRAM REPORT 17.1

PAVEMENT RESPONSE AND EQUIVALENCIES FOR VARIOUS TRUCK AXLE-TIRE CONFIGURATIONS

RESEARCH PROJECT

Y-1441

NOVEMBER 1974

PREPARED FOR
WASHINGTON STATE HIGHWAY COMMISSION
IN COOPERATION WITH
U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION

RONALD L. TERREL
SVENG RIMSRITONG

DEPARTMENT OF CIVIL ENGINEERING
UNIVERSITY OF WASHINGTON

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Weighted Load Applications	Compressive Strain At Surface of Sub-grade (in/in x 10^{-4})
10^5	10.5
10^6	6.5
10^7	4.2
10^8	2.6

Environmental Effects

Because the response of asphalt-bound materials is dependent on temperature, distributions of temperature within layers containing such materials should be determined.

Pavement temperatures can be computed from weather data. That is done by solving the heat conduction equation by numerical technique, such as finite-difference procedure or finite-element procedure, or by closed-form techniques as presented by Barber (28). Alternatively, a representative temperature can be estimated by the procedure suggested by Havens, Deen and Southgate or by Witczak.

Temperature stresses can often be as high as load stresses, as has been shown in numerous studies, particularly in rigid pavements, where temperature stresses are due to curling, warping, expansion or contraction. Those same types of stresses are present in asphalt concrete pavements. They are tensile or compressive stresses due to increase or decrease in the general level of temperature and bending stresses due to temperature differential within the pavement structure itself.

The tensile or compressive stresses due to general or seasonal changes in the level of temperature, as are the resulting changes in material properties, notably asphalt stiffness. The bending stresses,

