Project 279

Investigation of Composite Design
For
Buildings

Summary Report

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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**


2. Test Report

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 (Bl-B6, Fl-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


11. Project Committee Meeting No. 3 .... June 1960

12. Testing of Third Series of Tests

13. Test Report

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

2. Proposal for First Series of Tests Nov. 1959


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


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)

5. **List of Test Data - X-File**

**Accopress Binders**

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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
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170** Dimensions of test specimens
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172** Load deflection curve B3-T1
173** Load slip curves
174** Table of results
175** M/M_\text{y} comparison graph
176** Equilibrium of VQ/I at ultimate
177** AASHO design
178** The design of Composite Beams
179** The Design of Shear Connectors
180** Comparison of Test Data and Theoretical Values
181** Connector Types
8. List of Slides and Photographs (contd.)

Fig. 3 3/4"x4" Glass Slides

13** All pushout specimens, showing connectors
20** Pushout specimen in testing machine
33** Deformed connectors and concrete
50** B3 under load
58** Overall test set-up
94** Dimensions of beam specimens, first series of tests
95** Test set-up, top loading
96** Test set-up, hanging loads
97** M/My curve, first series of tests
98** M/My curve, first series of tests
99** M/My curve, first series of tests
100** Table of connector forces
101** Comparison of beam and pushout specimens
173** Load slip curves
174** Table of results
9. **List of Special Equipment**

1. Beam Tests (354)
   A. None

2. Beam Tests (279)
   A. Tie Bars Used to Produce Hanging Loads for Beams B1 and B4
   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)

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Expenditures 1 April, 1960 - 30 April, 1960

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Expenditures 1 May, 1960 - 30 May, 1960

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Expenditures 1 July, 1960 - 31 August, 1960

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Expenditures 1 September, 1960 - 30 September, 1960

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Expenditures 1 October, 1960 - 31 October, 1960

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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