NBSIR 74-497

US/UK Joint Complementary Research Program in Building, (Wind Loads, Water Supply, Fire Detection), July 1972-June 1973

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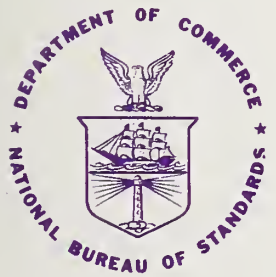
Center for Building Technology
Institute for Applied Technology
National Bureau of Standards
Washington, D. C. 20234

October 1973

Final



U. S. DEPARTMENT OF COMMERCE
NATIONAL BUREAU OF STANDARDS

NBSIR 74-497

US/UK JOINT COMPLEMENTARY RESEARCH PROGRAM IN BUILDING, (WIND LOADS, WATER SUPPLY, FIRE DETECTION), JULY 1972 – JUNE 1973

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U. S. DEPARTMENT OF COMMERCE, Frederick B. Dent, Secretary
NATIONAL BUREAU OF STANDARDS, Richard W. Roberts, Director

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Building Research Establishment
Department of the Environment
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UNITED STATES

BACKGROUND

C. C. RALEY
Coordinator of International Affairs
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On July 21, 1971, a memorandum of understanding was signed by Mr. Peter E. WALKER, Secretary of State, Department of the Environment, United Kingdom, and Mr. George ROMNEY, Secretary of the Department of Housing and Urban Development, United States. It outlined a program for cooperation in matters concerning urban environment including housing and building technology. The goal of this program is to achieve the maximum exchange of documents and visits, and it can be extended to such other activities as expert consultations, long-term exchanges of professionals, and joint research projects. In carrying out this understanding, the two national coordinators may invite participation from other agencies, organizations or private groups within their respective countries.

The Building Research Establishment (BRE) and the Center for Building Technology (CBT), have long been acquainted with each other's work and have had a great deal of interaction. During the March 1971 visit of Dr. F. Karl WILLENBROCK, Director of the Institute for Applied Technology (of which CBT is a part) with Mr. James B. DICK, Director of BRE, the subject of a joint BRE/CBT program was discussed. With the signing of the memorandum of understanding, impetus was given to establishing a formal cooperative program between the two groups. As a result, CBT developed a number of research proposals which later were reduced to three specific projects by Mr. DICK and Dr. James R. WRIGHT, Director of CBT.

During the first week of March 1972, Mr. Irwin A. BENJAMIN, Chief of the Building Fires and Safety Section, CBT, visited the Fire Research Station, BRE, in order to discuss a cooperative program on fire detectors.

The following May, three BRE staff members visited CBT. The first visit, May 1-2 and 8-10, 1972, was made by Mr. A. F. E. WISE, Head of the Environmental Design and Engineering Division, BRE; the second on May 10, was Mr. J. G. SUNLEY, Head of the Structures and Building Division, BRE; and the third, May 22-26, 1972, was Dr. S. C. C. BATE, Head of the Structural Engineering Division, BRE. Each examined appropriate areas of CBT with the formulation of cooperative projects in mind. At the conclusion of the meetings, three proposals were drawn up for possible implementation. These were: Wind Loads on Buildings, Design of Water Supply and Drainage Installations in Building, and Fire Detection in Buildings.

On July 6, 1972, Mr. Harry E. THOMPSON, Deputy Director/ Operations, CBT, met with Mr. DICK in England to discuss formal implementation of the three projects under the title of the "Joint Complementary Research Program." This resulted in the preparation of three documents of agreement; the first two on wind and hydraulics were signed by BRE on July 27 and countersigned by CBT on August 3, 1972. The third, on fire detection, was signed on September 1 and countersigned likewise on September 13, 1972. Copies of these documents are attached as appendices to this report.

Between October 22 and 25, 1972, Mr. William C. CULLEN, Assistant Chief of the Structures, Materials and Life Safety Division, CBT, visited BRE in conjunction with the wind loading and fire detection programs.

The following spring, Mr. P. BAKKE, Assistant Director of BRE, visited the CBT facilities between May 10-14, 1973, and discussed the status of the three projects in addition to familiarizing himself with other CBT activities.

Progress during the first year is reviewed in the following sections on each of the selected projects.

