NATIONAL BUREAU OF STANDARDS REPORT

7322

Bibliography of
National Bureau of Standards Reports and Papers
On Aviation Ground Lighting, 1945 - 1961

By
Andrew C. Wall
E. B. Way

U. S. DEPARTMENT OF COMMERCE
NATIONAL BUREAU OF STANDARDS

THE NATIONAL BUREAU OF STANDARDS

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On Aviation Ground Lighting
1945 - 1961

Prepared by
Andrew C. Wall
E. B. Way
Photometry and Colorimetry Section
Metrology Division

For
Bureau of Naval Weapons
Department of the Navy
Washington 25, D. C.

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INTRODUCTION

To make the results of the work of the National Bureau of Standards in aviation ground lighting more readily available, a bibliography has been prepared of the reports and papers issued in that field during the past fifteen years by the Aviation Ground Lighting Group of the Photometry and Colorimetry Section, Metrology Division. A summary of each report is given in the bibliography. Reports of tests of equipment and reports of transitory interest are not included.

1. AVIATION GROUND LIGHTING AND MARKING

1.1 GENERAL

Visual Landing Aids Field Service Operation

by C. A. Douglas, J. W. Simeroth, and J. E. Davis

NBS Report 3046, January 1954, 39 pages, 2 tables, 8 figures
NBS Project 0201-20-2327

This report gives the history of the establishment of the Visual Landing Aids Field Operation at Arcata, California, describes the facilities, and reports the progress in field testing for the first year. The testing program between December 1, 1952 and November 30, 1953, included approach beacons, cable fault locating, equipment, transmissometers, and condenser-discharge lights. A determination was made as to optimum frequency and duration of flashing lights used in approach beacons.

Report of a Survey of Visual Landing Aids

By James E. Davis

NBS Report 3260, May 1954, 27 pages
NBS Project 0201-20-2327

The results of a survey of the visual landing aids at eleven Naval and Marine Corps Air Stations in the Eastern part of the United States are presented. Particular attention is given to airfield lighting difficulties and maintenance problems and methods. The survey was accomplished by interviewing the personnel performing the maintenance, as well as those in charge, and by completing a survey form for each station. Each installation is a special problem in itself, but some of the problems are sufficiently similar to warrant recommendations which may improve efficiency in operations and maintenance.

Report of a Survey of Visual Landing Aids

by James E. Davis and John W. Simeroth

NBS Report 5893, June 1958, 73 pages

and

NBS Report 5893, Supplementary, November 1958, 13 pages, 12 tables
NBS Project 0201-20-2327

A survey of visual landing aids conducted at seven Naval and Marine Corps Air Stations in California is summarized. The survey was made to determine the operational and maintenance problems in this area. Many maintenance problems at the west coast stations were found to be similar to those reported previously (NBS Report 3260). From the findings of the survey, recommendations were made for improved airfield systems and equipment; standardization of lighting and marking systems at all fields; a comprehensive pilot training program in the use of all visual landing aids; more stringent requirements for contract installations; improved maintenance, including assignment of responsibility for maintenance to one man with special training; and the provision to maintenance personnel of the needed equipment, particularly suitable vehicles and communications equipment, special tools, and technical and maintenance information.

The supplementary report comprises a tabulation of the data pertinent to the application of visual aids at each station.

1.2 APPROACH AND RUNWAY LIGHTING

Development of Approach- and Contact-Light Systems

by F. C. Breckenridge and C. A. Douglas

Illuminating Engineering, 40, 785 (1945), 44 pages, 24 figures, 4 tables

It is the primary purpose of this paper to make available a report of the results obtained in a succession of development projects relating to approach- and contact-light systems. These projects were carried on through the joint activities of the Civil Aeronautics Adminstration and the National Bureau of Standards. Through the courtesy of the Army Air Forces it has been possible to include some additional information which shows the relationship of these projects to other progress which has been made in this field. A short account of such current developments as have come to their knowledge is included. A brief discussion of testing procedures and some recommendations for expediting progress toward a real solution of the approach- and contact-light problem is given.

Development of Optimum Runway Lights for Jet Aircraft, Interim Report No. 1

by C. A. Douglas, I. Nimeroff, A. N. Hill

NBS Report 4741, June 1956, 42 pages, 6 tables, 10 figures
NBS Project 0201-20-2331

and

Development of Visual Landing Aids for Jet Aircraft, Final Report

NBS Report 6862, June 1960, 60 pages, 5 tables, 19 figures
NBS Project 0201-20-02415

The visual guidance requirements of a total visual landing aids system are analyzed, noting that no component of the system, for example, runway lights, can be considered independently of the other components of the total system. A summary of pilot interviews is presented. The operational requirements are developed. From these, intensity distribution requirements for the several types of lights are computed. Increased vertical beam spread of the beacon, installation of runway-identification and circling-guidance lights are recommended, as are modified threshold lights, use of type MB-1 lights on runways over 200 feet wide, and development of lights suitable for use on non-instrument runways.

