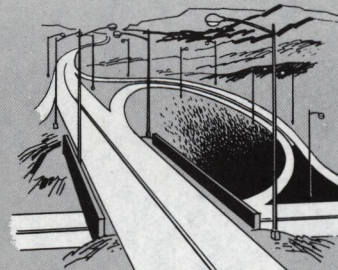


Street and Highway
SAFETY LIGHTING BUREAU



1400 TERMINAL TOWER • PHONE: TOWER 1-3232 • CLEVELAND 13, OHIO

August 28, 1959

Chief Editorial Writer
Herald
Yakima, Washington

Dear Sir:

The shocking slaughter of Americans on the highways becomes national news on holidays such as Labor Day.

Many of the reasons for it are with us all year long. The problems caused by lack of light on the highways are so serious that we solicit your help and that of your organization in bringing the facts to the attention of all Americans.

The enclosed booklet gives the facts. It tells how serious is our annual toll of nighttime accidents and deaths. It and the enclosed statement of policy suggest a program for causing a drastic reduction in this shocking waste through injuries, suffering, death and economic loss.

Any comments you would care to make, any recommendations on ways you or your organization can help make these facts and this plan of action known to all thoughtful citizens will be in the best interest of life and health for all who drive at night.

Further copies of this booklet are available at your request.

Sincerely yours,

Edmond Powers

Educational Director
STREET AND HIGHWAY SAFETY LIGHTING BUREAU

Edmond C. Powers/vs
Enclosures

STATEMENT OF POLICY REGARDING SAFETY

EQUIPMENT FOR USE ON THE INTERSTATE HIGHWAY SYSTEM

When these two conditions are fulfilled, highway officials and engineers can be credited with saving thousands of lives annually, inasmuch as there is clearly evidence of need by the traveling public that certain sections of the new Interstate Highway System be equipped with fixed roadway lighting to provide for the safety as well as the comfort and convenience of the taxpayers who are paying the costs of building and maintaining this system as well as exposing themselves to the nighttime hazards of driving.

The interests of the public are not being served unless the ten critical areas of driver decision are adequately lighted. These are the areas:

1. Entrances and exits.
2. Interchanges, and intersections where they occur.
3. Bridges, overpasses and viaducts.
4. Tunnels and underpasses.
5. Guide sign locations.
6. Dangerous curves and hills.
7. Heavily traveled sections in urban areas, or where entrances, exits or interchanges occur within one mile or less of each other.
8. Rest areas and connecting roads.
9. Railroad grade crossings.
10. Elevated and depressed roadways.

Not the entire highway system, but all these areas should be adequately lighted in accordance with proper interpretation of the IES practice, which was issued in 1953, approved by the American Standards Assn. and which is formally entitled "American Standard Practice for Street and Highway Lighting."

All scientific evidence accumulated to date clearly indicates that the recommendations are the absolute minimum required at any time, at any point of the highway in these ten areas. These 1953 IES standards supply only threshold visibility, with no factor of safety for the driver who is fatigued, under the influence of alcohol, or has less than perfect nighttime vision under heavy traffic conditions.

As early as January, 1958, responsible officials of the Bureau of Public Roads have stated in public that it is the policy of the Bureau of Public Roads to approve state plans for highway lighting which are in accordance with the 1953 IES code.

What is necessary in every state is -- first, the enabling legislation necessary for operation and maintenance of adequate highway lighting, and, second, adequate plans for the inclusion of highway lighting on the portions of the Interstate Highway System going through the state as well as other state highways.

When these two conditions are fulfilled, highway officials and engineers can be credited with saving thousands of lives annually, in assuring around-the-clock utilization of our valuable highways, and in the multiplication of their economic value. They will be fulfilling the public interest which requires that the Interstate Highway System provide for the comfort, convenience and safety of the traveling public.

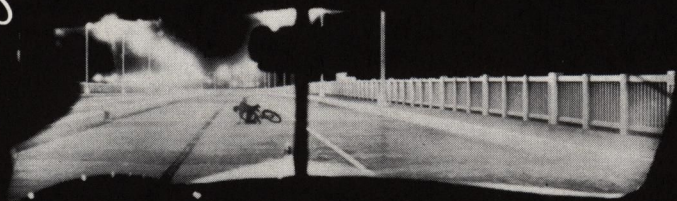
To do less is to obsolete our Interstate Highway System before it is even completed.

To do less is to squander public funds, and

To do less is to needlessly endanger the health and lives of the motoring public.

Adequate illumination of our 41,000 mile Interstate Highway System will cost less than 1% of the total cost, and will cost less to maintain than it does to keep the weeds out along the right-of-way and the guard rails and center lines painted.

Guide to nighttime highway safety



Capsule Comment

Daylight-Safe and Nighttime-Sorry Super-Highways
Will Be The Fate Of The Wonder Roads Authorized
By The Congress Of The United States in 1956

UNLESS

Legislator Leaders Channel Public Demand Into Laws
That Insure Lighting The Danger Spots On State and
Federal Highways



[Enclosure. 28 Aug 59]

IN the next 10 years, 40,000 miles of ultra-modern highways will give gypsy-minded Americans the opportunity to travel fast and far.

These wonder roads are the result of the tax-financed Federal Aid highway law passed by the Congress of the United States in 1956.

Some of the greatest engineering minds of our time are being called upon to build safety features into every inch of pavement, so that speed-loving motorists can go like crazy and still come home in one piece.

They will slant the roads at just the exact angle necessary to hold a car firmly in place while its driver confidently negotiates a curve at 65 mph. Bridges and tunnels will go over and through potential hazards. Signs and warnings will be posted to give ample notice of things to come, and much study will go into the size and color of the letters so they will attract instant attention.

But are these highways going to be as safe at night as they are in daytime?

Many of our fabulous highways are daylight safe—but nighttime sorry, for they are being constructed without lighting the danger spots. And without the lighting that can provide a comfortable and safe trip, many people are reluctant to travel at night.

In spite of the fact that our way of life demands that all public facilities be used on a 24-hour basis, our nation's roads are being geared to daylight travel.

America's magic carpet is being made obsolete before the concrete is poured.

As one state highway engineer put it, "without light, it will be murder."