WIND LOADS on BUILDINGS

R. D. MARSHALL
Structures Section
Center for Building Technology

Introduction

For the past several years, the Center for Building Technology (CBT) and the Building Research Establishment (BRE) have conducted a number of studies into the effects of wind on buildings. In general, these studies were conceived and carried out without direct communication between the two establishments, even though the goals of each were often the same. In view of the fact that both establishments have recently concentrated on problems associated with low-rise structures, the opportunity to establish a joint complementary research program in July 1972 was most welcome. This section of the report discusses the exchanges accomplished in this first year of the program and identifies topics being considered for future collaboration.

Full-Scale Investigations

BRE is currently conducting a series of studies at Aylesbury, England. Test structures include several two-story townhouses and a specially-constructed building whose roof pitch and story height can be altered.

It is anticipated that new construction will extend in the direction of the prevailing winds, thus providing an opportunity to observe the effects of a changing environment on wind loading. In addition to wind pressure and reference wind speed and direction, local velocities within the development are being measured. Also, net drag and uplift loads are being measured on the special test building.

CBT is currently conducting studies on two structures: one of the general-purpose laboratory buildings (Bldg. 226) on the Gaithersburg campus, and a duplex housing unit at Malmstrom Air Force Base (MAFB), Montana. Both of these buildings have a clear exposure to prevailing winds. Studies on a single-family dwelling, also located at MAFB, with several buildings located directly upwind, were completed in 1972.

Discussions between the liaison officers directly responsible for conducting the joint project (Dr. R. D. MARSHALL for CBT and Dr. K. J. EATON for BRE) have identified a number of items

that will increase the value of the studies in progress and that will avoid unnecessary duplication of effort in future studies. A two-week visit to CBT and the MAFB field site by Dr. EATON in November allowed a first-hand appraisal of the wind research program and associated programs within the Center for Building Technology.

Exchanges of Experimental Data

Exchanges of experimental data this past year included mean pressure coefficients, fluctuating pressure coefficients, peak factors, auto- and cross-correlation functions, power spectra, probability density functions and coherence functions. In addition, a uniform method of defining and presenting the data was agreed upon. Full-scale data collected by CBT and BRE will be extremely valuable in preparing future revisions of standards covering the design of structures subjected to wind forces.

Exchanges of Instrumentation and Experimental Techniques

This area of the complementary research program was very actively pursued by both sides. Instrumentation and experimental techniques were developed independently over the years and, although similar in many respects, were found to have many important differences.

The methods by which data are recorded and prepared for computer processing are much the same, analog tape recorders being used in the field and subsequent multiplexing and analog to digital conversion. Perhaps the most significant difference is in the instrumentation used to measure pressures. The BRE system is built around exposed-diaphragm transducers which are mounted flush with the building surface. The CBT system uses enclosed-diaphragm transducers which are either mounted under low-profile housing or are installed inside the building and connected to the exterior surface through short-pressure tubes. The BRE transducers are a strain-gage device specifically designed for wind pressure measurements while those used by CBT are a variable reluctance device obtained from commercial sources. The BRE transducers are more difficult to install but are not susceptible to clogging by wind driven rain.

Both types of transducers are somewhat temperature sensitive and demonstrate some long-term electrical drift. Because of the extremely small pressure differences to be measured, these errors cannot always be ignored. A very effective solution to this problem has been developed by BRE and is now being incorporated into the CBT system. A

solenoid valve is used to place the transducers into a "closed loop" configuration just prior to the data run and the output is recorded. On command from the data acquisition system, the valve is then switched back to the reference pressure line.

The measurement of wind speeds has differed mainly in the types of anemometers used. Both establishments have used 3-cup anemometers at the 10-meter level (this has not been possible at MAFB) and their distance constants are approximately equal. For the studies at Gaithersburg, turbulence components (U, V and U, V, W) have been measured by fast-response propeller anemometers. A three-component cluster of these anemometers has been loaned to BRE for the measurement of local wind speeds within the Aylesbury complex. BRE, in turn, has provided details of their mobile unit equipped with a telescopic anemometer mast. It is anticipated that a similar system will be installed in the CBT structural testing van.