The results of investigations by the National Bureau of Standards in the development of optimum lights for jet aircraft from 1953 through 1959 are summarized in the final report. Appendices are included listing 51 reports and 8 papers prepared during the course of the study.

Problems in the Control of Glare in Approach- and Runway-Light Systems

by C. A. Douglas

NBS Report 5747, January 1958, 10 pages, 4 figures
NBS Project 0201-20-2331

An investigation into the glare effects of the approach-light systems concludes that a modification of the system so that the lights in the outer zone have considerably higher intensity than those in the inner zone is desirable, and discusses possible methods of improving the means of obtaining the proper intensity setting.

Some Problems in Approach Lighting

by C. A. Douglas

NBS Report 5753, January 1958, 9 pages
NBS Project 0201-20-2331

A study is made of the perennial problems in approach lighting: standardization of visual landing aids, field testing of equipment, providing elevation guidance to the pilots, and the control of glare from visual landing aids.

Standardization of approach-light configurations is now being accomplished. Compatibility of systems appears to be a more desirable and attainable goal than complete and rigid standardization. It appears unlikely that formal flight tests will resolve major differences in opinion. A much more extensive use of service testing appears to be the most satisfactory way to resolve these major differences of opinion. A test facility available to all groups, at which lighting systems could be easily and cheaply installed and tested would greatly expedite the development of the systems to service-test stage. The need for elevation guidance is expected to become more critical as minimums are lowered. Development of new methods of elevation guidance may be required.

Operating the present approach-light systems at reduced intensity in order to reduce the glare in the inner approach zone can seriously reduce the effectiveness of the outer part of the approach-light system. Modification of the systems so that the lights in the outer zone have a considerably higher intensity than those in the inner zone appears desirable.

An Approach Beacon System

by Visual Landing Aids Field Laboratory, Photometry and Colorimetry Section, Optics and Metrology Division

NBS Report 5902, February 1959, 51 pages, 2 tables, 8 figures
NBS Project 0201-20-2327

An approach beacon system developed by the National Bureau of Standards is described. It is a low-cost visual guidance system for use during circling or radio-range approaches in marginal atmospheric conditions where a high intensity approach-light system is not available. The approach beacons provide guidance through 360 degrees of azimuth. They consist of continuously burning incandescent lamps which are rotated about a vertical axis to give the appearance of a flashing light. Two beacons

located on the extended centerline of the runway provide guidance in visibilities as low as one mile. The optimum flash rate is approximately 72 flashes per minute, for which the optimum flash duration is from 0.3 to 0.4 second.

Appendices contain a list of equipment needed for an installation; instructions for installing and servicing; and pilot evaluations of the system.

Problems in the Design of Flush Runway Lights, Memorandum Report

by C. A. Douglas

August 1959, 8 pages, 2 table, 2 figures
NBS Project 0201-20-02411

The purpose of this memorandum is to analyze some of the optical and geometrical limitations involved in the design of flush runway lights: angles of view, peak intensity, average brightness of aperture, length of the lighting unit, brightness of the source. The lengths required for flush lights are computed based on typical values for the parameters listed above.

1.2.1 RUNWAY LIGHTS, MECHANICAL EFFECTS

Results of Static Loading Tests of Elfaka Gratings by Aircraft Tires

by L. K. Irwin

NBS Report 4086, May 1955, 29 pages, 2 tables, 23 figures
NBS Project 0201-20-2331

Static load tests are reported of a study of the effects of gratings of the type used in open grid runway lights on 20 x 4.4 and 26 x 6.6 size aircraft tires under various loads and for various test positions. The load deflection curves indicate that when the tire is supported by one bar of a grating and the load exceeds the rated static load, the deflections of the tire are sufficiently large that the flange of the wheel would lie below the top of the grating. (Note: Present open grid lights are designed so the tire is supported at all times by more than one bar.)

Landing Gear Loads Resulting from Taxying Airplane Over a Projecting Runway Light. Progress Report 1

by W. D. Kroll

NBS Report 4574, March 1956, 29 pages, 4 tables, 15 figures
NBS Project 0201-20-2331

It was the purpose of this investigation to determine by theoretical analysis what the loads on the landing gear of an airplane would be if, while taxying on a runway, the airplane taxied over a runway light projecting above the runway surface, and what the optimum shape of the light would be. The results of this analysis indicate that:

1. The height of light is an important factor in the magnitude of the landing gear loads but the shape of the light edge has little, if any effect.

2. At high taxying speeds, there is little reaction of the F-86H airplane when its nose wheel taxies over a raised runway light of moderate height.

3. At high taxying speeds, the landing gear loads increase as the height of the light is increased, and, somewhat less, as the taxying speeds increase. The latter may be offset by an increase in lift at the higher taxying speeds.

