

Precast Tile Beam Floor

BY HENRY GIESE AND CHARLES T. BRIDGMAN

AGRICULTURAL EXPERIMENT STATION
IOWA STATE COLLEGE OF AGRICULTURE
AND MECHANIC ARTS

AGRICULTURAL ENGINEERING SECTION



RESEARCH BULLETIN 286
MAY, 1941
AMES, IOWA

May, 1941

Research Bulletin 286

Precast Tile Beam Floor

By HENRY GIESE AND CHARLES T. BRIDGMAN

AGRICULTURAL EXPERIMENT STATION
IOWA STATE COLLEGE OF AGRICULTURE
AND MECHANIC ARTS

AGRICULTURAL ENGINEERING SECTION

AMES, IOWA

CONTENTS

	Page
Summary and conclusions	200
Introduction	201
Development of reinforced masonry	201
Ideals for floor construction.....	203
The T beam floor	205
Beam test—first series (5)	206
Test methods	209
Live load—deflection performance of sections.....	210
Bending moment—steel stress performance of sections.....	210
Bending moment—tile and mortar strain	213
Unit stresses developed in the sections.....	214
Beam tests—second series (27)	215
Constructing test sections	219
Testing floor sections	222
Live load—deflection relationship	225
Live load—concrete deformation relationship	230
Live load—steel deformation relationship	230
Testing for elasticity	238
Calculation of stresses	241
Demonstration floors	245
Des Moines, Iowa	245
Lincoln, Nebraska	246
Iowa City, Iowa	247
Lead, South Dakota	248
Typical installations	249
Public buildings	250
Residences and apartments.....	251
Hospitals and clinics	252
Commercial buildings	252
Warehouses and industrial buildings.....	253
Farm buildings	254
Design	254
Precast construction	254
Built-in-place construction	256
Using joist design tables	258
Specifications—materials and workmanship	259
Materials	259
Construction	263
Computing costs	265
Materials estimate	265
Labor estimate	266
Sample cost estimate	266
Construction details and methods	267
Block design	267
Building beams	268
Handling and placing beams	272
Shoring under long spans	275
Placing span and filler tile	276
Placing topping	276
Temperature steel	277
Continuous beams	277
Locating ducts and plumbing members	278
Stair wells and other openings	279
Insulation and suspended ceilings.....	279
Construction at exterior walls	280
Bibliography	281

BIBLIOGRAPHY

- (1) American Concrete Institute. Building regulations for reinforced concrete. (A. C. I. 501-36T). Amer. Concrete Institute. Detroit, Mich. 1936.
- (2) American Society for Testing Materials. Structural clay load bearing wall tile. C34-39. 1939.
- (3) American Society for Testing Materials. Structural clay load bearing wall tile. C39-39. 1939.
- (4) American Society for Testing Materials. Structural clay floor tile. C57-39. 1939.
- (5) American Society for Testing Materials. Standard methods of sampling and testing structural clay tile. C112-39. 1939.
- (6) Anon. Use reinforced face brick slabs to build model farm house. Brick and Clay Rec. 84:160-163. 1934.
- (7) Barre, Henry J. The design of the masonry arch barn roof. Unpublished thesis. Library, Iowa State College, Ames, Iowa.
- (8) Bemis, Albert Farwell. The evolving home. II The economics of shelter. The Technology Press, Cambridge, Mass. 1934.
- (9) Bridgman, C. T. Design and test for a new type reinforced tile floor. Unpublished thesis. Library, Iowa State College, Ames, Iowa. 1935.
- (10) Caughey, Robert A. Reinforced concrete. D. Van Nostrand Co. 1936.
- (11) Davidson, J. B. Modern silo construction. Iowa Agr. Exp. Sta., Bul. 141. 1913.
- (12) Filippi, Hugo. History of reinforced brickwork. Contract. Record, 47:60-62. 1935.
- (13) Filippi, Hugo. Reinforced brick masonry principles of design and construction. Brick Mfgr. Assoc. of Amer. Cleveland, Ohio. 1933.
- (14) Frederick, John H. Industrial marketing. Prentice-Hall, New York. 1934.
- (15) Giese, Henry. Prevention of wind and fire losses to farm buildings. Iowa Agr. Ext. Ser., Cir. 127. 1931.
- (16) Giese, Henry, Barre, H. J. and Davidson, J. B. Masonry barn design and construction. Iowa Agr. Exp. Sta., Research Bul. 207. 1936.
- (17) Giese, Henry and Bridgman, C. T. A low-cost floor of reinforced tile. Ag. Eng. 17:14-16. 1936.
- (18) Giese, Henry and Davidson, J. B. The design and construction of masonry water supply tanks. Iowa Agr. Exp. Sta., Bul. 302. 1933.
- (19) Hansen, J. H. Development in reinforced brick masonry. Proceedings of American Society of Civil Engineers. 59:407-427. 1933.
- (20) Heitman, A. H. The production structure of the ceramic industry in Iowa. Unpublished thesis. Library, Iowa State College, Ames, Iowa. 1933.
- (21) Kanamori, S. Reinforced brickwork opens greater possibilities. Brick and Clay Record, 77:96-100. 1930.

