NATIONAL BUREAU OF STANDARDS REPORT

4164

PROJECTS RELATED TO BUILDING RESEARCH

AT THE

NATIONAL BUREAU OF STANDARDS

FOR FISCAL YEAR 1955

Compiled by the

Building Technology Division

D. E. Parsons, Chief

U. S. DEPARTMENT OF COMMERCE
NATIONAL BUREAU OF STANDARDS

U. S. DEPARTMENT OF COMMERCE
Sinclair Weeks, *Secretary*

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

THE NATIONAL BUREAU OF STANDARDS

The scope of activities of the National Bureau of Standards is suggested in the following listing of the divisions and sections engaged in technical work. In general, each section is engaged in specialized research, development, and engineering in the field indicated by its title. A brief description of the activities, and of the resultant reports and publications, appears on the inside of the back cover of this report.

Electricity and Electronics. Resistance and Reactance. Electron Tubes. Electrical Instruments. Magnetic Measurements. Process Technology. Engineering Electronics. Electronic Instrumentation. Electrochemistry.

Optics and Metrology. Photometry and Colorimetry. Optical Instruments. Photographic Technology. Length. Engineering Metrology.

Heat and Power. Temperature Measurements. Thermodynamics. Cryogenic Physics. Engines and Lubrication. Engine Fuels.

Atomic and Radiation Physics. Spectroscopy. Radiometry. Mass Spectrometry. Solid State Physics. Electron Physics. Atomic Physics. Nuclear Physics. Radioactivity. X-rays. Betatron. Nucleonic Instrumentation. Radiological Equipment. AEC Radiation Instruments.

Chemistry. Organic Coatings. Surface Chemistry. Organic Chemistry. Analytical Chemistry. Inorganic Chemistry. Electrodeposition. Gas Chemistry. Physical Chemistry. Thermochemistry. Spectrochemistry. Pure Substances.

Mechanics. Sound. Mechanical Instruments. Fluid Mechanics. Engineering Mechanics. Mass and Scale. Capacity, Density, and Fluid Meters. Combustion Controls.

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

Metallurgy. Thermal Metallurgy. Chemical Metallurgy. Mechanical Metallurgy. Corrosion.

Mineral Products. Porcelain and Pottery. Glass. Refractories. Enameled Metals. Concreting Materials. Constitution and Microstructure.

Building Technology. Structural Engineering. Fire Protection. Heating and Air Conditioning. Floor, Roof, and Wall Coverings. Codes and Specifications.

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

Data Processing Systems. Components and Techniques. Digital Circuitry. Digital Systems. Analogue Systems.

Cryogenic Engineering. Cryogenic Equipment. Cryogenic Processes. Properties of Materials. Gas Liquefaction.

Radio Propagation Physics. Upper Atmosphere Research. Ionospheric Research. Regular Propagation Services.

Radio Propagation Engineering. Frequency Utilization Research. Tropospheric Propagation Research.

Radio Standards. High Frequency Standards. Microwave Standards.

- Office of Basic Instrumentation
- Office of Weights and Measures

NATIONAL BUREAU OF STANDARDS REPORT

NBS PROJECT | **NBS REPORT**

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INDEX

INTRODUCTION

This report lists unclassified projects concerned with building research and related subjects in progress at the National Bureau of Standards in Fiscal Year 1955.

Most projects mentioned are directly related to engineering and research in the building field. However, other NBS projects not directly related, such as those on instrumentation and properties of gases, are included in the belief that the basic information is sometimes applicable to building research.

Each project is identified by ten digits. The first four, followed by a dash, indicate the division and section at NBS which is carrying out the work. The next two indicate the scientific activity class, as follows:

10 Research
20 Development
30 Testing, Calibration, and Specifications
40 General Scientific Services

The last four digits identify the projects within the basic organizational unit. Thus, project 1003-20-4832 refers to a Division 10, Section 3, development project.

ORGANIZATIONS AND ABBREVIATIONS APPEARING IN THIS REPORT

Organization	Abbreviations Used
American Association of Textile Chemists and Colorists	AATCC
American Electroplaters' Society	-----
American Gas Association	AGA
American Iron and Steel Institute	AISI
American Leather Chemists Association	ALCA
American Society for Testing Materials	ASTM
American Standards Association	ASA
Asphalt Roofing Industry Bureau	-----
Atomic Energy Commission	AEC
Building Research Advisory Board	-----
Bureau of Aeronautics, Department of the Navy	-----
Bureau of Engraving and Printing	-----
Bureau of Public Roads	-----
Bureau of Ships, Navy Department	-----
Bureau of Supplies and Accounts, Department of the Navy	-----
Bureau of Yards and Docks, Department of the Navy	-----
Corps of Engineers	-----
Department of the Air Force	-----
Department of the Navy	-----
Federal Construction Council	-----
Federal Fire Council	-----
Federal Housing Administration	-----
Federal Safety Council	-----
Federal Supply Board	-----
Federal Trade Commission	-----
General Services Administration	-----
Geodetic Survey of Canada	-----
Hydrographic Office, Department of the Navy	-----
Illuminating Engineering Society	IES
Inter-American Geodetic Survey	IAGS
International Business Machines Corporation	IBM
International Organization for Standardization	ISO
National Academy of Sciences	-----
National Advisory Committee for Aeronautics	NACA
National Bureau of Standards	NBS
National Conference on Weights and Measures	-----
National Fire Protection Association	-----
National Naval Medical Center	-----
National Research Council	-----
National Safety Council	-----
Naval Ordnance Laboratory	NOL

(over)

Organization	Abbreviations Used
Office of the Chief of Engineers, Department of the Army	OCE
Office of the Chief of Transportation, Department of the Army	-----
Office of Defense Mobilization	-----
Office of the Quartermaster General, Department of the Army	-----
Porcelain Enamel Institute	PEI
Portland Cement Association	-----
Post Office Department	-----
Society of Automotive Engineers	SAE
Technical Association of the Pulp and Paper Industry	TAPPI
U.S. Coast and Geodetic Survey	-----
U.S. Coast Guard	-----
U.S. Weather Bureau	-----

ACOUSTICS

0601-20-0600 Acoustic Calibration Procedures

Objectives: Researches into, and development of, methods for absolute measurement of sound pressure and intensity over wide frequency and intensity ranges. Application of such methods to determination of the threshold of hearing. Development of sound sources for calibrations of microphones for high-intensity sound measurements.

Background: Absolute measurements of sound intensity are basic to almost all researches in acoustics. Such measurements are most conveniently made by means of calibrated microphones, which are used by industrial, academic, and governmental acoustical laboratories. Calibrations are effected by comparison of the microphones with standards maintained in the NBS Sound Laboratory. Calibrated microphones are required for measurement of sound radiated by loudspeakers, and for measurement of noise and other complex sounds. They are required also for audiometric measurements. Recent engineering developments have resulted in the production of sounds of unprecedented high intensities, necessitating extension of calibrating procedures to cover this increased range.

Tasks: (1) Production and measurement of high-intensity sound fields at audio frequencies. (2) Measurement of the mechanical parameters of standard condenser microphones.

0601-30-0605 Acoustic Measurements

Objectives: (a) To measure the sound absorption of acoustic materials. To measure the sound-transmission properties of wall and floor constructions. (b) To calibrate and measure the performance characteristics of electro-acoustic devices such as microphones, loudspeakers, earphones, sound-level meters, and audiometers. To test acoustic devices such as dictating-machine cylinders, phonographs, etc., for agencies of the Federal Government.

Background: (a) Measurements of the sound-absorbing properties of acoustical materials and the sound insulation of building structures require elaborate and large-scale testing facilities, which are available in the NBS Sound Laboratory. The NBS facilities are used in making tests for the building industry and for Government agencies. (b) Microphones, sound-level meters, and other electro-acoustical instruments require calibration in order to be useful in the laboratory. Such calibrations are usually performed in the NBS anechoic chamber.

0601-30-0605 - continued

Tasks: (1) Sound-absorption coefficients of acoustical materials. (2) Sound insulation of wall and floor constructions. (3) Calibration of microphones, sound-level meters, and earphones. (4) Miscellaneous sound measurements.

0601-10-0632 Architectural Acoustics

Objectives: Research on basic physical phenomena involved in the transmission and absorption of sound in building materials and structures. Improvement of existing measuring techniques in architectural acoustics, and the development of new techniques.

Background: Acoustical materials are widely used for reducing noise and for improving the acoustics of buildings and autitoria. Other materials are used for the equally important job of reducing the sound transmission from one part of a building to another. The researches on this project are for the purpose of standardizing the methods of measurement in architectural acoustics. Many of the phenomena of sound propagation in structures are imperfectly understood and require experimental and theoretical elucidation before significant improvements in measuring techniques can be accomplished.

Tasks: (1) Redrafting of the ASTM standard on transmission-loss measurement to incorporate new results developed on this project. (2) Investigation of effect of interference patterns on the reverberation-room measurement of sound absorption. (3) Design and construction of new impedance tube. (4) Development of better bands of noise, using magnetic tapes, for use in acoustic measurements.

0302-10-2631 Thermodynamic Properties of Air

Objectives: To conduct experimental and theoretical research on the thermodynamic properties of air over a wide range of temperatures and pressures.

Background: The correlation of the existing experimental data on air for the NBS-NACA tables revealed the great need for experimental data for air. Such charts as exist are based only on Joule-Thomson and meager PVT data at low temperature. These data are not reliable enough to permit tabulations over an extended temperature range at pressures over 100 atmospheres. The first stage of this project involves the experimental determination of the data of state (P, V, T). These data and the earlier data will be fitted in accordance with existing theory to a Lennard-Jones potential function, from which the other thermodynamic data can be computed.

Tasks: (1) Measurements of the data of state of dry air from 100° to 300° K and to 200 atmospheres. (2) Correlation of the PVT and other thermodynamic data for air.

0402-30-3017 Properties of Radiometric Devices

Objectives: To assist the U.S. Weather Bureau in the application of radiometric instruments to their problems. To measure the intensity of sources and the response of detectors. To calibrate filters for various regions of the spectrum.

