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Symposium on the Development of the Plastics Fabrication Industry in Latin America

Bogotà, Colombia, 20 November - 1 December 1972

TRENDS IN THE DEVELOPMENT OF PLASTICS LIGHTING EQUIPMENT 1/

by

Walter Glass
American Louver Company
Skokie, Illinois, U.S.A.

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SUMMARY

TRENDS IN THE DEVELOPMENT OF PLASTICS LIGHTING EQUIPMENT[1/]

by

Walter Glass
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The introduction of plastics, particularly cellulose acetate, urea-formaldehyde and polyvinyl chloride occured mainly during the late 1930's. Subsequently these have been superceded by acrylics, polystyrene and more recently polycarbonate has been introduced for the more technically demanding applications. In parallel, the scope of lighting applications has expanded and current items range from automotive lenses to louvres, street lighting reflectors and diffusers, fluorescent tube lighting fixtures and integrated luminous ceilings. Fabrication techniques for their manufacture include injection moulding, extrusion and casting. Polystyrene and polymethyl methacrylate account for the bulk of plastic currently used in the United States of America with still relatively minor proportions of polycarbonate. While the consumption of polystyrene, however, has remained fairly static over the last five years,

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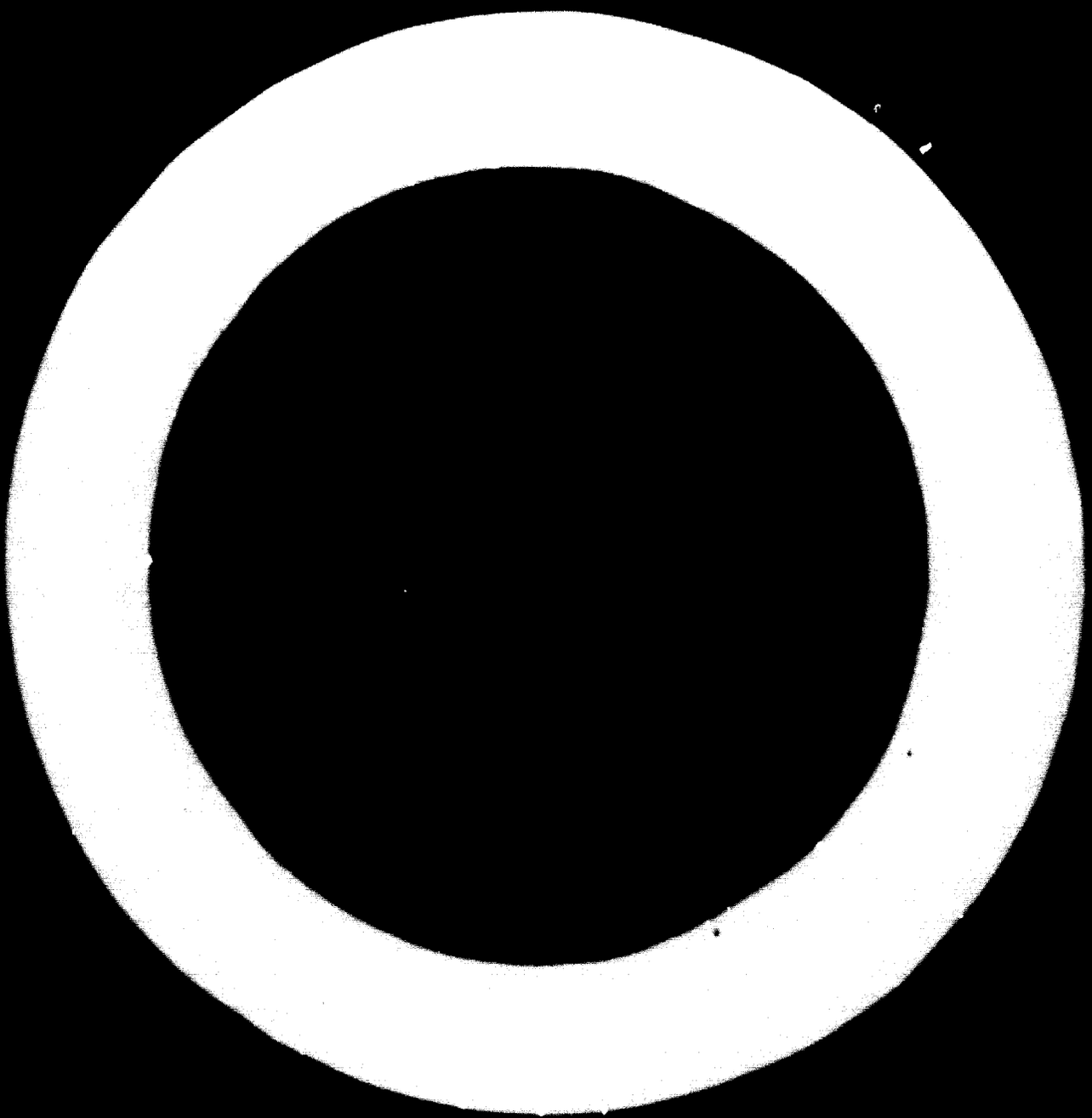
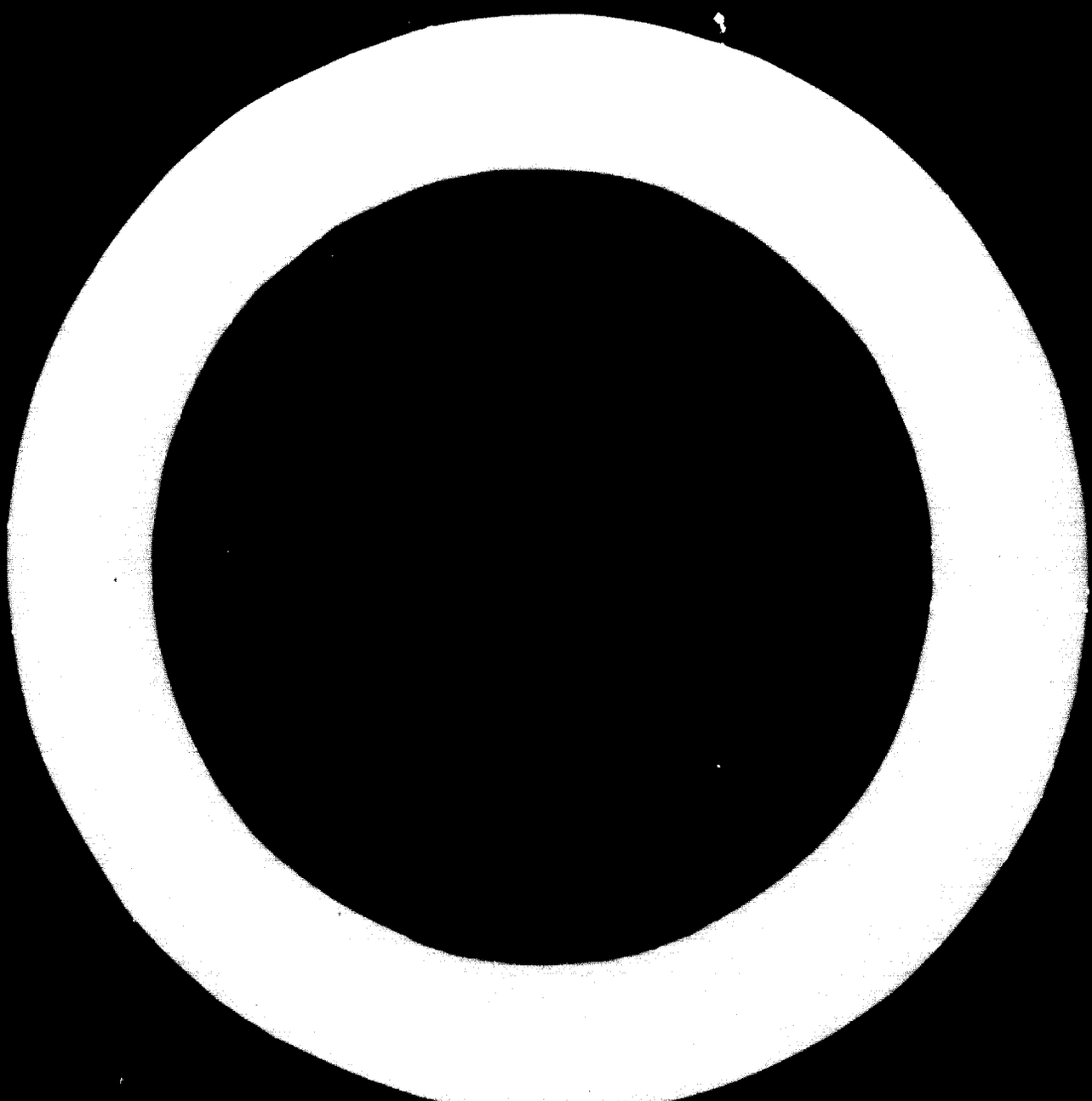