Wind Tunnel Modeling

One of the primary reasons for collecting wind pressure data on full-scale structures is to provide a basis for evaluating the accuracy of wind tunnel tests. Proper simulation of atmospheric flows in wind tunnels allows a systematic study of pressure distributions on buildings and is, with few exceptions, the only method available for establishing design pressure coefficients. Hence, both establishments are actively engaged in wind tunnel modeling. CBT has in the past contracted this work to Colorado State University while wind tunnel studies associated with the BRE program have been conducted in their own facility and at Bristol Univeristy. As wind tunnel test results have only recently become available, no comparisons between facilities have yet been made.

Data Reduction and Analysis

As indicated in a previous section, the methods used for recording and converting data are quite similar. BRE has an arrangement with the Electrical Research Association (ERA) for the conversion and analysis of random data while CBT conducts this work in-house. The digital analyses used by the two establishments are best compared by the following table:

	CBT	BRE
Sampling rate	16/second	32/second
Record length	750 seconds	1,024 seconds
Digital filtering	Every 4 points	Every 8 points
Cutoff frequency	2 Hertz	2 Hertz

Items for Future Collaboration

Based on exchanges initiated in the first year of the program and studies currently being carried out by the two establishments, the following items have been identified for future collaboration:

1. Exchanges of data obtained from both full-scale and wind tunnel model studies will continue.

2. Dr. MARSHALL will visit BRE in December 1973 to discuss details of data analysis programs, current full-scale studies, wind tunnel modeling and instrumentation problems. Of particular interest will be results of BRE research into environmental wind problems created by the construction of tall buildings.

3. Work will be initiated on the instrumentation of tall buildings to measure their response to wind. The electro-optical deflection measuring device recently developed at CBT will be made available for this study. BRE is currently exploring the possibility of making these measurements on the Post Office Tower in London.

4. Details of the portable data acquisition system currently being developed for use in the Philippines and along the U. S. Gulf Coast will be made available to BRE. Mobile wind-measuring equipment in use at Aylesbury will serve as a model for the build-up of a similar system at CBT.

DESIGN of WATER SUPPLY and DRAINAGE INSTALLATIONS in BUILDINGS

J. E. SNELL
Assistant Chief
Building Environment Division
Center for Building Technology

Introduction

In July 1972 the Center for Building Technology (CBT) and the Building Research Establishment (BRE) entered into a complementary research program in the area of building service systems. Early discussions centered on common interests in the areas of plumbing (water supply and drainage), solid waste handling, electrical distribution, and lifts and elevators. It was agreed to concentrate efforts initially on work in the area of water supply and drainage installations within buildings and, in particular, on a project entitled "hydraulic design of drainage installations in buildings." Two other activities of mutual interest in plumbing research were identified. These are development of means to predict design loads for plumbing systems and development of criteria for vacuum drainage, an alternative to the gravity sewer which has gained a degree of acceptance in Europe. As the program develops, it is expected that complementary efforts will be established in these latter two areas.

The central thrust of the initial project on hydraulic design of drainage systems is to test and compare results on alternative approaches to predicting the performance of drain-waste-vent systems. The following sections of this report discuss the technical substance of this complementary effort, the exchanges accomplished to date, and the tasks being considered for future collaboration.

Design/Evaluation of Gravity Drainage Systems

Until recently it has not been possible to predict accurately the performance of unusual (i.e., non-standard) or innovative gravity drainage systems. The major issues in drain-waste-vent system design are sizing, spacing, and configuration of drainage and vent piping to handle expected loads without inducing pressure fluctuations in the system that would upset the water seals in the fixture traps. These traps provide a barrier which prevents sewer gas, foul odors, and vermin from entering occupied spaces in buildings.

In a series of studies over the last two decades, researchers at the Building Research Establishment have developed a

simple procedure and computer program that BRE recommends for this purpose. This procedure/program determines the maximum suction likely to occur in a drainage system for comparison with an agreed-upon standard suction limit. The stack and vent system are thus sized to limit suction to this standard under specified hydraulic loading. The program takes into account the geometry of the installation, heights, lengths, pipe diameters, and so on, and also characteristics of branch fittings and the discharge rates of sanitary fixtures.

Researchers at BRE are interested in obtaining further field data on comparison with predictions obtained using their program. CBT researchers are interested in the potential for application of this approach to U. S. plumbing system designs which differ significantly from those used in the United Kingdom, and also in a comparison of vent sizes computed (a) by the BRE method and (b) by American methods for American systems already or soon-to-be evaluated in laboratory tests at CBT or elsewhere.