LIGHTING MUST BE LEGISLATED

Experience has shown the important part highway lighting plays in providing safety during the hours of darkness, yet some states are considering this factor lightly and others virtually not at all.

In a survey by the Street and Highway Safety Lighting Bureau, it was disclosed that only a smattering of states have any legislation to provide for adequate highway lighting.

Highway department directors and engineers in many states are actually handcuffed in their efforts to properly light vital portions of the federal highway system, segments of which pass through their states.

The necessity of highway lighting is contained in annual motor vehicle accident reports from every state in the union—cold, hard facts which tell a simple, but morbid, story.

These reports, which do not include economic loss, personal suffering or mental anguish felt by the traffic victim's survivors, state merely that the mileage death rate is three times as great at night as during daylight hours.

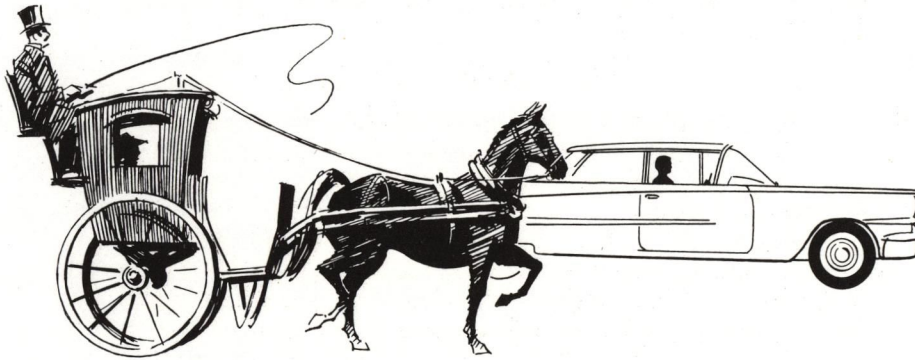
DEATH LURKS IN DARKNESS

More than half the total traffic fatalities occur at night—despite the fact that nighttime traffic is only one-third that of daylight hours!

Will lighting correct or improve this tragic situation?

In sections of the country where “before and after” figures are available, it has been proved over and over again that nighttime traffic deaths have been decreased an average of 50 percent after proper lighting was installed. In some cases, surveys of highway segments showed that death had been wiped out from one year—before lighting—to the next, after the lights had been in operation a full year.

This guide will show you the grim facts involving highway lighting, or the lack of it, and will assist you in pushing through the urgently-needed legislation to provide adequate lighting on your state’s highways.



Brief History of Lighting

The value and importance of lighting streets was recognized in the 19th century, long before the invention of the automobile.

Even old Dobbin clip-clopped more proudly down village streets after the lamp-lighter had been about his evening tasks.

Then one warm April evening in 1879, Charles F. Brush, the inventor of the arc light, marked the end of one lighting era and the beginning of another, by staging an experimental demonstration in Cleveland Ohio’s Public Square.

Thousands of people assembled to see if the 12 lamps mounted on 150 foot standards with 2000 candle power in each, would really work. At five minutes to eight, there was a flicker of light and then wonder of wonders all the lights blazed. A shout went up from the crowd, the famous Cleveland Grays Band began to play and a section of artillery on the lake shore fired a triumphant salute.

STREET LIGHTING WAS HERE TO STAY

Although lights and lighting systems did not for many years approach the present-day equipment, citizens realized that the streets were safer from criminals when lighting was in effect. Businessmen also found that lighting kept their towns “alive” after sunset.

It wasn’t until the invention of the automobile that lighting played an important part in increased driving safety at night. As America moved into the “mechanical era” and more and more cars appeared on the nation’s streets and highways, the number of so-called “accidental” deaths began to climb steadily through the years, with the result that today 40,000 lives a year are lost—wasted would be a better word—in traffic accidents.

The automobile was a great step in America’s history and economy, but it wasn’t long before city and state officials, as well as civic-minded citizens and safety workers, realized that while death on highways and streets was inevitable, they must seek ways and means to reduce the tragic death tolls in their cities and states.

NIGHT DRIVING DEADLY

After surveys were taken, and studies were made, it was shown that the most dangerous time to drive a car was at night. More persons died in auto accidents at night than during the day, despite the fact that daytime traffic was much heavier.

In the early days of the automobile, the emphasis on lighting was centered on city and town streets. It didn’t take long for the idea of street lighting to spread over the nation and officials found that traffic accidents were being held to a minimum in lighted areas of their communities.

It wasn’t until well into the 20th century, when two cars in every garage was more than a national joke, that the vital need for highway lighting became evident.

Bigger and better roads were constructed to meet the needs of the vastly increased traffic conditions, yet “mobilized” Americans were being “knocked off” like flies. Death on the country’s roads soared and methods were studied in an effort to stop the slaughter.

“Safety behind the wheel” was preached to the country, but it was found that even the safest drivers were losing their lives, especially at night.

SEEING IS RELIEVING

Lighting was installed at hazardous locations on some highways and in a short time there was a noticeable decrease in traffic accidents at the newly-illuminated spots.

Typical of the results obtained through better lighting is the case of U. S. Route 40 near Indianapolis.

Traffic and police officials found that a large number of accidents were occurring at and near the intersection of U. S. 40 and state Route 100 east of Indianapolis. Lighting was installed as officials conducted a two-year study of traffic accidents and fatalities on the three-mile stretch of road.

This study provided striking evidence of the important role that adequate highway lighting plays in the reduction of nighttime accidents. It showed that after-dark accidents dropped from 100 to 68 following com-

pletion of the lighting system. Daytime accidents, on the other hand, remained about the same, 140 to 138. Overall reduction in property loss amounted to \$20,616, dropping from \$77,756 to \$57,140.