- (22) Krauss, E. E. and Vodgas, J. Results on ten demonstrations of reinforced brick structures. *Journal of American Ceramic Society*, 15:273-300. 1932.
- (23) Louis, L. R. and Brown, F. E. Loading tests on clay tile flat arch floor. *Journal Western Society Engineers*, 36:273-279. 1931.
- (24) MacCarty, T. G. Determining loading characteristics on reinforced brick. *Brick and Clay Record*, 80:148-150. 1933.
- (25) Miller, R. C. The battle for adequate farm buildings. *Amer. Soc. of Agr. Eng. Jour.*, 16:3. 1935.
- (26) Natl. Assoc. of Housing Officials. A housing program for the United States. *Natl. Assoc. of Housing Officials*. 3-4. Chicago. 1934.
- (27) Parsons, D. E., et al. Shear tests of reinforced brick masonry beams. *Journal of Research. U. S. Bureau of Standards*, 9:749-768. 1932.
- (28) Parson, D. E. and Stang, A. H. Tests of composite beams and slabs of hollow tile and concrete. *U. S. Dept. of Comm., Res. paper 181*. 1930.
- (29) Parsons, D. E. and Stang, A. H. Test of hollow tile and concrete slabs reinforced in one direction. *U. S. Dept of Comm., Technologic papers 291*. 1925.
- (30) Reid, Margaret G. Status of farm housing in Iowa. *Iowa Agr. Exp. Sta., Res. Bul. 174*. 1934.
- (31) Reid, Margaret G. Status of town and village housing in Iowa. *Iowa Agr. Exp. Sta., Res. Bul. 174*. 1935.
- (32) Sailer, Albert J. Tests and application of a new type reinforced tile floor. Unpublished thesis. Library, Iowa State College, Ames, Iowa. 1936.
- (33) Spangler, M. G. Strength and durability tests of mortar mix mortar. *Jour. Am. Cer. Society*. 16, 5.
- (34) Stav, Heinrich. Neues bauen auf dem lande. H. B. Hobner & Co., Altona, Rolandsburg, Germany, 1930.
- (35) U. S. Bureau of Home Economics. Farm housing survey. Preliminary State Tables. *U. S. Bur. Home Econ.* 1934.
- (36) Vaugh, Mason. Reinforced brickwork. *Missouri Univ. Engr. Exp. Sta., Columbia, Mo., v. 29, No. 37*. 1928.
- (37) Whittemore, J. W. and Dear, P. S. An investigation of the performance characteristic of reinforced brick masonry slabs. *Va. Polytechnic Institute Engr. Exp. Sta., 25:9*. 1932.
- (38) Wittausch, W. K. United States housing market. *Domestic Commerce*, 15:(6): 82-83. 1935.