Background: For many years the Radiometry Section has advised the U.S. Weather Bureau on radiometric devices. They are interested in measuring the radiation from the sun and the measurement of water vapor in the air. As the instruments they use are similar to those NBS uses in other work, the services performed for them fit well with the program on radiometry.

Tasks: (1) To measure the transmission of special filters of special interest to the U.S. Weather Bureau. (2) To calibrate in absolute units detectors of radiant energy used by the U.S. Weather Bureau for measuring the radiation from the sun.

0507-20-0532 Utilization of Fuel Gases

Objectives: Research on fuel gases and gas-burning appliances, their use and control.

Background: Since 1910, NBS research on methods of testing gases to determine their useful properties, and on the design, adjustment, and use of gas-burning appliances has been the basis of many State public utility regulations, a large part of the AGA appliance-approval program, and of various safety codes. A continuation of the work is needed to meet the needs of Government, industry, and the public for standards and technical guidance in this field.

Tasks: (1) Complete a study of the factors affecting the accuracy of recording gas colorimeters. (2) Assist in the inauguration of a program of supply of gases of standard heating value for instrument calibration. (3) Study safety and other regulations in the field of fuel-gas utilization, and assist in their development. (4) Assist in revision of the Gas Code of the District of Columbia. (5) Test gas burning appliances and give advice and assistance in connection with such appliances when required.

0603-30-0613 Wind Equipment

Objectives: To conduct research on air flow and methods of measurement. To conduct tests and calibrations of instruments and equipment applied to air movement.

Background: This project covers research and development on wind equipment and problems connected with air-flow phenomena and measurement. It includes the development of new ideas and preliminary work on investigations that may later develop into separate projects. Also included is the testing and calibration of a variety of equipment, such as anemometers, pitot tubes, and liquid manometers, applied to the measurement of air flow.

Tasks: (1) Conduct research on skin friction using specially prepared surfaces. (2) Calibrate and test anemometers, pitot tubes, and manometers for Federal and State agencies, universities, manufacturers, and users. Maintain standards for accuracy and devise new techniques as required.

1003-20-1014 Heating and Air-Conditioning Equipment

Objective: To develop test methods for heating, air-conditioning and air-cleaning equipment and to develop specifications, codes and standards for heating, refrigerating, air-conditioning, and associated equipment.

Background: There is a continuing need for collaboration with other government agencies, professional societies, and industry in preparing and improving codes and standards for heating, air-conditioning, refrigerating,and air-cleaning equipment. At present, for example, there is no one standard method for testing and rating baseboard radiators and convectors. The NBS, working with industry associations, has proposed certain test methods and some progress is being made toward a uniform rating code. Another example is the increased use of package air conditioners by the Federal Government and the entry of many new manufacturers into production of these units which has placed new emphasis on the Federal specification and on the testing and rating codes for such devices. It has also created demands for humidity control and capacity control not covered by existing standards and specifications.

Tasks: (1) Complete the development of the portable infiltration meter designed at the NBS, including field tests made in heated and/or air-conditioned houses to study and develop information regarding infiltration rates in houses under various conditions. (2) Initiate study of methods of rating window and room-size air-conditioning units, and of methods of calculating design cooling loads for air-conditioning applications.

1003-30-1015 Heat-Transfer Measurements

Objective: To develop and maintain equipment for accurately determining the thermal conductivity and heat-transfer properties of materials and constructions for governmental and scientific agencies, and to calibrate suitable specimens for the standardization of similar equipment in other governmental, scientific, and industrial laboratories upon consultation; to furnish advisory technical information on heat-transfer matters to governmental agencies for assistance in connection with design, specifications, standards, and special applications.

Background: The need for accurate and complete data on the thermal properties of materials, and for the improvement and standardization among laboratories of equipment for determining such properties, is continuous. Commercial, industrial, government, university, and scientific laboratories depend upon

the NBS as a source of assistance in calibrating their devices and in standardizing their methods of measurement for determining the thermal conductivity of solids.

Tasks: (1) Continue to develop and maintain equipment for more accurate and expeditious thermal-conductivity measurements on various materials, including thermal insulations and building materials; undertake cooperative calibrations for standardization purposes in this field; conduct required referee measurements. (2) Continue development and use of apparatus for determining the thermal conductivity of metals and solids of high conductivity, to obtain accurate data on materials, and for the calibration of equipment in other laboratories. (3) Initiate preparation, for publication as a BMS report, of a compendium on the thermal insulation of dwellings and similar buildings, presenting summarized data from NBS files on representative insulating values of building materials and fibrous and reflective insulations.

1003-10-4831 Air Conditioning in Underground Structures

Objective: To obtain the engineering data essential to the proper design of air-conditioning equipment for underground protective structures. This involves problems of heat transfer in large rock masses, the removal of moisture from underground spaces, the changes in sensible and latent heat content of ventilating air drawn through long underground shafts in all seasons, the investigation of promising heat sources and heat sinks for use with underground air conditioning, and the effect of these phenomena on the insulation and construction methods to be used for underground protective structures.

Background: Lack of information on the magnitude of heat and moisture transfer in underground spaces surrounded by large rock masses has made it impossible to design systematically air-conditioning equipment for such spaces, with the result that too much capacity or the improper kind of equipment has been installed in a number of instances. To prevent such loss in the future, and because the need for such information could become critical at any time in the future, the Office of the Chief of Engineers, Department of the Army, initiated this project at NBS about four years ago. A large primary site was occupied and observations of heat and moisture transfer in ventilating air shafts and in the surrounding rock are planned during the shakedown tests of all mechanical equipment. Another experimental site has been in operation for two years and a large amount of data has been taken at this site. Experiments at this latter site are still in

progress. This project is a part of the Bureau's basic program of study of the properties of building materials and structural elements.

Tasks: (1) Analyze the data gathered at both sites during FY1953 and FY1954, mathematically or empirically, whichever proves more practical. (2) Correlate the data from Task 1 and prepare it for use as a part of an engineering manual of the Corps of Engineers, OCE, dealing with the air conditioning of underground spaces. (3) Complete the gathering of engineering data at the second site on the use of the presently equipped underground spray and cooling ponds as heat sources and sinks. (4) Complete portions of the study of the heating and cooling effect of the rock mass on ventilating air drawn through long underground shafts at both sites. (5) Prepare engineering manual material for submittal to the Office of the Chief of Engineers.

1003-20-4832 Refrigeration Equipment

Objective: To determine by means of laboratory investigations the extent to which portable and mobile refrigerating units and systems for military use can be improved in performance and reduced in size and weight by utilizing improved designs and newly developed components; and to prepare and revise specifications for refrigerating equipment used by the military services.

Background: The NBS Heating and Air Conditioning Section has conducted this program of research and development on refrigeration equipment for the Office of The Quartermaster General, Department of the Army, since 1944. It represents a continuing effort on the part of the Research and Development Branch of the Office of The Quartermaster General (a) to develop portable and mobile refrigerating systems for the Army that will have the desired military characteristics of performance under extreme temperatures, of ruggedness, and of durability without excess weight for size by incorporating new developments and materials in their construction whenever they are beneficial; (b) to standardize equipment or components thereof with other branches of the military where similar equipment is required; and (c) to revise specifications where possible, so that commercial items can be purchased. Many of the systems used during

1003-20-4832 - continued

World War II were hastily assembled for rapid production without sufficient consideration for adequate performance with the minimum of size and weight. This project is a part of the broad program of the NBS in developing devices for the special needs of the Government.

Tasks: (1) Investigate the feasibility and desirability of utilizing the heat-pump principle for maintaining required temperatures for food preservation during transportation in trucks, trailers, or cars. (2) Revise the Federal Specification on electric refrigerators to include requirements on automatic defrosting, door racks, low-temperature compartments, and other special features. (3) Complete study of the basic requirements of an automatic defrosting system for refrigerating units operating near 0° F. (4) Complete portions of a study of the air distribution in loaded and partially loaded refrigerated trailers. (5) Complete portions of a study of the temperatures attained on the insulated doors of refrigerated warehouses with particular attention to the gasketed areas and latch areas as they affect the tendency for doors to freeze shut. (6) Complete study of the effect of independent speed variations of the compressor, condenser fan, and evaporator fan on the capacity of several plug-type refrigerating units.

1003-20-4838 Air Filter Systems for Army Aircraft

Objective: To develop and construct models of air cleaners that will be more effective than present devices in protecting aircraft and helicopter engines from excessive wear in dusty atmospheres. This involves gathering existing information on air-cleaning methods and a study of all known physical principles that may be used for removing dust from a moving air stream.

Background: Aircraft, especially helicopters, necessarily operate in dusty atmospheres much of the time, and available evidence indicates that present air cleaners for combustion air are inadequate to protect them from excessive wear. Reports of engine failure due to this cause in less than 100 hours are common. Experiments on this subject have been sporadically conducted by various agencies of the United States Government, as well as by the governments of other nations. It is highly desirable that present information on the subject be gathered and correlated and that steps be taken to assure application of the best physical principles to the development of more effective air filters for aircraft engines.

Tasks: (1) Obtain basic information from the Office of the Chief of Transportation, Department of the Army, in regard to helicopter engine types, sizes, and operating schedules, and consult with personnel of interested services regarding helicopter field operation. (2) Investigate various dusts suitable for testing air cleaners, with a view to adopting one or more for the purposes of this project. (3) Develop a suitable test method for examining the performance of air cleaners for helicopters and auxiliary apparatus. (4) Initiate a program of laboratory tests of air cleaners considered feasible for helicopter service, of currently available or prototype designs. (5) Study, as considered necessary, such factors in the problem as abrasive wear of engines due to dust, new methods of dust arrestance, use of precleaners, etc., where information in the literature is insufficient for the purposes of this project.

1003-20-4881 Insulation of Underground Pipe

Objective: To investigate properties of two materials proposed for use as thermal insulation and protective coatings for buried steam and hot-water pipe lines in military installations. Components of the materials will be identified, their physical properties determined, and their performance observed under simulated service conditions.