REDUCTIONS IN TRAFFIC DEATHS FOLLOWING IMPROVED LIGHTING Night Traffic Deaths

WHERE LIGHTING WAS INSTALLED		Year Before Lighting	Year After Lighting	Reductions in Deaths
UNITED STATES				
1. Calif.	state highway entering Hayward	6	0	6
2. Calif.	30 intersections in Los Angeles	11	1	10
3. Calif.	3.8 miles of thoroughfare in Oakland	6	3	3
4. Calif.	5.7 miles of thoroughfare in Oakland	1	0	1
5. Conn.	31 miles of thoroughfare in Hartford	58	13	45
6. Conn.	main thoroughfare in West Haven	17	1	16
7. Conn.	7.25 miles of Berlin Turnpike	9	0	9
8. Fla.	Bayshore Boulevard, Tampa	3	0	3
9. Ill.	thoroughfares in Peoria	10	8	2
10. Ind.	intersection of two state highways	10	1	9
11. Ind.	intersection of state and federal highway	3	0	3
12. Ind.	thoroughfares in 10 areas of Indianapolis	11	4	7
13. Ind.	main thoroughfares in Gary	43	20	23
14. Ind.	3 mile stretch of U. S. 40	1	0	1
15. Ind.	main thoroughfares in Indianapolis	30	27	3
16. Ind.	State Road 40 in Indianapolis	5	1	4
17. Md.	major intersection in Baltimore	16	6	10
18. Mich.	4 miles of highway entering Grand Rapids	14	3	11
19. Mich.	Thoroughfares in Detroit	32	2	30
20. Mo.	3 main thoroughfares in Kansas City	5	2	3
21. Mo.	5 main thoroughfares in Kansas City	4	2	2
22. N. Y.	thoroughfares of Buffalo	66	27	39
23. N. Y.	1.6 mile of main thoroughfare in Utica	3	0	3
24. Ohio	main thoroughfares in Cleveland	59	42	17
25. Ohio	main thoroughfares in Dayton	22	13	9
26. Ohio	main thoroughfares in Rocky River	8	3	5
27. Penna.	6 intersections of main highway in Darby	6	0	6
28. Tenn.	main thoroughfares in Nashville	19	6	13
29. Tex.	bridge approaches in Dallas	2	0	2
30. Tex.	4.3 miles of thoroughfare in Houston	5	1	4
31. Tex.	main thoroughfare in San Antonio	6	0	6
32. Tex.	1/3 mile of main thoroughfare in San Antonio	15	0	15
33. Utah	3 mile stretch of highway entering Salt Lake City	12	1	11
34. Vir.	West Broad Street in Richmond	3	0	3
35. Wash.	main thoroughfare in Seattle	2	0	2
36. Wash.	main thoroughfare in Spokane	5	0	5
GREAT BRITAIN				
37. thru 100.	64 lengths of road, or groups of lengths	28	15	13
TOTALS		556	202	354
REDUCTION IN NIGHT DEATHS—64%				

TRAFFIC ACCIDENTS—NIGHT AND DAY COMPARED

ALL accidents—night only 53% of day
FATAL accidents—night 111% of day

STATE	Daylight		Night	
	Accidents	Fatal	Accidents	Fatal
Colorado	28,273	127	14,947	185
Delaware	3,730	27	2,367	35
Florida	70,901	426	29,578	526
Illinois	16,377	315	11,695	394
Indiana	68,556	427	35,692	459
Iowa	36,393	328	13,674	251
Kentucky	24,709	334	11,315	310
Louisiana	9,713	199	6,587	268
Maryland	14,822	124	10,807	193
Minnesota	38,419	298	19,742	297
Missouri	10,906	342	6,325	306
Nebraska	6,020	148	3,544	100
New Hampshire	8,274	48	4,254	35
New Mexico	11,285	130	5,793	194
North Dakota	5,956	61	3,691	62
Ohio	93,585	739	49,929	829
Oklahoma	26,576	300	11,013	236
Oregon	11,416	148	5,935	145
Texas	22,499	574	17,198	740
Utah	14,891	85	7,065	86
Washington	44,093	201	29,157	315
West Virginia	3,684	14	1,510	18
TOTALS	571,078	5,395	301,819	5,984

In addition to these statistics, there are several other reasons why lighting should be an integral part of any highway to preserve the lives of the nation's motorists and pedestrians.

H. A. Friede, chairman of the Committee on Highway Lighting of the American Road Builders Association, said that at night, good illumination can provide the extra moment for making what may be a life-saving decision.

SPLIT SECOND SAVES LIVES

"Ninety percent of the decisions and actions of drivers are based on what they see," he asserted. For that reason, Friede contended, "fixed lighting systems are a necessity on modern, high-speed highways in areas of driver decision such as interchanges, intersections, tunnels and underpasses, bridges and viaducts, access lanes, and heavily-travelled urban areas."

Friede backs up his belief with these three key points concerning night driving: (1) visual efficiency of all drivers is lower at night; (2) the older the driver, the more acute the problem of distinguishing objects at night (for example, the average 55-year-old person with 20/20 vision needs twice the light needed by a 20-year-old with the same vision); and (3) as traffic speeds increase, the eye sees less when it needs to see more and at a greater distance in order to provide for safe driving. (For example, at 50 miles an hour, a person sees 14 percent less than at 45 miles per hour.)

BRITAIN'S WINNING WAY

Great Britain, which has a highly progressive highway and lighting program, is well aware of the life-saving ability of lighting at night.

Granville Berry, city engineer and surveyor for the city of Coventry, England, reports:

"There were more road fatalities last year in the United States and in both Australia and South Africa, and in each of the principal countries of

Urgent Need for Highway Lighting

There is no question of the need for lighting U. S. highways. Any police or highway official will attest to the fact that lighting provides much greater safety on highways at night.

For those who require proof, about half the states keep records of day-night traffic accidents and fatalities.

Following is a list of the states that provide reports, listing day and night accidents and fatalities for the year 1958:

western Europe than there were in Great Britain, which has the highest density of traffic on its roads of any of these countries."

"And there is no doubt that the provision of modern lighting on our Trunk and other roads is reflected in the accident figures."

Berry pointed out that investigations have been in progress to determine the relationship between road accidents and light.

"While the results of the investigations carried out have necessarily varied from country to country," he stated, "they clearly indicate that there is economic justification for the provision of modern street lighting on our traffic roads, and that it is one of the biggest single factors today in **KEEPING DEATH OFF THE ROADS.**"

A Northwestern University eye specialist, Dr. James E. Lebensohn of Chicago, asserts that 10,000 lives and one and one half billion dollars are lost annually because of poor lighting.