that of polymethyl methacrylate has more than doubled to an anticipated consumption of 70 million pounds in 1972.

It is contended that lighting standards in the United States of America are considerably higher than those of other countries and that, in consequence they provide an indicator of short term potentials elsewhere. The ultimate potential for this market is much greater, however, as even in the United States this has not yet been achieved.



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I. INTRODUCTION

A - Lighting standards, although varying greatly from country to country have grown continuously for centuries. However, the most dynamic growth has been in the twentieth century.

B - The early indoor light came first, from wood fires, followed by torches, tallow candles, oil and kerosene lamps, arc light, gas lamps, electric filament bulbs and finally gas filled tubes, quartz lamps and mercury vapor lamps.

C - As light sources became more concentrated and powerful, so too did glare and discomfort increase. Consequently various types of shielding was introduced, beginning with baffles placed at right angles to the light source, followed by glass panels, metal louvers, prismatic glass lenses and finally alzac aluminum reflectors and baffles, each development and improvement coinciding with the increase of lighting standards and light intensity.

II. INTRODUCTION OF PLASTIC INTO LIGHTING PRODUCTS

A - Plastics were introduced to lighting equipment in the late 1930's however, early plastic shades, diffussers and accessories, with the exception of small compression molded parts were highly unsatisfactory. These early plastic products had a tendency to warp, discolor, crack, craze and generally discourage the architect and lighting equipment manufacturer and his customer. These early materials were cellulose acetate, urea formaldehyde, vinyl, polychloride. Styrene and acrylic followed.

B - As plastic powders and resins improved, and molding, extruding and casting techniques advanced, satisfactory lenses and diffusers were produced to a point where they were generally accepted in lighting equipment, by the middle of 1940.

C - In early 1950 plastic diffusers and lenses were not only accepted but actually specified for both indoor and outdoor lighting applications. As improved light sources were developed, revolutionary fixture design followed, primarily made possible by the use of plastics.

Such features as automobile tail lamps, followed by sealed beam headlights, flood lighting and street lighting reflectors, life buoys and beacons to name a few outdoor applications. The advantages in order of diminishing importance are:

1. Less breakage (versus glass)
2. Even light distribution
3. Lightness of weight
4. Appearance
5. Adaptability to varied fixture design
6. Cost
7. Ease of maintenance
8. Light transmission
9. Durability
10. Ease of installation and handling
11. Variety of colors available.

In the middle of 1950 a plastic louver was developed and patented by an American Lighting Company and this accomplishment influenced the design and development of indoor lighting equipment for many years to come. Specifically the introduction of the four foot and later the eight foot fluorescent tube, required fixture design of very heavy construction to support steel or glass diffusers of such magnitude. This caused a definite increase of ceiling construction and fixture installation. The plastic louver, because of its light weight of five pounds, constructed of light stabilized polystyrene versus ten poundsfor a steel louver and eight pounds for an aluminum louver, efficient diffusing angles and low cost permitted exceptional savings in fixture costs through elimination of weight and materials, and reduced installation costs by some sixty (60%) percent. Also it led to the development and installation of luminous ceilings which is the forerunner of the integrated ceilings of today. Additional plastic lighting diffusers were developed to a point where some seventy-five (75%) percent of all lighting diffusers in the United States today are made of plastic and in some cases complete lighting fixtures are constructed of plastic. These diffusers in addition to louvers are injection molded, prismatic sheet and forms, extruded prismatic sheet and forms, cast acrylic sheet and forms, polycarbonate diffusers for hazardous locations, and the Zenith of all lighting diffusers, the parabolic louver of silver or gold vacuum plated.