Background: Central-heating plants often require extensive underground piping systems for distribution of steam or hot water to the areas of usage. Such piping systems are usually insulated to reduce heat losses and to prevent rapid corrosion of the pipe as a result of chemical and electrolytic action. Some of the characteristics desired for underground pipe insulation are low thermal conductivity, low moisture permeance, high crushing strength, suitable expansion characteristics, adequate stability under operating temperatures and below-freezing temperatures, and long life. Several types of embedment and pipe insulation have been used in addition to various kinds of tunnel construction. As many of these methods are expensive, a continued search for more effective and more economical methods of insulating underground pipe is essential.

Tasks: (1) Make laboratory determinations of the thermal conductivity of the material in loose, sintered, and consolidated conditions. (2) Observe characteristics of thermal insulation under simulated service conditions. (3) Study effect of pipe motion due to expansion and contraction action at an expansion loop.

CEMENT, CONCRETE, AND MASONRY

0903-20-4428 Refractory Qualities of Concretes

Objectives: To investigate the thermal stability and other properties of refractory concretes prepared with each of three different types of hydraulic cement and a wide variety of aggregates, for the purpose of developing suitable material for use as warm-up and power-check aprons for jet aircraft.

Background: The inventions of the jet plane, the ramjet, and the rocket engine have brought with them the problem of suitable materials of construction for warm-up and power-check aprons for the aircraft and launching pits for rockets. The more recent development of the afterburner for jet planes makes the solution to the problem even more imperative. The intense heat developed preceding takeoff or launching of planes or ramjets may cause destruction of ordinary portland cement concrete, because of cracking, spalling, or deterioration in strength. In addition to resistance to destruction by heat, such installations must have and maintain high strength and, if concrete is used, the aggregates should preferably be readily obtainable, both as to quantity and proximity to the site of installation. The program for developing suitable materials must therefore be broad enough to provide not only for present needs but also for future developments because the trend is toward ever-increasing higher temperatures of use.

Tasks: (1) Continuation of the design of refractory concretes using portland, portland pozzolan, and high-alumina hydraulic cements with a wide variety of dense or heavy aggregates, and the fabrication of several types of specimens therefrom for test purposes. (2) The measurement of certain physical properties of the concretes such as length changes during heating, thermal conductivity, Young's modulus, strength in bending and compression, and abrasion. Certain of these tests will be made both before and after heating at 250°, 500°, and 1000° C.

0906-20-0910 Physical Structure and Properties of Concrete and Concreting Materials

Objectives: To obtain a better understanding of the submicroscopic structural changes which occur as portland cement hydrates, and to ultimately relate the structure of hydrated cement and other constituents of concrete to the strength and durability of concrete. To attempt to relate the durability of concrete with existing laboratory tests and with those to be developed.

Background: The durability of stone and concrete under exposure to the action of freezing and thawing, wetting and drying, salt action, etc., is of major concern to the construction industry and those who employ such materials. The durability is so closely related to the pore size, pore distribution, and fine structure of the solids that information on the latter is of prime importance. The study of volume changes accompanying exposures is expected to throw new light on the disintegration process.

Tasks: (1) It has been shown that hydrated cement undergoes structural changes after hydration has been stopped. It is planned to study these changes using adsorption techniques and to determine the conditions under which they occur, and their importance in concrete. (2) To determine by adsorption methods what part carbonation plays in modifying the structure of hydrated cement. (3) To complete a cooperative study with the NBS Organic and Fibrous Materials Division on the compressibility behavior of hydrated cement and its components. (4) To correlate the results of comprehensive laboratory tests on some 120 portland cements and concretes made from them. To conduct tests on the concrete specimens during outdoor exposure.

0906-10-0923 Thermo-Chemistry of Mineral Products

Objectives: The determination of the heats of reaction and heats of formation of various mineral products, such as the individual constituents of portland, high alumina, and oxychloride cements, and other allied or analogous compounds.

Background: Thermodynamic data are scanty or lacking for most of the substances occurring in mineral products or in related systems of oxides. Such data are needed for understanding the energy relations and for determining the stability of the compounds controlling the behavior of mineral products. Additional data are also desirable for a better understanding of the heat evolved in the setting of cements in mass concrete.

Tasks: (1) Publication of a paper on magnesium oxychlorides. (2) Determination of the heat of reaction of $Ca(OH)_2$ and silica gel from various sources when both reactants are (a) in solution, (b) in paste form. (3) Determination of the heat of reaction between $Ca(OH)_2$ and active alumina. (4) Design an all-platinum calorimeter vessel with low temperature lags, suitable for operation at room and elevated temperatures, with test of design of reaction vessel fabricated in copper.

0906-10-0943 Mechanism of the Hardening of Cementitious Materials

Objectives: To determine the nature of the chemical reactions, and the composition and properties of the compounds formed, during the setting and hardening of portland cement, portland-pozzolan cement, plaster, and other cementitious materials; and to ascertain how these reactions and products are affected by temperature and by the presence of alkalies or other substances.

Background: The chemical reactions involved in the hydration and setting of portland cement, portland-pozzolan cement, gypsum plaster, and other cementitious materials are still incompletely understood. A better knowledge of the mechanism of the reactions and the effects of varying conditions may result in improved performance of such materials.

Tasks: (1) To obtain further data on the formation of the lime-alumina-silica hydrogarnet series in relation to steam-cured cement products. (2) To study lightweight aggregate plasters and pertinent chemical reactions of the aggregate. (3) To study the reactions between lime, silica, alumina, and water, as related to pozzolanic activity.

0906-20-4415 Cement Reference Laboratory

Objectives: Standardization and calibration of equipment in cement-testing laboratories throughout the United States.

Background: This project is jointly financed by the NBS, the Bureau of Public Roads, the Office of the Chief of Engineers, and by funds received through the ASTM. The project was initiated to standardize cement-testing procedures and equipment and to clarify specifications for portland cement.

0906-30-4433 Portland Cement Testing

Objectives: To make acceptance tests on portland cement as requested by other Federal agencies and investigate and inspect test methods and procedures.

Background: Acceptance tests of portland cement are normally performed on samples obtained while the cement is being transferred to storage silos or bins. The cement is held in storage until the tests are complete and, upon acceptance, is shipped as orders are received. It is not practicable for the manufacturers to maintain separate stocks of tested cement for each Federal agency and hence, the need for a

single testing agency for Federal Government purchases. The NBS has been rendering this service for over 40 years and currently operates testing stations at San Francisco, Seattle, Denver, Kansas City, Allentown, and Washington, D.C. Inspection facilities are maintained at some 90 cement plants while at others samples are submitted to the NBS by the Inspector of Naval Material. During FY1954, samples representing some 13,000,000 barrels of portland cement were tested. Development and comparative work on test methods for cement are a proper adjunct to the testing program.

Tasks: (1) Samples will be tested as submitted. (2) Interlaboratory comparative tests will be made. (3) A variety of representative cements will be used to fabricate concrete specimens for long-time outdoor exposure as a means for correlation of laboratory tests with effect of natural exposure.

0907-10-0914 The Chemistry of Portland Cement

Objectives: To improve the usefulness, the dependability, the quality, and the economy of cement in concrete and to contribute to the fundamental knowledge of the physical chemistry of cementitious materials.

Background: A considerable number of advances in the technology of cement production and in the art of designing cement for special purposes have resulted from investigations which have been supported jointly by the Portland Cement Association and the NBS for the past 30 years. At the present time, investigations are in progress that are making possible designed control of the molecular structures by virtue of which cement functions as a bonding agent. These studies include X-ray crystal structure, phase equilibria, differential thermal analysis, and electron microscopy.. Incidental discoveries are proving of value in the entire field of physicochemical research. Such are precision temperature control, growth of perfect single crystals, high-temperature furnace centrifugation, and mathematical contributions to increase the applicability of phase-rule techniques.

Tasks: (1) The crystal structure of cement compounds is under study in several laboratories in various countries. NBS studies in this field were initiated four years ago and a part of this work, on the crystal structure of tricalcium aluminate, is now nearing completion. (2) The gels of

0907-10-0914 - continued

hydrated-cement compounds have been under study in the NBS laboratory for over two years by means of electron microscopy. The ultimate particles of calcium silicate hydrate have been observed for the first time and this part of the investigation has been completed. The work will continue with a study of other phases of the cement gel and of cement reaction products.

1001-10-1000 Masonry and Reinforced Concrete

Objective: To secure basic data in the laboratory on properties of masonry, concrete and reinforced concrete, natural building stone, brick, concrete masonry units, masonry mortars, and lightweight concretes. These data will be used as a means for establishing satisfactory specification requirements for various service conditions and for effecting economies in the use of critical materials.

Background: (a) In order to predict durability of brick and stone under various conditions of weathering, there is a need for correlating various physical properties determined in the laboratory with results of outdoor exposure tests. Exposure tests of brick started on the NBS grounds in 1936, of roofing slate in 1933, and of building stone in 1948, are being continued in this connection as one phase of this project. (b) Another large phase of the project is the work on Masonry Research done in collaboration with the producers of masonry cement. Such research is needed to provide information on the structural properties of masonry to indicate how the various available materials can be used in the most economical ways. (c) Continuation of a study of properties of reinforced concrete is planned. In this study the distribution of stresses in beams, dimensional changes in concrete, and efficiency of various types of high-strength reinforcement will be investigated. In order to conserve steel, high-strength steel is being utilized as prestressed reinforcement, and studies are being made of methods for improving design practices and how best to conserve steel during emergencies. It is also planned to continue collaborative work with the Fellowship of the American Iron and Steel Institute. This will include research and development of theory needed to formulate new design practices with respect to control of the widths of cracks and resistance of concrete to shear.

Tasks: (1) Make periodic examinations of stone exposure-test wall, study effects of 20-year exposure of roofing slate, and analyze observations from long-term masonry exposure tests. (2) Study of thermal and moisture characteristics

1001-10-1000 - continued

of marble, sandstone, and limestone over natural temperature range. (3) Collaborate with Masonry Research Fellowship by conducting a survey of portland masonry cement and by performing tests of masonry assemblages. (4) Collaborate with AISI in performing tests and analyzing data on shear strength of reinforced concrete and formation of tensile cracks in beams and slabs.

