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5. First Wisconsin Center, Milwaukee, Wisconsin (USA)

Owner:	*First Wisconsin Development Corporation, Milwaukee, Wisconsin*
Architects-Engineers:	*Skidmore, Owings & Merrill, Chicago, Illinois*
General Contractor:	*Carl A. Morse, Inc.*
Completion date:	*1973*

The 42-story First Wisconsin Center (Fig. 1) is one of the first buildings designed on the basis of a partial steel tube concept with a subsystem of vertical core trusses, and belt trusses. The belt trusses, located at the 3rd, 15th, and 41st floor levels, are connected through outrigger trusses to the vertical core trusses which by their interaction with exterior frame improve the cantilever behaviour of the total system. The tower is 5 bays by 3 bays in plan with a 40 ft. x 40 ft. (12.2 m x 12.2 m) bay as a standard module, creating plan dimensions of 200 ft. x 120 ft. (Fig. 2). The gross framed area is 1.3 million sq. ft., with tower rising 602 ft. above street level.

Fig. 1 First Wisconsin Center, Milwaukee, Wisconsin

Structural System

The partial tubular system was selected for the First Wisconsin Center to create a light open-frame type structure on the exterior with columns 20 ft. apart along the perimeter. The frame is continuous with the belt trusses which are expressed architecturally on the exterior (Fig. 1). The belt truss at the third floor also functions as a transfer truss to effect a column spacing of 40 ft. below that level. Fig. 3 shows the outrigger trusses which connect the core vertical trusses and the belt trusses. Fig. 4 depicts the overall behaviour under wind forces. The outrigger trusses act as stiff header beams inducing tension and compression in exterior frame columns. The belt trusses assist in distributing these tension forces to many frame columns. The improvement in the overall lateral stiffness can be noted from the plot of lateral deflections vs. height with and without the belt-outrigger truss system. The improvement in lateral drift was of the order of 30% for this case. Partial tubular system is symbolized by the higher order of cantilever mode of behaviour. The forces acting on the short face is resisted by fascia frames along the long direction frames.

The typical floor-to-floor height is 13 ft. (3.96 m) with 26 ft. (7.93 m) floor heights occurring at the 3rd, 15th, and 41st floors. The 40 ft. x 40 ft. (12.2 m x 12.2 m) interior bay system was realized through use of the composite deck resting on composite steel beams spaced 10 ft. (3.05 m) on center. A 4,000 psi lightweight concrete was used for decking.

Both rolled and built-up steel sections were used for main beams and columns. The spandrel beams were 36 in. deep and column depth ranged between 14 in. and 36 in. at the base. Various strengths of structural steel were utilized to optimize strength and drift requirements, and to minimize total tonnage. All exterior frames are moment connected, and all interior frames simply supported. Due to efficient structural systems used, the required structural steel was approximately 24 lbs per sq. ft. for this building with a height of about 600 ft.

Foundation System

The tower site substrata consists of nearly 200 ft. (60 m) of soft fill and glacial deposit materials. The 12 HP steel bearing piles driven to lengths of up to 160 ft. (48.78 m) below cut-off grade were used. The pile capacity was 250 tons each.

