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LEHIGH UNIVERSITY  
DEPARTMENT OF CIVIL ENGINEERING  
FRITZ ENGINEERING LABORATORY  
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File 205

17 January 1952

Mr. William Spraragen  
Director  
Welding Research Council  
29 W. 39th Street  
New York 18, New York

Re: ONR Status Report  
No. 6  
NR 064-345

QUARTERLY REPORT  
10/1/51-12/31/51

Dear Mr. Spraragen:

Attached is our quarterly report including a financial statement submitted by request of the Welding Research Council.

Sincerely yours,

Lynn S. Beedle  
Assistant to the Director

LSB:jb

cc: T. R. Higgins  
LaMotte Grover  
Members, Lehigh Project Subcommittee, WRC  
Paul Kratz  
ONR Scientific Section (N.Y.)  
J. F. Baker  
Armed Forces Special Weapons Project  
CRC Research Committee, A and D

Enclosure

LEHIGH PROJECT: WELDED CONTINUOUS FRAMES  
AND THEIR COMPONENTS

Quarterly Report

1 October 1951 to 31 December 1951

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GENERAL

1. Meetings Attended.

On October 4th a meeting of the special committee on the Beam Column Connection Study was held at Lehigh University attended by Mr. F. H. Dill (Chairman), Mr. Carl Kreidler, Professor C. D. Jensen, and the writer. Agreement was reached on the desired objectives of the program and a second meeting was decided upon to discuss a revised version of the proposal to be submitted to the Welding Research Council.

During the week of October 15th, two papers were presented at the Annual Meeting of the American Welding Society, Detroit, one by Mr. Robert L. Ketter and one by Dr. C. H. Yang (see following reports).

On October 17th, the meeting of the University Research Committee was attended and a short five-minute talk presented before the group on the work of the project.

On November 29th, a meeting was held with Dr. Bruce Johnston at the time of the SESA convention in Philadelphia. Various phases of the project were discussed.

2. Reports Prepared.

A translation of a portion of a 1927 paper by Maier-Leibnitz, "Contributions to the Problem of Ultimate Carrying Capacity of Simple and Continuous Beams of Structural Steel and Timber" was prepared by Dr. Knud E. Knudsen. Copies were distributed to Members of the Lehigh Project Subcommittee and are available upon request.

3. Project Reports.

Work accomplished on the various phases of the program is presented in the reports which follow.

Lynn S. Beedle  
Project Director

COLUMNS

1. Tests Completed: - One test (T-19) on an 8WF31, 8 ft. long column was completed during this period.

This test is part of a series whose objective is to experimentally investigate the effect of slenderness ratio on a member bent in single curvature [C] for a "load" ratio of  $P/P_y$ . In each of the tests an axial load of approximately  $0.12 P_y$  was first applied to the member, then end bending moment was added until collapse occurred. Experimentally determined results are compared with the predicted initial yield moment in the following table:

Test No.	L/r	1st Yield Line	Yield Strength	Collapse
		$M/M_y$	$M/M_y$	$M/M_y$
T-12	55.22	0.49	0.92	1.00
T-16	41.25	0.63	0.88	0.97
T-19	27.61	0.74	0.90	1.01

The above table shows that these columns have no reserve strength beyond the predicted yield moment,  $M_y$ . Since there is a reserve strength of from 50 to 100% beyond the moment at which yield lines are first observed, it is inferred that the influence of residual stress is quite pronounced.

2. Further Work:-

- (a) Size of member will be the principal variable studied in the next two tests. The conditions of testing will be identical to earlier tests T-3 and T-12 except that a 4WF13 section will be used instead of an 8WF31.
- (b) Proposal: On December 14, 1951 members of the Lehigh Project Subcommittee of the Welding Research Council were sent a detailed proposal for further tests. Copies were sent to Column Research Council Committee D. Replies to date have all indicated approval.

3. Reports:- Progress Report No. 6, "Column Strength Under Combined Bending and Thrust" by Robert L. Ketter, Lynn S. Beedle and Bruce G. Johnston, was presented in October at the annual meeting of the American Welding Society in Detroit. The final draft of the paper has been prepared and will soon be submitted to the Welding Journal for publication.

Robert L. Ketter  
Research Assistant

CONTINUOUS BEAMS

1. On October 15th, at the meeting of the American Welding Society the paper "Residual Stress and the Yield Strength of Steel Beams" was presented by Dr. Yang. In November, the manuscript was submitted to the Editor of the Welding Journal for publication, which is now expected in the February or March issue of the Research Supplement.

Lynn S. Beedle

CONNECTIONS

1. Work on Part III of the paper, "Connections for Welded Continuous Portal Frames" (Beedle, Topractsoglou, and Johnston) was continued.

Lynn S. Beedle

PORTAL FRAMES

A report on the testing equipment and procedure, "Welded Portal Frames Tested to Collapse", has been prepared for presentation at the SESA Spring Convention and publication in the Proceedings. Editing of the report is under way after which it will be submitted to members of the Lehigh Project Subcommittee for review.

No tests have been performed during the quarter. One portal frame test remains on the approved program.

During the last quarter of 1951 the analysis of the data provided by the two frame tests conducted earlier in the year was continued. No additional experimental work was undertaken relative to the portal frame study.

A major portion of the test data has been plotted; and satisfactory agreement with theoretical results has been obtained for most items. Satisfactory agreement in the elastic range has been noted with regard to over all frame behavior as indicated by the center time deflection curve.

The several rotation indicators which were used in the tests have proved satisfactory and have provided an expedient means of obtaining the  $M-\theta$  curves.

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It is expected that a preliminary report of these tests will be submitted during the first quarter of 1952.

E. Russell Johnston  
Assistant Professor of  
Civil Engineering

K. E. Knudsen  
Assistant Professor of  
Civil Engineering

#### INELASTIC INSTABILITY

1. Work on the first technical report has continued during the quarter. Numerous trips to Bethlehem have been made to discuss the project and to carry on further studies.
2. The Office of Naval Research Mechanics Branch has approved the program and the contract is being prepared.

Harry Yang

#### RESIDUAL STRESSES IN COLUMNS

1. No further tests were performed during the period. A Proposed Pilot Investigation was submitted to the Column Research Council (October 22, 1951) and is now in the hands of Research Committee A. The Proposal has also been submitted to the Pennsylvania State Highway Department for partial financial support.

2. Further analytical study of the residual stress problem was made and a general proposal developed. (This was submitted to Column Research Council on January 8, 1952).

Lynn S. Beedle

STRESS -STRAIN PROPERTIES

A report setting forth the present status of the project is partially written. The report will contain the data evaluated to date and an estimate of the additional material available.

Dale R. Young  
Instructor

FINANCIAL STATEMENT

Deficit, 30 September 1951		\$5223.25	
Income - U.S. Navy	\$7516.31		
WRC	<u>2550.00</u>	<u>10066.31</u>	
			\$4843.06

EXPENDITURES:

Salaries and Wages	\$2382.59
Overhead	710.56
Expenses and Equipment	<u>665.60</u>

TOTAL EXPENSES	<u>3758.75</u>
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Balance, 31 December 1951	\$1084.31
Amount due on Navy contract	1574.61