1001-10-4811 Precast Thin-Shell Concrete Structures

Objective: To evaluate and develop prototype design of thin-shell precast and prestressed concrete elements and buildings. This will include the determination of strength, elastic stability, adequacy of joint watertightness, and resistance to fire, of precast thin-shell ribbed concrete panels and hollow-section framing members, with and without prestressed reinforcement.

Background: Precast thin-shell ribbed panels and hollow-section framing members are a relatively new type of construction, particularly those containing prestressed reinforcement. Technical data are urgently needed on design aspects such as the cross-sections of the members, orientation and amount of reinforcement, and losses in prestress resulting from plastic flow. Buildings making use of structural members of this type are being planned at present by the Bureau of Yards and Docks, Department of the Navy.

Tasks: This study is of a continuing nature in which the designs of structural members evolve as the evaluation tests proceed. The following tasks are included: (1) Assemble several panels into a single unit and determine adequacy of prestressing in securing watertight joints. (2) Determine effect of fire on strength of panels with and without prestress. (3) Evaluate the strength and rigidity of prestressed and non-prestressed thin-shell panels subjected to sustained loads. (4) Evaluate the strength and rigidity of a thin-shell panel prestressed transversely with welded wire fabric and longitudinally with the conventional prestressing rods. (5) Evaluate properties of autoclaved thin-shell cell-like blocks with emphasis on their possible use in prestressed slab and beam assemblies.

1001-10-4812 Shrinkage Stresses in Masonry

Objective: To determine by means of tests of small-scale models and by approximate theoretical analysis the direction and relative intensities of stresses in masonry walls of various sizes which are restrained from shortening at the foundation level while undergoing drying shrinkage or thermal contraction.

Background: Both the results of tests conducted in laboratories and the results of extensive experience with structures indicate that the drying shrinkage of walls of concrete masonry and of monolithic concrete is responsible for much of the cracking observed. Despite widespread interest in cracking resulting from drying shrinkage, the literature contains no method by which design engineers may estimate the minimum spacing of control joints and the least amount, the location, and the form of reinforcement that would be most effective in minimizing objectionable cracking under various conditions.

Tasks: (1) Test several plaster models of masonry walls attached to rigid foundations varying between wide limits the ratio of wall length to height. (2) Continue the computational work determining the effect of length on the direction and relative magnitude of shrinkage stresses in walls attached to rigid foundations. (3) Compare the theoretical and observed values of shrinkage stresses in masonry walls and prepare a report on the findings.

1001-40-4813 Control of Leakage Through Cast-Stone Panel Facings

Objective: To determine method of controlling the leakage of wind-driven rain through the walls of Building No. 1 and certain other buildings at the National Naval Medical Center, Bethesda, Md.

Background: Thermal and moisture length changes in exposed aggregate cast-concrete panels used as facing in the National Naval Medical Center have resulted in leakage of wind-driven rain through the joints between panels. In an effort to find a remedy for this problem, the Bureau of Yards and Docks, Department of the Navy, requested the NBS to undertake a study of the movement of the joints and to determine means of controlling the leakage through the joints in this structure. This problem is encountered in monumental buildings faced with large cast-stone panels.

Tasks: (1) Make preliminary measurements of joint movement of Building No. 1 of National Naval Medical Center. (2) Make preliminary measurements of thermal and moisture length changes in prisms cut from cast-stone panels representative of those in Building No. 1. (3) Make laboratory examination of joint fillers and joint-sealing methods with the view of formulating specifications for remedying the leakage of wind-driven rain through cast-stone panels. (4) Prepare report on significant findings.

CODES AND SPECIFICATIONS

0201-30-0208 Specifications for Lamps, Colors, Electrical Supplies

Objectives: Formulation of Federal Specifications for lamps, colors, and electrical supplies, and cooperation with ASA and IES in allied fields in order to attain coordination, particular stress being placed upon the development of improved qualification tests for lamps, on insuring interchangeability of lamps, and on the assignment of uniform designations to lamps.

Background: Closely related to the acceptance and qualification-inspection and testing of lamps for the Government which have been conducted by the NBS for many years, applicable Federal Specifications are developed and kept current under this project. Closely allied with these specifications are Federal Specifications for aeronautical colors and electrical supplies, also developed under this project. Cooperation given ASA in the development of American Standards for these products promotes uniformity between Federal Specifications and ASA Standards.

Tasks: (1) The development of a Federal Specification for projection lamps. (2) The formulation of 1956 Supplements to the incandescent lamp specifications. (3) The revision of the fluorescent lamp specification. (4) The development of a specification for fluorescent lamp ballasts with special attention to the specification of the requirements for reference ballasts. (5) Modifications of current specifications will be considered and made as required.

0501-30-0501 Preparation and Revision of Federal and Other Specifications for Paints, Varnishes, Lacquers, and Ingredient Materials

Objectives: To prepare, revise, and amend when necessary, Federal Specifications for (a) paints, enamels, varnishes, lacquers, putties, and similar coating and filling materials; and (b) ingredient raw materials including pigments, oils, resins, driers, thinners, plasticizers, and solvents. Also, to participate in the specification work of ASTM Committee D-1 and of the ISO Committee on Shellac, and to assist Government agencies in the development of departmental specifications for special products.

Background: The competitive bidding system under which most Government paint purchases are made depends for its success on the availability of specifications that provide accurate and adequate descriptions of the products purchased. Government procurement agencies, notably the General Services Administration, have long depended on the NBS to assist them in the technical aspects of specification writing.

Tasks: (1) Preparation of Federal Specifications for brushing lacquer and alkyd flat wall paint. (2) Review of proposed specifications prepared by other agencies. (3) Participation in drafting of product specifications by ASTM and ISO. Phthalocyanine blue and shellac are included in current projects of these organizations.

0705-30-0719 Preparation of Specifications and Standards for Organic and Fibrous Materials

Objectives: To provide specifications and standards for organic and fibrous materials and to establish and maintain standard samples.

Background: One of the functions of the NBS is to cooperate with Government agencies such as General Services Administration, Federal Supply Board, Department of the Army, Department of the Navy, Department of the Air Force, Post Office Department, etc., and with non-governmental agencies and technical organizations such as ASTM, TAPPI, AATCC, ALCA, ISO, in the preparation of specifications, test methods, and standards for organic and fibrous materials. The specifications are used by both Government agencies and industrial organizations in the procurement of such materials. This activity is conducted in large part through leadership and membership on committees. The NBS has accepted the responsibility for preparing and keeping up to date the Federal Specifications covering test

0705-30-0719 - continued

methods for rubber, textiles, paper, leather, plastics, and adhesives, and for certain materials and products in these fields. Standard samples of rubber-compounding ingredients are maintained to assist the Government and industry plants in controlling the uniformity of the synthetic rubber that they manufacture.

Tasks: (1) Prepare test-method specifications for paper products, nontextile floor coverings, and brushes and brooms. (2) Keep up to date test-method specifications for rubber, leather, textiles, plastics, and adhesives. (3) Replace depleted standard samples for rubber-compounding ingredients. (4) To prepare approximately 100 commodity specifications for rubber, leather, paper, plastic, textiles, brushes, and nontextile floor coverings. (5) Participate in committee activities of ISO, ASA, ASTM, TAPPI, AATCC, ALCA, and other organizations concerned with standardization.

1005-40-1022 Construction Codes and Safety Standards

Objective: Utilization of NBS laboratory results and specialized knowledge in connection with recommendations for safe building construction, safety of building equipment, industrial safety, and home safety.

Background: Government officials, construction and safety engineers, and the general public look to the NBS for technical information to be used in regulations and manuals designed to prevent injuries and loss of life. As a consequence of presenting data to various standardizing bodies, results of NBS work find wide application in State and local codes and in national safety standards. Among the organizations concerned are the American Standards Association, American Society for Testing Materials, National Safety Council, National Fire Protection Association, Federal Safety Council, and Federal Fire Council.

Tasks: Activities are of a continuing nature, requiring (1) development of new safety standards, (2) periodical revision of existing safety standards, (3) determination of factors affecting personal safety, (4) technical research on safe use of materials and assemblies in buildings, building equipment, industrial processes, and the home, and (5) assistance to government officials and the general public in problems of good construction practice.

FIRE DETECTION AND PREVENTION

1002-10-1029 Fire-Hazard Studies

Objective: To investigate methods of preventing and reducing losses resulting from accidental fires. This involves the determination of the fire-resistive properties of various types of materials and construction and investigations of (a) the self-ignition characteristics and ignition temperature of materials; (b) the stimuli and sensing devices which may be used for fire detection; (c) the mechanism of fire spread; and (d) the methods of fire extinguishment.

Background: There is a constant need for up-to-date information on the fire-resistive properties of new building-construction materials and of fabricated assemblies, particularly those designe d t o reduce weight and cost as far as possible. A better knowledge of the basic mechanism of fire spread in full-scale structural members and of the mechanism of extinguishment by available agents is essential for effective detection and control of fires.

Tasks: (1) Make modifications in radiant-panel flame-spread test method as appear necessary on the basis of theoretical interpretation of the radiant-energy measurements at the specimen face. Study behavior of materials with modified apparatus and correlate results with energy measurements and behavior during use of other test methods. (2) Fill in missing experimental data in the study of self-heating properties of liquids. Prepare a paper presenting results of theoretical analysis and of experiments. (3) Investigate relative merit of various fabric flammability test methods and prepare report.

1002-30-4824 Evaluation of Marine Use Materials

Objective: To obtain data on the constructional features and evaluate operating behavior of equipment and materials requiring U.S. Coast Guard approval for marine use.

Background: The NBS has for several years made numerous tests for the U.S. Coast Guard and has provided technical data to permit action to be taken on materials and equipment submitted for approval for marine use.

Tasks: Completion of tests and examinations of equipment and materials as required by U.S. Coast Guard. Typical work includes type tests of fire extinguishers submitted for U.S. Coast Guard approval and a program for evaluation of various methods for test of flame-spread hazards of materials.