Also, in its methodology BRE assumes drainage flows are steady state, although results have been compared with results of tests under transient conditions with good agreement. CBT researchers feel dynamic effects may be significant. This complementary program is designed to answer these questions and, hopefully, to provide further improvement to the design and evaluation methodology now available in both countries. A significant objective is a gradual reduction in dependence on full-scale, empirical tests that require elaborate, expensive testing facilities and procedures.

Technical Exchange Activities in FY 1973

BRE has made its methodology and computer programs available to CBT and currently these are under review. CBT and BRE have agreed on full-scale tests on typical townhouse and ten-story plumbing system designs. The townhouse was erected in the CBT Plumbing Research Laboratory and the 10-story system was constructed at Stevens Institute's Building Technology Research Laboratory (Hoboken, New Jersey) in a program funded by the Department of Housing and Urban Development (HUD Contract H-1317 "The Study and Evaluation of Several Innovative Drainage Systems"). The designs of these systems have been reviewed by both parties. Vent sizing was by American procedures. Full-scale performance tests were conducted on each of these systems prior to detailed

analysis of fixture discharge characteristics and evaluation of branch-stack fitting pressure loss factors. This was necessitated by the requirements of other programs at CBT and Stevens Institute. Therefore, the performance of these systems as they would be designed according to the BRE procedure will be established by comparison of the BRE-recommended designs with the American designs actually tested. If necessary, subsequent testing would be conducted on the same or similar systems.

CBT has shipped the appropriate stack-branch fittings to BRE for pressure loss calibration. BRE is preparing a protocol for such calibration tests for subsequent review and use by CBT. Similarly, CBT engineers are developing a simplified fixture calibration methodology and reporting format. Initial tests have been completed on selected U. S. water closet designs. BRE has selected five European designs for CBT testing and these are being shipped to the U. S.

CBT completed design of its test installation and work plans for testing the steady-state versus dynamic flow hypothesis. Construction of the test assembly was initiated in FY 73. As noted earlier, the major issues to be resolved are: (a) dependence of peak air-demand rate on the dynamics of actual fixture loadings, (b) the relationship between water and air flow in stacks running partly full, (c) the relationship of pneumatic pressure fluctuations to trap-seal retention in a dynamic loading mode, and (d) the extent to which air circulation in a DWV network reduces the peak demand for air in any particular element of the network.

Technical Exchange Activities Being Contemplated for FY 1974

Major activities by both parties to this project involve a natural continuation of efforts undertaken in FY 1973. At CBT these include completion of analysis of BRE computer programs, further testing and reporting of fixture calibration methods, and testing of stack-branch fittings in a representative assembly. Also, CBT looks forward to participation with BRE in further full-scale testing on systems yet to be constructed (most likely several types of so-called single stack system designs). It is anticipated that a researcher from BRE will come to CBT for these tests and to observe results of the stack-branch assembly tests. This interchange is important because there are significant issues of instrumentation and experimental method to be resolved and agreed upon.

Also in FY 1974 CBT will be field testing a prototype system for collection of plumbing system event and load data. This system design draws heavily from BRE's previous experience in this area. It is expected that BRE will review the performance of this system. The data collected in this study will be used to test and validate analytical models of plumbing system loads being developed independently in the U. S. and U. K.

Detailed work plans for the new tasks in this cooperative program will be developed in discussions between SNELL and WYLY of CBT, and WISE and WEBSTER of BRE, in September 1973.

FIRE DETECTION in BUILDINGS

I. A. BENJAMIN*
Chief
Building Fires and Safety Section
Center for Building Technology

Introduction

The National Bureau of Standards (NBS) and the Building Research Establishment (BRE) have similar programs leading towards development of acceptance standards for smoke detectors. The emphasis at NBS is on criteria for the self-contained, residential smoke detector, while the emphasis at BRE is for criteria for smoke detectors for commercial application.

Exchange of Information

The smoke detector program at NBS is of recent origin. The detector program at BRE has been in existence for a much longer period of time. As a consequence, the interchange between the two programs has been limited, during this early phase, to an exchange of information in the form of reports and correspondence relative to the results of experimental work.