III. POTENTIAL OF THE LIGHTING MARKET

A - The potential of the lighting market is so huge that it can easily excite the imagination.

B - Long considered a growth industry, its rate of growth has increased dramatically in recent years, and promises to accelerate as time progresses. Not too many years ago there was only one tail lamp on an automobile, no light in a refrigerator, stove or vacuum cleaner, only an occasional street lamp on a corner; 15 to 20 foot candles was considered a well lighted school room, or office and a single light bulb in a corridor was sufficient. Today there are a minimum of half a dozen lights in the tail light of an automobile, street lights every 200 feet, and 100 foot candle installations considered as just average. Lighting equipment continues to improve in efficiency, in design, operation, and in the uses of material in keeping with improved light sources and higher lighting standards. Today there are many new innovations in the development stage of lighting equipment, both as to appearances as well as efficiency.

As a measure of potential in 1956 the value of all plastic fixtures used in indoor, non-residential building was approximately $80,000,000. This was an increase of specifications of plastic materials in 1955 of 25%. Between 1958 and 1970 while the commercial lighting level was rising 4% in the United States, sales of lighting equipment rose 143% to $1.8 billion a year and sales of lamps and bulbs doubled to $775 million. Industry officials ascribe the growth to broader use of electricity and national expansion. Critics contend the boosts in lighting levels clearly

helped. Today the acrylics and styrenes, between them, account for the major bulk of the lighting market. There is a small amount of two million pounds of PVC used. Polycarbonate accounts for another two million pounds at the present time but is increasing at a modest pace. Below is a table of increase of pounds of material used from 1959 through 1971:

Year	Millions of Pounds Styrene	Millions of Pounds Acrylic
1959 thu 1971	12	-0-
1960	14	-0-
1961	16	-0-
1962	24	-0-
1963	25	3
1964	27	6
1965	32	12
1966	34	22
1967	38	31
1968	36	39
1969	37	43
1970	37	47
1971	34	50
1972	38	70

These figures pertain primarily to the indoor lighting equipment market and do not take into consideration uses of plastic and outdoor lighting

industries such as automobiles and other various types of specialized lighting equipment.

C - Lighting standards in the United States are considerably higher than in any other country by a considerable margin. Lighting standards in the Common Market have been about ten years behind the lighting standards in the United States, but the gap is narrowing rapidly. North countries and parts of South Africa, are some twelve years behind the United States standards. Some of the Latin and South American countries, with minor exceptions are about fifteen years behind United States' standards. The rest of the countries in the world are probably even further behind that.