1002-20-4825 Motorboat Fire Extinguishers

Objective: To improve test methods for evaluation of motorboat fire extinguishers and to use improved test methods for study of performance of currently approved types.

Background: The methods used for evaluation of motorboat fire extinguisher performance must provide a valid basis for comparison of relative effectiveness of different types of extinguishers when used on actual motorboat fires. A systematic study is needed of the effect of design of the standard fire used for testing these extinguishers on the effectiveness of the various types of extinguishers.

Tasks: (1) Visit various commercial and research laboratories to obtain best current information on subject. (2) Study design of fire types originally used by U.S. Coast Guard during preliminary work they did on this project. (3) Continue program initiated in 1954 with the objective of concluding study. (4) Test various approved extinguishers on standard fires. (5) Prepare report on results of investigations.

1002-10-4828 Fire Extinguishment with Dry Chemicals

Objective: To investigate the mechanism of fire extinguishment by dry chemicals.

Background: The mechanism by which dry chemicals are effective in extinguishment of fires is not properly understood. Because of this the NBS has initiated some research on this process in cooperation with the U.S. Coast Guard. It is believed that the information derived will be useful not only for suggesting improved fire extinguishing materials but also will assist in proper evaluation of extinguishers for marine and other uses.

Task: Development of a flow metering and mixing device for application of the powder to standard fires.

PLUMBING

0603-20-3586 Hydraulics of Short Pipes

Objectives: To investigate the effect of inlet design on the capacity of pipe culverts.

Background: Laboratory tests and field observations have both shown that the conventional square-edged-pipe culvert installation does not, under most conditions, flow full when the inlet is submerged. Under these conditions, the flow contraction at the inlet causes the culvert to flow only partially filled, with consequent low hydraulic efficiency. The purpose of this investigation is to determine means of causing the culvert to flow full with a minimum degree of submergence and with consequent decrease in required diameter and cost of culvert.

Tasks: (1) Make control tests to determine hydraulic characteristics of square-edged culverts flowing full. (2) Develop tests to determine best means of causing culvert to flow full with minimum submergence. (3) Design a recommended standard culvert inlet based on experimentation in 2. (4) Make tests of standard inlet design. Determine hydraulic characteristics of standard inlet. (5) Write report.

0804-10-0815 Mechanism of Corrosion Processes

Objectives: To determine the nature, mechanism and rates of the corrosion of metals by different processes in various corrosive media and environments.

Background: Corrosion, or the destruction of a metal by its environment is an extremely expensive phenomenon, the costs for the United States alone being estimated at 5 to 7 billions of dollars annually. It is a complex process which may be of one or more types no one of which is completely understood. For several years the fundamental nature of three of these types has been studied at the NBS with a view to developing satisfactory working theories and the ultimate development of mitigation processes. Stress corrosion is baffling in its inception and progression in that it proceeds along grain boundaries in certain metals and deliberately avoids them in others. Pitting corrosion, a localized type of attack, is studied by means of large single crystals of metals to determine the relationship of corrosion to the optical, mechanical and electrical properties of the crystal. Galvanic corrosion is that which may be caused by current flow between unlike metals in a suitable electrolyte or between two areas on a metallic surface where differences in potential exist because of segregation, nonmetallic inclusions, corrosion products, etc. Fundamental studies of potential distribution and local current flow as affected by some of the above variables are under way and significant progress has been made.

Tasks: (A) Stress corrosion: (1) Complete study of beta brass. (2) Continue studies of the corrosion of low carbon killed steels by molten and gaseous zinc emphasizing the effect of crystal orientation. (3) Study the stress corrosion of low carbon killed steels in alkalies and salts and to study magnesium alloy AZ61. (B) Pitting corrosion: (1) To continue the preparation of large single crystals of metals. (2) To continue the study of the corrosion of aluminum and to start the study of corrosion of magnesium, tin and silver. (C) Galvanic corrosion: (1) To continue the study of the effect of alloy composition and heat treatments upon the potential and current characteristics particularly of steels of various carbon content and to measure local currents and potentials on metallic surfaces and their effects in initiating and extending corrosion.

PROPERTIES OF MATERIALS

0204-10-0221 Thermal Expansion

Objectives: Determinations of dimensional changes of elements, alloys, and other solid materials, of coefficients of thermal expansion, and of the temperatures and magnitudes of dimensional changes during transformations, for science and industry. Derivations of relationships between thermal expansion and other properties of materials. Compilation of references to the literature on thermal expansion apparatus and thermal expansion of materials.

Background: The problems in which thermal expansion of materials must be recognized are as varied as our industries. In the design and construction of devices, provisions for changes in dimensions of parts incident to temperature changes must be made for satisfactory service. Data on thermal expansion of rare elements are necessary to supply a demand for fundamental data. Knowledge of the properties of the elements is necessary in order to understand the properties of alloys and compounds.

Tasks: (1) Preparation of manuscript for Circular giving an annotated bibliography of publications on thermal expansion of solids by members of the NBS. (2) Investigation of and preparation of manuscript on thermal expansion and transformations of polytetrafluoroethylene. (3) Investigation of and preparation of manuscript on thermal expansion of some rare metals. (4) Continue compilation of references.

0302-10-0303 Heat Measurements

Objectives: (a) To investigate the need and satisfy the demand for improved standard substances to be used in calorimetric work in the range 12° to 1200° K. This includes measurements of heat capacities of solids, liquids, and gases, heats of transitions, and heats of reactions such as in combustion. (b) To determine the thermal properties of selected pure substances which are of fundamental importance to thermodynamics and related fields. Also, to determine the purity of certain materials, using calorimetric measurements. (c) To develop suitable standards for thermal conductivity of gases in the range up to 500° C and 100 atmospheres pressure.

Background: The need for more and improved standard substances for heat measurements is widely recognized. The NBS is participating in the program for standard substances proposed by the Fourth Conference on Calorimetry (U.S.).

0302-10-0303 - continued

In addition to this program, which is concerned mostly with heat-capacity standards, the field of microcalorimetry is rapidly expanding, resulting in the need for standards for accurately measuring small heats, such as heats of reaction.

Accurate calorimetric measurements on solids, liquids, and gases are essential to the evaluation of the thermodynamic functions enthalpy, entropy, and free energy. The calorimetric laboratories in the Thermodynamics Section are able to measure with the highest accuracy all of the following: (a) heat capacity of solids and liquids over the temperature range 12° to 1200° K, (b) heat capacity of gases at moderate temperatures and pressures, and (c) heats of combustion and solution. The calorimetric measurements have added significance in that they permit a check on the interpretation of molecular spectra and structure which is used to extrapolate thermodynamic functions to very high temperatures where it is impossible to make accurate experimental determinations.

Very closely related experimentally to the calorimetric measurements are the measurements on thermal conductivities of gases. Need for accurate conductivity data arises not only because of need for standards but also because the data are essential in checking present theories of thermal conduction of gases.

0702-10-0731 Research on Properties of Textiles

Objectives: To provide basic information on the properties of textile materials; in particular, on the mechanisms involved in the deterioration of textiles in corrosive atmospheres and at elevated temperatures.

Background: (a) Previous work at NBS indicates that the boundaries on fibrous materials between dry areas and areas wet with liquids constitute regions of enhanced chemical reactivity. With some fiber-liquid systems, the fibrous material undergoes chemical changes at these boundary regions; with others, the liquid undergoes change. As wet-dry regions occur frequently on textiles during processing and use, a more complete understanding of this "interface" phenomenon is of practical as well as of theoretical importance. (b) Although loss of strength and color changes in textiles are often attributed to atmospheric contaminants such as dinitrogen tetroxide and sulfur dioxide, the chemical and physical effects of exposure to low concentrations of these gases in air of controlled humidity and temperature have not been thoroughly investigated. The results of such an investigation should serve as a basis for selecting textiles for specific uses and possibly for developing protective treatments for textiles. (c) The thermal degradation of textiles results in considerable

0702-10-0731 - continued

economic losses annually. Improved procedures are needed for following the degradation of textiles under controlled conditions in order to establish the mechanism of the reaction.

Tasks: (1) Study the effect of radiant energy and oxygen on the interface reactions in the quartz fiber--toluene and cellulose--water systems. Attempt to identify the products and determine the mechanism of the reactions. (2) Follow the change in strength exhibited by cotton, rayon, silk, wool, and the synthetic fibers on exposure for varying periods of time to air of specified temperature, humidity, and dinitrogen tetroxide or sulfur dioxide content. By means of fluidity measurements and functional group analysis, determine the nature of the chemical changes produced in cellulose fibers by these exposures. (3) Design and construct equipment for exposing cotton and rayon textiles to air having 0 to 100% R.H. and temperatures in the range of 140° to 200° C that will permit following the degradation produced in cellulose by these exposures.

0707-10-0733 Research on Properties of Plastics

Objectives: To provide basic information on the properties of plastics; in particular, the effect of atomic bombardment on physical and chemical properties of plastic films and the mechanism of crazing of plastics.

Background: (a) Studies of atomic irradiation of some specific plastics during the last year have shown that the physical and chemical properties of the plastics change as a result of such exposure. Physical and chemical data on numerous plastic films were obtained on this project during fiscal years 1953 and 1954. These same films will be pile irradiated and changes in their physical and chemical properties will be studied. Such work is of practical importance in connection with utilization of plastic films by military, civil defense, and other government agencies. (b) Crazing of transparent plastics is a serious problem in use of these materials as aircraft glazing and in other commercial applications. More information on this phenomenon is needed in order to reduce or eliminate crazing in polymers. Recent studies conducted at NBS using the multiple-beam interferometer showed that crazing involves surface dislocations and flow. Further information can be obtained by examining crazed surfaces and fracture surfaces with the electron microscope.

Tasks: (1) Determine the physical and chemical changes occurring in various plastic films representing various chemical structures as a result of atomic pile bombardment. (2) Study the phenomenon of crazing of plastics using the electron microscope as an analytical tool.

