Second survey of current structural research abstract, April 1969, to be published in ASCE journal

Beedle, L. S.
1969

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SURVEY OF CURRENT STRUCTURAL RESEARCH

By
Survey Committee
and
Research Committee of ASCE Structural Division

February 1969

Fritz Engineering Laboratory Report No. 312.12
SYNOPSIS

This report of the second survey of current structural research describes more than 1700 subjects in 28 countries and in 11 categories of particular interest to structural engineers. Results to date show a substantial increase in the number of projects reported in comparison with the 1965 survey. This report purports to present the responses received with a brief discussion, tables for comparison, and subject, author, and institutional indexes.
INTRODUCTION

This survey of current structural research is the second one which has been undertaken by the Research Committee of the ASCE Structural Division. The first survey was initiated by the Division in November, 1963. Completed and reported in 1965, the first survey listed 789 current projects in 15 countries throughout the world. It was published in the Journal of the Structural Division (February, 1965).

This second survey was commenced in January, 1968. As in the first instance, a survey committee was again set up at Lehigh University to carry out the program. The principal purposes remain the same: to assist the American Society of Civil Engineers and its committees with structural orientation in planning future research and to establish contact with investigators. It also provides individuals working on the same topic an opportunity to exchange information and ideas with one another, and facilitates similar contacts between industry and government. In addition it has the potential of providing a major step in reducing the time lags that may take place between the conduct of research and its actual application to practice. Finally, the results of the survey inform the members of ASCE about current investigations being undertaken, and helps to avoid unnecessary duplication of research endeavors.

The purpose of this report is to present the responses received with a brief discussion. The titles and abstracts are included as the major portion of the report. Copies of the completed questionnaires are being furnished to the appropriate task committees of the Structural Division as requested.
CONDUCT OF THE SURVEY

Questionnaires were printed in the Structural Division Newsletter (January, 1968 issue), and additional questionnaires were distributed by the Executive Secretary of ASCE and Fritz Engineering Laboratory, Lehigh University. Other major sources of information were the Science Information Exchange, the European Convention of Constructional Steelwork Associations, and the American Concrete Institute.

The survey does not purport to be a complete summary of structural research in progress, since reliance was placed on the questionnaires and submitted reports. Anticipating that there will be omissions, the Survey Committee suggests that additional topics be reported through the submission of discussions of this report.

Difficulties were encountered in assigning some particular projects to their appropriate category number; thus the Survey Committee made some reassignments, recognizing that complete accuracy still has not been achieved. A fairly complete index has been prepared, and this should help lead the user to the appropriate topic. Only a few topics were excluded because the subject matter did not fall within the scope of the Structural Division's activity.
ORGANIZATION AND ARRANGEMENT OF MATERIAL

The general arrangement of the material in the survey primarily is according to the administrative and task committees of the ASCE Structural Division. In addition a few interest categories were included where no appropriate committee has been established. The complete list of these categories is given in Table 1. The task committees (or subtopics) are listed beneath the appropriate administrative grouping as subcategories. Number designations have been given to each category to facilitate locating the projects through indexes provided.

The sequence for listing data for the research is as follows. The individual research projects are listed under the appropriate task committee. The first item of each individual project is its title. The second item begins with the institution where the investigation is being performed, followed by the principal investigators listed in parenthesis. Next comes the sponsor designation (the word "same" has been used in the last item to indicate that the sponsor and the institution where the work is performed are the same). The abstract for each project is the final item in the project description. The description of the project is the same as has been furnished by each investigator except for minor editing.

The arrangement of the material within a particular category or subcategory is alphabetical according to the institution. If several projects are listed for the same institution within a particular subcategory, then they are arranged alphabetically according to the last name of the first investigator. If the same investigator is involved in more than one project, the material is then arranged alphabetically according to the title of the project.
A total of 1733 projects are reported in this survey, from which 1331 projects are almost evenly divided between three administrative committees ("Analysis and Design" with 430, "Masonry and Reinforced Concrete" with 441, and "Metals" with 460). Table 1 contains the number of projects listed for each committee. The total is more than twice that contained in the first survey.

The large number of projects listed under subcategory 1.4, "Methods of Analysis", indicates the possibility of regrouping some of this material. Similarly, the large number of projects listed under "Other Topics" (for example 4.21) suggests the need for further attention to the scope of the task committees. Few projects are classified under category 3, "Electronic Computation". Instead the material is listed under appropriate task committees.

Table 2 lists the 28 participating countries and the number of replies received from each country. After the United States, the largest number of projects listed are from Japan, followed by England, Canada, Australia, and India. There is nearly a two-fold increase in the number of countries participating.

Table 3 summarizes the number of different organizations falling under a specific sponsor classification and the number of projects supported by these organizations. Here only the replies that have specified their sponsors are included. The largest number of projects sponsored belongs to the categories "Federal, Non-Defense" in the U.S. and "Research Councils" abroad.
Table 4 lists the institutions at which the research is being performed and the corresponding number of research projects coming under each main category. Almost 70% of the included research projects are being conducted at universities both in the United States and abroad.

Table 5 gives a breakdown of the number of projects having financial support within a specified range for each main category (40% were unspecified). The largest total is in the $1000-$10,000 range, and there are 138 projects reporting budgets of over $50,000. Less than 10% report no support whatever (this probably means support by the institution reporting).

It was the original intent to list only those projects that were being supported with active financing. But, since some of the questionnaires were returned without this information, most of them were included in the survey with the designation "none listed".

Three indexes are included: one according to institution, a second according to subject, and the last index according to investigator.