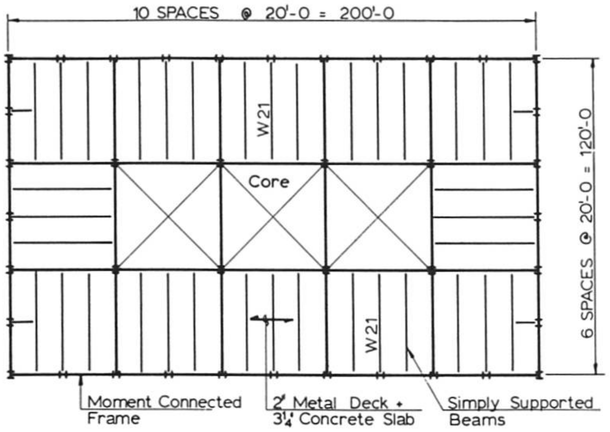

Fig. 2 Typical floor framing plan — First Wisconsin Center

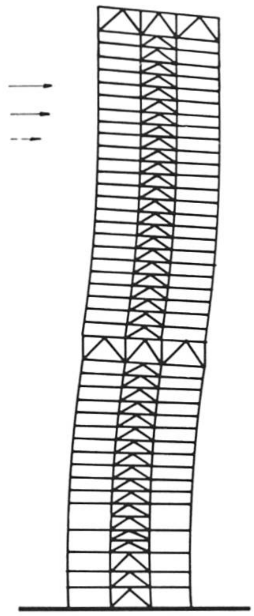

Fig. 4a Behaviour under lateral forces

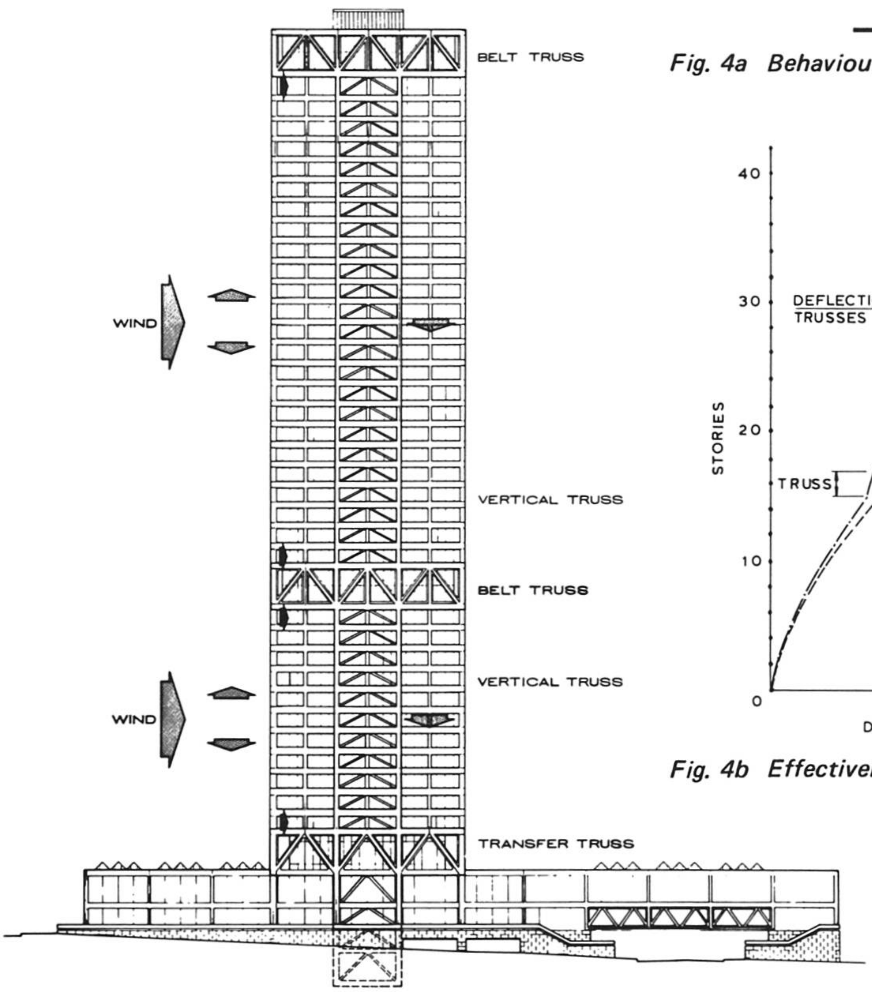

Fig. 3 East-West section showing lateral load resisting trusses

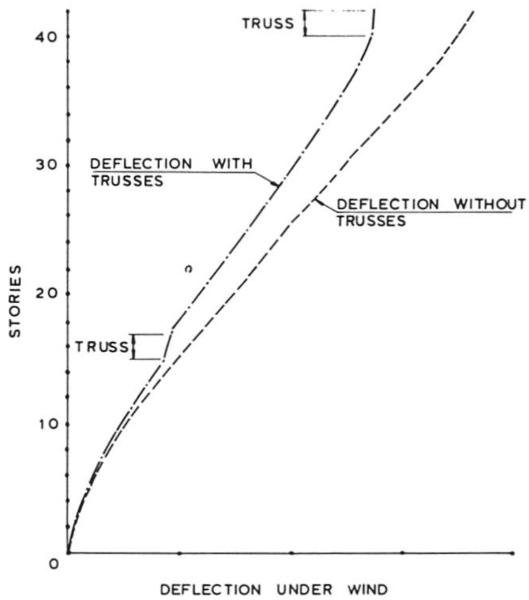

Fig. 4b Effectiveness of trusses in lateral resistance