Program Objectives

The application of self-contained smoke detectors to residential fire safety dictates the use of detectors sensitive to the earliest-appearing products of combustion. The detector must exhibit a high degree of sensitivity, yet it must not exhibit any appreciable impedance to the entry of smoke into its sensing chamber. The type of fire environment to which the detector must respond is one in which the heat output of the fire may be of such a low level that the determining smoke transport mechanisms will likely be those of the normally-present ambient conditions as opposed to convective flow patterns established by the fire. The program objective, therefore, of NBS is the

*On October 1, 1973, Mr. BENJAMIN became the Acting Chief of the Fire Technology Division, IAT, and the technical activity of his former Section was transferred to the Fire Technology Division.

establishment of acceptance criteria which will ensure the development of detectors which will meet this performance while maintaining a high degree of signal-to-noise ratio so as to minimize false alarms.

The objective of the BRE program is less concerned with the detector hardware, and more with the conditions which must or must not be detected. The controlling factors are, first, the size of fire that can be tolerated before detection without giving undue danger to life or great difficulty in extinction, and second, the occurrence of false alarms due to the conditions in the neighborhood of the detector. The currently proposed criteria are (a) detection before visibility falls to 10 meters and in time to allow the fire brigade to extinguish the fire with one hand line, and (b) on an average not more than one false alarm due to ambient conditions per fire detected. Work in progress is aimed at producing sensitivity limits meeting these criteria.

Areas of Mutual Concern

As far as the program objectives alone are concerned, the knowledge gained by both NBS and BRE as they move towards these objectives will be of interest to the other. In addition, there are areas of mutual concern such as long-term reliability of the detectors, avoidance of false or needless alarms, resistance of the detector to environmental changes such as changes in pressure, temperature and relative humidity, resistance to corrosion, to vibration, and other deleterious effects. Exchange of experimental data in these areas can be expected to increase as additional laboratory work is conducted by both NBS and BRE.

Exchange of Instrumentation

One problem besetting smoke detectors is that certain environmental ambient conditions tend to produce false alarms from the detectors. Given some knowledge of what ambient conditions can be expected in typical environments, it should be possible to develop criteria for an acceptable lower response limit for detectors to these ambient conditions. BRE is developing an ambient-conditions monitoring system which will assist in determining these lower limits. NBS has been in contact with BRE with a view towards purchasing one or more of these systems for use in the U. S. BRE has agreed to reduce the data generated by NBS and process it through BRE's computer analysis program.

Items for Future Collaboration

Based on exchanges initiated in the early part of this complementary program and research work being carried out by the two organizations, the following items have been identified for future collaboration:

1. Visits by BRE personnel to NBS and by NBS to BRE during the next 6 months.

2. Exchanges of information on development of full scale testing procedures for smoke detectors.

3. Exchanges of data on reliability of presently-available smoke detectors.

4. NBS purchase of BRE ambient-condition monitoring system with data reduction and processing by BRE after U. S. data has been obtained.

5. Details of studies on smoke movement in typical residences will be made available to BRE as the work proceeds. It is anticipated that the results of the smoke movement studies will have some applicability to commercial and industrial occupancies and will, therefore, be of interest to BRE.

APPENDICES

Memorandum of Understanding

Wind Loads in Buildings Agreement

Design of Water Supply and Drainage Installations in Buildings Agreement

Fire Detection in Buildings Agreement

MEMORANDUM OF UNDERSTANDING

This Memorandum of Understanding between the Department of Housing and Urban Development (HUD) of the United States and the Department of the Environment of the United Kingdom outlines a program for cooperation in matters concerning the urban environment falling within their competence, such as physical planning, urban management, housing and building technology, and community development. The goal of this program is to achieve the maximum exchange of experience in specified subject areas. The program will include an organized exchange of documents and visits and may be extended as mutually agreed to such other activities as expert consultations, the long-term exchange of scholars and professionals, or joint research projects. In carrying out specific activities under this Memorandum of Understanding, the Department of Housing and Urban Development may invite participation by other U.S. departments and agencies or private groups; the Department of the Environment may similarly invite participation by other agencies and organizations in the United Kingdom.

The general subject areas for initial cooperation may include, but are not limited to, community and regional planning, construction technology, housing management and financing, citizen participation, program evaluation techniques, policy and legislation. These general subject areas may be expanded, added to, or modified by mutual agreement. Further discussions and exchange of correspondence will further define these general areas, and it is specifically envisaged that joint projects of mutual interest, when proposed by either side and accepted by the other, will be undertaken.