Breaking Strength of Frangible Tube Base Adapters

by L. K. Irwin and J. I. Price

NBS Report 5239, April 1957, 25 pages, 5 tables, 9 figures
NBS Project 0201-20-2331

This report covers the results of static and dynamic load tests, and chemical analysis of a type of frangible tube base adapter used to mount standard elevated runway marker lamps for military airports. The results of this report are intended to provide the basic technical data required to supplement procurement specifications for frangible adapters. Included in this report are the results of the above tests of adapters furnished to the Air Force by three manufacturers. A method for measuring the wall thickness under a notch, and limitations of dynamic tests to determine energy to fracture are discussed.

Since, for a given manufacturing process, material, and geometry of frangible adapter, there is a relationship between the static breaking moment and the impact breaking strength, the use of the static breaking

moment only should be considered for procurement specifications.

Landing Gear Loads Resulting From Taxying an Airplane Over a Projecting Runway Light, Progress Report 2

by W. D. Kroll

NBS Report 5641, November 1957, 14 pages, 2 tables, 7 figures
NBS Project 0201-20-2331

This report gives the results of a mathematical analysis of the deflection of an airplane wheel when an airplane is taxied over a protruding runway light (damping neglected). The analysis made would be indicative of the loads on an airplane landing gear if there were no relative motion in the oleo strut. This is a condition that would occur many times during the taxying of the airplane but only for very short periods of time. Although this analysis might give a fairly accurate value of the maximum load to be expected if an airplane were taxied over a protruding runway light, it does not give a true picture of the response of either the airplane mass or of the tire. Damping in the oleo strut should be considered.

Results of Questionnaire on Forces on Landing Gears Due to Guidance Lights on Runways

by L. K. Irwin

NBS Report 5676, December 1957, 24 pages, 2 tables, 7 figures
NBS Project 0201-20-2331

This report summarizes replies received from eleven aircraft manufacturers in response to a questionnaire on the possible damage to the landing gear of aircraft caused by lighting equipment projecting above the runway. The investigation was for the purpose of determining some of the optical and mechanical characteristics which would govern the final design configurations of runway lights for jet aircraft. The replies ranged from brief affirmative statements that the aircraft being manufactured would traverse the light covers without forseeable difficulty to extensive discussions of the dangers inherent in placing protrusions on the runway, with supporting numerical and graphical data.

Static Tests of Model L-809 (Modified) Airport Marker Light Base and Multi-Electric Class BB Light

by L. J. Davis and A. F. Kirstein

NBS Report 7046, December 1960, 22 pages, 18 figures
NBS Project 0201-20-02411

Results are reported of static load tests of a Type MS24526 airport marker light base to determine whether the base is structurally adequate for use with runway marker lights. Data are also reported on the load deflection relations of aircraft tires on the class BB light and on the behavior of the light base assembled with this light or a cover plate.

Static load tests were made on an assembled light and light base with 20 x 4.4 and 32 x 8.8 tires. Tests were made on light bases assembled with cast iron or with steel cover plates, applying the loads through the aircraft tires or through a steel strut. There was no appreciable damage to the light or tires during the static tests with the tires.

Since the measured strains in the light base indicate permanent set after unloading, it was evident that some portion of the material in the light base yielded under the load exerted by the 32 x 8.8 tire.

When the steel strut was used to load the light base well beyond the yield strength of the material, the strains on the underside of the flange changed from compressive to tensile. The main purpose for grossly overloading the light base was to demonstrate visually the yield mode of failure exhibited by the light base. The yield mode of failure is usually considered a conservative design criterion, and in general a structure designed to fail by yielding under static load will support much larger momentary dynamic loads.

1.3 OBSTRUCTION LIGHTING AND MARKING

Memorandum Report of a Study of the Visual Range of Radio and Television Towers, Section I and Addendum

by C. A. Douglas

May 20, 1954, 22 pages, 1 table, 9 figures
Addendum, June 3, 1954, 2 pages, 1 table
NBS Project 0201-20-2301

These memoranda present a theoretical and experimental analysis of the factors affecting the visual range of radio and television towers: sky background; terrestrial background; contrast-thresholds; color of objects

relative to background.

Values are given for the expected visual range of the tower structures. It was found that the visual range of these tall, slender, "lacy," structures is a complex function of the reflectance of the structural members; their area and separation; the sky conditions; the direction of the sun; the direction from which the tower is viewed; as well as the transmissivity of the atmosphere and the background against which it is seen. The analysis was made within the following framework: black areas with sky background (summarized by a table comparing the visual ranges of the several objects considered); gray or white objects with sky background; colored objects with sky background; and objects viewed against terrestrial backgrounds. Noted: Guy wires viewed from the air against a grass background were not seen from 0.5 mile except momentarily by reflection.

Memorandum Report of a Study of the Visual Range of Radio and Television Towers, Section II, Visual Range of Obstruction Lights and Hazard Beacons

by C. A. Douglas

June 3, 1954, 13 pages, 5 tables, 1 figure
NBS Project 0201-20-2301

Results of an analysis of the visual range of the obstruction lights and hazard beacons used to mark radio and television towers are presented.

