1960

Investigation of composite design for buildings summary report, February 1960

Charles Culver

Project 279

Investigation of Composite Design For Buildings

Summary Report

Report Prepared by Charles Culver

Fritz Engineering Laboratory
Department of Civil Engineering
Lehigh University
Bethlehem, Pennsylvania

Fritz Laboratory Report No. 279.8
February 1960

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1. Introduction

A proposal for a research program on composite beams for buildings was prepared by Dr. Bruno Thurlimann and submitted to the American Institute of Steel Construction on April 9, 1959. The research outlined in this proposal stemmed from several composite beam tests conducted by two senior Civil Engineering students at Lehigh University in the Fall of 1958 and supervised by Dr. Bruno Thurlimann.

The research proposed was to cover a period of two years with the main objective being to develop the best method of design for composite beams for buildings and to establish design values for the component parts of such composite beams.

The above mentioned research proposal was accepted by AISC and work on project 279, as it was to be called, began in June 1959. The initial stage of this project consisted of a literature survey of the material available on the subject and preparation of a proposal for a series of beam tests and pushout tests.

On November 4, 1959 a committee meeting was held at AISC Headquarters in New York and the test proposal approved. After partial completion of these tests a preliminary report was prepared and a committee meeting held on February 1, 1960 to discuss the results. In view of some of the test results further tests were proposed by the committee and it was agreed to incorporate these additional tests in the second series of tests.

Project supervision was transferred from Prof. Bruno Thurlimann to Prof. George C. Driscoll in March 1960 due to Professor Thurlimann's transfer from Lehigh University to the Swiss Federal Institute of Technology in Zurich, Switzerland.

The first series of tests was completed and a test report, Progress Report 1, submitted to the committee. The third committee meeting was held at Lehigh University on June 30, 1960. At this time, Progress Report 1 was discussed and a proposal for a second series of tests approved.

Upon completion of the second series of tests, Progress Report 2 was prepared. With the completion of these tests information was available covering all the problems initially put forth to be investigated in the initial proposal for this research program.

This summary report will cover all the material from the four beam tests up to and including Progress Report 2.

2. Summary of Pertinent Dates

1.	Testing of Four Ten Foot Composite Beam Specimens -	2/11/59 - 3/14/59
2.	Test Report "Culver, C., Coston, R., " Tests of Composite Beams with Stud Shear Connectors," Fritz Lab Report No. 354.1.	April 1959
3.	Proposal for Research Grant to AISC	4/9/59
4.	Commencing of Project Work	June 1959
5.	Project Committee Meeting No. 1 Submission of Proposal for First Series of Tests (B1-B6, P1-P6)	11/4/59
6.	Beginning of Testing on First Series of Tests .	1/6/60
7.	Project Committee Meeting No. 2	2/1/60
8.	Completion of Testing on First Series of Tests	April 1960
9.	Test Report "Culver, C., Zarzeczny, P., Driscoll, G. C., "Tests of Composite Beams for Buildings", Fritz Lab Report No. 279.2	June 1960
10.	Testing of Second Series of Tests	6/3/60 - 6/20/60
11.	Project Committee Meeting No. 3	June 1960
12.	Testing of Third Series of Tests	
13.	Test Report Culver, C., Zarzeczny, P., Driscoll, G. C., "Tests of Composite Beams for Buildings", Fritz Lab Report No. 279.6	Feb. 1960
14.	Summary Report	Feb. 1960

3. List of Specimens Tested

Beam Specimens (354)

Beam 1	Provided with 1/2-in. diameter L-studs
Beam 2	Provided with 1/2-in. diameter L-studs
Beam 3	Provided with 1/2-in. diameter L-studs
Beam 4	Provided with 1/2-in. diameter L-studs (Fatigue Loading)

3. List of Specimens Tested (cont.)

Beam Specimens (279)

Beam B1	No mechanical shear connection, Tie Rods provided to prevent bond breakage prior to testing, Hanging loads
Beam B2	No mechanical shear connection, Tie Rods provided to prevent bond breakage prior to testing, Top loading
Beam B3	Provided with 1/2-in. diameter L-studs, Top loading
Beam B4	Provided with 1/2-in. diameter L-studs, Hanging loads
Beam B5	Provided with channel sections as shear connectors
Beam B6	Under reinforced shear connection, using 1/2-in. diameter L-studs
Beam B7	One-half-inch diameter L-studs used as mechanical shear connection
Beam B8	Shear connection provided in the form of 1/2-in. diameter headed studs
Beam B9	Three-quarter-inch diameter headed studs used for shear connection
Beam B10	Constant spacing of 1/2-in. L-studs used on a beam specimen subjected to loads producing a variable shear diagram
Beam B11	Constant spacing of 1/2-in. L-studs used on a beam specimen subjected to loads producing a variable shear diagram
Beam B12	Variable spacing of 1/2-in. L-studs used on a beam specimen subjected to loads producing a variable shear diagram
Beam B13	Thirty-foot continuous beam specimen with 1/2-in. L-studs