0707-10-3862 Adhesion of Resins to Glass Fibers

Objectives: To evaluate the basic factors involved in obtaining high-bond strengths between synthetic resins and glass fibers.

Background: Glass-fiber-reinforced plastics have many important military uses. The present method for evaluating new glass fibers, fiber treatments, and resins intended for use in the construction of reinforced plastics is by the empirical process of making reinforced panels and testing. This is a time-consuming and costly method and provides no fundamental data as a guide for development work. Therefore, the Bureau of Aeronautics, Department of the Navy, is initiating this work to provide the fundamental data necessary to predict the properties of glass-fiber laminates on a more scientific basis and hence to serve as a basis for the selection of suitable materials and treatments to produce reinforced plastics of high strength and durability. The degree of adhesion of the synthetic resins used as bonding agents to the glass fibers used as the high-strength reinforcing medium is a vital factor in obtaining optimum performance characteristics in the reinforced plastic. The role of various finishes or surface treatments applied to the glass fiber in promoting this adhesion under both dry and wet conditions needs to be investigated.

Tasks: (1) Study the comparative degree of adhesion between glass fibers with various treatments and several types of resins using a microscopic technique to observe the wetting of the fiber with the liquid resin. (2) Determine the strength properties of the glass fibers and the resins. (3) Determine the properties of rods made with these fibers and resins, including flexural and compressive strengths and modulus, water absorption, effects of repeated loading and unloading, voids, and density. (4) Relate the degree of adhesion and the properties of the components to the properties of the reinforced plastic rods.

0801-10-0802 Properties of Metals at High Temperatures

Objectives: To determine the influence of stress, strain rate, temperature, and thermal and mechanical history on the characteristics and mechanism of creep and the failure of metals at elevated temperatures.

Background: Numerous formulae have been proposed to predict the time-temperature relationship in single and polycrystalline metals but none is entirely satisfactory. Additional studies, under carefully controlled conditions, are essential before a theory completely acceptable can be established. A fundamental knowledge of the mechanism of deformation, including

0801-10-0802 - continued

the physical and metallurgical changes occurring during deformation at different temperatures is essential for the most economical utilization of the present metals and alloys and for the development of new materials for the defense agencies and industrial applications. This is a part of a comprehensive program to study the mechanism of creep of high-purity polycrystalline copper, nickel, and alloys of nickel and copper and to evaluate the creep behavior of the metals in comparison to the alloys.

Tasks: (1) Complete creep tests on high-purity 70% Ni-30% Cu alloy and prepare paper summarizing these results. (2) Complete short-time high-temperature tests on 30% Ni-70% Cu alloy. (3) Make creep tests on 30% Ni-70% Cu alloy.

0901-10-0942 Improvement of Ceramic Glazes

Objectives: To study the solid-liquid phase reactions in glazes, and at the glaze-body interface, for the purpose of improving resistance to chemical and mechanical attack in service.

Background: The increasing use of mechanical washing machines for tableware in the mess-halls operated by the Government, as well as in public restaurants, is bringing about an acceleration to surface abrasion and a material shortening of service life. It is believed that a fundamental study of the reactions taking place in a glaze, and at the glaze-body interface, will disclose information which can be used to improve the service life by greatly decreasing or eliminating the so-called "bubble structure" and by producing a surface more resistant to chemical and mechanical abrasion.

Tasks: Suitable specimens representative of tableware will be coated with glaze formulations and the reactions taking place during the maturing will be studied in detail, principally by petrographic means. Starting with conventional formulations, the effects of method of preparation, kiln atmosphere, and rates of heating will be observed with regard to physical structure of the glaze and surface "hardness", the latter to be determined by diamond indenter and chemical tests.

0903-20-0903 Development of Evaluation Criteria and Methods for Refractory Materials

Objectives: The investigation of the physical properties of refractory materials for the purpose of obtaining data which will be useful in revising existing standards, including Federal Specifications, or for forming the basis for the technical requirements of new specifications.

Background: Castable refractory is a comparatively recent addition to this group of commodities. Its importance to industry is continuously increasing because of the shortage of men capable of laying firebrick. The variety of high-temperature installations in which this refractory is used is constantly increasing. The properties of castables are therefore being investigated for the purpose of establishing technical requirements for a new Federal Specification and to publish information on compositions and properties as an aid to small business.

Tasks: (1) Firebrick: Inactive. (2) Fire-clay plastic refractories: Accumulated results of tests to be written into manuscript form. Change of length of proprietary brands to be studied during heating from 20° to 1500°C. This work is dependent on the progress made on 3. (3) Castable refractories: Calibration of furnace and equipment and the measurement of length changes from 20° to 1350°C. Also the measurement of strength and elastic properties at elevated temperatures.

0907-10-0917 Effect of Heat on Inorganic Hydrates

Objectives: To study the causes of the formation of intermediate amorphous phases after the dehydration of certain inorganic hydrates such as silicates or phosphates. To find the factors which inhibit or promote the formation of these amorphous conditions.

Background: The amorphous material formed immediately after dehydration by heating of such compounds as many clays, silicates, and phosphates is extremely active chemically. The factors which promote the formation of this amorphous material are not known. The theory has been advanced that if, because of solid solution, the final product after dehydration is composed of more than one compound, this formation of amorphous material as an intermediate

0907-10-0917 - continued

step will be promoted, and conversely that if the end product is a single compound, crystallization will be promoted. Because of the high-surface and high-chemical activity these in-between states are of potential chemical interest and the various factors promoting or hindering their formation should be known.

Tasks: A hydrated compound which exists over a wide range of compositions could be used to study the effect of single or multiple end products on the rapidity of crystallization after dehydration by heat. The amphiboles and the hydrogarnets are two such series. These compounds would be made artificially over a range of composition, and heat treated in differential thermal analysis equipment, and the products at various times would be studied by X-ray diffraction. The effect of range of composition and other factors on the formation of intermediate amorphous material would be determined.

1000-30-4801 Properties of Building Materials

Objective: To obtain data on the properties of building materials, equipment, and structural assemblies and their probable service performance, to assess their value for use in military structures.

Background: The NBS has, for some time, provided the office of the Chief of Engineers, Department of the Army, with technical data necessary to permit it to solve technical problems relating to the design and construction of buildings. One important phase of this service has been advisory services on use of materials, construction methods, and building failures. Another phase of importance has been the testing and evaluation of materials and structures such as stone, brick, flashing materials, door locks, beams, etc., proposed for use in the installations. The major portion of the testing is done in the Building Technology Division; a considerable amount, however, is accomplished in laboratories of other divisions of NBS.

Tasks: As requested by OCE. Typical work includes assistance in the revision of the OCE concrete-masonry design requirements, measuring drying shrinkage of concrete-masonry units, testing door locks, etc.

0201-20-0203 Spectrophotometry and Colorimetry

Objectives: To develop and maintain spectrophotometric standards; and to study improvements in spectrophotometric instruments and techniques, particularly for the standardization and specification of color and the determination of the permanence of standard samples of ceramics, glasses, pigments, paints, papers, plastics, textiles, and other materials of special interest in colorimetry.

Background: Spectrophotometry is the fundamental basis for the analysis, standardization, and specification of color. It is also a research and analytical tool in physics, chemistry, engineering, and technology. The color of a standard is always of questionable permanence, and spectrophotometric information concerning the change of color of these standards is required in art, industry, and science.

Tasks: (1) Spectrophotometric and colorimetric permanence study of white chemical materials suitable for reflectance standards for spectrophotometry and colorimetry and of NBS standard samples of paint pigments, artists' oil paints, standard light-sensitive papers, and other materials subject to natural and accelerated weathering, including the effects of radioactive irradiation on humans and on building materials. (2) Specification of special sets of material color standards such as highway-marking colors, railroad signal target enamels and glasses, safety color code for marking physical hazards, radiation hazard warnings, and other colors relating to safety. (3) Spectrophotometric study of optical glasses, species of foliage, eggs, skin, teeth, blood, hair, crops, sand, and other materials, including glass and solution standards of spectral transmission.

0201-20-0205 Photometry and Illumination

Objectives: To maintain the national photometric units of luminous intensity (candlepower) and luminous flux; to develop and maintain standards of illumination and photometric brightness; to participate in national and international comparisons of photometric standards; to study the luminosity factors of the human eye by means of which the candlepowers of lights of different colors are evaluated.

0201-20-0205 - continued

Background: The maintenance of the national units for photometric values for lights of all colors is one of the basic functions of the NBS. Lamp companies and other commercial laboratories, universities, and government agencies depend upon the photometric standards calibrated against the national standards. National and international comparisons insure the uniformity of photometric values both in this country and in other nations.

Tasks: (1) Calibrate lamps for international intercomparison of photometric units. (2) Conduct national intercomparisons of lamp standards. (3) Maintain and intercompare master lamp standards, check on calibrations of photometric equipment, develop new devices or procedures. (4) Study the problems encountered in low-luminance photometry.

0201-30-0207 Standards of Light and Color

Objectives: The calibration and issuance of lamp standards of candlepower, luminous flux, and color temperature; spectrophotometric standards; standards of color, transmittance, reflectance, opacity, gloss, and luminance.

Background: Standards of light and color are in continuing demand by government and industry for the calibration of instruments or working standards, or for the testing of materials for compliance with specifications.

0501-30-3240 Analysis and Testing of Paint, Varnish, Lacquer, and Related Materials

Objectives: To test and analyze paints, varnishes, lacquers, enamels, and ingredient raw materials for compliance with specifications. Also, to examine and evaluate organic coating materials for which no specifications exist; and to conduct special tests and investigations for regulatory agencies.

Background: The testing of the delivered product to determine compliance with established requirements is the final essential step in a specification procurement program. Most government paint purchases are made in such a manner. Tests are required also to provide legal evidence for government agencies that have regulatory functions and for other special purposes.

0506-20-0526 Permeability and Protective Value of Electroplated Coatings

Objectives: To develop and evaluate methods of measuring porosity in electroplated coatings. To determine the cause and effect of porosity in electroplated coatings.

