GENERAL MOTORS PARTS DISTRIBUTION CENTER, CARTER INDUSTRIAL PARK, FORT WORTH, TX

By

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POST-TENSIONING INSTITUTE ®

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Located on Interstate Highway 35, south of Fort Worth, TX, the General Motors Parts Distribution Center, a distribution warehouse facility, was built in 1986 and was one of the first "super flat floor" warehouses to use unbonded monostrand post-tensioning.

The project consisted of approximately 340,000 ft^2 (31,587.03 m^2) of super flat F-100 minimum slab area and an additional 57,000 ft^2 (5295.47 m^2) of very flat F-30 minimum slab area. The F-100 areas were required to accommodate the extremely tight vertical and horizontal tolerances required of a high rack storage system that used a sophisticated computerized handling system.[1-3]

The F-100 areas were constructed using 103 strips, placed alternately (Fig. 1. and 2), approximately 15 ft (4.6 m) wide, 220 ft (67.1 m) long, and 8 in. (203 mm) thick. The design called for residual compression of 210 psi (1.45 MPa) at mid-slab length, which was accomplished by placing 1/2 in. (12.7 mm) monostrand tendons in the long direction (Fig. 3). The post-tensioning was supported with 18 in. (457 mm) No. 4 reinforcing bar in the center (Fig. 4) and four 15 ft (4.6 m) long No. 5 (16 mm) reinforcing bars, which were placed in all corners in the long direction to accommodate anticipated differential shortening between the strips (Fig. 5). An aggressive stressing cycle was implemented to allow adjacent strips to be poured within 2 days of each other (Fig. 6). An initial stress of 50% of the design jacking force was applied to each tendon when the concrete reached a strength of 1500 psi (10.34 MPa), typically within 12 hours, and the final stress was completed within 24 hours, based on concrete test cylinder breaks, confirming a concrete strength of 3000 psi (20.68 MPa). Metal keyways were used to form the first groups of alternating strips and were removed prior to placing the adjacent strips.

The inherent advantages of the post-tensioning system over nonprestressed reinforcement provided substantial initial and long-term benefits, including the following:

Fig. 1—General view (looking right).

Fig. 2—General view (looking left).

- Reduced slab thickness resulted in significant reductions of concrete and reinforcing quantities.
- A reduced number of required construction and crack-control joints reduced initial construction costs and long-term joint maintenance costs.

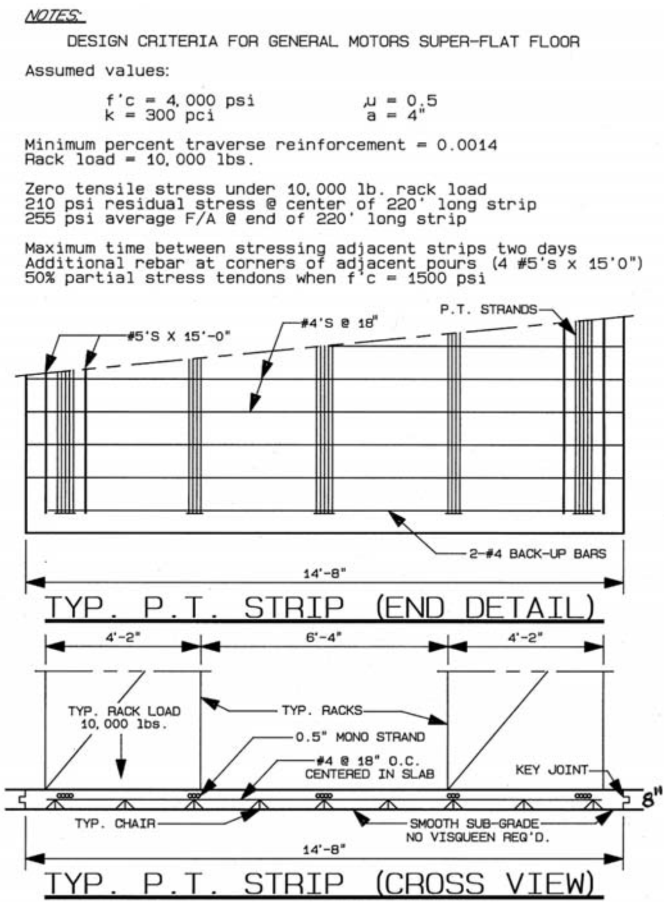

Fig. 3—Design criteria and strip details.

- The possibility of shrinkage cracks that could negatively affect the function of the automated handling system was minimized, and long-term crack maintenance costs were eliminated.
- Any potential effects of differential soil movement that would negatively affect the function of the automated handling system were minimized.
- Long term durability was improved.

Initial construction cost savings of 15 to 20% were realized, whereas long-term cost savings, although difficult to substantiate, were significant. The use of post-tensioning resulted in a floor that has provided the owner with over 26 years of superior performance with reduced initial and long-term costs. No official statistics have been kept on the use of post-tensioning in industrial floors, but it has proven to be a great alternative for the design and construction of this type of slab.

Fig. 4—Close-up showing tendons, support bar, and column detail.

Fig. 5—Close-up looking down an individual strip.

Fig. 6—Concrete placement.

REFERENCES

1. Vejvoda, M., "Post-Tensioned Industrial Floors," *Concrete International*, V. 15, No. 1, Jan. 1993, pp. 53-55.

2. Loov, R.E., "Is the F-Number System Valid for Your Floor," *Concrete International*, V. 12, No. 1, Jan. 1990, pp. 68-76.

3. Face, A., "Specifying Floor Systems and Levelness: The F-Number System," *The Construction Specifier*, Apr. 1987, pp 125-132.

CREDITS

Owner: General Motors Corporation
Architect: Carter & Burgess, Inc., Fort Worth, TX
Engineer: Owens Engineering Company, Milan, TN
General Contractor: H&M Construction Company, Inc., Milan, TN
Concrete Contractor: Mobley-Speed Cement Contractors, Dallas, TX
Post-Tensioning Supplier: VSL Corporation, Dallas/Fort Worth, TX

PROJECT FACTS

F-100 Area: 340,054 ft^2 (31,592.05 m^2)
F-30 Area: 56,699 ft^2 (5267.51 m^2)
Concrete: 9796 yd^3 (7489.58 m^3)
Prestressing Steel: 113 tons (102.51 tonnes)

Jack W. Graves Jr. *is a PTI Fellow and has been involved with the post-tensioning industry for over 39 years. He is currently Executive Vice President of Builders Post-Tension, Dallas/Fort Worth, and serves as Chair of PTI Committee MKT-150, Marketing, and PTI Subcommittee DC-10D, Slab-on-Ground—Construction and Maintenance; is a member of PTI Committee DC-10, Slab-on-Ground; and serves on the PTI Board of Directors.*