1.4 RUNWAY MARKINGS

A Field Evaluation of the Relative Brightness of Eight Types of Runway Marking Materials

by R. T. Vaughan, S. B. Russell, and C. A. Douglas

NBS Report 6549, October 1959, 20 pages, 2 tables, 6 figures
NBS Project 0201-20-02415

A comparison is made of the relative performance of eight types of materials tested for use as runway markings in the touchdown area of a runway at Washington National Airport over a period of seventeen months. The data presented in this report are of necessity very limited and are

based only upon the performance of materials placed within the touchdown area of a very heavily used asphalt runway with a "rough" finish to its surface. It is therefore recommended that comparative service tests be made using those materials considered suitable for additional tests. Runways in different climatic areas and having different degrees of usage should be marked, using on each of these runways all the materials under test in a statistically planned distribution in the standard runway marking pattern. The performance of these materials should be evaluated primarily from motion pictures taken from an airplane. Brightness and reflectance measurements could be used to supplement the photographs if necessary. An evaluation based upon personal opinion, pilot or ground personnel, should be avoided.

Because of the difficulties in maintaining a serviceable centerline marking in the touchdown zone of a busy runway, the National Standard runway marking pattern should be changed to replace or supplement the centerline in this area.

1.5 SEADROME LIGHTING

A Redesign of the Switching Mechanism of the Type FMF-6B Channel Marker Light

by R. T. Vaughan

NBS Report 5781, February 1958, 9 pages, 4 figures
NBS Project 0201-20-2301

A fluorescent lamp unit was developed to simplify the operation of the FMF-6B buoy-mounted channel marker light. It was tested in the laboratory and at the Naval Air Test Center, Patuxent River, Maryland. (See also NATC Report on Project TED No. PTR AE 100.27, 12 Dec. 1957.)

A Modification of the Type MB-1 Light for Sealane Marker Service

by R. T. Vaughan

NBS Report 6419, May 1959, 7 pages, 2 tables, 2 figures
NBS Project 0201-20-2301

A type MB-1 light was modified to adapt it for use on a self-orienting channel light support and to improve the efficiency of the light by reducing leakage currents which occur when the light is wet by salt water.

1.6 TAXIWAY LIGHTING

Proposed Design of a Taxiway Guidance System for Miramar Naval Air Station

By J. W. Simeroth and J. E. Davis

NBS Report 6846, June 1960, 32 pages, 1 table, 18 figures
NBS Project 0201-20-02414

This report contains design details of a proposed installation of lighting, guidance signs, and markings for the taxiways of the Miramar Naval Air Station, California, planned to serve as an operational test for evaluating the system as a proposed Navy standard for lighting and marking of taxiways.

2. AIRFIELD LIGHTING EQUIPMENT

2.1 GENERAL

Maintenance of Airfield Lighting Systems, Part III, Troubleshooting Procedures for Series Circuits

by John W. Simeroth and James E. Davis

NBS Report 5243, May 1957, 53 pages, 10 plates
NBS Project 0201-20-2327

This report is one of a series planned to constitute a complete airfield lighting maintenance manual. It includes four types of troubleshooting procedures for series airfield lighting systems: 1) a detailed step-by-step procedure, 2) a set of troubleshooting charts, 3) a brief step-by-step procedure, and 4) a procedure for troubleshooting by symptoms. (The other reports of the series have not yet been issued.)

2.2 RUNWAY DISTANCE MARKERS

Field Tests of Runway Distance Markers

by John W. Simeroth, Earl I. Bienz, and M. R. Carrothers

NBS Report 5466, September 1957, 14 pages, 5 figures
NBS Project 0201-20-2327

The results of tests of the visual range and recognition distance of externally illuminated runway distance markers in conditions of restricted visibility are reported. The optimum level of illumination and lamp position were determined. It was found that the visual range of markers using fluorescent orange paint was greater than that of those using international orange, but that the recognition distance of the numeral on international orange was greater.

Field Tests of Runway Distance Markers Constructed by NAS Cecil Field

by John W. Simeroth and James E. Davis

NBS Report 6904, July 1960, 11 pages, 3 tables, 2 figures
NBS Project 0201-20-02414

The results of a study of the visual range and recognition distance in conditions of restricted visibility of a type of runway distance marker developed and fabricated at NAS Cecil Field are reported. The markers are internally illuminated for nighttime use. The performance of these markers at night is much better than that of the externally illuminated markers which were tested previously. Runway distance markers of this type are recommended for adoption as a standard for Naval Air Stations.