Background: The protective value and life of plated coatings are widely considered to be related to the porosity of the coatings. At the present time, the relation has not been satisfactorily determined due to the lack of a suitable method of measuring the porosity. Also, the causes of porosity are not fully understood. This project is conducted by NBS in association with the American Electroplaters' Society to provide fundamental information which may lead to significant changes in industrial electroplating processes and specifications.

Tasks: (1) To further develop and evaluate radiographic methods of detecting pores in electroplated coatings. (2) To compare the radiographic method with other existing tests to determine the relative advantages and the limitations of this method.

0904-20-0908 Development of Evaluation Criteria for Porcelain Enamels

Objectives: To develop laboratory test procedures by which important properties of porcelain enamels and enameled items may be evaluated; to evaluate test methods by comparison of laboratory results with performance data, providing a basis for selection of test procedures giving the most reliable criteria of performance in service, including the rapidly growing field of architectural enamels as well as home fixtures and advertising signs.

Background: Work on the development of standard tests for porcelain enamels has continued at NBS since 1934. Industry has cooperated through the research associateship maintained by the Porcelain Enamel Institute. Tests developed have been adopted as standards by the PEI and the ASTM. Approximately 12 tests have been developed, but tests are needed to evaluate several properties for which satisfactory test methods are not available. Several of the previously developed test methods are in need of revision to keep up with recent advances in industry.

0904-20-0908 - continued

Tasks: (1) Make preliminary studies of the mechanism of attack on porcelain enamels by aqueous solutions, using radioactive tracers. (2) Make field inspections of weathering specimens at Atlantic City, N. J., Lakeland, Fla., and St. Louis, Mo., after 15 years of exposure. (3) Prepare revision of PEI standard test for abrasion resistance of porcelain enamels. (4) Study the stress distribution in the enamel-metal system as affected by heating and cooling and thermal gradients, with a view to developing a test for thermal-shock resistance. (5) Continue laboratory tests, analyze data, and prepare draft of manuscript describing types of attack observed during 5 years of service of household kitchen appliances and the correlation between field results and laboratory test data. Some of the coatings which were developed earlier in this same project are now being used for the protection of aircraft engine parts.

0904-10-4412 Protective Mechanisms of Ceramic Coatings

Objectives: To investigate ceramic coating; in particular, to obtain a fundamental insight into such mechanisms as the diffusion of ions through the coating layer, the behavior of coatings with respect to temperature gradients, and the factors responsible for bond development.

Background: The goal of the adherence work is to evolve a theory that will apply to all ceramic-metal bonding or, if necessary, to evolve different theories for different types of bonding. Nine-phase reports have been prepared and six of them have been published since this work on adherence was initiated and all of these have been helpful to some degree in arriving at a better understanding of the bonding phenomena. Emphasis will be placed during the coming year on preparing the groundwork for a summary report on the mechanism of adherence. In the meantime, increased attention will be given to fundamental studies of the mechanism of the protective functions of coatings. A better knowledge of this mechanism should lead either directly or indirectly to the improvement of current types of ceramic and cermet coatings.

1004-10-1017 Properties of Roofing, Waterproofing Flooring, and Coating Materials

Objective: To determine the properties of floor, roof, and wall covering materials and to formulate specifications and test methods applicable thereto.

Background: (a) The principal roofing materials used in this country contain asphalt. Since the deterioration of such roofing materials is closely associated with the degradation of the asphalts, the work on roofing materials, at present, consists primarily of fundamental studies of the degradation of asphalts and of methods of retarding this process. The work on this subject at the NBS since 1946 has been carried on in collaboration with the Asphalt Roofing Industry Bureau. (b) The compositions and constructions of floorings have undergone appreciable change in the past several years, notably through the introduction of vinyl plastic floor coverings. Comparable and up-to-date information on different types of materials and their installation is of direct and economic interest to architects, builders, and consumers in selecting a flooring material to meet a particular need. The NBS is repeatedly asked for such information by other agencies of the government and the public in general. (c) Modern practice of tight construction and the increased use of insulation and air conditioning have emphasized the importance of moisture control in structures. Water-vapor barriers are one means of exercising such control. Such work is proposed as another large phase of the project. Requests from other agencies of the government for information on the water-vapor permeance of structural elements and of coating materials necessitate basic work by the NBS in this field.

Tasks: (A) Roofing Materials: (1) Follow, in asphalts of widely different characterists, the chemical changes that take place on weathering and seek the reasons for the differences in behavior. (2) Develop further methods for functional group analyses. (3) Prepare reports on the procedures developed and the results obtained during fiscal year 1954. (B) Flooring Materials: (1) Determine the resistance of flooring materials to abrasion and cleaning materials. (2) Study the antislip characteristics of floor surfaces and protective coatings. (3) Develop methods for evaluating the relative performance of flooring materials. (C) Coating Materials: (1) Prepare and publish a report on completed work.

1004-40-4843 Preparation of Roofing Manual

Objective: Preparation of a roof-maintenance Manual.

Background: Field studies of roofing problems at Army and Navy stations have indicated the great need for a roof-maintenance manual and for the savings that a manual of this type would accomplish. Field studies, completed within the United States, will be extended to overseas areas at the request of the Department of the Navy.

Tasks: (1) Conduct field studies of the behavior of roofing materials in the following overseas areas: South Pacific, Caribbean, Alaska (2) Complete preparation of roofing manual.

1004-40-4844 Stapler Method of Applying Asphalt Shingles

Objective: To evaluate the stapler method of applying asphalt shingles.

Background: The Federal Housing Administration has requested this evaluation because of the receipt of numerous representations that the stapler method of applying asphalt shingles reduces roof costs appreciably and at the same time provides a durable watertight roof.

Tasks: (1) Conduct field studies of roofs with asphalt shingles applied by the stapler method, in areas representing various climatic conditions, with particular attention to : (a) Behavior of stapled shingles in areas where wind damage to asphalt shingles is known to occur. (b) Resistance of staples to rusting in service. (c) Retention of holding power of staples. (d) Positioning of staples (randomness). (2) Make laboratory determinations necessary to establish: (a) Relative resistance to tear of asphalt shingles applied by nailing and by stapling method with staples placed horizontally, vertically, and at an angle of 45° to the base line of the shingle. (b) Practicability of stapling method for applying asphalt shingles to 5/16-in. plywood decks.

0201-30-2320 Qualification Inspection and Testing of Lamps for the Government

Objectives: To conduct qualification tests of manufacturers currently supplying incandescent, fluorescent, and photographic flash lamps to government by inspecting and life-testing the lamps supplied in order to determine compliance with applicable Federal Specifications; also to conduct qualification tests of prospective bidders not currently supplying lamps to the government.

Background: Contracts to supply lamps to the government are awarded only to suppliers who have passed qualification tests conducted at the NBS in accordance with the applicable specifications.

Tasks: (1) The qualification testing of all groups of all brands of lamps supplied to the government for which qualification requirements are specified. (2) The qualification tests of lamps manufactured by prospective bidders as requested by GSA. (3) Development of improved methods for the photometry and colorimetry of fluorescent lamps. (4) Development of methods for testing projection lamps.

0502-30-3241 Analysis and Evaluation of Detergents and Miscellaneous Materials

Objectives: Testing detergents, waxes, and miscellaneous materials for conformance to Federal and other specifications; identification, analysis, and evaluation of a wide variety of miscellaneous products that are not covered by any specifications. Development of new specifications and test methods for detergents and miscellaneous materials, and revision of the Federal Specification for Methods of Sampling and Testing Soaps and Soap-Products (Including Synthetic Detergents). Technical services of analytical, investigative, and advisory nature pertinent to regulatory or judicial functions of governmental agencies.

Background: The services outlined are required by other government agencies for procurement of materials and in carrying out their assigned functions.

0502-30-3241, continued

Tasks: (1) Continuation of testing detergents, waxes, and related materials. (2) Study, improvement, and development of methods for the analysis of detergents, waxes, and related material. Continuation of the revision of the Federal Specification. (3) Continuation of the identification, analysis, and evaluation of miscellaneous materials. (4) Improvements in methods and techniques for the analysis and evaluation of miscellaneous materials will be developed as opportunity permits.

0702-20-0709 Development of Methods for Testing Textiles

Objectives: To provide methods for evaluating the properties of textile fibers, yarns, fabrics, and related products of importance to the government and other users.

Background: A continuing effort is necessary to keep textile testing methods abreast of the needs of the government and the public because of the novel properties of the products being developed, in particular the synthetic-fiber textiles. Rating of color-fastness to light continues to be a major problem; and use of the NBS light-sensitive paper standards is growing and extending to fields other than textiles. Methods for the quantitative analysis of textiles containing the newer fibers are required for checking deliveries of mixed-fiber textiles to the government and checking the accuracy of labels for the Federal Trade Commission. Recent developments in spectrophotometric techniques suggest that spectrophotometric measurements may serve as a basis for these analyses.

Tasks: (1) Colorfastness to light: Install new master lamp, calibrate it, and produce standard faded strips for distribution by the Standard Sample Service. (2) Analytical methods for mixed-fiber textiles: Investigate the use of infrared-absorption measurements on pellets composed of potassium bromide and ground fibers and on pyrolyzates of fibers in the quantitative analysis of mixed-fiber textiles. (3) Development of new or improved methods as needed in connection with Federal Specifications.

1000-30-4800 Testing Building Materials

Objectives: To perform miscellaneous tests on building materials, equipment, or structures, as requested by Federal agencies.

Background: This is a continuing project in which the NBS conducts miscellaneous testing of building materials and equipment, including items purchased for use of government departments and independent establishments.

Tasks: Items tested in sufficient numbers to permit the establishment of standard fee schedules are as follows: 1011, Brick; 1012, Masonry Units; 1013, Pipe of Clay, Asbestos Cement, and Concrete; 1014, Prefabricated Concrete Slabs; 1015, Asbestos-Cement Products; 1016, Waterproofing for Masonry Walls; 1017, Building Stone; 1018, Calking Compounds; 1019, Roofing Slate; 1021, Fire Resistance; 1022, Fire Extinguishers; 1031, Thermal Conductivity; 1032, Air Filters; 1041, Road Materials; 1042, Bituminous Construction Materials; 1051, Elevators. These, as well as other tests requested by government agencies, will be conducted.

