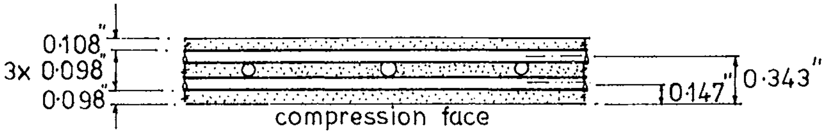
APPENDIX 1

PANEL CONSTRUCTION (continued)

PANELS 10, 11



	Steel Content lb/cu ft	Steel Cross Section percent	Specific Surface in^2/in^3
Panels 10 and 11			
12 1/2g wire - 3 layers	22	3.0	1.85
steel wire fibers	7	1.5	3.65
	29	4.5	5.50

3 layers of 12 1/2g (.098 in.) high tensile hand loomed to form straight wire mesh - yield stress 154,000 psi

Wire fibers 1/2 in. x .016 in. square section with enlarged ends.

APPENDIX 2

CALCULATED FLEXURAL STRENGTH OF PANEL 2

See Appendix 1 for panel dimensions and wire spacing.

Wire mesh properties

- 11 of 10g (0.128 in. diameter) wires per layer
- wire area = 0.0127 x 11 = 0.1397 in.^{2} per layer
- yield stress for straight wire = 54,700 psi
- proportional limit for woven wire = 31,100 psi
- woven wire yield load = 0.1397 x 31,100 = 4345 lb per layer

Wire fiber mortar

- post cracking tensile strength = 200 psi
- E compressive = 2.5 x 10^6 psi
- modular ratio = 12

APPENDIX 2

Yield Moment

Assume neutral axis is 0.045 in. from compression face.

T top layer = 4345 lb

T central layer = 4345 x (.56 - .405)/(.80 -.405) = 1705 lb

T mortar = 200 x 12 x (1.0 - .405) = 1428 lb

T = 7478 lb

Concrete compressive stress at face

$$= \frac{31,100}{12} \times \frac{0.405}{(.80 - .405)} = 2657 \text{ psi}$$

C mortar = 1/2 x 2657 x 12 x 0.405 = 6457 lb

C bottom layer = 4345 x (.405 - .31)/(.80 - .405) = 1045 lb

C = 7502 lb

Moment = 4345 x (.80 - .405) = 1716 lb in

+ 1705 x (.56 - .405) = 264

+ 1428 x (1.0 - .405)/2 = 425

+ 6457 x (.405) x 2/3 = 1743

+ 1045 x (.405 - .31) = 99

M = 4247 lb in

Compare with test moment = 4380 lb in

Calculated concrete strain = 2657 ÷ 2.5 x 10^6 = 1062 x 10^{-6}

Measured strain at yield load = 1100 x 10^{-6}

Ultimate Moment

Assume neutral axis is 0.188 in. from compression face

i.e. All steel in tension

T - 3 layers = 4345 x 3 = 13035 lb

T mortar = 200 x 12 x (1.0 - 0.188) = 1949

T = 14984 lb

C mortar = 0.85 x 12,000 x .65 x .188 x 12 = 14957 lb

APPENDIX 2

Moment =	4345 x (.80 - .188)	= 2659 lb in
	+ 4345 x (.56 - .188)	= 1616
	+ 4345 x (.31 - .188)	= 530
	+ 1949 x (1.0 - .188) x ½	= 797
	+14957 x (.188 x .675)	= 1898
		M = 7500 lb in
Compare with test moment		= 7752 lb in

