Uses of Cinder Concrete in Floor Construction 1880-1950

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ABSTRACT

As a cheap, local, abundant, and fire-resistant resource, burnt coals from industrial heating furnaces and steel production were a popular aggregate for concrete structures prior to the gradual standardization of stone-concrete rebar-reinforced flat slab floor systems over the first half of the 20th century. Lightweight and plentiful by comparison to high-density stone aggregates, cinders served as filler in mostly non-structural applications and as a fire-resistant encasement over steel framing. The growth and diversification of steel building products in the years between 1880 and World War II spawned an equally diverse set of responses to the challenges of framing floors between steel members. Designers and builders experimented with twisted wire mesh, expanded, and corrugated metal sheeting, cylindrical and arched tile units, steel rod reinforcement and precast cinder concrete elements. They also designed around city codes that stipulated fire-resistance performance standards following catastrophes such as the Great Chicago Fire of 1871, and the 1906 San Francisco earthquake and subsequent fire. While cinder concrete is inseparable from the notion of fire-protection in buildings during this period, builders used it because of its cheapness, lightness, and its ability to fill the gaps left by various systems spanning steel beams. Yet despite its immediate benefits, the defects associated with cinder concrete led to its eventual demise. Gathered as a second-hand material from a variety of industrial settings, cinder aggregates contain varying degrees of carbon and sulfur which decreased fire resistance and caused ferrous reinforcement to corrode.

Figure 1. Friedman, Donald. “The Metropolitan Floor: Modern Analysis of an Archaic Structure” APT Bulletin, The Journal of Preservation Technology, Association of Preservation Technology International. Vol. 38. No. 1 2007. p. 4

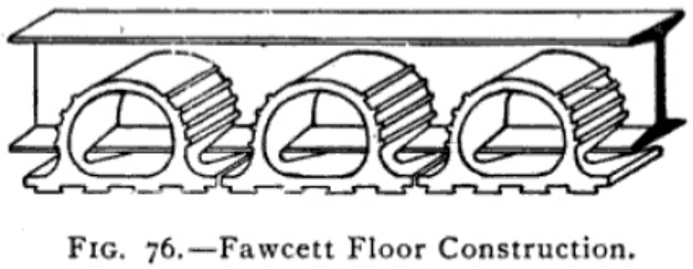

FIG. 76.—Fawcett Floor Construction.

Figure 2. Freitag, Joseph Kendall. The Fireproofing of Steel Buildings. J. Wiley & sons, 1899. p.203

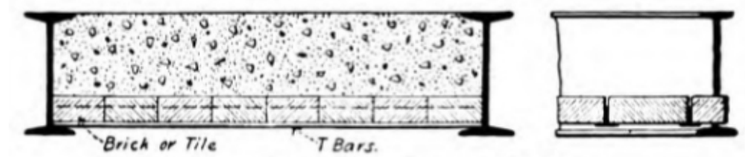

FIG. 3.—Rapp Floor with Flat Ceiling.

FIG. 4.—Rapp Floor with Arched Ceiling.

Figure 3. Buel, Albert W., and Charles Shattuck Hill. Reinforced Concrete. Part I. Methods of Calculation. New York: The Engineering news Pub. Co., 1906.p. 13.

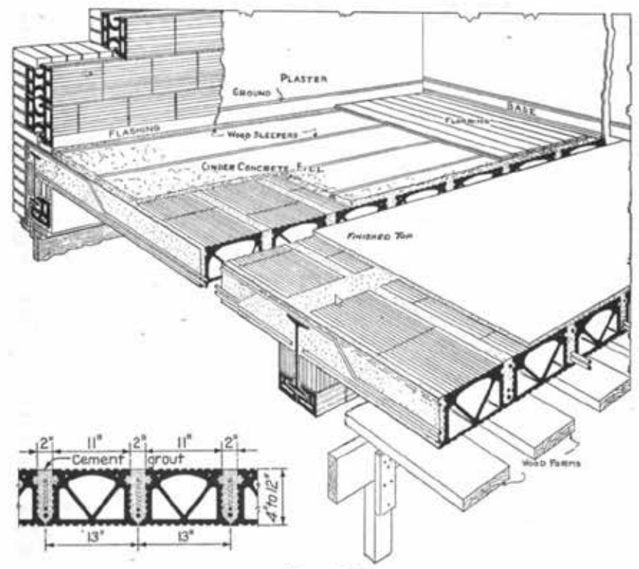

Figure 10-8

Perspective view showing "Natco-flor" tile and cement-grout rib combination "One-Way" floor system.

Figure 4. Plummer, Harry C., and Edwin F. Wanner. Principles of Tile Engineering; Handbook of Design. Washington: Structural Clay Products Institute, 1947.p. 287