THE SEEING EYE

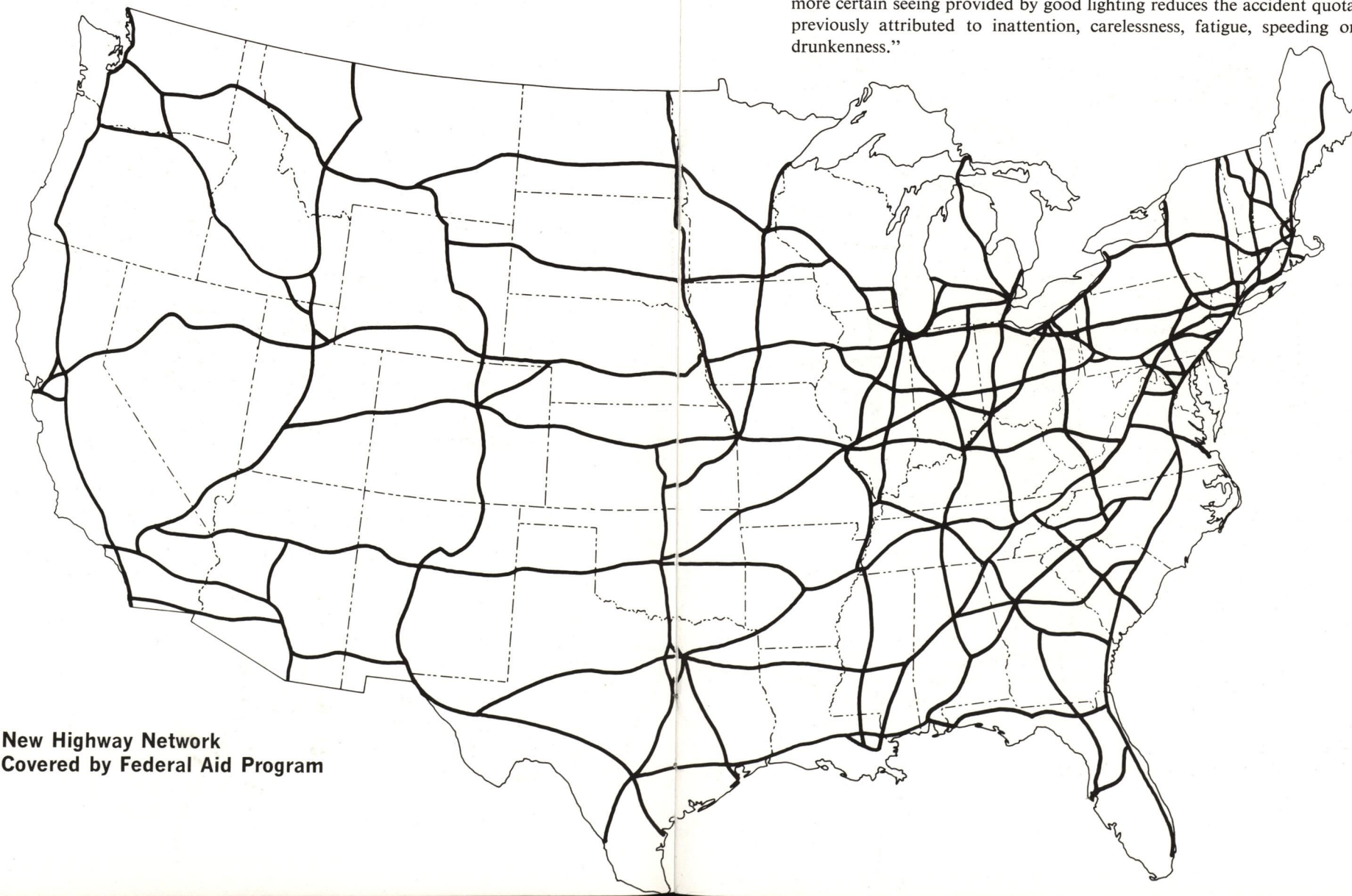
Dr. Lebensohn stated: "Modernized lighting . . . can be had at *half* this dollar loss and would, moreover, expedite pedestrian and vehicular traffic, increase property values and promote civic pride."

The ophthalmologist added: "The three most important visual factors involved in night driving are: discrimination under conditions of poor illumination; ability to see against glare; and recovery from glare."

"The prime reason for the excess of night accidents is inadequate vision. A shorter sight distance results and because of unreliable visual clues, errors in the judgment of distance and speed occur."

"The hazards of night driving can be reduced by improved highway lighting."

"Automobile accidents are brought about by a combination of circumstances and the removal of one often results in avoiding the accident. The more certain seeing provided by good lighting reduces the accident quota previously attributed to inattention, carelessness, fatigue, speeding or drunkenness."

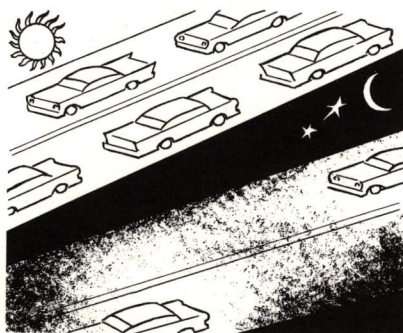


**New Highway Network
Covered by Federal Aid Program**

Light Up for Savings

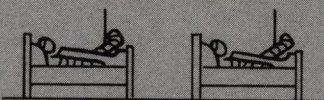
THOUGH ALL TAXES MAKE US HOLLER
LIGHT GIVES MOST FOR HIGHWAY DOLLAR

WITHOUT LIGHTING



Day jams make you swear.
Nights, the roads are bare.

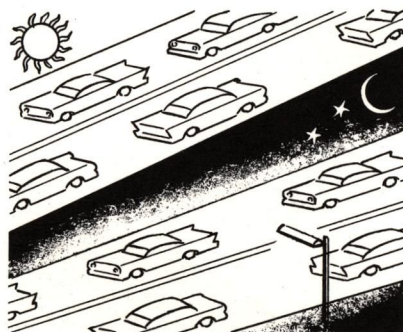
21,000 TRAFFIC FATALITIES
1,000,000 INJURIES
1½ BILLION IN ECONOMIC LOSS



PER YEAR AT NIGHT

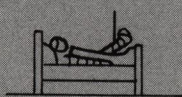
Crashes come at night
From the lack of light.