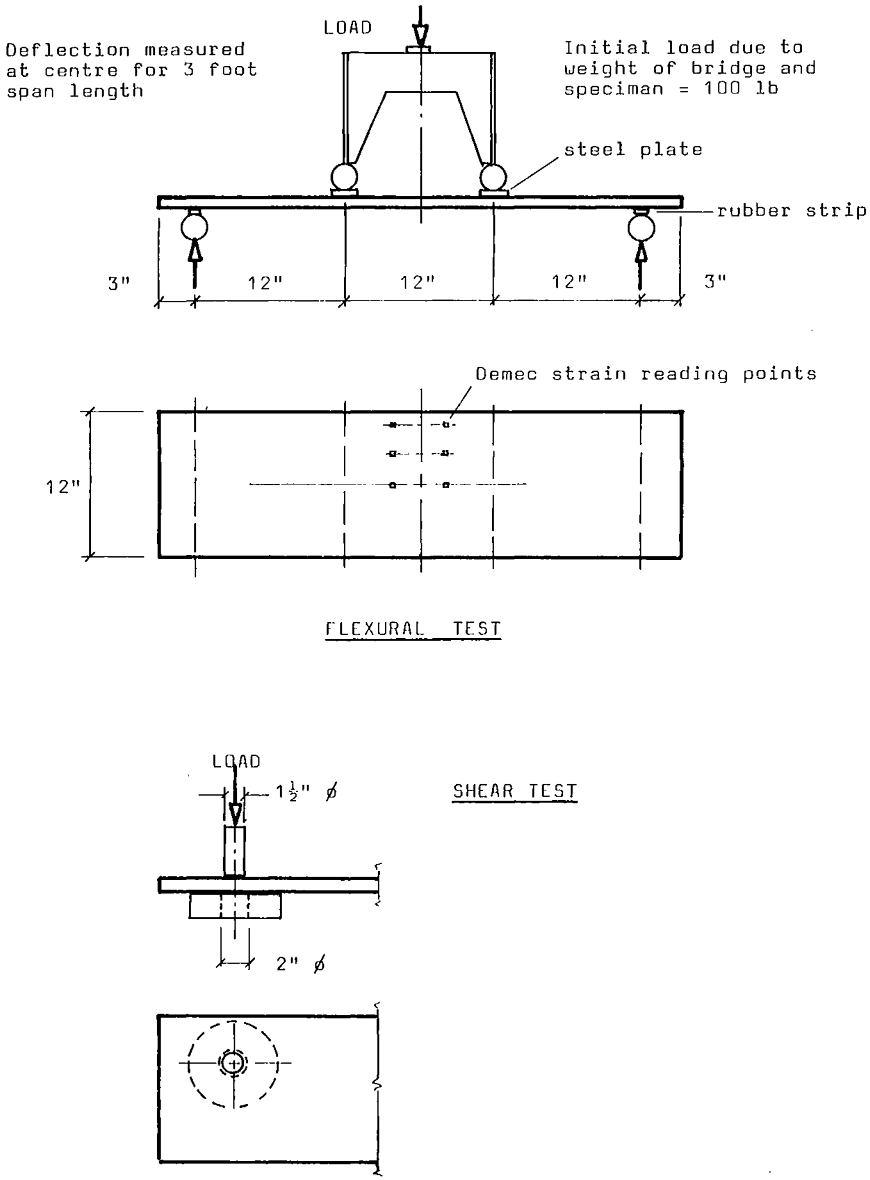


Fig. 1--Illustration of test apparatus for flexural and punching shear tests

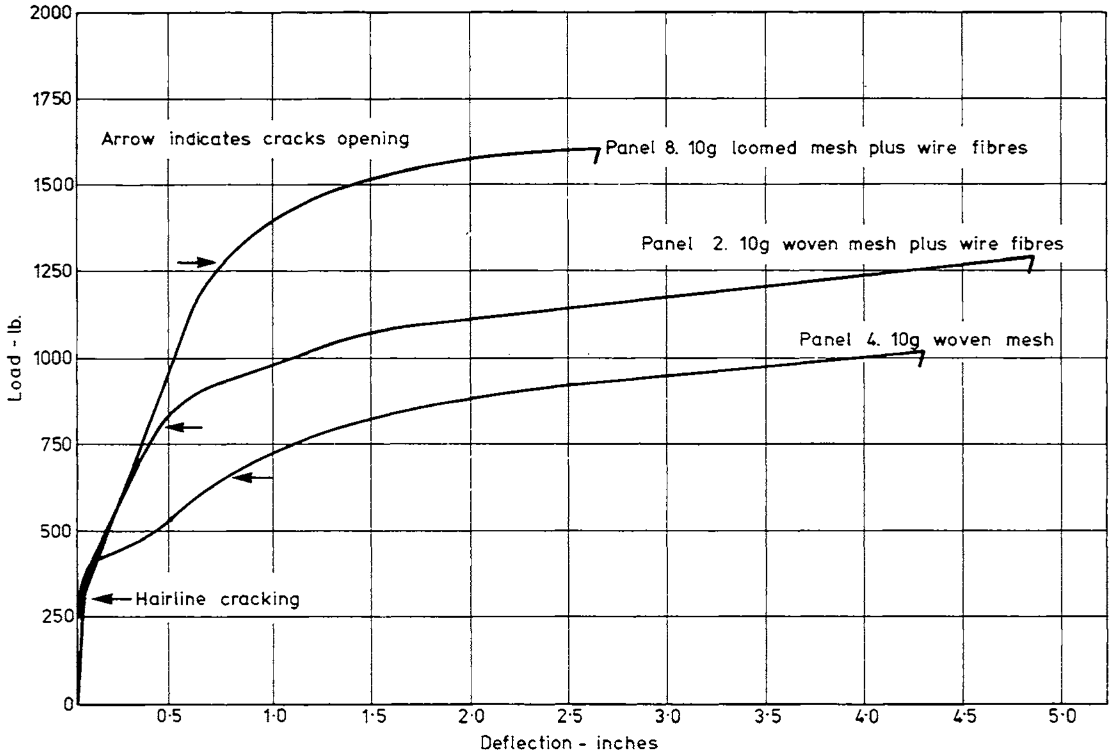


Fig. 2--Load deflection curves for 1 in. panels

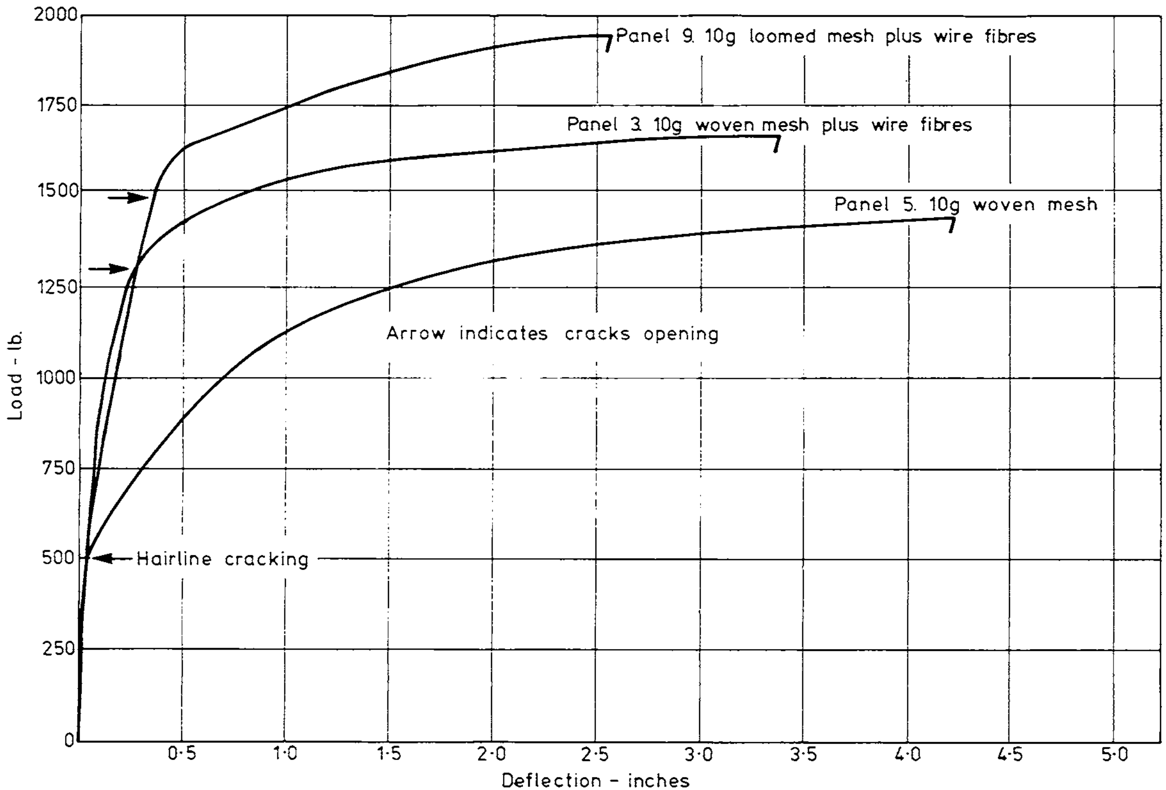


Fig. 3--Load deflection curves for 1-3/8 in. panels

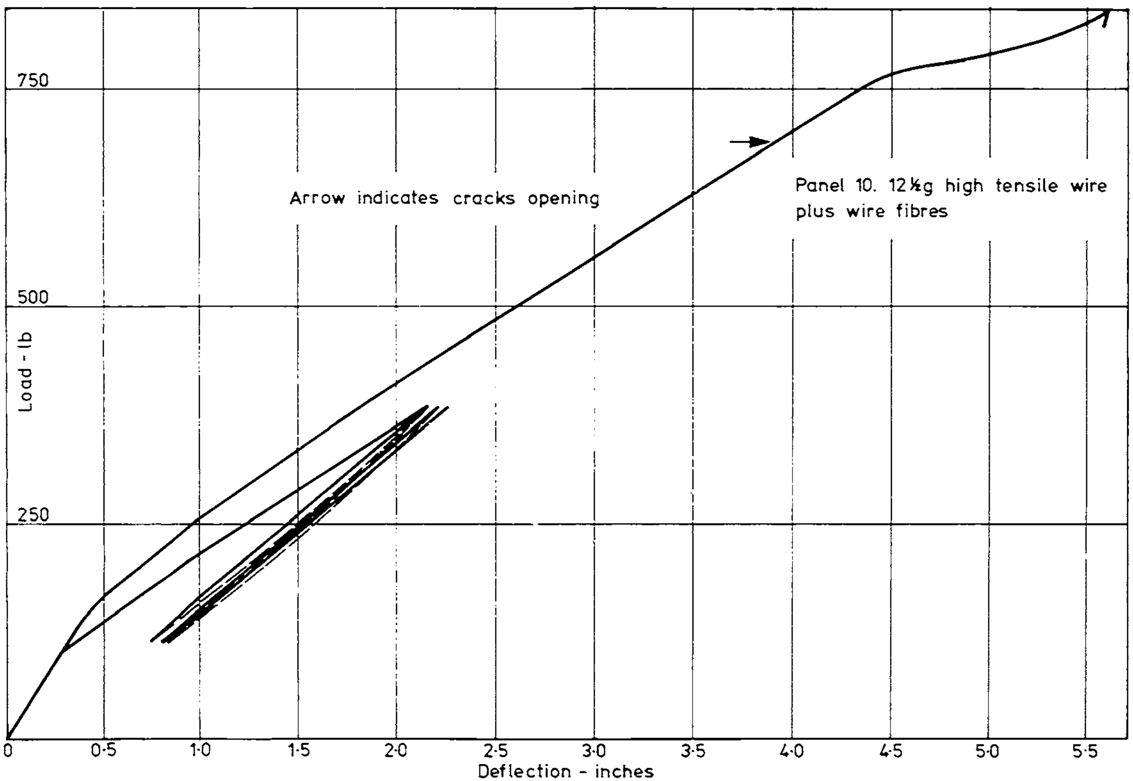


Fig. 4--Load deflection curves for 1/2 in. panels

Fig. 5--Ultimate deflection on 1 in. panels

SP 61-6

Tentative Recommendations for the Construction of Ferrocement Tanks

By S. P. Shah

Synopsis: Although some practical specifications are available for the construction of ferrocement boats, to the best of the author's knowledge no technical specifications for the construction of ferrocement structures have yet been published. Specifications are essential if the use of ferrocement is to become widely accepted and if the gap between the "try and see what happens" approach and advanced research results is to be reduced. Based on 1) tests at the University of Illinois at Chicago Circle of model pressurized ferrocement water tanks where cracking and leakage characteristics were studied, 2) the experience in ferrocement and knowledge