2.3 TRANSFORMERS

Output Characteristics of Three 200-Watt Series-Series Transformers With Multiple Lamps as Loads

by James E. Davis

NBS Report 6337, March 1959, 13 pages, 7 figures
NBS Project 0201-20-2327

and

NBS Report 6337 Supplementary, March 1960, 23 pages, 20 figures
NBS Project 0201-20-02414

Data from tests made of series-series transformers of three 6.6/6.6-ampere, 200-watt, runway lighting transformers, each from a different manufacturer, using different wattage 120-volt, multiple-type lamps as the load, are presented. The characteristics of the transformers are shown as plots of secondary voltage versus input current and of output wattage as a function of the rated wattage of the lamp load. Plots of the computed light output as a function of lamp load are included.

In the supplement, the results of similar measurements with 60- and 75-volt lamps are presented.

2.4 RETROREFLECTORS

Photometric Tests of 36 Retroreflective Samples

by Photometry and Colorimetry Section, Optics and Metrology Division

NBS Report 3789, November 1954, 61 pages, 8 tables, 18 figures
NBS Project 0201-20-2301

This report describes the method of test and gives the results of specific intensity measurements made at various angles of incidence and divergence on samples of colorless retroreflective devices or materials representative of types produced in the United States. Types tested include: "cat's-eye," beads in paint, embossed lens, and lens-reflector (all of Type I, image forming); corner-cube and trihedral, or triple mirror (of Type II); and mosaic plaque (a combination of either type in a closely spaced flat grouping).

Photometric Tests of 21 Colored Retroreflective Samples

by Photometry and Colorimetry Section, Optics and Metrology Division

NBS Report 4343, November 1955, 26 pages, 5 tables, 6 figures
NBS Project 0201-20-2301

Results are presented of photometric tests made on 21 samples of colored retroreflective devices or materials of the following types: trihedron mosaic plaque, red and green; beads in plastic, red, yellow, and green; embossed lens, red, amber, blue, and green; "cat's-eye," red and green. Angles of incidence varied from 0° to as much as 60° for some samples.

3. FOG DISPERSAL

Fog Dispersal by Radiant Tubes

by Ernest F. Fiock and Andrew I. Dahl

NBS Report 1914, September 1952, 49 pages, 5 tables, 24 figures

Results of thermal evaluation tests of a prototype radiant tube unit designed for dispersing fog over aircraft runways are given. Calculations show that an eight-tube system would be moderately effective only in still air, but would be complex and bulky, with a high power requirement.

4. LAMPS

Analysis of Mercury Lamps and Filter Combinations for Use as Aviation-Green Lights

by I. Nimeroff

NBS Report 4449, December 1955, 9 pages, 4 tables, 4 figures
NBS Project 0201-20-2331

The purpose of this analysis was to compute the luminous transmittance and chromaticity coordinates of present aviation-green filters (designed for use with incandescent lamps) when they are used in combination with currently available mercury lamps. If combinations failed to meet either the present or proposed aviation-green light specification, suitable filters would then be designed. Since the resultant colors for mercury lamps were outside the specified limits of aviation green, special two-component filters were designed. The luminous transmittance of these filters, used with mercury lamps, is about 55%.

Current-Intensity, Voltage-Intensity, and Current-Voltage Characteristics of Runway- and Approach-Light Lamps

by Photometry and Colorimetry Section, Optics and Metrology Division

NBS Report 4463, December 1955, 23 pages, 1 table, 20 figures
NBS Projects 0201-20-2301, 0201-20-2331

This report is a compilation of measurements of the intensity-current-voltage characteristics of lamps of the types generally used in approach, runway, and taxiway lighting systems. This report is no longer available. The data are included in NBS Report 6190.

Current-Intensity, Voltage-Intensity, and Current-Voltage of Airfield Lighting Lamps

by Photometry and Colorimetry Section, Optics and Metrology Division

NBS Report 6190, October 1958, 63 pages, 1 table, 59 figures
NBS Projects 0201-20-2301, 0201-20-2331

This report is an expansion of National Bureau of Standards Report 4463 and contains a compilation of measurements of the intensity-current-voltage characteristics of lamps of the types generally used in approach, runway, and taxiway light systems. The results of a study of the effects of color filters on the relative intensity of the lamps are included.

5. VISIBILITY

5.1 GENERAL

Some Factors Affecting the Relation Between Reported Visibility and Visibility from Aircraft

by C. A. Douglas

NBS Report 2715, August 1953, 24 pages, 4 tables, 9 figures
NBS Project 0201-20-2301

An analysis is presented of some of the factors which affect the accuracy of the prediction of the visual guidance received by a pilot landing an aircraft: variability of the atmospheric transmittance, cockpit cutoff, search time, effects of terrestrial background and the intensity distribution of the lights. Numerical examples of the cumulative effects of these factors are given. The unpredictable variations in the atmospheric transmission and in the position of the aircraft limit the accuracy with which guidance can be predicted.