WITH LIGHTING



Spread the load this way
Even, night and day.

ACCIDENTS, DEATHS,
AND ECONOMIC LOSS
CAN BE
CUT IN HALF



Half the highway loss
Won, when light's the boss.

INSURANCE
CAN GO
DOWN

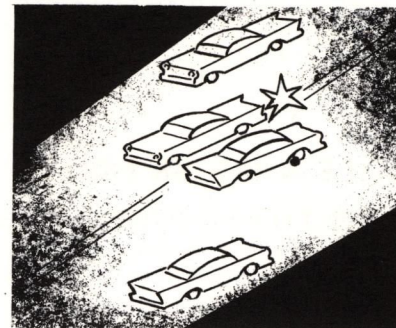


Costs will take a slide
With the safer ride.

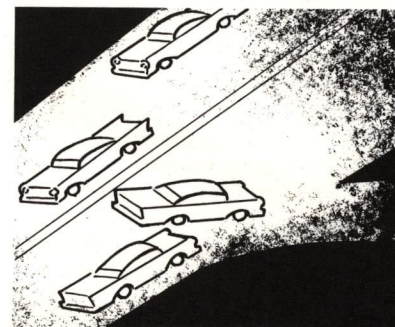
COST OF
CAR INSURANCE
PER U. S. NEWS

Insurance is a fright
When you have no light.

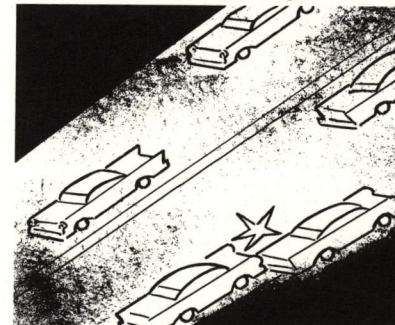
WITHOUT LIGHTING



Dark road drivers rip
Toward the center strip.



Lightless exits strange
Fouls up interchange.

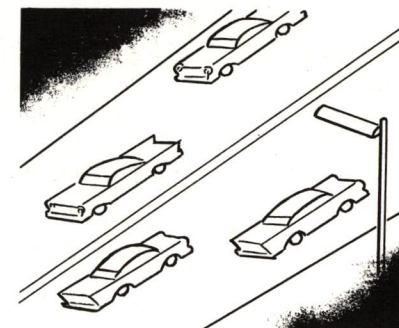


Cars disabled might
Not be seen at night.

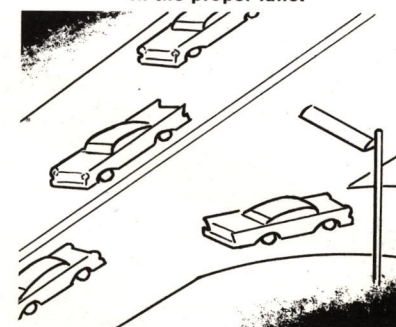


Tension mounts at night
Without proper light.

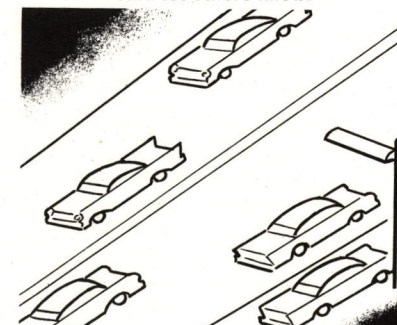
WITH LIGHTING



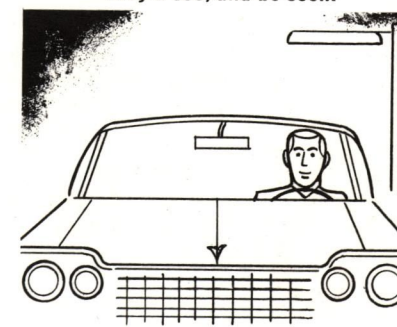
Light makes cars remain
In the proper lane.



Light gives time to slow
And let others know.



Light would simply mean
They'd see, and be seen.



Lighted roads, you bet
Drivers find, no sweat.

Vital Need for Legislation

THE PEOPLE WANT HIGHWAY LIGHTING POLICE WANT HIGHWAY LIGHTING DIRECTIVE LEGISLATION WILL GET HIGHWAY LIGHTING

A question which now arises is: how can my state insure that its present highways and the roads under construction will be adequately lighted?

In some states, civic groups instigated programs resulting in the lighting of dangerous highways locations; in others, police, state patrolmen and other officials have taken the initiative.

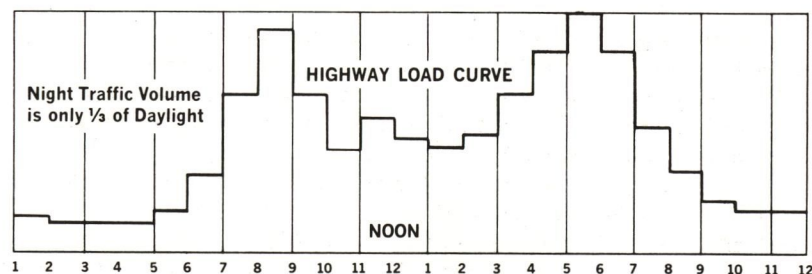
But the only way a state can be certain that its highways—both new and old—will be as safe as possible is through legislation.

An engineer of the Ohio Department of Highways said he is convinced that little or no lighting will go into highways so long as the laws governing highway construction remain purely permissive with regard to lighting. That is, leave lighting to the discretion of state highway officials.

What is needed, he said, is directive legislation, specifically stating that lighting shall be put into highways. Only then, he added, will it become a certainty.

Public information and public support are vital to assure continuing progress of highway lighting, but the public support must be in voice and in action.

In the next 10 years, the United States will have better than 40,000 miles of new and ultra-modern highways, engineered to provide the greatest possible degree of safety and to alleviate the flow of traffic.



LIGHTING CAN LEVEL OUT THIS HIGHWAY LOAD CURVE

But safety will be taking a back seat unless adequate lighting at hazardous locations is included in the program.

Some states already have lighting legislation, but many more do not.