The program will begin with the early exchange of views on the establishment of a mutually acceptable program. This first exchange will further define the interests of each country in the other's specific programs and legislation. Visits of experts and teams may be made thereafter without regard to reciprocity at the option of the visiting agency and subject to arrangements with the host agency. Each side will bear its own travel and related living costs under the program.

It is understood that the pace of the program outlined in this Memorandum of Understanding will be contingent upon the availability of funds and other resources on each side.

This Memorandum of Understanding will become effective when signed by authorized representatives of the Department of Housing and Urban Development of the United States and the Department of the Environment of the United Kingdom and will remain in effect for five years. It may be renewed by mutual agreement, and may be terminated at any time by either party on thirty days' notice.

U. S. Department of Housing and Urban Development

George Romney
Secretary

U. K. Department of the Environment

Peter E. Walker
Secretary of State

Signed in London the day of July 1971.

BUILDING RESEARCH ESTABLISHMENT (DOE/UK)
AND CENTER FOR BUILDING TECHNOLOGY (NBS/USA)
JOINT COMPLEMENTARY RESEARCH PROGRAM(ME) *

Project title: Wind Loads on Buildings

Project outline: Revised criteria and standards are required for the design of buildings for wind loading. Research in this area is also essential for the proper installation of materials, the cost of construction and protection of the user. Research will be carried out on buildings in low density and built-up areas. Both laboratories have worked on this subject and have common research objectives. In each case the basic requirement is to establish the validity of using wind tunnel studies for design by comparing wind tunnel data with measurements made on full-scale structures. Each laboratory has several full-scale experiments on hand and the scope for joint research is substantial.

Also, both laboratories have acquired or developed unique instrumentation and equipment for their research work. Sharing usage and experience in development of instrumentation and equipment will expedite results and provide more comprehensive research to both countries.

Working arrangements: Directors have agreed to nominate officers who will be responsible for developing and progressing the joint programme. This project will be initiated on 1 August 1972 and will be reviewed on 30 June of each year by each Director for continuation or revision of the project outline. It is expected that the project will be completed by July 1975. The manpower, funding and equipment necessary to conduct the complementary research will be provided by each organisation. Exchange visits by personnel are essential and will be encouraged.

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* Initiated in response to the Memorandum of Understanding between Mr George Romney, Secretary US Department of Housing and Urban Development and Mr Peter Walker, Secretary of State, UK Department of the Environment dated July 1971

LIAISON OFFICERS NOMINATED BY DIRECTORS:

Dr J B Menzies
(Building Research Establishment)

Dr Richard Marshall
(Center for Building Technology)

.....J.B.Dick.....

DIRECTOR

BUILDING RESEARCH
ESTABLISHMENT

Dated....27th...July..1972.....

James K. Wright....

DIRECTOR

CENTER FOR BUILDING
TECHNOLOGY

Dated..August 3, 1972.

BUILDING RESEARCH ESTABLISHMENT (DOE/UK)
AND CENTER FOR BUILDING TECHNOLOGY (NBS/USA)
JOINT COMPLEMENTARY RESEARCH PROGRAM(ME) *

Project title: Design of Water Supply and Drainage Installations in Buildings

Project outline: A sound method is required for the design of conventional drainage systems in buildings. Both laboratories have worked on this subject to provide theory and data. BRE has found it possible to develop and gain application in the UK of a simplified system - single stack drainage - that is now beginning to be applied in the USA. A computer program is available at BRE for sizing drainage and vent stacks on traditional as well as single stack systems.

Its adaptation for American conditions requires the determination of some further data on certain parameters by laboratory research. Once this information is available the computer program would be modified and applied to design installations for trials in USA, for example, on Operation BREAKTHROUGH sites.

The CBT has been developing empirical methods for determining the air demands of plumbing systems based on laboratory studies of reduced sized venting systems. This work will provide a basis for review and analysis of the BRE computer program.

The CBT has a new laboratory and field data collection facility offering the means for collecting many of the data needed in this program for fixtures, fittings and for drainage systems up to seven storeys in height. A ten-storey facility sponsored by HUD is currently under construction, this is designed to test the performance of alternative drainage system designs.