of its mechanical behavior and 3) an extensive survey of ferrocement related literature where some forms of specifications or recommendations were found and analyzed, the author has developed tentative recommendations for the construction of ferrocement water tanks. Although these recommendations are written specifically for water tanks, they may be used either as a model for other types of ferrocement structures or as part of a more general and complete specification document on ferrocement.

Keywords: concrete construction; construction materials; ferrocement; quality control; shotcrete; specifications; structural design; tanks (containers); tests; water tanks; welded wire fabric; wire cloth.

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INTRODUCTION

Although some practical specifications are available for the construction of ferrocement boats, to the best of the author's knowledge no technical specifications for the construction of ferrocement structures have yet been published. Specifications are essential if the use of ferrocement is to become widely accepted and if the gap between the "try and see what happens" approach and advanced research results is to be reduced. Complete technical specifications should also reflect the type of structure to be built and its serviceability under working load conditions; the effect of uncertainty as to the material's behavior, which generally leads to overdesign, may be systematically avoided thus leading to substantial savings.

Based on 1) the tests at the University of Illinois at Chicago Circle of model pressurized ferrocement water tanks where cracking and leakage characteristics were studied (Ref. 1), 2) the experience in ferrocement and knowledge of its mechanical behavior (Refs. 2-6), and 3) an extensive survey of ferrocement related literature where some forms of specifications or recommendations were found and analyzed (Refs. 7-18), the author has developed tentative recommendations for the construction of ferrocement water tanks. These are divided into four major sections described as follows:

SECTION 1. MATERIALS

- 1.1 Cement
- 1.2 Fine Aggregates
- 1.3 Water
- 1.4 Admixtures
- 1.5 Mortar Mix Proportions
- 1.6 Paint Coating
- 1.7 Steel Reinforcement (mesh; welded fabric; rods, wires, strands)

SECTION 2. TESTING

- 2.1 Preliminary Tests
- 2.2 Quality Control and Delivery Tests