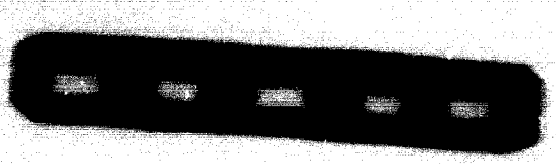
IV. CONCLUSIONS

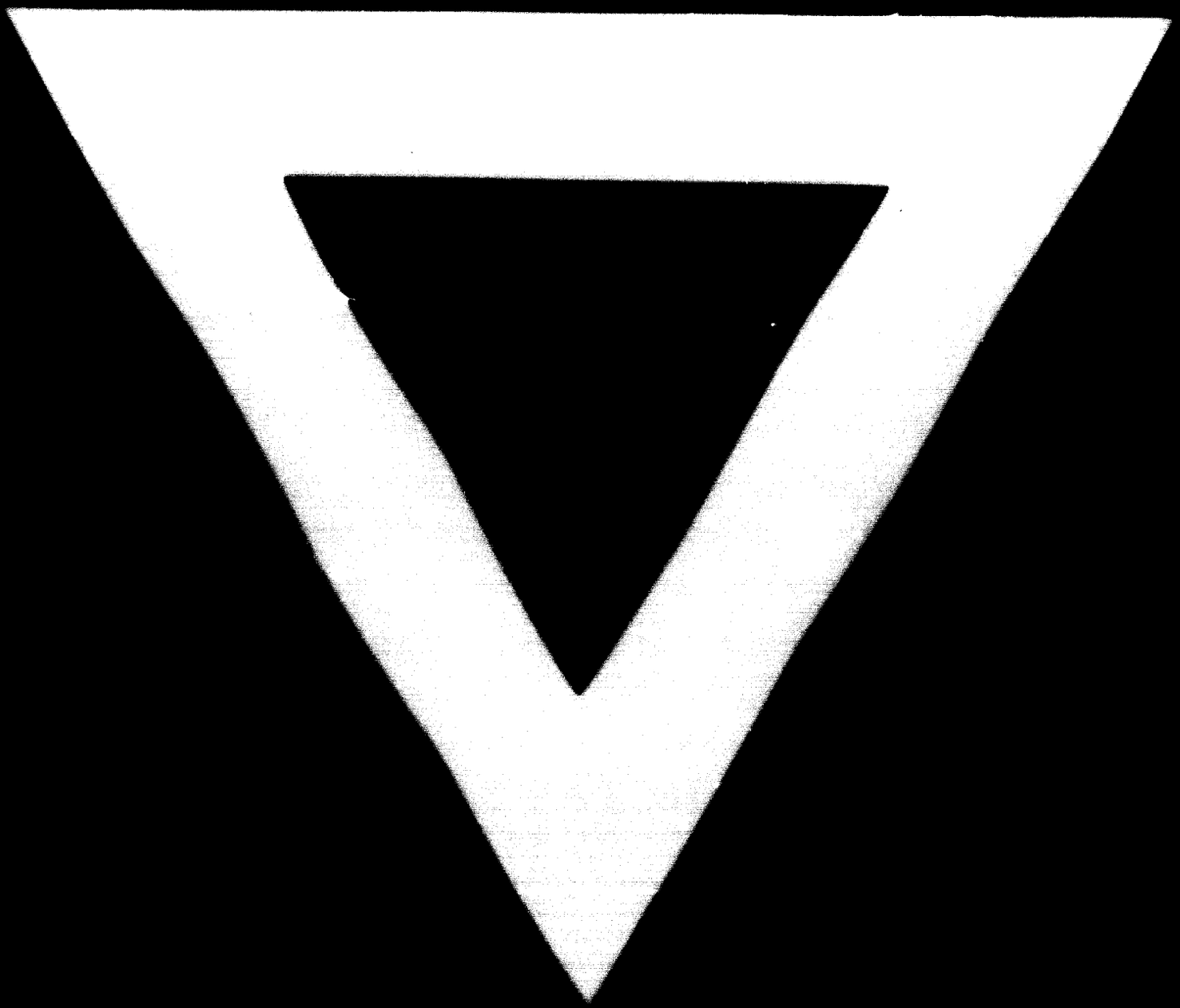
The reasons for the lower lighting standards in other countries, as compared to the United States are varied. Ignorance and indifferences are not real reasons in most cases. Recovery after periods of war, lack of adequate power facilities, political changes, financial conditions and stability and economic conditions in general have been the primary reason for lagging improvement in lighting standards. The United States, having been blessed with an almost continuous comparative prosperity, has had the opportunity to forge ahead in the development of better light sources, superior lighting equipment and advanced lighting standards.

V. RECOMMENDATIONS

Today as communications and travel have improved considerably, the gap between the United States and other countries, lighting standards, and

equipment is narrowing rapidly. Improved economic conditions, more stability in governments, higher standards of living, increased constructions and financial aid by the United Nations and World Bank, have and are contributing to improved lighting standards throughout the world. "Better Light, Better Sight" was the United States slogan twenty-five years ago and it is true that there is no more important gift a country can give its citizens, both present and future, than to carefully develop the young childrens' eyes, particularly during school years. Higher lighting standards though costing slightly more at the beginning, is much cheaper in the long run, effecting many economics, such as improved worker efficiency, greater traffic safety, personal safety, efficient operating procedures and general human well being. Let us all put an effort toward "BetterLight - Better Sight - Better Living".





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