Computation of the Effective Intensity of Flashing Lights

by Charles A. Douglas

Illuminating Engineering, 52, 641 (1957), 6 pages, 6 figures

and

NBS Report 4554, March 1956, 13 pages, 6 figures
NBS Project 0201-20-2301

A mathematical analysis is made of the effects on the effective intensity I_e, computed from the Blondel and Rey relation,

$$I_e = \frac{\int_{t_1}^{t_2} I dt}{a + t_2 - t_1}$$

produced by changes in the limits of the integral. Methods which facilitate the computation of I_e; the checking of conformance to effective-intensity specifications, and the computation of the visual range of flashing lights are given.

Effective Intensity of Flashing Lights

by Theodore H. Projector

Illuminating Engineering, 52, 630 (1957), 11 pages, 14 figures

and

Effective Intensity of Flashing Aircraft Lights

by Theodore H. Projector

NBS Report 4830, September 1956, 38 pages, 20 figures
NBS Project 0201-20-2300

Since the classical work of Blondel and Rey in 1911 established the relation between the duration of a flash and its effective intensity, a considerable amount of research has been done on various aspects of the problem. This body of research is summarized and critically evaluated in this report. It is shown that the Blondel-Rey equation is still the best expression of the relation, and covers flash durations down to the micro-second range. The integral form of the equation, proposed by Blondel and Rey in 1911, appears valid for flashes of any wave shape, and a method for handling this form, recently developed at the National Bureau of Standards, is recommended for use in computing the effective intensity of all flashing lights.

NBS Report 4830 is no longer available.

The Determination of the Effective Intensity of Composite Light Units in Restricted Visibility

by Visual Landing Aids Field Laboratory, Photometry and Colorimetry Section, Optics and Metrology Division

NBS Report 5644, November 1957, 23 pages, 1 table, 11 figures
NBS Project 0201-20-2327

This report gives the results of measurements made in fog of the effective intensity of composite light units. The effective intensity of the lights at distances of 700 to 6300 feet was determined by day and by night by finding the intensity of a single light which had the same visual range as the test unit. Observations indicate that the "shape" factor developed by de Boer is applicable except at short visual ranges.

Determination of the Effective Intensity and the Visual Range of Flashing Lights in Restricted Visibility

by Visual Landing Aids Field Laboratory, Photometry and Colorimetry Section, Optics and Metrology Division

NBS Report 5905, August 1958, 31 pages, 3 tables, 19 figures
NBS Project 0201-20-2327

Effective intensity and visual range measurements in fog of four types of flashing lights designed for approach and identification lighting at airports are presented. The effective intensity of these lights was determined by finding the intensity of a single steady burning light which had the same visual range as the test light. The observation distances covered a range of 600 to 6300 feet for both daytime and nighttime conditions.

The results of this study show no significant deviations from the Blondel-Rey law. For night conditions a value of 0.35 was found for the value of the constant a in the Blondel-Rey equation. For day conditions the value of a was 0.15.

5.2 TRANSMISSOMETER

Development of a Transmissometer for Determining Visual Range

by C. A. Douglas and L. L. Young

Technical Development Report No. 47, February 1945, 27 pages, 10 figures, 5 tables
Civil Aeronautics Administration, U. S. Department of Commerce, Washington 25, D. C.

A discussion is presented of the problem of determining visual range from measurements of the transmission of the atmosphere between two fixed points, a description of the development of an instrument for measuring atmospheric transmission, and a study of the correlation between the measurements of transmission obtained with this instrument and the prevailing visual range.

Visibility Measurements by Transmissometer

by C. A. Douglas

Electronics, 20, 106 (1947), 4 pages, 8 figures

A brief description of the theory of operation and the application of the transmissometer developed at the National Bureau of Standards is given.

Development of Lamps for Transmissometer Use

by J. W. Simeroth, C. A. Douglas

NBS Report 1815, July 1952, 11 pages, 3 tables, 6 figures
NBS Project 0201-30-2301

The development of the lamp designed for use in Transmissometer Set AN/GMQ-10 is described.

Development of a Special Test Set for Transmissometer Use

by C. A. Douglas and A. N. Hill

NBS Report 2567 (Revised), March 1958, 18 pages, 2 figures
NBS Project 0201-20-2301

This report describes a test set developed at the National Bureau of Standards for testing the tubes used in the transmissometer,

which can not be tested on the usual types of tube testers. The set also provides a means of testing the photoelectric receiver of the transmissometer.

Instruction Book for Transmissometer Set AN/GMQ-10

by Photometry and Colorimetry Section, Optics and Metrology Division

NBS Report 2588 (Revised January 1955, Rerun November 1959 with minor corrections), 213 pages, 14 tables, 87 figures
NBS Projects 0201-20-2302, 0201-20-2301

This instruction book describes the installation, operation, maintenance, and repair of Transmissometer Set AN/GMQ-10, a system for measuring continuously the atmospheric transmission between two fixed points and indicating this measurement at a remote location. Instructions for determining the horizontal visibility from these measurements by means of known relations are included. There are two appendices: a list of references, and an identification table of parts.