MISCELLANEOUS

0204-30-2312 Calibration of Surveying Instruments

Objectives: To calibrate base-line tapes, steel tapes, leveling rods, and other basic equipment used in geodetic surveys in Central and South America.

Background: The Inter-American Geodetic Survey (IAGS) is supervising basic surveys (giving the framework for maps) of the Western Hemisphere that are not under the jurisdiction of the U. S. Coast and Geodetic Survey or the Geodetic Survey of Canada. Specifications for the equipment require calibrations similar to those made at the NBS for the equipment of the U. S. Coast and Geodetic Survey.

0506-40-3251 Consulting Services for Government Agencies

Objectives: To provide consulting services in the field of electrodeposition to other government agencies. This is to include experimental work as required.

Background: Other government agencies, such as the Bureau of Engraving and Printing, frequently require assistance with electroplating problems. It may be necessary, for example, to determine if a plated coating with certain characteristics will be suitable for a particular purpose, or whether some modification of a plating process would be advantageous.

Tasks: Tasks will be completed as requested by sponsors.

0604-20-0614 Development of Techniques for Static and Dynamic-Load Measurements

Objectives: Development of elastic load-measuring devices for calibrating testing machines, and development of methods for evaluation and comparison of hardness-testing machines.

Background: With the greatly increased amount of testing, research, and development work involving mechanical testing in both governmental and commercial laboratories, there is a continued need for the development of accurate, portable, elastic calibration devices. There is need for the development of less time-consuming methods for the calibration of devices having capacities exceeding the capacities of the

largest dead-weight testing machine (111,000 lb.). There is also need for the development of devices suitable for calibration work for loads less than 200 lb. Such devices would be very useful in investigating the performance of hardness-testing equipment and of machines now in wide use in testing textiles, plastics, and other organic and fibrous materials.

Tasks: (1) Extend the range of static-load calibration equipment above 500,000 lb. and below 200 lb. (2) Investigate factors in the field of hardness and micro-hardness tests bearing on the accuracy and reproducibility of the results. (3) Study improved methods for measuring the output of elastic-load calibrating devices using wire strain gages.

0604-30-0616 Calibration of Mechanical Testing Machines and Apparatus

Objectives: Calibration of mechanical testing machines, dynamometers, load cells, and force, strain, displacement, velocity, and acceleration measuring equipment, development of test equipment and methods; assistance in the formulation of specifications.

Background: The NBS provides the only service available for the accurate calibration of elastic devices used for calibrating testing machines. Some 600 devices per year, ranging in capacity from a few hundred pounds to several million pounds, are calibrated for government agencies and commercial laboratories. The accuracies of the testing machines used by the government and by producers and consumers are dependent on periodic calibrations made with devices calibrated at NBS. Calibration cells used by manufacturers of aircraft-weighing devices and load cells for measuring the thrust of jet engines and for weighing the contents of bins and hoppers are calibrated in the NBS dead-weight machines. Calibrations of strain and displacement measuring equipment are performed for other government agencies. Assistance is given in reviewing the requirements for mechanical tests included in specifications.

Tasks: (1) Calibrate elastic calibration devices and calibration cells by dead weights or other calibrated devices. (2) Determine the absolute value of electrical input to output ratio as a function of load for basic laboratory standards used to control production of industrial load-weighing equipment. (3) Calibrate strain and displacement measuring equipment. (4) Assist in the formulation of specifications

0604-30-0616 - continued

for mechanical tests of materials and devices. (5) Calibrate displacement, velocity, and acceleration pickups.

0604-10-3516 Engineering Structures

Objectives: To determine the stress distribution and strength of structural connections at bulkhead intersections in welded ships.

Background: The large number of structural failures in welded merchant ships during World War II led the Ship Structure Committee to initiate long-range studies of the design and methods of construction of welded ships. A part of this investigation was to be concerned with design details of structural discontinuities. At the request of the Bureau of Ships, Department of the Navy, a program of tests on design details of bulkhead intersections and interrupted longitudinals for welded tankers was undertaken at NBS in 1948.

Tasks: Preparation of a paper on measurements of elastic stress distribution at room temperature, plastic strain distribution at 0°F and energy to fracture on nineteen welded bulkhead intersection specimens representing structural details in welded tankers.

0604-30-3567 Survey of High-Temperature Strain Measuring Devices

Objectives: To make available in the form of a critical survey comprehensive information on the current status of development of high-temperature strain gages and calibration methods, and an evaluation of their theoretical and practical limitations useful in the planning and conduct of research and development on such devices and methods, and useful for provision of general guidance in instrumentation problems concerned with high-temperature strain gages.

1000-40-1099 Consultative and Advisory Services

Objective: To provide miscellaneous consultative and advisory services as required in technical fields under the cognizance of the Building Technology Division.

1000-40-1099 - continued

Background: The Federal Government has a large interest in building technology, looking toward lowering costs and improving construction of buildings. Inquiries are received from many Federal agencies on subjects such as fire resistance, strength of materials and structures, heating, air conditioning, floor and roof coverings, plastering, masonry and safety and building codes. These inquiries may be in the form of visits, letters, or telephone calls. They may require detailed consideration involving field trips or laboratory tests. Private citizens and industrial organizations also call on NBS for the solution to a variety of problems.

1000-40-4802 Federal Construction Council

Objective: To provide a mechanism for establishing a Federal Construction Council, an organization for the exchange of technical information between the various Federal construction agencies and for general improvement of construction technology in Government buildings and structures.

Background: In Fiscal Year 1952, the Building Research Advisory Board of the National Research Council, under the National Academy of Sciences, operated a mechanism for assisting Federal agencies in the solution of their technical problems in construction engineering and building technology by exchanging technical information and collaborating on building research. These activities were carried out under contract between the National Academy of Sciences and the Office of Defense Mobilization, but in FY 1953 the latter office was unable to continue the operation. Late in FY 1953, it was determined that continuation of the activity could be achieved only by securing funds from agencies concerned with construction, and the NBS was requested to continue the operation using funds transferred to the Bureau by the participating agencies. A contract between NBS and the National Academy of Sciences was negotiated thereupon in which the Chief of the Building Technology Division of NBS was designated as the "Agency Representative" charged with responsibility for directing the conduct of the subject work.

1000-20-4804 Miscellaneous Engineering Investigations

Objective: To provide for other agencies short-duration engineering investigations in the field of building technology.

1000-20-4804 - continued

Background: This project is designed to include a number of smaller short-duration investigations which are too small to warrant the establishment of separate projects. Most of these will be engineering investigations involving studies of new structural procedures, heating systems, air-conditioning techniques, fire-protection systems, problems in flooring, building-code problems, and other studies of similar nature. Acceptance testing is not included under this project.

3300-30-7510 High-G Accelerometer Calibration

Objective: To develop methods for the routine calibration of accelerometers at accelerations in the range of 100 to 100,000g with accuracy comparable to that now attained in lower ranges.

Background: The increasing application of accelerometers to measurement problems concerned with shock and vibration, particularly that due to explosions, has resulted in an increasing need for methods for calibrating accelerometers in the range of acceleration values up to 100,000 g or higher. The accuracy of these calibrations should be of the same order as the accuracy now attainable in lower ranges. Present methods are generally limited to the use of specialized equipment, such as a method in which the accelerometer being calibrated is subjected to a shock resulting from impact of a projectile fired under controlled conditions, and by indirect methods, such as those involving the use of strain gages to determine deflection of a heavy vibrating beam. In the present project, it is planned to explore new methods of attaining high-g calibrations as well as to investigate possible improvement of present methods.

Tasks: (1) Investigate new methods of high-g calibrations, including the use of airgun and inclined trough to obtain calibrations at accelerations up to 100,000 g or more and pulse widths down to 20 microseconds or less. (2) Develop accelerometer with reliable characteristics up to 100,000 g or more, and a resonant frequency above 150 Kc. (3) Investigate steady-state high-g calibration methods, including transversely and longitudinally resonating bars, and various excitation schemes. (4) Prepare NBS technical reports on these tasks.

THE NATIONAL BUREAU OF STANDARDS

Functions and Activities

The functions of the National Bureau of Standards are set forth in the Act of Congress, March 3, 1901, as amended by Congress in Public Law 619, 1950. These include the development and maintenance of the national standards of measurement and the provision of means and methods for making measurements consistent with these standards; the determination of physical constants and properties of materials; the development of methods and instruments for testing materials, devices, and structures; advisory services to Government Agencies on scientific and technical problems; invention and development of devices to serve special needs of the Government; and the development of standard practices, codes, and specifications. The work includes basic and applied research, development, engineering, instrumentation, testing, evaluation, calibration services, and various consultation and information services. A major portion of the Bureau's work is performed for other Government Agencies, particularly the Department of Defense and the Atomic Energy Commission. The scope of activities is suggested by the listing of divisions and sections on the inside of the front cover.

Reports and Publications

The results of the Bureau's work take the form of either actual equipment and devices or published papers and reports. Reports are issued to the sponsoring agency of a particular project or program. Published papers appear either in the Bureau's own series of publications or in the journals of professional and scientific societies. The Bureau itself publishes three monthly periodicals, available from the Government Printing Office: The Journal of Research, which presents complete papers reporting technical investigations; the Technical News Bulletin, which presents summary and preliminary reports on work in progress; and Basic Radio Propagation Predictions, which provides data for determining the best frequencies to use for radio communications throughout the world. There are also five series of nonperiodical publications: The Applied Mathematics Series, Circulars, Handbooks, Building Materials and Structures Reports, and Miscellaneous Publications.

Information on the Bureau's publications can be found in NBS Circular 460, Publications of the National Bureau of Standards ($1.25) and its Supplement ($0.75), available from the Superintendent of Documents, Government Printing Office. Inquiries regarding the Bureau's reports and publications should be addressed to the Office of Scientific Publications, National Bureau of Standards, Washington 25, D. C.


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