Both for water supply and drainage, sound theoretical framework and adequate field data are necessary for the specification of design loads and water storage requirements. Current procedures rely on a fixture unit method which has been

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* Initiated in response to the Memorandum of Understanding between Mr George Romney, Secretary US Department of Housing and Urban Development and Mr Peter Walker, Secretary of State, UK Department of the Environment dated July 1971

useful but is not rigorous and is known to lead to overdesign. Some research on the subject has been done in recent years to provide a sounder basis and this needs developing and extending for general use. BRE is organising an international seminar (on behalf of CIB Commission 62) in September 1972 to review this subject and discuss research needs. It is intended that this seminar will provide a basis for identifying priorities for collaborative research into this problem between BRE and CBT. It is expected that even though US and UK use quite different fittings and fixtures, a common theoretical framework may emerge for demand estimation and also for field test and measurement technology.

Working arrangements: Directors have agreed to nominate officers who will be responsible for developing and progressing the joint programme. This project will be initiated on 1 August 1972 and will be reviewed on 30 June of each year by each Director for continuation or revision of the project outline. It is expected that the project will be completed by July 1975. The manpower, funding and equipment necessary to conduct the complementary research will be provided by each organisation. Exchange visits by personnel are essential and will be encouraged.

LIAISON OFFICERS NOMINATED BY DIRECTORS:

Mr C J D Webster
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Dr J E Snell
(Center for Building Technology)

.....J B Dick.....

DIRECTOR

BUILDING RESEARCH ESTABLISHMENT

Dated...27th July 1972.....

.....James R. Wright.....

DIRECTOR

CENTER FOR BUILDING TECHNOLOGY

Dated ...August 3, 1972

BUILDING RESEARCH ESTABLISHMENT (DOE/UK)
AND CENTER FOR BUILDING TECHNOLOGY (NBS/USA)
JOINT COMPLEMENTARY RESEARCH PROGRAM(ME)*

Project title: Fire Detection in Buildings

Project outline: The development of criteria and test methods for establishing the level of performance of fire detectors is required for various types of building. Each year lives are lost and there is much property damage because of the lack of good fire detection systems in buildings. Both laboratories have worked in this area and have some common research objectives.

The work at CBT has been particularly concerned with detectors for use in the home. This CBT work is directed to detecting smoke and products of combustion from fires at a lower level of intensity than would be required for industrial systems.

The BRE has been concerned with defining how sensitive a detector system must be in order to do its job, and also how insensitive it must be to prevent too many false alarms occurring. As part of the programme BRE is embarking on a substantial long term programme of measuring relevant ambient conditions in buildings in the absence of fire in order to obtain systematic information on the conditions which give rise to false alarms. This requires the development of special sensing and data logging equipment.

Co-operation between laboratories will be achieved by close communication specifically on the CBT work on detectors for domestic use and the BRE work on the monitoring of ambient conditions since both countries have a deep interest in both programmes.

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* Initiated in response to the Memorandum of Understanding between Mr George Romney, Secretary, US Department of Housing and Urban Development and Mr Peter Walker, Secretary of State, UK Department of the Environment dated July 1971.

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LIAISON OFFICERS NOMINATED BY DIRECTORS:

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Mr Irwin Benjamin
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.....G B Dick.....

DIRECTOR

BUILDING RESEARCH
ESTABLISHMENT

Dated....1st September 1972...

.....James R. Wright.....

DIRECTOR

CENTER FOR BUILDING
TECHNOLOGY

Dated. SEPTEMBER 13, 1972

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15. SUPPLEMENTARY NOTES

16. ABSTRACT *(A 200-word or less factual summary of most significant information. If document includes a significant bibliography or literature survey, mention it here.)*

This is a status report of the progress achieved under the "Joint Complementary Research Program" sponsored by the Building Research Establishment (UK) and the Center for Building Technology (US), during the period July 1972 through June 1973. The program includes three projects: Wind Loads on Buildings, Design of Water Supply and Drainage Installations in Buildings, and Fire Detection in Buildings, each of which is discussed in the report.

17. KEY WORDS *(six to twelve entries; alphabetical order; capitalize only the first letter of the first key word unless a proper name; separated by semicolons)*

Cooperative programs; fire safety; hydraulics; international building technology; wind loads

18. AVAILABILITY

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