3. List of Specimens Tested (cont.)

Pushout Specimens (279)

P1	One-half-inch L-studs
P2	Channel shear connectors
P3	Three-quarter-inch headed studs
P4	One-half-inch L-studs
P5	One-half-inch headed studs
P6	One-half-inch headed studs
P7	One-half-inch L-studs
P8	One-half-inch headed studs
P9	Three-quarter-inch headed studs

4. List of Reports and Publications

1. Culver, C; Coston, R. "Tests of Composite Beams with Stud Shear Connectors", Fritz Laboratory Report 354.1 (Submitted to ASCE for publication in The Structural Journal) Apr. 1960

2. Proposal for First Series of Tests Nov. 1959

3. Preliminary Test Report on First Series of Tests (B1 - B6) Feb. 1960

4. Progress Report No. 1 (279.2) June 1960

5. Preliminary Test Report on Second Series of Tests (B7 - B9) (279.4) June 1960

6. Proposal for Third Series of Tests (279.5) June 1960

7. The Moment Curvature Relations For Composite Beams (279.7) Dec. 1960

8. Progress Report No. 2 (279.6) Jan. 1961

9. Summary Report (279.8) Feb. 1961

10. "Research on Composite Design at Lehigh University." George C. Driscoll, Jr. & Roger G. Slutter. Published: American Institute of Steel Construction. National Engineering Conference - 1961 Proceedings. (279.9) April 1961

11. Progress Report No. 3 (279.10) Nov. 1961

12. "Plastic Design of Steel and Concrete Composite Beams." Roger G. Slutter& George C. Driscoll, Jr. (279.11) Oct. 1961

13. "Ultimate Strength of Composite Members" Roger G. Slutter and George C. Driscoll, Jr. (279.12) March, 1962

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5. List of Test Data - X-File

Accopress Binders

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   - D. Final Beam Calculations
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3. Project Reports
   - A. Culver, C; Coston, R. "Tests of Composite Beams with Stud Shear Connectors" Fritz Laboratory Report 354.1
   - B. Initial Proposal
   - C. Proposal for First Series of Tests (279.1)
   - D. Preliminary Report on First Series of Tests
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Investigation of Composite Design for Buildings (279)

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Project 279

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2A*	Formwork for beam specimens	
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Number only - denotes both slide and photograph
* - denotes photograph only
** - denotes slide only
() - denotes Fritz Laboratory Number

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Number only - denotes both slide and photograph
* - denotes photograph only
** - denotes slide only

8. List of Slides and Photographs (contd.)

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$3\frac{1}{4}$"x4" Glass Slides

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9. List of Special Equipment

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   A. None

2. Beam Tests (279)

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   B. Special Loading Beam Fabricated to Test Specimens B7 - B9, Using the Five-Million-Pound Testing Machine as a Test Frame

3. Pushout Tests (279)

   A. Plywood Forms Used in Construction of Pushout Specimens

10. Budget and Expenditures

Expenditures 1 June, 1959 - 30 March, 1960 (Acct. 1051-45)

Wages and Salaries	$ 6,177.83
Overhead	2,059.27
Expenses	2,493.73
Total	$10,730.83

Expenditures 1 April, 1960 - 30 April, 1960

Wages and Salaries	$ 675.95
Overhead	225.30
Expenses	153.31
Total	$ 1,054.56

Expenditures 1 May, 1960 - 30 May, 1960

Wages and Salaries	$ 479.45
Overhead	159.81
Expenses	222.38
Total	$ 8 861.64

Expenditures 1 July 1960 - 31 August, 1960

Wages and Salaries	$ 2,532.10
Overhead	844.04
Expenses	542.78
Total	$ 3,918.92

Expenditures 1 September, 1960 - 30 September, 1960

Wages and Salaries	$ 631.48
Overhead	210.47
Expenses	528.83
Total	$ 1,370.78

Expenditures 1 October, 1960 - 31 October, 1960

Wages and Salaries	$ 1,653.54
Overhead	551.13
Expenses	96.33
Total	$ 2,301.00

11. List of Personnel

Project Directors

Bruno Thürlimann
June 1, 1959 - February 28, 1960

George C. Driscoll, Jr. March 1, 1960 - to date

Research Workers

Charles Culver

Paul Zarzeczny