GAMBLING WITH LIVES

In states which have no legislation, the lighting—and therefore the safety—of highways is left to chance, or to the decision of one or two state officials.

In some states, the money for highway lighting is available but cannot be used because there is no legislation.

One state highway official, frustrated in his attempt to install lighting at several dangerous highway locations, commented:

"The state has the money and we need the lighting. But we don't have the authority to spend the money for lighting. We have no legislation governing it."

The Committee on Highway Illumination of the American Road Builders Association, recognizing the need, prepared the following sample legislation.

Sample Highway Lighting Legislation

The Responsible Highway Authority is hereby authorized and empowered to illuminate dangerous curves and intersections or any portion of a highway or major structure thereon wherever said Authority deems such illumination necessary for the safety and convenience of the public. The cost of providing lighting service including installation, maintenance, and operation of such lighting shall be paid out of funds appropriated for construction and for maintenance of highways. Such costs may be proportioned to, but not limited to, the participation with Federal or other governmental units.

Introducing Legislation

BE A FACT FINDER

TALK WITH YOUR HIGHWAY OFFICIALS

WORK WITH YOUR LEGISLATORS

You may ask now: how do I go about the task of impressing the legislature that action must be taken for greater safety at night?

First of all, you must have all the facts and figures at your fingertips. This guide will give you a good deal of information, statistics, etc. But to "localize" your proposal, there are other methods.

First of all, you should get the accident facts from your state highway department. Cull through the accident records. Many states break down the figures into night and day categories. You will find that the mileage death rate is much greater at night. That is, more people are killed on your highways at night than during daylight hours, despite the fact that only one-third the number of accidents occur at night and that daytime traffic is vastly greater.

Approach your highway department and get the views of the officials there. Utility companies in your state are also a good source. They often have "before and after" reports, showing a sizeable decrease in traffic accidents and deaths after lighting had been installed at dangerous locations on highways.

Invite the support of legislators. Show them your plans, pointing out the great advantages of better lighting and that legislation is necessary to insure that your highways are adequately lighted. *The greatest feature of highway lighting is that it saves lives*, and this should be stressed completely. When lives are at stake, people invariably listen, and nearly always take appropriate action.

Where Lighting Should be Installed

EXPERTS SAY THERE ARE TEN WAYS TO DEATH LET'S SEE THEM

No one would seriously suggest lighting an entire highway except where unusual conditions warrant.

One notable example of conditions that make this necessary is in Connecticut, where 58 miles of de luxe highway is completely lighted. This was done because of many interchanges, and continuous lighting was essential for efficient manipulation of the complicated traffic problem involved.

For high-speed highways, there are 10 potential night danger spots. These same areas may be no problem in daylight when the spread of vision is wide and clear, but in darkness, with only the distance of your headlight's beam to show the way, they are an invitation to disaster.

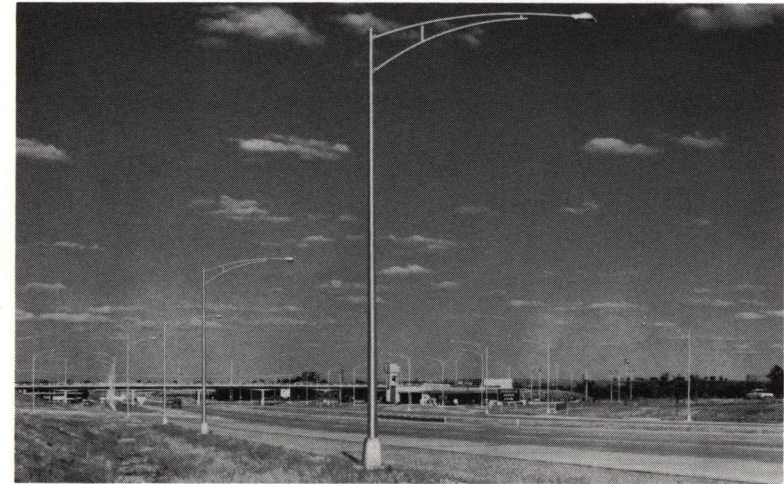
(1) INTERCHANGES AND INTERSECTIONS.



Interchanges handle the smooth flow of vehicular traffic on and off modern high-speed roadways. Lighting here functions partly as a warning indication, but primarily as a means of improving "seeing" in a critical area. Exit and entrance roadways are narrower than high speed through traffic lanes. High speeds—50 to 70 mph—make it desirable to illuminate adequately acceleration and deceleration lanes adjacent to exit and entrance roads as an added warning to drivers.

Regarding intersections, surface level intersections of two or more roadways may create the most hazardous point on a highway system unless the motorist is forewarned by signs and protected by complete visibility. It is good practice to provide an illumination level for intersections equal to the sum of the illumination values on the intersecting roadways.

(2) CONNECTIONS TO SERVICE AREAS.



While these places were primarily intended to take care of cars, the long distances of many super highways have made the inclusion of eating facilities mandatory. Gradation lighting well ahead of deceleration lanes, as a warning of service area locations, is very desirable. Parking areas must be lighted so well that the most eye-weary driver will have no difficulty following his proper route.

Since it is actually an expanded roadway, illumination level and ratio of minimum to average illumination should conform to that for heavily traveled roadways.

High illumination levels serve as an inducement to attract restaurant customers, and as safety features in many somewhat remote locations.

(3) ELEVATED AND DEPRESSED EXPRESSWAYS.



The illumination for elevated or depressed express roadways varies with traffic conditions. However, such structures usually include special construction features to facilitate traffic flow and to provide means of entrance and exit. Lighting units should be properly located to identify dividing curbs, curves in roadways, or changes in width. Ramps for exit and entrance should receive particular consideration as to lighting unit placement, and may require somewhat greater illumination than the remainder of the roadway.

(4) TUNNELS AND UNDERPASSES.



Tunnels, which may include a long underpass or shielded viaduct present more difficult light problems than those encountered in lighting of the open roadway.

All factors which may improve visibility and comfortable useability must be considered in designing tunnels and underpasses and their lighting systems.

Brightness ratios between the ceiling and sidewalls of the tunnel as compared to the roadway surface and area surrounding the entrance may be of equal or greater importance than roadway illumination.