Addenda to Instruction Book for Transmissometer Set AN/GMQ-10

by Photometry and Colorimetry Section, Optics and Metrology Division

NBS Report 3094, February 1954, 36 pages
NBS Project 0201-20-2301

Six addenda contain the changes in the Transmissometer Instruction Book (NBS Report 2588) required to adapt it to the various modifications of the transmissometer set manufactured commercially.

Appendix II to Instruction Book for Transmissometer Set AN/GMQ-10

by Photometry and Colorimetry Section, Optics and Metrology Division

NBS Report 3606, August 1954, 28 pages
NBS Projects 0201-20-2302, 0201-20-2301

This report is an identification parts list for Transmissometer Set AN/GMQ-10. It is included as Appendix II of NBS Report 2588 (Revised).

Sensitivity and Current Leakage of Twenty-One Cold Cathode Electron Tubes, Type WL-759 and Thirty-One Photoelectric Tubes, Type WL-919

by Photometry and Colorimetry Section, Optics and Metrology Division

NBS Report 4436, December 1955, 14 pages, 2 tables, 1 figure
NBS Project 0201-20-2301

The tubes were tested for: sensitivity; plate-voltage plateau; current leakage; dark current; sensitivity to incident radiant flux; to determine suitability for use in transmissometer pulse-amplifier units. Test methods are described.

Theory of the Transmissometer Photometric System

by C. A. Douglas and A. N. Hill

NBS Report 4558, March 1956, 20 pages, 1 table, 5 figures
NBS Project 0201-20-2301

An analysis of the theory of operation of the photometric system of the transmissometer, a discussion of the sources of errors in the photometric system and methods of minimizing the errors, and an analysis of the effects of these errors on the indicated visual range are presented.

A Modification of the Metering-Bridge Circuits of Transmissometer Indicators

by M. R. Carrothers, J. E. Freiheit, J. W. Simeroth

NBS Report 6407, May 1959, 13 pages, 2 tables, 6 figures
NBS Project 0201-20-2327

A modification made in the bridge circuit of the transmissometer indicator in an effort to improve stability is described and results obtained from modified circuits are reported.

6. MISCELLANEOUS

Design and Calibration of a Remote-Indicating Photoelectric Brightness Meter

by C. A. Douglas and I. Nimeroff

NBS Report 4421, November 1955, 9 pages, 3 tables, 10 figures
NBS Project 0201-20-2327

This report describes a remote-indicating photoelectric brightness

meter designed at the National Bureau of Standards and gives the results of the calibration and test of the instrument. The instrument was designed for use in making horizon-sky brightness measurements during the visibility tests conducted at Newark Airport. The photometric and indicating components of the instrument are adaptations of transmissometer components.

Comparative Table - Chromaticity Requirements of U. S. and International Specifications and Standards for Aviation Signal Light Colors

by F. C. Breckenridge

NBS Report 4456, January 1956, 8 pages, 2 tables, 4 figures
NBS Projects 0201-20-2303, 0201-20-2304, 0201-30-2328

The equations used as boundaries for aviation signal-light colors in the United States are shown, together with the corresponding equations used in the standards of the International Civil Aviation Organization and the 1955 Recommendations of the International Commission on Illumination. The purpose is to bring out similarities and differences between the specifications. Diagrams show the boundaries of the several colors in the different specifications.

Photometer for the Measurement of the Effective Intensity of Condenser-Discharge Lights

by C. A. Douglas

NBS Report 5294, June 1957, 8 pages, 3 figures
NBS Projects 0201-20-2301, 0201-20-2331

and

Illuminating Engineering, 53, 205 (1958), 4 pages, 3 figures

A method is described for measuring the effective intensity of flashing lights which produce flashes of short duration, e.g., condenser-discharge lights. This method is directly applicable to sources having flash durations of less than 0.01 second and can often be applied to lights producing flashes with durations longer than 0.01 second. By the use of this method it is possible to record effective-intensity distributions automatically. Examples of such distributions are included.

NBS Report 5294 is no longer available.

Background and Objectives of the U. S. Standard for the Colors of Signal Lights

by F. C. Breckenridge

NBS Report 6413, January 1959, 9 pages, 3 figures
NBS Projects 0201-20-0229, 0201-20-2300, 0201-20-2301

The U. S. Standard for the Colors of Signal Lights is being developed by the U. S. National Committee on the Colors of Signal Lights which is sponsored by the U. S. National Committee of the International Commission on Illumination. Technical studies essential to the development of this standard are provided by the National Bureau of Standards. The present report was presented at the 1959 meeting of the Highway Research Board and was published in their Bulletin 226. Some of the technical problems of standardizing are covered, as well as problems of correct recognition of colors presented to the observer.