The Survey Committee recognizes the fact that there are other current structural research projects not reported here. Each investigator is urged to submit information on additional projects. The Research Committee will try to eventually publish these if the format follows that of the questionnaire form used in this survey. These additions to the survey are needed to make it complete, and the committee earnestly solicits them.
ACKNOWLEDGEMENTS

This survey was conducted at the Fritz Engineering Laboratory, Lehigh University, through the Research Committee of the ASCE Structural Division. The Survey Committee gratefully acknowledges the interest and financial sponsorship provided by the Office of Science Information Service, National Science Foundation. The Science Information Exchange was particularly helpful in supplying data on a number of the projects. Appreciation is extended to all those who contributed to the survey by submitting completed questionnaires.

Thanks are also extended to Mrs. Flo Ann Gera for assisting with the organization of the replies and for typing the manuscript, and Mr. Donald Taylor, Research Manager of ASCE, for coordinating the mailing and receipt of the questionnaires.

Survey Committee
L. S. Beedle, Chairman
J. A. Corrado
S. Parsanejad
R. J. Poletto
R. J. Smith
W. W. Sanders (Iowa State University)
A. L. Lazano

Research Committee
W. A. Shaw, Chairman
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J. J. Byrne
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L. N. FitzSimons
W. E. Fluhr
J. Penzien
R. C. Reese
J. L. Rumpf
C. P. Siess
G. M. Sturman
W. H. Walker

Note: ASCE Manual __ contains the main body of the survey briefly described above.
### TABLE 1: ASCE STRUCTURAL DIVISION: COMMITTEES AND INTEREST CATEGORIES

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<th>1. ANALYSIS &amp; DESIGN OF STRUCTURES</th>
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<td>1.3 Methods of Analysis</td>
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<td>1.6 Esthetics in Design</td>
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<td>1.8 Models</td>
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<td>1.9 Behavior &amp; Design of Structural Systems</td>
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<td>2.3 Blast Forces</td>
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<td>1. Air Blast (incl. sonic boom)</td>
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<tr>
<td>2. Ground Shock</td>
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<tr>
<td>2.4 Others</td>
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| 3. ELECTRONIC COMPUTATION                | 28  |

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<th>4. MASONRY &amp; REINFORCED CONCRETE</th>
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<td>4.5 Limit Design</td>
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<td>4.6 Precast Structural Concrete Design</td>
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<td>and Construction</td>
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<td>4.8 Reinforced Concrete Columns</td>
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<td>4.9 Reinforced Masonry Design and Practice</td>
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<td>4.10 Shear &amp; Diagonal Tension</td>
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<td>4.11 Lateral Load Distribution</td>
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<td>4.12 Corrosion</td>
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<td>4.13 Creep</td>
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<td>4.15 Concreting Materials</td>
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<td>4.16 Reinforcing Materials &amp; Methods</td>
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<td>4.17 Deflection Predictions</td>
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<td>4.20 Bond &amp; Anchorage Reinforcement</td>
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<th>5. METALS (continued)</th>
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<td>1. Bolted Joints</td>
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<td>3. Welded Joints</td>
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<td>4. Bonded Joints</td>
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<td>5.9 Structural Fatigue</td>
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<td>1. Fatigue Analysis &amp; Theories</td>
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<td>2. Fatigue of Members &amp; Details</td>
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<td>3. Loading History &amp; Cumulative Damage</td>
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<td>4. Design</td>
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<td>5.11 Special Structures</td>
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<td>5.12 Fracture</td>
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<td>5.13 Fabrication Techniques</td>
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<td>5.14 Corrosion</td>
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<th>6. NUCLEAR STRUCTURES &amp; MATERIALS</th>
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<tbody>
<tr>
<td>6.1 Shielding</td>
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<td>6.2 Containment Vessels</td>
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<tr>
<td>7.1 Design Criteria for Adhesives &amp; Connections</td>
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<td>7.3 Properties of Selected Structural Plastics &amp; Systems</td>
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<td>7.4 Structural Applications</td>
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<th>8. WOOD</th>
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<td>8.1 Composite Construction</td>
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<tr>
<td>8.2 Laminated Elements</td>
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<td>8.6 Buckling and Stability</td>
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<td>8.7 Fire Retardant Treatment</td>
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<td>8.9 Others</td>
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<th>9. RESPONSE OF FULL SCALE STRUCTURES</th>
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<tr>
<td>9.1 In-Service Performance</td>
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<td>9.2 Controlled Load &amp; Destruction Tests</td>
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<th>11. STRUCTURES IN OTHER ENVIRONMENTS</th>
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<tr>
<td>11.1 Outer Space</td>
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<td>11.3 Buried Structures</td>
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| 12. OTHERS (Please Specify)              | 43  |

| TOTAL                                    | 1733|
### TABLE 2: PARTICIPATING COUNTRIES

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<th>Country</th>
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<th>Country</th>
<th>Count</th>
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<td>Norway</td>
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<td>Canada</td>
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<td>Switzerland</td>
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<td>Venezuela</td>
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<td>Yugoslavia</td>
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<td>855</td>
<td>147</td>
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### TABLE 4: INSTITUTIONS WHERE RESEARCH IS BEING PERFORMED

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<tr>
<th>Categories</th>
<th>Analysis &amp; Design of Structures</th>
<th>Dynamic Forces</th>
<th>Electronic Computation</th>
<th>Masonry &amp; Reinforced Concrete</th>
<th>Metals</th>
<th>Nuclear Structures &amp; Materials</th>
<th>Plastics</th>
<th>Wood</th>
<th>Response of Full Scale Structures</th>
<th>Other Structural Materials</th>
<th>Structures in Other Environments</th>
<th>Others</th>
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<td>Other Universities</td>
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¹Research councils, institutions, associations, and private foundations.
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