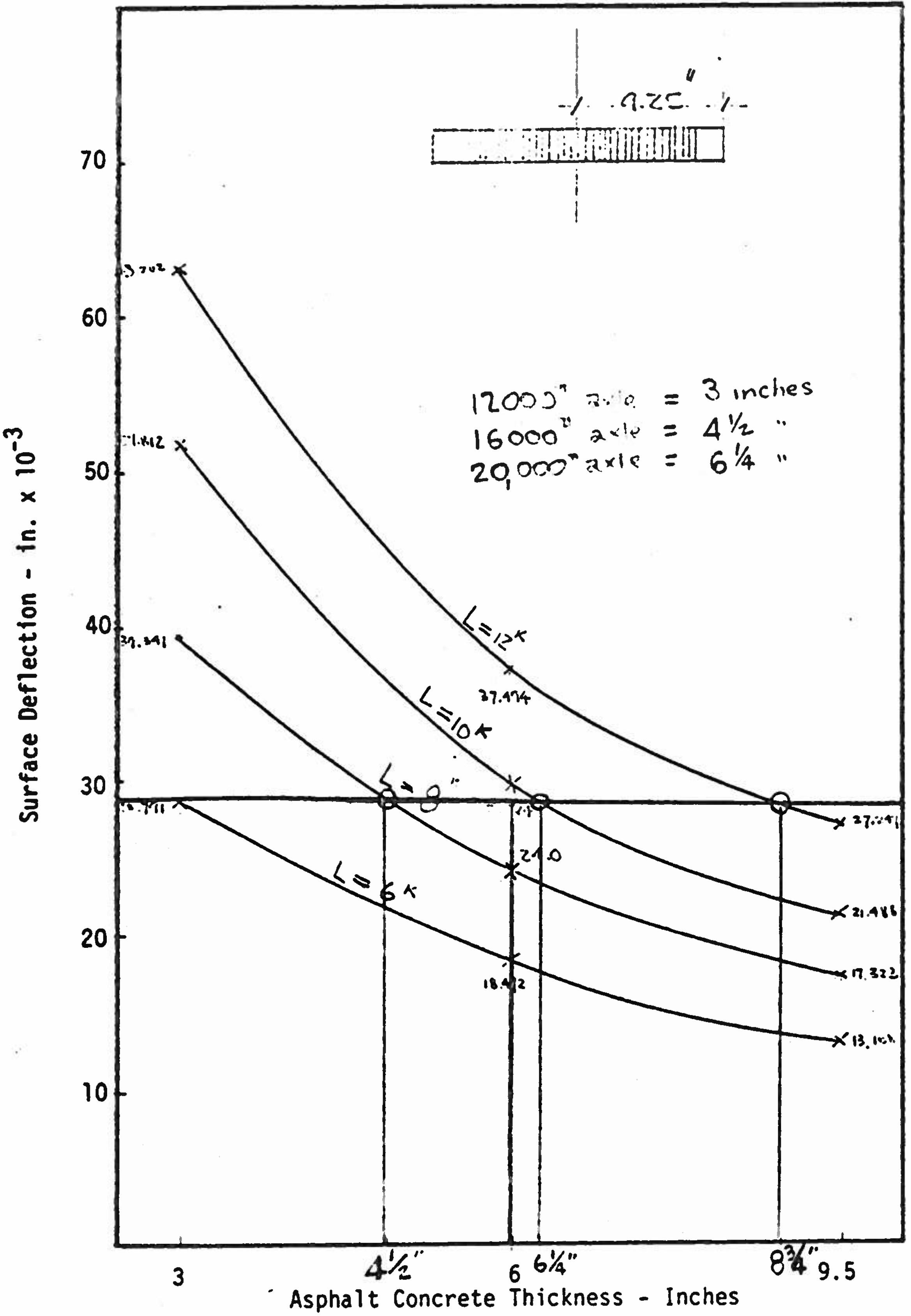

FIGURE A12 - MAXIMUM SURFACE DEFLECTION VS. ASPHALT CONCRETE THICKNESS RELATIONSHIPS FOR VARIOUS WHEEL LOADS

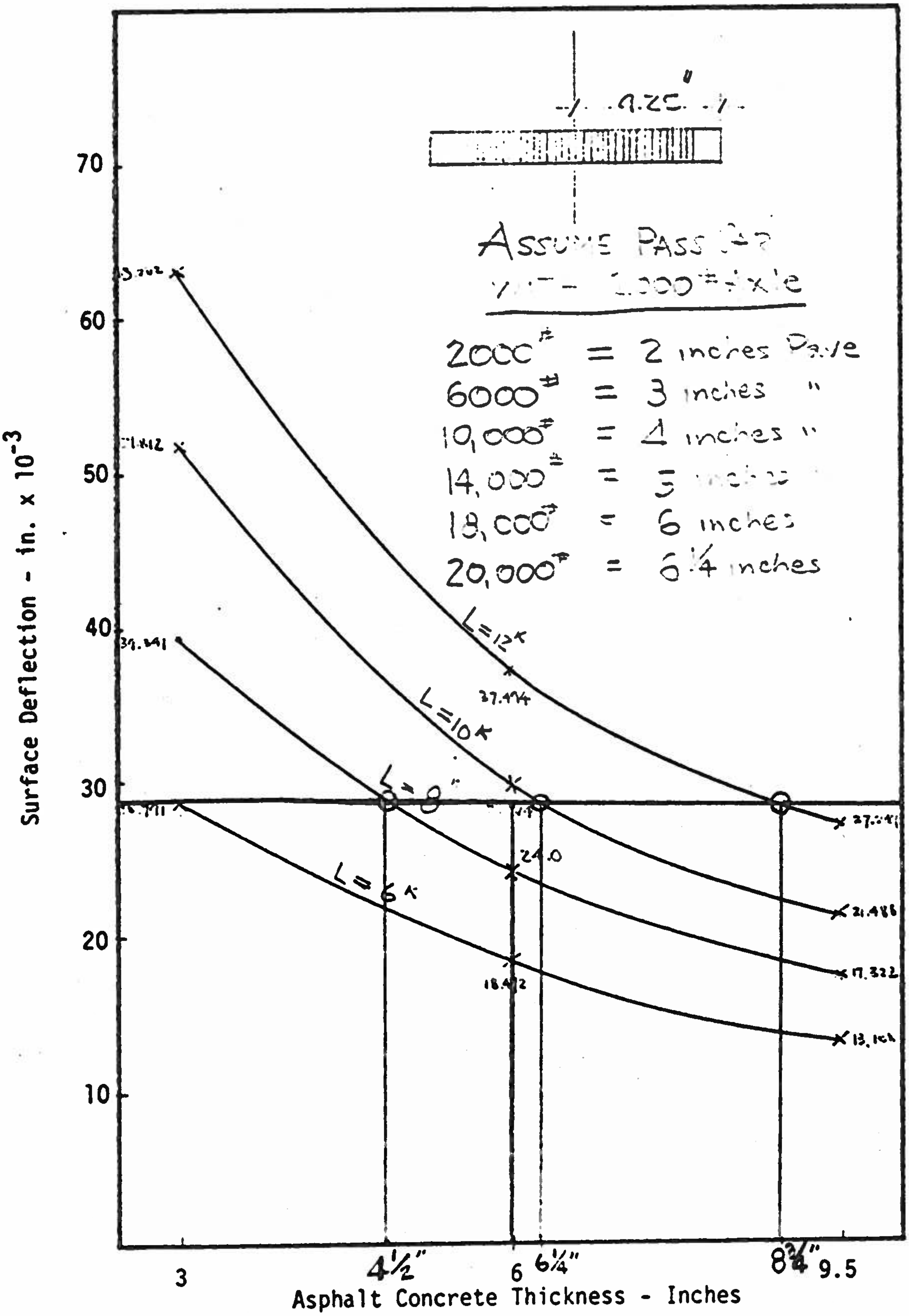