Potentiometer for Measurement of Small Photoelectric Currents

by C. A. Douglas and M. R. Freund

NBS Report 6422, June 1959, 12 pages, 6 figures
NBS Project 0201-20-2331

General Radio Model 1230A Electrometer-Amplifier was modified at the National Bureau of Standards for use as an electronic galvanometer in a potentiometer circuit of sufficient accuracy (three-place) to measure the small photoelectric currents (10^{-10} to 10^{-11} amperes) present in determinations with a photoelectric tristimulus colorimeter. The theory of operation and results of tests of linearity and accuracy are given.

Development of Taxi Guidance Wands for Carrier Deck Personnel

by R. S. Rinkenen

NBS Report 6518, August 1959, 9 pages, 1 table, 4 figures
NBS Project 0201-20-02411

A description is given of an illuminated taxi guidance wand for use by plane directors on aircraft carriers. The wand developed at the National Bureau of Standards is lighter than wands previously used, has an average luminance 20 times greater than that of previous wands, and is unbreakable.

NBS Report 7322
August 1961
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US COMM NBS DC

U. S. DEPARTMENT OF COMMERCE
Luther H. Hodges, *Secretary*

NATIONAL BUREAU OF STANDARDS
A. V. Astin, *Director*

THE NATIONAL BUREAU OF STANDARDS

The scope of activities of the National Bureau of Standards at its major laboratories in Washington, D.C., and Boulder, Colorado, is suggested in the following listing of the divisions and sections engaged in technical work. In general, each section carries out specialized research, development, and engineering in the field indicated by its title. A brief description of the activities, and of the resultant publications, appears on the inside of the front cover.

WASHINGTON, D.C.

Electricity. Resistance and Reactance. Electrochemistry. Electrical Instruments. Magnetic Measurements. Dielectrics.

Metrology. Photometry and Colorimetry. Refractometry. Photographic Research. Length. Engineering Metrology. Mass and Scale. Volumetry and Densimetry.

Heat. Temperature Physics. Heat Measurements. Cryogenic Physics. Equation of State. Statistical Physics.

Radiation Physics. X-ray. Radioactivity. Radiation Theory. High Energy Radiation. Radiological Equipment. Nucleonic Instrumentation. Neutron Physics.

Analytical and Inorganic Chemistry. Pure Substances. Spectrochemistry. Solution Chemistry. Standard Reference Materials. Applied Analytical Research.

Mechanics. Sound. Pressure and Vacuum. Fluid Mechanics. Engineering Mechanics. Rheology. Combustion Controls.

Organic and Fibrous Materials. Rubber. Textiles. Paper. Leather. Testing and Specifications. Polymer Structure. Plastics. Dental Research.

Metallurgy. Thermal Metallurgy. Chemical Metallurgy. Mechanical Metallurgy. Corrosion. Metal Physics. Electrolysis and Metal Deposition.

Mineral Products. Engineering Ceramics. Glass. Refractories. Enameled Metals. Crystal Growth. Physical Properties. Constitution and Microstructure.

Building Research. Structural Engineering. Fire Research. Mechanical Systems. Organic Building Materials. Codes and Safety Standards. Heat Transfer. Inorganic Building Materials.

Applied Mathematics. Numerical Analysis. Computation. Statistical Engineering. Mathematical Physics. Operations Research.

Data Processing Systems. Components and Techniques. Digital Circuitry. Digital Systems. Analog Systems. Applications Engineering.

Atomic Physics. Spectroscopy. Infrared Spectroscopy. Solid State Physics. Electron Physics. Atomic Physics.

Instrumentation. Engineering Electronics. Electron Devices. Electronic Instrumentation. Mechanical Instruments. Basic Instrumentation.

Physical Chemistry. Thermochemistry. Surface Chemistry. Organic Chemistry. Molecular Spectroscopy. Molecular Kinetics. Mass Spectrometry.

Office of Weights and Measures.

BOULDER, COLO.

Cryogenic Engineering. Cryogenic Equipment. Cryogenic Processes. Properties of Materials. Cryogenic Technical Services.

Ionosphere Research and Propagation. Low Frequency and Very Low Frequency Research. Ionosphere Research. Prediction Services. Sun-Earth Relationships. Field Engineering. Radio Warning Services.

Radio Propagation Engineering. Data Reduction Instrumentation. Radio Noise. Tropospheric Measurements. Tropospheric Analysis. Propagation-Terrain Effects. Radio-Meteorology. Lower Atmosphere Physics.

Radio Standards. High Frequency Electrical Standards. Radio Broadcast Service. Radio and Microwave Materials. Atomic Frequency and Time Interval Standards. Electronic Calibration Center. Millimeter-Wave Research. Microwave Circuit Standards.

Radio Systems. High Frequency and Very High Frequency Research. Modulation Research. Antenna Research. Navigation Systems.

Upper Atmosphere and Space Physics. Upper Atmosphere and Plasma Physics. Ionosphere and Exosphere Scatter. Airglow and Aurora. Ionospheric Radio Astronomy.


NBS