Based on experience accumulated from scores of tunnel lighting projects both here and abroad, the accompanying tables have been prepared as a guide for use in future designs.

TABLE I
RECOMMENDED MINIMUM AVERAGE
"MAINTAINED IN SERVICE" ILLUMINATION LEVELS FOR TUNNELS

Traffic Conditions**	Night and Normal-Day-Zone (Beyond Entrance Section)		
	Reflectance of Ceiling and Wall	Minimum Avg. Footcandles	Minimum Avg. Footlamberts
HEAVY (1200 and Above)	70%	5	3.5
with Well-Lighted	60%	6	3.6
Approaches	40%	9	3.6
LIGHT TO MEDIUM (150 to 1200)	70%	4.5	3.0
with Minimum	60%	5	3.0
Approach Lighting	40%	7.5	3.0

**Maximum night hour traffic, both directions.

Circuits affording variable illumination levels are used in some recent installations, thus providing illumination compensation for differences in daylight levels, traffic volume and ambient temperature.

TABLE II
RECOMMENDED DAY TIME ENTRANCE LIGHTING FOR TRAFFIC TUNNELS
(MAINTAINED IN SERVICE) 15 FT. PORTABLE HEIGHT ASSUMED

TIME	Distance in Feet from Portal at		Reflectance of Walls and Ceiling	Minimum Avg. Footcandles at		Minimum Avg. Footlamberts at	
	30 mph	60 mph		30 mph	60 mph	30 mph	60 mph
1st 5 Seconds...	0-225	0-450	70%	50	75	35	50
			60%	60	85	35	50
			40%	85	125	35	50
2nd 5 Seconds...	225-450	450-900	70%	30	50	20	35
			60%	35	60	20	35
			40%	50	85	20	35
3rd 5 Seconds...	450-675	900-1350	70%	10	30	7	20
			60%	12	35	7	20
			40%	18	50	7	20

NOTE: This tabulation indicates higher advised illumination levels for tunnel lining reflectances which are lower than 70%, namely 60% and 40%. From "Lighting Traffic Tunnels and Underpasses" prepared by Subcommittee on Tunnel and Underpass Lighting of the Street and Highway Lighting Committee of I.E.S.

*Illuminating Engineering Society, 1860 Broadway, New York 23, N. Y.

At night, eye adaptation in entering and leaving a tunnel usually is aided by lighting a 500 to 600 foot section of the approach roadway to a level of approximately 50 percent of the average illumination inside the tunnel.

For daytime operation, the entrances, for maximum safety, should have a supplementary lighting system. The purpose of supplementary light, shown in Table II, is to avoid an abrupt change from the several thousand footcandles of daylight to the few footcandles in the tunnel. Such an abrupt change temporarily reduces to a hazardous degree the motorist's ability to see until his eyes have become adapted to the change.

Generally speaking, tunnels may be considered 1,000 feet or more in length, underpasses less than 1,000 feet.

Underpasses less than 75 feet in length generally do not require lighting systems for daytime use. At night, some illumination is essential, ranging from two to three times the illumination on the adjacent roadways.

(5) BRIDGES, OVERPASSES AND VIADUCTS



Width of roadway and traffic flow dictate the illumination levels required for good seeing at night. Fluorescent, incandescent, or mercury luminaires may be used for both applications and maintained illumination levels should be consistent with the values shown in Table III below.

TABLE III
CURRENT RECOMMENDED AVERAGE HORIZONTAL FOOTCANDLES

Illumination Values (Lumens per Square Foot) are for dark roadway surfaces having reflectances of the order of 3 percent.

*VEHICULAR TRAFFIC CLASSIFICATION				
PEDESTRIAN TRAFFIC	Very Light (Under 150)	Light (150-500)	Medium (500-1200)	Heavy to Heaviest (1200 up)
Heavy	0.9	1.2	1.5	1.8
Medium	0.6	0.9	1.2	1.5
Light	0.3	0.6	0.9	1.2

*Numbers in parentheses are Maximum Vehicles per Hour at Night in both directions.

(6) HIGH TRAFFIC DENSITY SECTIONS (Main traffic lanes).



Experience has indicated that there is a justification for lighting the main traffic lanes on limited access roadways, especially where the interchanges or intersections are closely spaced. Also, in areas where some pedestrian traffic is present, main traffic lane lighting is a valuable aid to safety.

The illumination level for main traffic lanes should follow the minimum specifications as outlined in the American Standard Practice with due consideration for the potential traffic volume and vehicular speeds of the roadway twenty-five years hence.

On a traffic thoroughfare or freeway, the lighting units should be located a sufficient distance from the edge of the curb or traffic lane to minimize the chance of serious accident should a car be forced to depart from the regularly assigned traffic lane.

As a general rule, if the overall width of the roadway, including median strip, does not exceed 125 feet, the area should be treated as a single roadway with the lighting standards located on the outside.

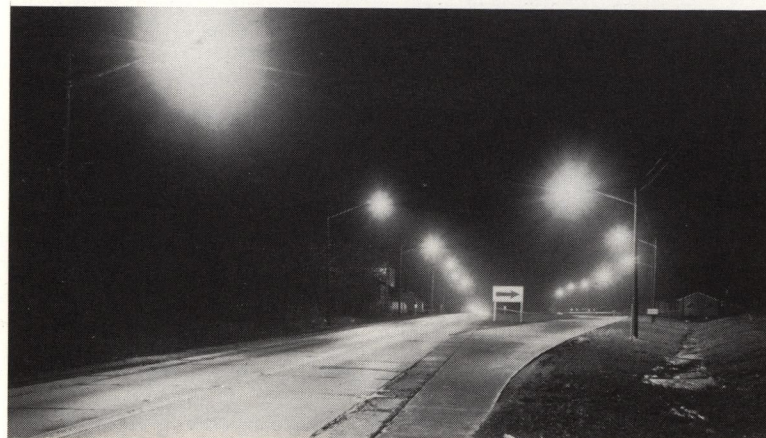
NO MEDIAN STRIP TEASE

There is a tendency under the new concept of highway construction to increase the width of the median strip. Where the total width of the roadway, including median strip, exceeds 125 feet, lighting units may be placed in the strip to supplement the outside rows of lighting units.