FIGURE A12 - MAXIMUM SURFACE DEFLECTION VS. ASPHALT CONCRETE THICKNESS RELATIONSHIPS FOR VARIOUS WHEEL LOADS

EXHIBIT E

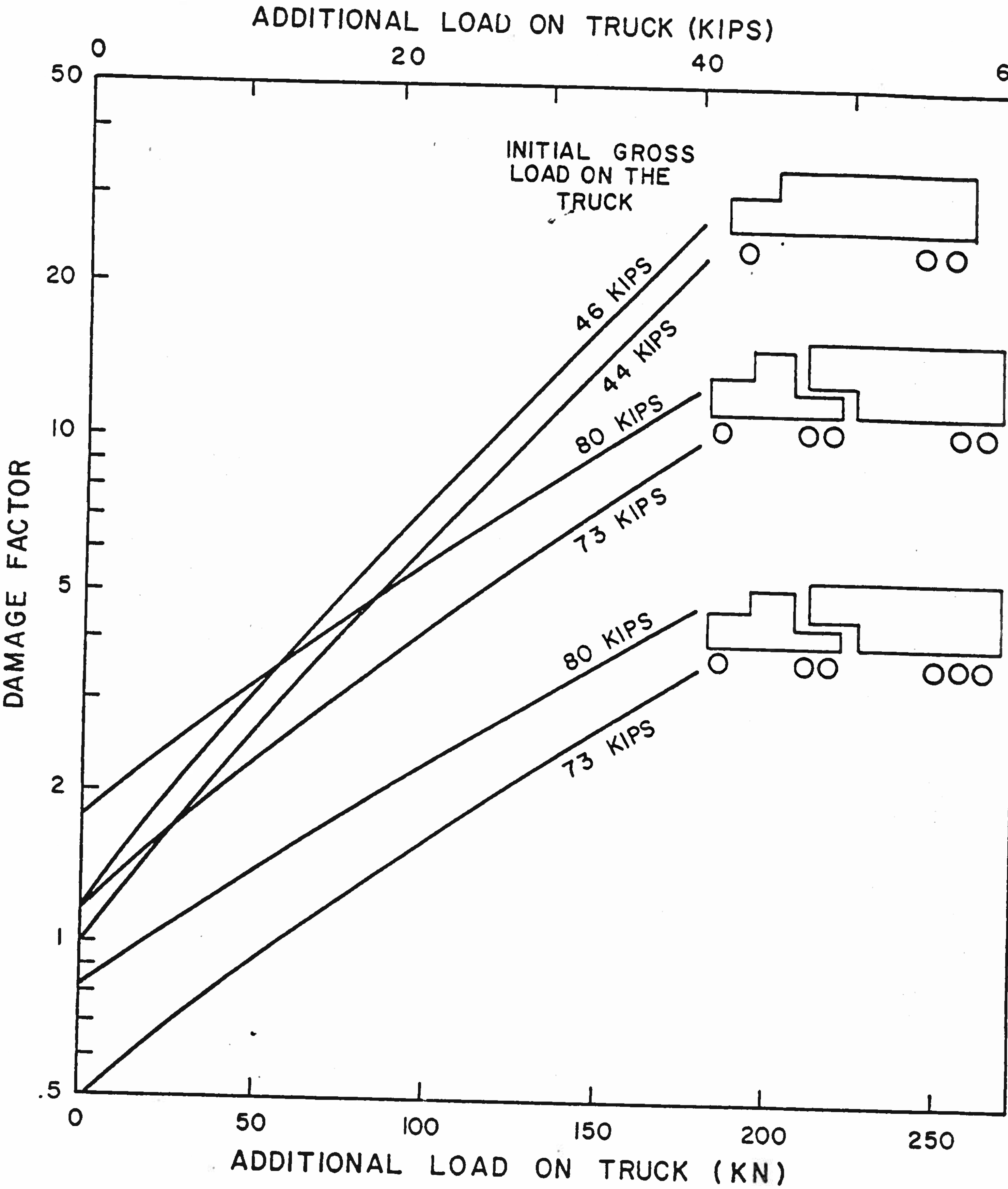

Fig 12