When the median strip is wider than about 30 feet, it will usually be a more practical solution to consider the individual roadways as separate problems and light each one individually.

While twin-mounted luminaires located on a median strip have been used, the practice is generally avoided because of the increased possibility of a vehicle running into a lighting standard located in the median strip.

(7) TRANSITION SECTION SUCH AS CHANGES IN NUMBER OF LANES AND TRAFFIC DIRECTION—TOLL PLAZAS.



Control points and toll plazas require a higher level of visibility and greater seeing ability than any other single area on turnpikes and expressways. Good illumination is essential as a clear indication to the vehicle operator of a full-stop area and as a protection to personnel.

The illumination level required for such areas should be somewhat higher than that specified on the basis of traffic volume alone.

(8) DANGEROUS CURVES AND HILLS.



Traffic hazards are usually greater on hills and curving roadways. The specular characteristics of the usual pavement surfaces require that the luminaires be more closely spaced than along adjacent straight sections. Luminaires should, if possible, be placed on the outside of horizontal curves so that reflections between the luminaire and the eyes of an approaching driver are located on the pavement.

On hills, the problem is also one of effective continuity and overlapping of the pavement brightness area from successive luminaires, closer spacing is an aid in this respect.

(9) RAILROAD GRADE CROSSINGS.



Railroad grade crossings should be identified by adequate lighting. Driver attention and recognition of hazard may be as important as visibility of railroad cars. If the street or highway is unlighted, at least two luminaires with adequate size lamps are recommended. The distance between luminaires and the outside track should not exceed 75 feet. Where the roadway is already lighted, the luminaires adjacent to the crossing should be located as described above and the lamp should be at least one size larger than those employed on the remainder of the installation. Light of a cautionary color may be used.

(10) APPROACH TO URBAN AREAS AND HIGHWAYS RUNNING THROUGH MUNICIPALITIES WITH BUILT-UP AREAS, SUCH AS SUBURBAN BUSINESS DISTRICTS AND CONGESTED RESIDENTIAL SECTIONS.



Approaches to and highways through urban and other built-up areas point up the need to consider such factors as pedestrian traffic volume, street-crime experience, turning movements of vehicles and parking practices.

The classifications of pedestrian traffic and vehicular traffic should be taken into consideration when approaching lighting problems of urban or built-up areas. Upgrading of existing facilities and/or the addition of any new facilities should be taken into consideration, as well as the locale's street crime experience.

In areas where parking is permitted, high intensity lighting should be installed so that drivers can see pedestrian movement in and out of parked vehicles, either by direct discernment or by silhouette.

Types of Lighting

THERE IS THE RIGHT LAMP FOR EVERY HIGHWAY PROBLEM.

LAMPS: There are three general types of lamps available for highway lighting. They are: incandescent, mercury vapor, and fluorescent.

Incandescent lamps provide pleasing color at the lowest initial cost but the light efficiency is low compared to the other two.

Mercury lamps are increasingly popular because of high efficiency, long life and low overall maintenance expense.

Fluorescent lamps are particularly well suited to continuous rows of lighting such as in a tunnel, or where a broad streak of brightness may aid discernment. They likewise have high efficiency, long life, and low maintenance.

LIGHTING POLES: There are four different types of poles available for highway lighting—aluminum, concrete, steel and wood.

Aluminum poles of alloys combining strength and durability are widely used as highway lighting supports. They are generally attractive in appearance and have excellent resistance to most corrosive atmospheres. They, therefore, will present few problems of maintenance involving corrosion.

Concrete poles, made by the centrifugal machine process or pre-stressed, reinforced concrete, have wide acceptance. They are strong and durable and are corrosion resistant to all atmospheres. They seldom require cleaning, painting or other maintenance.

Steel poles have been popular for years and still are widely accepted for all types of applications. They have the advantage of strength, rigidity and extreme durability, but should be painted periodically.

Wood poles, made of fir, pine or western red cedar, either hewn or turned, are suitable for use in highway lighting. They should be treated with such chemicals as creosote or pentachlorophenol to secure long life.

How Much Light is Needed?

**THE BEAM OF YOUR CAR HEADLIGHT
IS LIKE THE GLOW OF A SMALL CANDLE
IN THE GREAT DARKNESS OF THE HIGHWAY.**

The A.A.S.H.O. establishes desirable minimum passing distances for different types of highways as follows:

SPEED IN MPH	TWO LANE	THREE LANE
30	600 feet	—
40	1100 feet	—
50	1600 feet	1100 feet
60	2300 feet	1500 feet
70	3200 feet	2000 feet

The lighting installed on the highway (See Table I) should provide these safe night visibility distances. Obviously, vehicle headlights, even high beams, do not penetrate darkness to the safe distances needed for passing at these speeds. The answer is the supplementary protection afforded by highway lighting.

Cost of Lighting

**"IT CAN'T BE MUCH, COMPARED TO
WHAT LACK OF LIGHTING HAS
COST US", SAY THE VICTIMS
OF ACCIDENTS DUE TO DARKNESS.**

Cost figures vary considerably because of several factors, but illuminating engineers say the lighting cost is generally less than one percent of the total cost of the highway. Naturally, installation of adequate lighting is considerably cheaper if it is done at the time the highway is constructed. Installation of lighting on roadways already constructed is more expensive.

It has been proved in most cases, however, that the economic loss from auto accidents, injuries and fatalities would more than pay for the amount of lighting needed to prevent a good percentage of the after-dark mishaps.

The Sum of Safety

Americans like to travel fast and far.

Their tax dollars to be spent on super-highways in the next 10 years attest their willingness to foot the bill.

BUT unless these roads of tomorrow are built for 'round-the-clock use, they are fulfilling only half their mission.

Without lighting the danger spots that loom up in the darkness, our highways will be only half safe. Many motorists will be afraid to travel at night and those who do, may be riding the road to disaster.

As things stand now, lighting of our highways is left to chance.

What is needed is directive legislation so that safe adequate lighting will be engineered into America's roads.

Street and Highway Safety Lighting Bureau

**1400 Terminal Tower
Cleveland 13, Ohio**

**155 East 44th Street
New York 17, N. Y.**